Cyclical-Adjusted External Balance of Goods and Services in the Czech Republic

Zdeněk Pikhart [1] **|** *University of Economics, Prague, Czech Republic*

Abstract

Article develop the cyclical adjustment methodology of the balance of goods and services, which is beneficial especially for a small open economy. Cyclical adjustment procedure is applied and adjusted to the Czech data by quantifying cyclical determinants of foreign trade such as domestic and foreign output gap and trade prices deviations from the trend. Results show that cyclical adjustment of external trade balance provide a useful tool for assessing the sustainability of trade development and thus help to better analyze current situation and forecast short-term future development.

Keywords	JEL code
Business cycle, cyclical adjustment, external balance of trade	*E32, F32, F44*

INTRODUCTION

The turnover and balance of foreign trade represents significant aggregates for the assessment of the internal and external balance of the economy. The balance of goods and services enters the use of the gross domestic product, but is also one of the main items on the current account of the balance of payments. Its development is thus closely linked to the overall macroeconomic situation of the country. For the purposes of macroeconomic analyses and forecasts, it is useful to adjust the balance of foreign trade for the business cycle, that is, to break down the balance of goods and services to the structural and cyclical components.[2]

The openness of the economy, captured by the ratio of foreign trade turnovers to GDP, is determined by the size and geographical position of the economy, barriers to trade, infrastructure, education, cultural proximity of states, the institutional framework, political risks and other factors. Higher international division of labour usually leads to narrower specialization and deeper use of comparative advantages as one of the factors of labour productivity growth.

However, if we focus on the balance of foreign trade, its structural component is related to the intertemporal position of the current account of the balance of payments in the broader economic

---

[1]   University of Economics, Prague, Faculty of Finance and Accounting, W. Churchill Sq. 1938/4, 130 67 Prague 3, Czech Republic. E-mail: xpikz00@vse.cz. Also the Ministry of Finance of the Czech Republic, Letenská 15, 118 10 Prague 1, Czech Republic. E-mail: zdenek.pikhart@mfcr.cz.

[2]   This is a significantly extended version of the text published in the Macroeconomic Forecast (Ministry of Finance, Box 3.1, 2018).

convergence process. A young, transforming economy strongly attracts foreign capital, and the resulting excess of investment over savings leads to an increase in imports of goods and services and in turn, to a negative balance of foreign trade. An increasing production of foreign companies in the economy gradually improves the balance of goods and services, and the deficit of primary income with a predominant share of reinvested earnings is simultaneously increasing. In the later stages of the investment cycle, the balance of foreign trade is characterized by significant surpluses, which are to a large extent offset by the outflow of dividends abroad. The Czech economy has gone through these stages in the past and, at present, the positive balance of foreign trade even exceeds the negative balance of primary income, as a result of which the Czech Republic is approaching countries with net exports of savings (see Figure 1).[3]

Figure 1 Current account balance – national accounts (% of GDP)
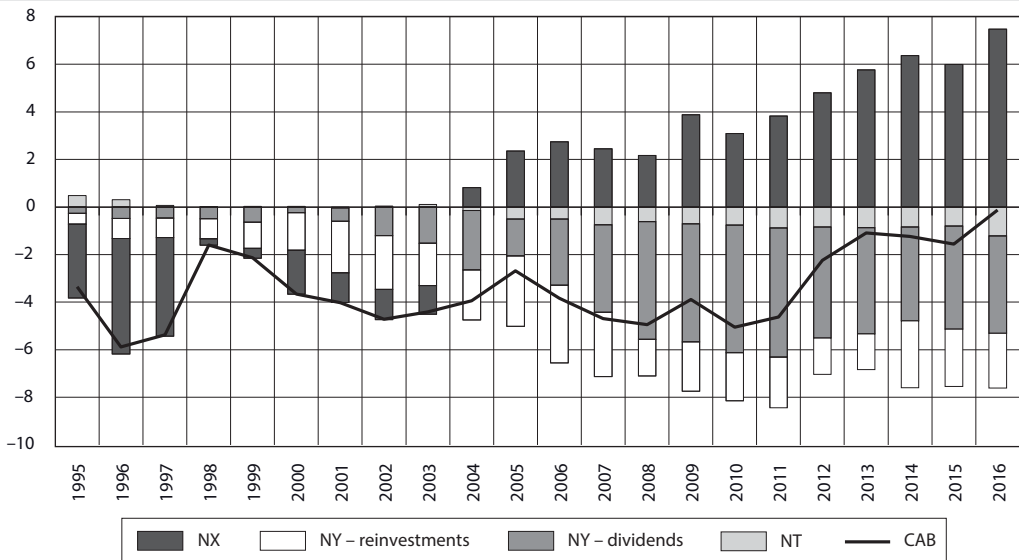
Note: NX = net exports of goods and services, NY = net primary income, NT = net secondary income, CAB = current account balance.
Source: Czech Statistical Office

