North American Journal of Economics and Finance 72 (2024) 102146

Contents lists available at ScienceDirect

North American Journal of Economics and Finance

journal homepage: www.elsevier.com/locate/najef

# The effect of output and the real exchange rate on equity price dynamics

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A R T I C L E  I N F O

*JEL:*
E44
G15

*Keywords:*
Equity prices
Output gap
Exchange rates
Good news case
Bad news case

A B S T R A C T

This study uses a standard equity price equation derived from arbitrage between short-term bonds and shares to explain the conditions under which the relationship between equity prices and the measures of economic activity could yield a Bad News Case or a Good News Case while controlling for the effect of the real exchange rate. We estimate the baseline model and its variants for 18 countries. The results reveal that the good news case dominates the data in advanced and emerging market economies. We find no evidence in support of the bad news case. Furthermore, the real equity price declines with a real appreciation in some countries while it rises with a real appreciation in others.

## 1. Introduction

The interaction between the equity market and the real economy has received significant attention in both partial and general equilibrium models from various angles. Since the work of Blanchard (1981), where the scholar describes the reaction of interest rates, output, and the stock market to both anticipated and unanticipated monetary and fiscal policy shocks, the literature in this category has grown significantly; however, it focuses more on measuring the effect of monetary policy shocks on equity prices. Examples of studies on the impact of monetary policy shocks on stock prices are the works of Rigobon and Sack (2004), Bernanke and Kuttner (2005), Bjørnland and Leitemo (2009), Li et al. (2010), Abouwafia and Chambers (2015), and many others. Studies such as those by Challe and Giannitsarou (2014) and Alovokpinhou et al. (2024) used a general equilibrium model to show the magnitude of the stock price response to monetary policy shocks. In most cases, scholars in this category conclude that the immediate effect of monetary policy shocks on the US stock market ranges from 2.2 to 9 % (see, for example, Challe and Giannitsarou, 2014).

Prior to the studies that focus on measuring the reaction of equity prices to monetary policy shocks, Blanchard (1981) had already argued that the total effect of output on the equity price is ambiguous. Blanchard shows that the up and down movements in output affect equity prices through their effect on profits and, therefore, dividends. The fluctuation in output also affects equity prices through its role in the "liquidity preference-money supply" (LM) curve. In other words, profits and interest rates are a positive function of output, and the effect of output on equity prices may be ambiguous. The linear approximation of the equity price in Blanchard (1981) shows that the sign of the coefficient on the output variable is ambiguous. Blanchard calls a scenario where the effect of output through the interest rate channel dominates the profit channel as the "Bad News Case" (BNC). A Good News Case (GNC) arises when the effect of output through the profit channel dominates the interest rate channel.

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https://doi.org/10.1016/j.najef.2024.102146
Received 17 June 2023; Received in revised form 2 January 2024; Accepted 20 March 2024
Available online 21 March 2024

In the GNC and BNC environments, Gavin (1989) characterizes the relationship between the real exchange rate and the stock market using an open economy version of Blanchard (1981). Gavin studied the dynamics of the aggregate variables, including the real exchange rate, with respect to both monetary policy and fiscal policy shocks. In both Blanchard (1981) and Gavin (1989), the stock market determines the aggregate demand rather than the bond market. Gavin demonstrates that if the rise in the stock price after an expansionary monetary policy significantly affects the aggregate demand, there could be a reverse overshooting (or a real exchange rate appreciation) given that the aggregate demand rises enough to quickly reverse the dynamics of the short and the long-term real interest rates. As noted by Gavin (1989), the correlation between the real exchange rate and stock prices can be positive or negative. Gavin shows that these results depend heavily on the sensitivity of profits to changes in the output.

In this paper, we focus more on the GNC and BNC by extending the equity price equation in Blanchard (1981) and introducing the role of the real exchange rate through the firm's profit function. We explain the effect of exchange rates on equity prices by borrowing from Gavin (1989) and the existing literature on the relationship between equity prices and exchange rates. Theoretically, some existing studies have noted that the effect of exchange rates on the equity price depends on the transmission mechanism. The two most important channels revealed in the existing literature are the "portfolio balance" approach and the "goods market" approach (Bahmani-Oskooee & Sohrabian,1992; Phylaktis & Ravazzolo, 2005; Pan et al., 2007; Tsai, 2012; Wong, 2017).

The goods market approach looks at how the exchange rate affects the stock market through its effect on the firm's profit. Firms may sell a portion of their output to meet foreign demand or import some of their inputs from the rest of the world. The movements in the exchange rate influence both export revenues and the cost of acquiring imported inputs, and thus, they affect the firm's discounted value of future cash flows. From the "goods market" channel perspective, the effect of the exchange rate on the firm's equity price is ambiguous depending on whether the firm is a net exporter of goods or a net importer of input materials. According to Phylaktis and Ravazzolo (2005), the portfolio balance approach also has an ambiguous effect on the equity price; therefore, whether from a "flow" or "stock" scenario, the impact of the real exchange rate on the stock price is ambiguous.

