APPENDIX

1. Model Description

This article uses a New Keynesian (NK) Dynamic Stochastic General Equilibrium (DSGE) model which is derived from microeconomic behavior of particular economic agents. These include domestic and foreign households, domestic and foreign producers, domestic importers and domestic and foreign monetary authority. The model is in small open economy (SOE) setting, therefore presuming two countries – a small open economy influenced by a big closed economy. The small open economy is the home (Czech) economy, the big large economy is the foreign (euro area with 12 countries) economy. Most of the model assumptions are adopted from Lubik and Schorfheide (2006).

The economy is populated by a continuum of households that consume, work in order to earn money for consumption, and enter financial market in order to bridge the time gap between pay-day and consumption.

The production part of the economy consists of a continuum of monopolistically competitive firms which produce a differentiated product. Each producer enters a perfectly competitive labor market and uses labor input to produce goods according to production with labor-augmenting home-specific stationary technology. Technology is identical for all producers and it evolves exogenously over time. Each period, fraction $1-\theta_H$ of domestic firms sets their prices optimally, and fraction θ_H of firms does not change prices. The optimized price-setting decisions of firms results in a New-Keynesian Phillips curve.

Deviations from purchasing power parity (PPP) can occur in the short run due to existence of monopolistically competitive importers. Importers buy from foreign producers for prices set by foreign producers in a foreign currency. This means that law of one price holds at the border but not necessarily in the domestic economy, because importers set prices in domestic currency for domestic consumers with a possible mark-up. The fact that the law of one price does not have to hold can be also interpreted by an incomplete pass-through from exchange rate movements to prices of imports for domestic consumers.

Similarly to producers, importers operate under the Calvo-style price-setting with $1-\theta_F$ importers who are able to re-optimize their prices. The solution of this optimization problem results in a Phillips curve for imported inflation which can be derived by analogy to producers' sector.

The model presumes complete markets for securities traded internationally as there is a perfect risk-sharing between households in domestic and foreign economy. In another words, stochastic discount factors for domestic and foreign economy must be equal.

2. Log-linearized model form

This section summarizes log-linearized equations that are used as model equations. Starting with households, the system contains equations for evolution of marginal utility of income (1), the law of motion of habit stock (2), Euler equation (3), and the definition of inflation from domestic and imported inflation (4):

$$-\lambda_t = \frac{\tau}{1-h\beta} c_t - \frac{h\beta}{1-h\beta} E_t(\tau c_{t+1} + z_{t+1}) \tag{1}$$

$$c_t = \frac{1}{1-h}(c_t - hc_{t-1} + hz_t) \tag{2}$$

$$-\lambda_t = -E_t\lambda_{t+1} - (r_t - E_t\pi_{t+1}) + E_t z_{t+1} \tag{3}$$

$$\pi_t = (1-\alpha)\pi_{H,t} + \alpha\pi_{F,t}, \tag{4}$$

Behavior of producers yield the New-Keynesian Phillips Curve (5) with marginal cost evolution described by (6)

$$\pi_{H,t} = \frac{1-\theta_H}{\theta_H}(1-\beta\theta_H)mc_{H,t} + \beta E_t\pi_{H,t+1} \tag{5}$$

$$mc_{H,t} = -\alpha q_t - \lambda_t - a_t \tag{6}$$

Importers' optimization is analogous to that of producers and for the log-linearized system is utilized importers' Phillips curve (7)

$$\pi_{F,t} = \frac{1-\theta_F}{\theta_F}(1-\beta\theta_F)\psi_{F,t} + \beta E_t \pi_{F,t+1} \tag{7}$$

There are also some simple definitions, namely definition of the depreciation rate of nominal exchange rate (8), differenced definition of terms of trade (9) and combined definition of real exchange rate and LOP gap (10).

$$\Delta e_t = \Delta s_t + \pi_t - \pi_t^*, \tag{8}$$

$$q_t = q_{t-1} + \pi_{H,t} - \pi_{F,t} \tag{9}$$

$$s_t = \psi_{F,t} - (1-\alpha)q_t \tag{10}$$

Equilibria equations includes equation regarding international risk-sharing (11), UIP condition (12) and log-linearized market clearing equation (13).

$$\lambda_t = \lambda_t^* - s_t. \tag{11}$$

$$r_t - r_t^* = E_t \Delta e_{t+1} \tag{12}$$

$$y_{H,t} = (1-\alpha)c_t + \alpha c_t^* + \alpha\eta(s_t - q_t) + g_{H,t} \tag{13}$$

Foreign economy is modeled structurally so that there exist foreign households and producers that also show optimizing behavior. However, since foreign economy is big and closed, its agents are not influenced in their optimization behavior by home economy activities.