The identification of structural and cyclical determinants of the external balance of trade is definitely relevant for policy-making and has indeed attracted the academic interest, with a number of theoretical models flourishing in the literature after the pioneering works by Sachs (1981) and Buiter (1981), later extended by the classic inter-temporal approach of Obstfeld and Rogoff (1995). Several empirical applications of these models have drawn on the national accounting identity between the current account balance and the difference between national saving and investment and have suggested a variety of fundamental determinants of current account positions (Faruqee and Debelle, 1996; Blanchard and Giavazzi, 2002; Chinn and Prasad, 2003; Gruber and Kamin, 2007; Ca'Zorzi et al., 2009).

First currently used method how to distinguish between structural and cyclical factors proceeds from quantifying structural drivers of foreign trade as demography, openess, barriers, convergency and leaves the cyclical determinants as a residual (Cheung et al., 2010). Similarly, the IMF, within its External Balance Assessment procedure, estimates the structural component of the current account

---

[3] According to the national accounts statistics; the balance of payments statistics shows that the Czech Republic has been a net exporter of savings already since 2014.

on the basis of a reduced-form panel regression that relates the observed balance to a set of variables including both structural and cyclical factors, summarized by the domestic output gap relative to the world output gap (Phillips et al., 2013).

Second group of methods approachs the distribution of trade balance on the contrary by quantifying cyclical deviations from equilibrium balance of goods and services through trade elasticities (Wu, 2008; Kara and Sarikaya, 2013; Haltmaier, 2011 and 2014), often using effects of foreign and domestic output gaps and real exchange rate deviations. But there are many country specific factors which have to be taken into the account such as different import intensities of gross domestic product components, relevant foreign trading partners, assymetric effects of price level deviation, equilibrium real exchange rate appreciations in economic convergence process and, last but not least, unique estimate of trade elasticities. Fabiani et al. (2016) documented different sizes of trade elasticities for multiple economies carried out by regression estimates. Thus, this article applies and develops the approach of substracting cyclical components which best fits to the data of the Czech Republic.

1 DATA AND METHODOLOGY

In addition to the aforementioned structural foreign trade factors, the external position of the economy is significantly influenced by cyclical fluctuations of domestic and foreign economies. These are related to deviations of the koruna price levels (P) of traded goods and services resulting from the deviations of prices on foreign markets and of the nominal exchange rate. Price deflators of exports and imports of goods and services from the national accounts are used. Functional relationships within the nominal balance of goods and services (NX) are captured by Formula (1). Exports of goods and services (EX) are the function of foreign demand at constant prices of 2010[4] (Y_F), and imports of goods and services (IM) depend on the development of import-intensive exports and domestic demand at constant prices of 2010 (Y_{DOM}).

$$NX = \left[EX \to f\left(Y_F\right)\right] - \left[IM \to f\left(EX, Y_{DOM}\right)\right] \tag{1}$$

The structural component of exports (EX*) and imports (IM*) is quantified in Formulas (2) and (3) as actual exports and imports adjusted for the percentage deviation[5] of the variables from their equilibrium levels while taking into account the specific elasticities in foreign trade. The cyclically-adjusted balance of foreign trade (NX*) is then the difference in structural values of exports and imports (4). Seasonally adjusted data from quarterly national accounts (Czech Statistical Office, 2018) have been used:

$$EX^* = EX\left[1 - \varepsilon^{EX,Y_F}\left(Y_F - Y_F^*\right) - \varepsilon^{EX,P_{EX}}\left(P_{EX} - P_{EX}^*\right)\right] \tag{2}$$

$$IM^* = IM\left[1 - \varepsilon^{IM,EX}\left(EX - EX^*\right) - \varepsilon^{IM,Y_{DOM}}\left(Y_{DOM} - Y_{DOM}^*\right) - \varepsilon^{IM,P_{IM}}\left(P_{IM} - P_{IM}^*\right)\right] \tag{3}$$

$$NX^* = EX^* - IM^* \tag{4}$$

Figures 2–5 show the development of domestic and foreign demand and foreign trade prices with their deviations from trend values. Statistical approach by using of the Hodrick-Prescott filter with recommended λ = 1 600 for quarterly data was applied to seasonally adjusted time series from national

---

[4] The real gross domestic product of the Euro Area was used, constant prices of 2010.