This paper provides both theoretical and empirical contributions to the existing literature. First, we extend the equity price equation in Blanchard (1981), which we compare to the equity price equation often presented in the new Keynesian literature. Second, it is rare to find studies that have used a structural equity pricing equation to empirically test the GNC and the BNC, as postulated by Blanchard (1981). Furthermore, the existing literature heavily relies on vector autoregressive (VAR) or structural vector autoregressive (SVAR) models to unpack the real exchange rate and stock market relationship. A thorough review of the literature can be found in the study by Bahmani-Oskooee and Saha (2015). We deviate from the literature that uses the VAR and the SVAR models by using a structural equity price equation to empirically investigate the prevalence of the GNC and BNC in both advanced and emerging market economies while considering the role of the real exchange rate.

Structural equity pricing equations often appear in general equilibrium models (see, for example, Nisticò, 2012; Challe and Giannitsarou, 2014; Milani, 2017; Alovokpinhou et al., 2024). More specifically, and similar to the argument made by Fuhrer and Rudebusch (2004) that "estimates of the New Keynesian output equation have been extremely rare," it is equally correct that estimates of structural equity price equations have been scarce. Moreover, the role of financial markets in the economy has become more critical following the 2008 Global Financial Crisis, and almost every undergraduate macroeconomics textbook contains chapters on the role of financial markets. For instance, Blanchard (2021: chapter 14) introduces the relationship between the stock market and economic activity. Thus, if one were to use the stock market-output model in Blanchard (1981) to illustrate the impact of shocks to the equity market on the real economy, it becomes vital to know which between the GNC and the BNC prevails in a specific country. Our study falls into the same category as those by Ince et al. (2016), Huang et al. (2021), Chang and Chang (2023), and Wang et al. (2023).

The remainder of the paper is structured as follows: In Section 2, the study exposes the concept of GNC and BNC by borrowing from Blanchard's (1981) paper. Section 3 presents an extended version of the equity price equation in Blanchard (1981) and demonstrates the conditions under which the GNC and the BNC arise. Section 4 presents empirical evidence on GNC and BNC for 18 countries. Section 5 concludes the work with some recommendations.

## 2. Blanchard's output-stock market relation

To evaluate the effects of anticipated and unanticipated monetary and fiscal policy shocks on output, the stock market, and interest rates, Blanchard (1981) extends the IS-LM model to emphasize the interaction between asset values and output. Like the assumption underlying the IS-LM model, Blanchard's model is built on the assumption that output is demand determined with a gradual adjustment in the price level. To expose the interaction between asset values and output, as presented in Blanchard (1981), we start directly from equation (6) in Blanchard's paper, where the scholar assumes arbitrage between short-term bonds and shares to obtain the following relationship between the total return from investing in shares versus the short-term real interest rate. The arbitrage relationship is as follows:

$$\frac{\dot{q}_t^*}{q_t} + \frac{\Pi_t}{q_t} = r_t^* \tag{1}$$

The first term on the left-hand side (LHS) is the expected capital gain from holding shares, and the second term on the LHS is the dividend yield, which the scholar assumes is proportional to profits. The variable $q_t$ is the real price of equity shares, $\dot{q}_t^*$ is the expected change in equity price or time derivative of equity prices, and $r_t^*$ is the expected short-term real interest rate. Blanchard further assumes that the profit function is linearly related to the real income, where the scholar specifies the profit function as follows:

$$\Pi_t = \alpha_0 + \alpha_1 y_t \tag{2}$$

Where $\alpha_1 \geq 0$ and $y_t$ is the real income. Using equation (2), equation (1) is reformulated as follows:

$$\frac{\dot{q}_t^*}{q_t} + \frac{\alpha_0 + \alpha_1 y_t}{q_t} = r_t \tag{3}$$

To illustrate the total effect of the real income on equity prices, Blanchard assumes that prices do not adjust, which implies that the expected inflation rate is equal to zero in the steady state and the nominal interest rate is approximately equal to the real interest rate. Under this assumption, Blanchard employs the "liquidity preference-money supply" (LM) relation to characterize the monetary policy rule, which is presented as follows:

$$i_t = r_t = cy_t - h(m_t - p_t) \tag{4}$$

Where $c, h > 0$, the variable $i_t$ is the nominal interest rate, $r_t$ is the real interest rate, $y_t$ is the real income, $m_t$ is the logarithm of nominal money, and $p_t$ is the logarithm of the price level. Using equation (4), the assumption of fixed prices, and assuming that $\dot{q}_t = \dot{q}_t^* = 0$ in the steady state, the steady state level of equation (3) is presented as follows:

$$q = \frac{\Pi}{r} = \frac{\alpha_0 + \alpha_1 y}{cy - h(m - p)} \tag{5}$$

Equation (5) states that the steady state level of the real stock price is the ratio between the steady state profit and the steady state interest rate. The time subscript is ignored to describe the variables as their steady-state values. According to Blanchard, the total effect of the real income depends on the relative strength of the interest rate channel or the output's effect through the denominator of equation (5) and the profit channel or the output's effect through the numerator of equation (5). The following section presents the standard equation of the equity price that we employ to investigate the prevalence of the GNC and the BNC.