Following equations are introduced in analogy to home case: A result of foreign representative household's optimizing behavior (14) and (15) analogous to (1) and (2), foreign producers' Phillips curve (16) analogous to (7) and rather collapsed version of market clearing (17) analogous to (13).

$$-\lambda_t^* = \frac{\tau}{1-h\beta}c_t^* - \frac{h\beta}{1-h\beta}E_t(\tau c_{t+1}^* + z_{t+1}) \tag{14}$$

$$c_t^* = \frac{1}{1-h}(c_t^* - hc_{t-1}^* + hz_t) \tag{15}$$

$$\pi_t^* = \frac{1-\theta^*}{\theta^*}(1-\beta\theta^*)(-\lambda_t^* - a_t^*) + \beta E_t \pi_{t+1}^* \tag{16}$$

$$y_t^* = c_t^* + g_t^* \tag{17}$$

The model is closed by specifying monetary policy. Towards this end, standard Taylor-type rule is used. This formulation of monetary policy assumes that central banks respond to deviations of inflation from steady state, growth rate of output from steady state growth rate γ and possibly to deviations of nominal exchange rate depreciation from steady state. Home and foreign monetary rules are therefore

$$r_t = \rho_r r_{t-1} + (1-\rho_r)[\psi_1\pi_t + \psi_2(\Delta y_{H,t} + z_t) + \psi_3\Delta e_t] + \varepsilon_{r,t} \tag{18}$$

$$r_t^* = \rho_r^* r_{t-1}^* + (1-\rho_r^*)[\psi_1^*\pi_t^* + \psi_2^*(\Delta y_t^* + z_t)] + \varepsilon_{r,t}^*, \tag{19}$$

where r_t is nominal interest rate, which is supposed to be monetary authority's tool, ρ_r is backward-looking parameter, ψ s are weights that monetary policy places on different economic variables it reacts to, and $\varepsilon_{r,t}$ is direct innovation to the rule that captures non-systematic part of monetary policy. Analogous explanations hold for foreign economy.

The model is supplemented with AR(1) processes describing evolution of government expenditures (acting as a demand or market clearing shock) g_t, country-specific technology shock to production function (acting as a supply shock) and the evolution of z_t, which is growth rate of world-wide non-stationary technology shock.

$$a_t = \rho_a a_{t-1} + \varepsilon_{a,t} \quad a_t^* = \rho_a^* a_{t-1}^* + \varepsilon_{a,t}^*$$
$$g_{H,t} = \rho_g g_{H,t-1} + \varepsilon_{g_H,t} \quad g_t^* = \rho_g^* g_{t-1}^* + \varepsilon_{g,t}^*$$
$$z_t = \rho_z z_{t-1} + \varepsilon_{z,t}$$

3. Summary of model variables, shocks and parameters

Table 1 Summary of model variables'

Variable	Loglinearized	Description
A_t	a_t	home-specific stationary technology shock
C_t	c_t	consumption relative to the level of technology
$C_{H,t}$	$c_{H,t}$	domestic consumption of domestic goods (relative to the level of technology)
$C_{H,t}^*$	$c_{H,t}^*$	foreign consumption of domestic goods (relative to the level of technology) = exports
$G_{H,t}$	$g_{H,t}$	domestic government expenditures
	g_t^*	foreign government expenditures
$MC_{H,t}$	$mc_{H,t}$	real marginal cost
$P_{H,t}$	$p_{H,t}$	domestic goods price index
$P_{F,t}$	$p_{F,t}$	foreign goods price index
P_t	p_t	price index
R_t	r_t	nominal interest rate (as growth coefficient)
S_t	s_t	real exchange rate
$Y_{H,t}$	$y_{H,t}$	domestic output
	y_t^*	foreign output
Z_t	z_t	growth coefficient of a world-wide technology shock
C_t	c_t	effective consumption relative to the level of technology
E_t	e_t	nominal exchange rate (direct quotation)
Q_t	q_t	terms of trade
Λ_t	λ_t	marginal utility of real income (adjusted for the level of technology)
Π_t	π_t	inflation
$\Psi_{F,t}$	$\psi_{F,t}$	law of one price gap

Note: Variables with direct transcript from domestic to foreign variable just with adding a star (*) are not listed.

Table 2 Summary of model shocks and innovations

Innovation	Enters as	Description
$\varepsilon_{r,t}$	directly	domestic monetary shock
$\varepsilon^*_{r,t}$	directly	foreign monetary shock
$\varepsilon_{a,t}$	AR1	domestic supply shock
$\varepsilon^*_{a,t}$	AR1	foreign supply shock
$\varepsilon_{g,t}$	AR1	domestic demand shock
$\varepsilon^*_{g,t}$	AR1	foreign demand shock
$\varepsilon_{z,t}$	AR1	world-wide technology shock

Notes: There is another misspecification innovation to the system. It is not listed here because the misspecification innovation is not a part of conceptual model. Final model for estimation therefore has 7 innovations listed here plus one more added due to model misspecification.