[5] $\left(Y_F - Y_F^*\right); \left(P_{EX} - P_{EX}^*\right); \left(EX - EX^*\right); \left(Y_{DOM} - Y_{DOM}^*\right); \left(P_{IM} - P_{IM}^*\right)$ are interpreted as differences of logarithms, i.e., approximately a percentage deviation from trend values.

accounts (Hodrick and Prescott, 1997). Filtering was performed on quarterly data from 1996 to 2021, adding values from the current Macroeconomic Forecast of the Ministry of Finance (2018) to address the endpoint problem. Domestic demand is represented by import intensive real gross fixed capital formation, since final consumption expenditure of households and government sector remain statistically insignificant in variety of models.

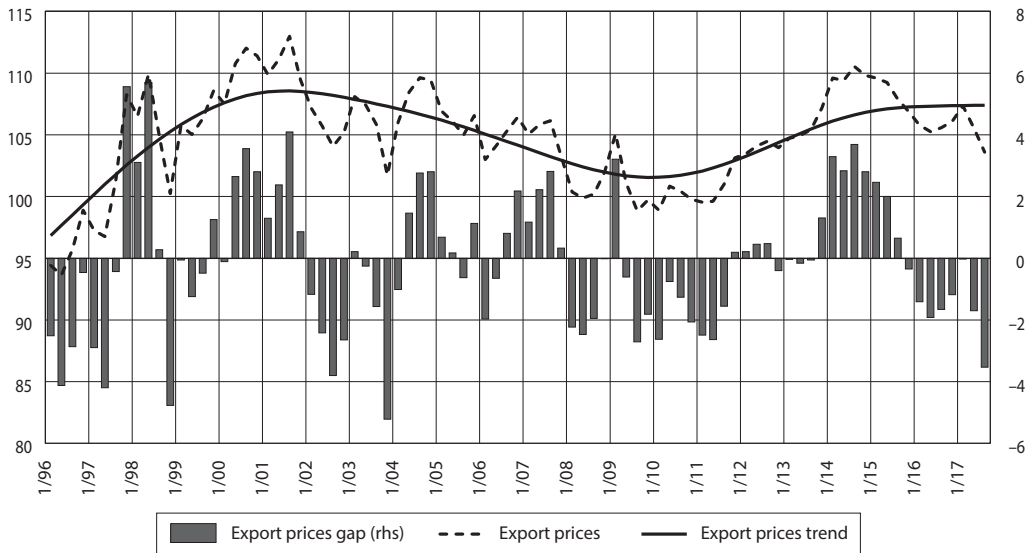**Figure 2** Domestic demand gap (Ø2010 = 100, in %)
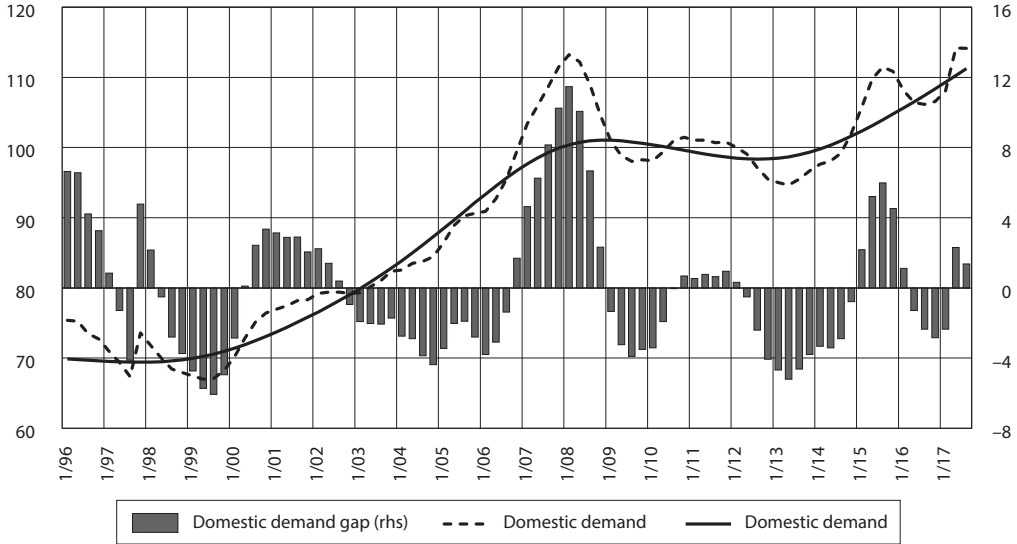
Source: Czech Statistical Office, own construction, (rhs = right hand side)

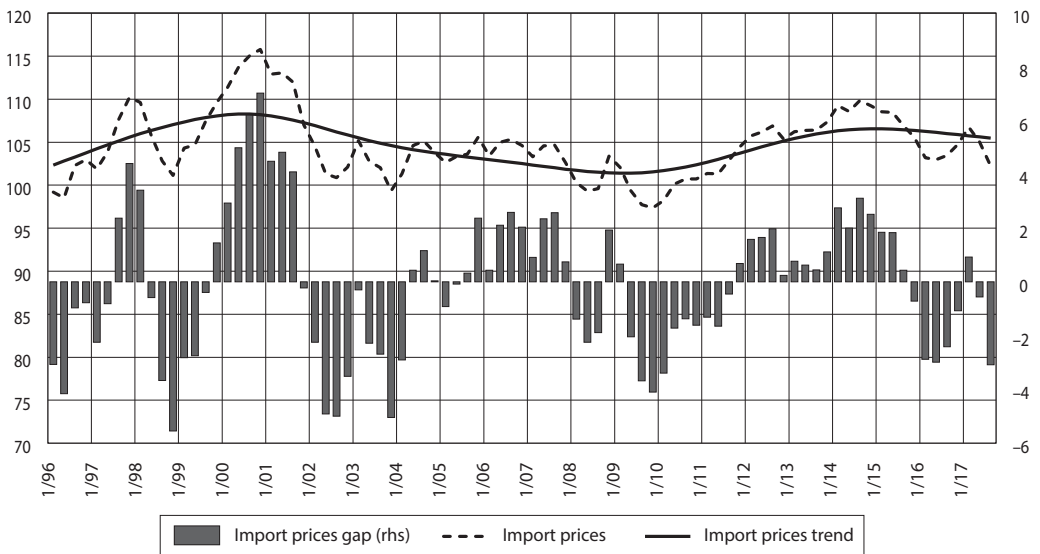**Figure 3** Foreign demand gap (Ø2010 = 100, in %)
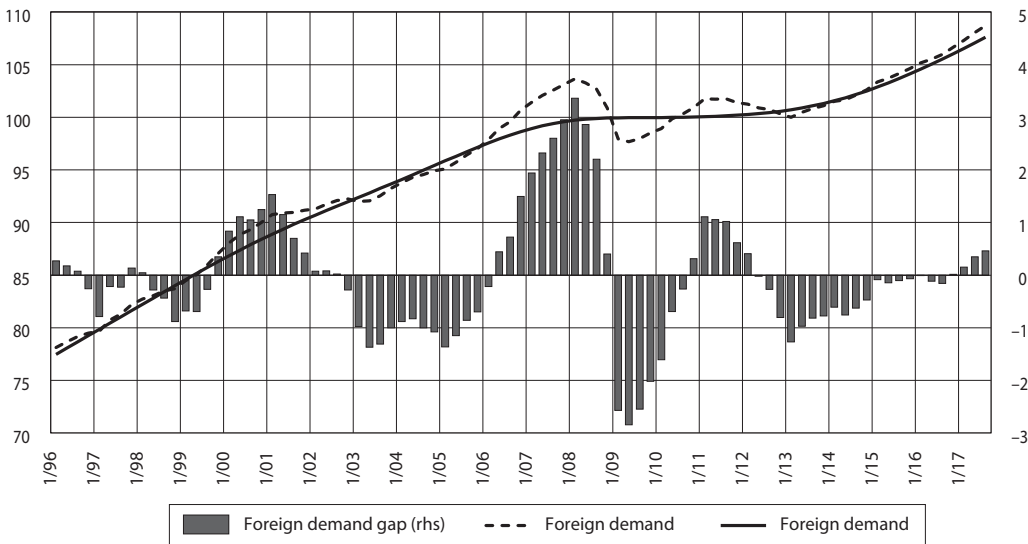
Source: Eurostat, own construction, (rhs = right hand side)

Figure 4 Export prices gap (Ø2010 = 100, in %)

Source: Czech Statistical Office, own construction, (rhs = right hand side)

Figure 5 Import prices gap (Ø2010 = 100, in %)

Source: Czech Statistical Office, own construction, (rhs = right hand side)

Table 1 shows description statistics for gap variables used in estimates. Quarterly data from the first quarter 1996 to the third quarter 2017 are used. All time series are stationary according to augmented Dickey-Fuller statistic.

Table 1 Data description

Variable	abr.	mean	st. dev.	Jarque-Bera	ADF
nominal export gap	ex_gap	0.13	6.49	5.42*	−4.64***
nominal import gap	im_gap	0.07	6.32	3.46	−4.24***
euro area output gap	ea_og	−0.03	1.17	6.69**	−4.34***
real gross fixed capital formation gap (constant prices of 2010)	gfcf_gap	−0.04	3.93	10.63***	−4.32***
export price deflator gap	pex_gap	−0.07	2.29	0.90	−4.54***
import price deflator gap	pim_gap	−0.06	2.68	0.88	−4.59***

Note: JB is Jarque-Bera statistic under the null of normal distribution. ADF is augmented Dickey-Fuller statistic under the null of unit root. (*, **, *** denote rejection of the null at 10%, 5% and 1% level of significance, respectively).
Source: Czech Statistical Office, Eurostat, own construction

In order to estimate volume and price elasticities in foreign trade regression estimates have been carried out by the method of least squares. All coefficients are statistically significant at 1% level of significance. Residual autocorrelation and heteroscedasticity is not present in the models. Results show very high dependence of exports deviations from the trend on foreign output gap. Relatively strong is also price elasticity of exports gap. Both effects affecting exports are then indirectly reflected on the imports side, since export gap is the strongest factor of the imports deviation. The import intensity of total gross fixed capital formation at 23% is significantly below the value from the input-output tables,[6] but might be influenced by EU investment cycle, which is closely related to government and construction investment with reasonably lower import intensity.

Table 2 Estimates

Endogenous variable:	ex_gap		Endogenous variable:	im_gap	
ea_og	3.52		ex_gap	0.72	
	[0.77]	***		[0.05]	***
pex_gap	1.00		gfcf_gap	0.23	
	[0.16]	***		[0.08]	***
ex_gap(−1)	0.79		pim_gap	0.37	
	[0.06]	***		[0.14]	***
			im_gap(-1)	0.51	
				[0.12]	***
Observations	86		Observations	86	
Adj. R-sq	0.86		Adj. R-sq	0.93	
Breusch	1.17		Breusch	0.52	
Harvey	1.00		Harvey	0.17	
AIC	4.74		AIC	3.88	
Durbin-Watson stat.	1.86		Durbin-Watson stat.	2.00	
RMSE	2.40		RMSE	1.58	
TC	0.19		TC	0.13	

Note: J Estimates of the coefficients with standard errors in parenthesis are given. Adj. R-sq denotes the adjusted coefficient of determination. Breusch and Harvey represent tests of heteroscedasticity under the null of homoscedastic residuals. AIC is the value of Akaike information criterion. RMSE is a root mean square error. TC is Theil inequality coefficient. (*, **, *** denote rejection of the null at 10%, 5% and 1% level of significance, respectively).
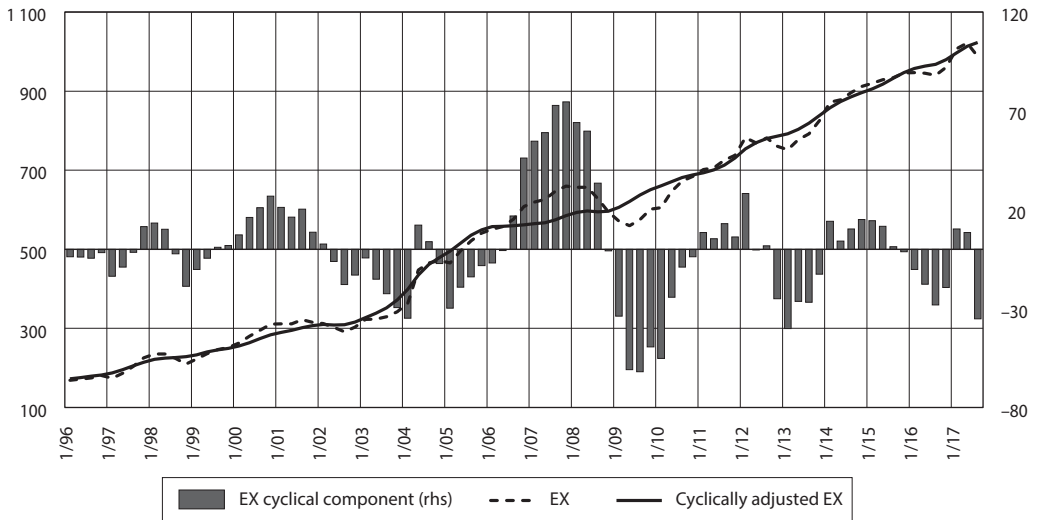**Source:** Own construction

---

[6]   Import intensity of gross fixed capital formation is 44% based on symmetric input-output tables 2010.

2 RESULTS

It follows from the breakdowns in Figure 6 and 7 that the Czech economy recorded the strongest cyclical fluctuations in exports and imports in the 2007–2008 boom and the subsequent decline in the recession in 2009.[7] The positive cyclical component of exports is evident in 2014 and 2015

Figure 6 Cyclically adjusted exports, (current prices, CZK bn)

Note: Adjusted values of export smoothed by the Hodrick-Prescott filter (λ = 1).
Source: Czech Statistical Office, own construction, (rhs = right hand side)

**Figure 7** Cyclically adjusted imports, (current prices, CZK bn)
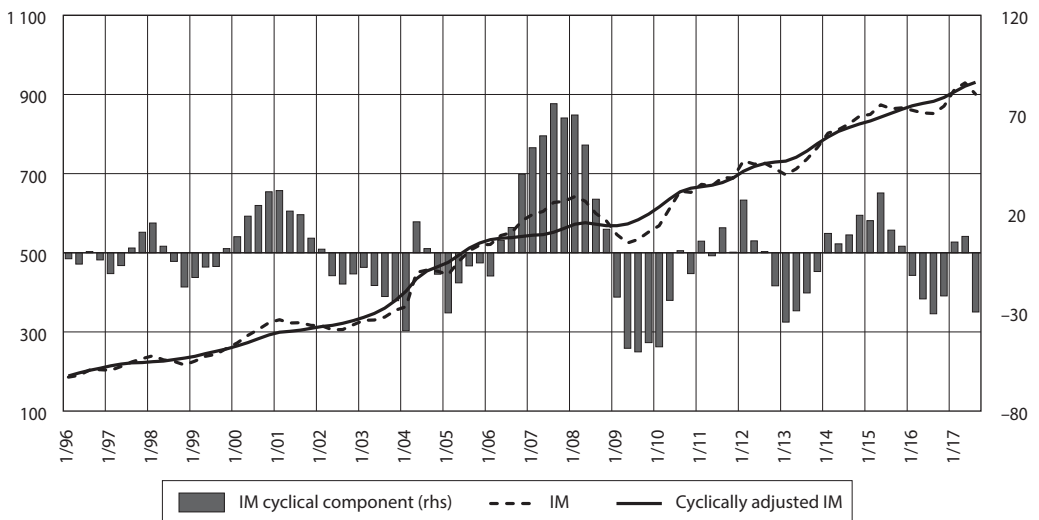
Note: Adjusted values of import smoothed by the Hodrick-Prescott filter (λ = 1).
Source: Czech Statistical Office, own construction, (rhs = right hand side)

---

[7]   Presented data smoothed by the Hodrick-Prescott filter (λ = 1) for the sake of graphic readability.

in response to the devaluation of the koruna exchange rate by the CNB. On the import side, however, this effect was outweighed in 2015 by acceleration in import-intensive investment activity associated with dynamic end of allocation of EU funds from the previous financial perspective. For that reason, Figure 10 shows a significantly negative deviation of the balance of foreign trade in 2015.

Deviations of exports from the equilibrium levels are, for most of the time, created by the output gap abroad, which is also – indirectly – strongly reflected in imports. The deviation of prices in foreign trade from the trend is of a generally more pro-cyclical nature. However, in 2014, there is a clear positive contribution of the deviation of export prices stemming from weakening of the exchange rate after adoption of the CNB's exchange rate commitment. A relatively imminent reflection of the weakening of the koruna in the export deflator can be explained by price formation on export markets. Exported goods are sold at global prices, and devaluation will thus cause the koruna prices of exports and the profitability of exporters to jump. However, that effect gradually fades away over the horizon of 2 years due to the increased export supply, and pressures on reduction in foreign prices and trade margins of exporters at a stable exchange rate. It should be added that the crude oil price drop also affected the development during that period. Deviations of the balance of imports of goods and services from the equilibrium are determined mainly by export fluctuations, to a lesser extent by gross fixed capital formation and import prices.

Figure 8 Contributions to exports cyclical component (current prices, CZK bn)
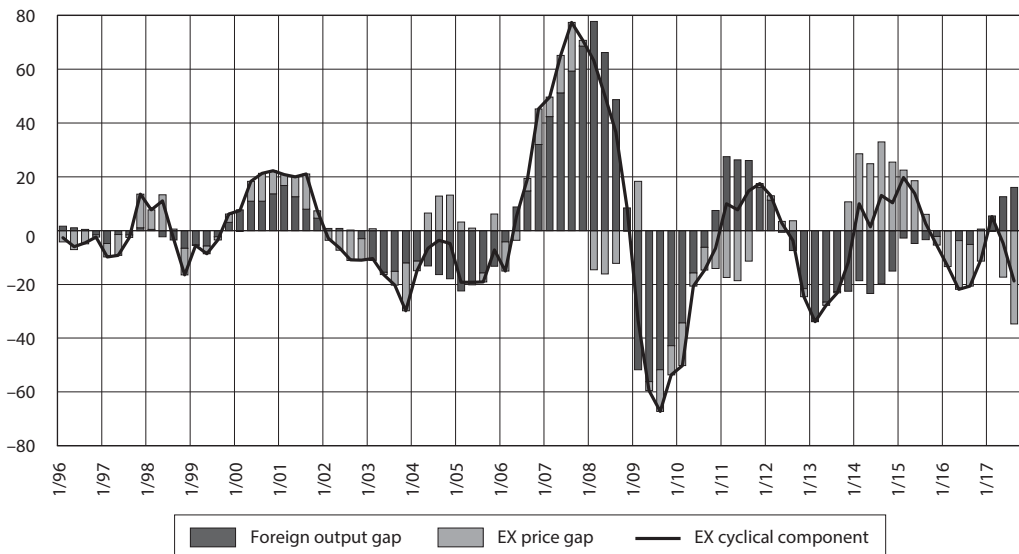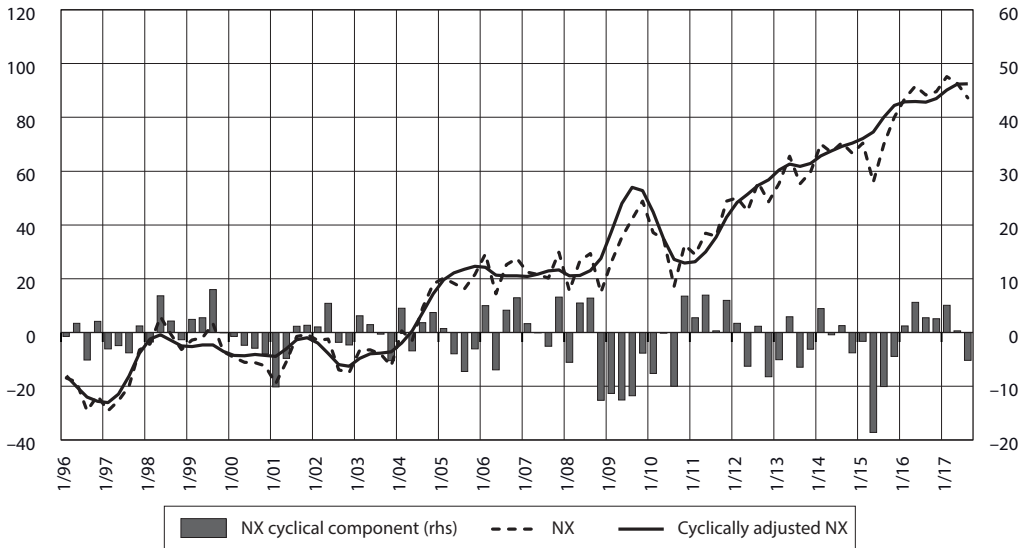

Source: Own construction

Exports, imports and the balance were close to their equilibrium values in mid-2017. However, the appreciation of the exchange rate after the discontinuation of the CNB's exchange rate commitment significantly reduced the nominal values of exports and imports and shifted the balance of goods and services below its equilibrium level in the third quarter of 2017 as a result of the synergy of the statistical effect (higher exports more influenced by the appreciation of the exchange rate than imports) and the classic economic effect (a stronger exchange rate curbs exports and promotes imports).

Figure 9 Contributions to imports cyclical component (current prices, CZK bn)

Legend: EX cyclical component   Fixed investment gap
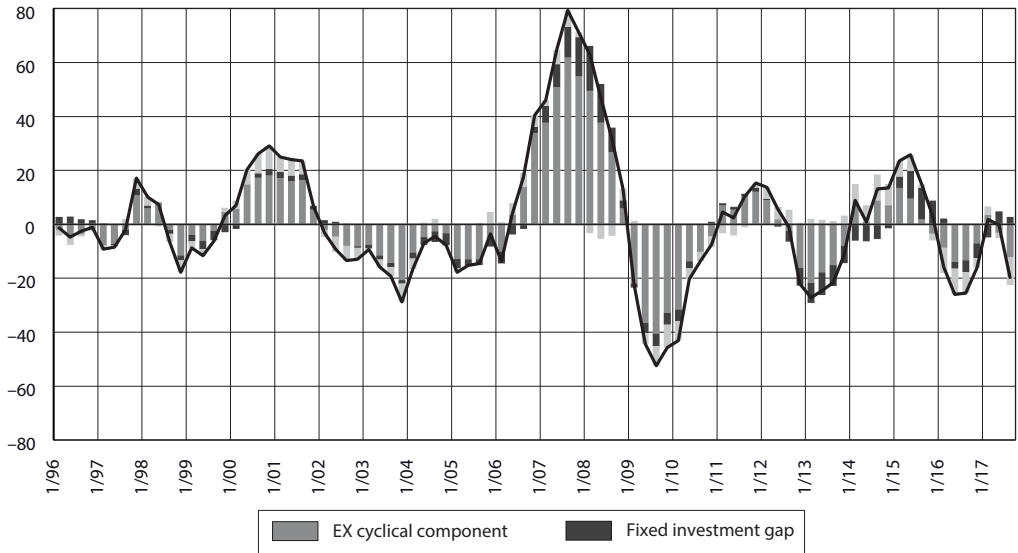
Source: Own construction

Figure 10 Cyclically adjusted net exports (current prices, CZK bn)

Legend: NX cyclical component (rhs)   NX   Cyclically adjusted NX

Note: Adjusted values of export and import smoothed by the Hodrick-Prescott filter ($\lambda = 1$).
Source: Czech Statistical Office, own construction, (rhs = right hand side)

CONCLUSION

Following the cyclical adjustment of a general governement sector overall balance, the article contributed to the methodology of cyclical adjusting another important macroeconomic variable, especially in the small open economy – balance of goods and services. Rather country specific cyclical adjustment

procedure has been applied to the Czech economy by quantifying cyclical determinants of trade balance. Like the government sector balance, foreign trade is also affected by the behaviour of output gap. In addition, foreign trade prices deviations stemming mostly from the volatility of the exchange rate also play a significant role.

The analysis outlined usefulness of cyclical adjusting of foreign trade balance, which provides an apropriate tool for the assesment sustainability of essential part of the external equilibrium and helps not only to analyze current situation more accurately, but also to better predict short-term future development.

ACKNOWLEDGMENT

References

BLANCHARD, O. AND GIAVAZZI, F. Current account deficits in the euro area: the end of the Feldstein-Horioka puzzle? *Brookings Papers on Economic Activity*, 2002, No. 2, pp. 147–186.

BUITER, W. Time preference and international lending and borrowing in an overlapping-generations model. *Journal of Political Economy*, 1981, No. 89, pp. 769–797.

CA' ZORZI, M., CHUDIK, A., DIEPPE, A. Current account benchmarks for Central and Eastern Europe: a desperate search? *ECB Working Paper*, 2009, No. 995.

CHEUNG, C., FURCERI, D., RUSTICELLI, E. Structural and Cyclical Factors behind Current Account Balances. *OECD Working Papers*, 2010, No. 775.

CHINN, M. AND PRASAD, E. Medium-term determinants of current accounts in industrial and developing countries: an empirical exploration. *Journal of International Economics*, 2003, No. 59, pp. 47–76.

CZECH STATISTICAL OFFICE. *Quarterly National Accounts* [online]. Prague: CZSO, 2018. [cit. 2.2.2018]. < https://www.czso.cz/csu/czso/hdp_cr>.

FABIANI, S., FEDERICO, S., FELETTIGH, A. *Adjusting the external adjustment: cyclical factors and the Italian current account.* Banca d´Italia, Ocasional papers, 2016, No. 346.

FARUQEE, H. AND DEBELLE, G. What Determines the Current Account? A Cross-Sectional and Panel Approach. *IMF Working Paper*, 1996, No. 96/58.

GRUBER, J. AND KAMIN, S. Explaining the global pattern of current account imbalances. *Journal of International Money and Finance*, 2007, No. 26, pp. 500–522.

HALTMAIER, J. Cyclically Adjusted Current Account Balances. *International Finance Discussion Papers*, Board of Governors of the Federal Reserve System, 2014, No. 1126.

HALTMAIER, J. Empirical Estimates of Trend and Cyclical Export Elasticities. *International Finance Discussion Papers,* Board of Governors of the Federal Reserve System, 2011, No. 1030.

HODRICK, R. AND PRESCOTT, E. Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit, and Banking,* 1997, No. 29(1), pp. 1–16.

KARA, H. AND SARIKAYA, C. *Cyclically Adjusted Current Account Balance.* Türkiye Cumhuriyet Merkez Bankasi, Research notes in economics, 2013, No. 18.

MINISTRY OF FINANCE OF THE CZECH REPUBLIC. *Macroeconomic Forecast of the Czech Republic*. January, 2018. ISSN 1804-7971.

OBSTFELD, M. AND ROGOFF, K. *The intertemporal approach to the current account*. Handbook of International Economics, 1995, No. 3, pp. 1731–99.

PHILLIPS, S. et al. The External Balance Assessment (EBA) Methodology. *IMF Working Paper*, 2013, No. 272.

SACHS, T. The current account and macroeconomic adjustment in the 1970s. *Brookings Papers on Economic Activity*, 1981, No. 1, pp. 201–268.

WU, Y. Growth, Expansion of Markets, and Income Elasticities in World Trade. *Review of International Economics*, 2008, Vol. 16, Iss. 4, pp. 654–671.