## 3. Model

### 3.1. The standard equity price equation

It is not easy to think of an open economy equity price equation that fits the characteristics of our sample's selected countries. Some of these countries are commodity exporters, some are importers, some are borrowing in domestic currency, some are borrowing in foreign currency, some have negative current accounts, and some have positive current accounts. However, most of these countries are small, open economies subjected to exchange rate fluctuations. Thus, in explaining the Good News and Bad News cases, we extend Blanchard's asset price equation to control for the role of the real exchange rate. The importance of the exchange rate variable comes from the fact that some of these countries import raw materials while others export finished goods. Thus, the exchange rate affects the firm's profit through the cost of production and revenues.

The asset price equation in Blanchard (1981) offers avenues for an extension that would yield an asset price equation similar to the ones often presented in the new Keynesian literature. We start from the arbitrage relation between the total return on the equity financial asset and the real interest rate as presented in Blanchard's (1981) paper or equation (1) above. We first restate the arbitrage relation or equation (1) as follows:

$$\frac{\dot{Q}_t}{Q_t} + \frac{\Pi_t}{Q_t} = r_t \tag{6}$$

Equation (6) above is the same as equation (7) in Gavin (1989, p. 184). The left-hand side of equation (6) states that the total return on equity assets is equal to capital gain $\left(\frac{\dot{Q}_t}{Q_t}\right)$ plus dividend yield $\left(\frac{\Pi_t}{Q_t}\right)$. However, one of the assumptions made in this study is that dividends depend on profits while profits are a function of the output. The variables in equation (6) are described as follows: $Q_t$ is the real equity price, $\dot{Q}_t$ represents the expected change in the real equity price, $\Pi_t$ is profit, and $r_t$ is the real interest rate. We first rewrite equation (6) as follows:

$$\frac{E_t Q_{t+1} - Q_t}{Q_t} + \frac{\Pi_t}{Q_t} = r_t \tag{7}$$

Where we assume that the expected real equity price change is $\dot{Q}_t = E_t Q_{t+1} - Q_t$. The arbitrage relation in equation (7) above can be rewritten as follows:

$$\frac{E_t Q_{t+1}}{Q_t} + \frac{\Pi_t}{Q_t} = (1 + r_t) \tag{8}$$

The linear approximation of equation (8) is presented as follows:

$$E_t\hat{q}_{t+1} - (1+\theta)\hat{q}_t + \theta\hat{\Pi}_t = \hat{r}_t \tag{9}$$

Where $\frac{\Pi_0}{Q_0} = \theta$ is the steady state dividend yield if we assume all profits are paid in dividends. We can rewrite equation (9) as follows:

$$\hat{q}_t = -\frac{1}{1+\theta}\hat{r}_t + \frac{1}{1+\theta}E_t\hat{q}_{t+1} + \frac{\theta}{1+\theta}\hat{\Pi}_t \tag{10}$$

We assume that $\hat{r}_t = (\hat{i}_t - \hat{\pi}_t)$, where $\hat{i}_t$ is the nominal interest rate and $\hat{\pi}_t$ is inflation. By inserting the real interest rate definition into equation (10), we obtain the following asset price equation:

$$\hat{q}_t = -\frac{1}{1+\theta}(\hat{i}_t - \hat{\pi}_t) + \frac{1}{1+\theta}E_t\hat{q}_{t+1} + \frac{\theta}{1+\theta}\hat{\Pi}_t \tag{11}$$

In deriving the profit function, we assume a small open economy where firms face two types of demand: domestic and foreign demand for domestic goods. Thus, we specify the firm's cost and revenue functions by considering the potential role of the real exchange rate. The real exchange rate does affect profits through both costs and revenues. As noted in the study by Phylaktis and Ravazzolo, (2005), Pan et al. (2007), Tsai, (2012) and Wong (2017), the exchange rate affects both imports and exports; thus, a firm importing input materials is subjected to rising production costs if the exchange rate depreciates. If the firm exports its goods, it will also be subjected to fluctuations in its revenues driven by the up and down movements in the exchange rate. For the sake of simplicity, we follow Maccini et al. (2015) and use constant elasticity cost and revenue functions. The total cost and revenue functions are specified as follows:

$$TC_t = A_t Y_t^{\delta_1} S_t^{\delta_2} \tag{12}$$

$$TR_t = \varepsilon_t Y_t^{\vartheta_1} S_t^{\vartheta_2} \tag{13}$$

Equation (12) shows that the total cost of production depends on the output $Y_t$, the real exchange rate $S_t$, and a production cost shifter $A_t$. Equation (13) shows the firm's total revenue as a function of output, the real exchange rate, and a demand shifter $\varepsilon_t$. The parameters $\delta_1$ and $\delta_2$ are the sensitivities of the total cost function to changes in the output and the real exchange rate, respectively. $\vartheta_1$ and $\vartheta_2$ are the sensitivities of the total revenue function to changes in the output and the real exchange rate, respectively. We assume that a rise in $S_t$ is a real depreciation and a decline in $S_t$ is a real appreciation; however, the interpretation of the empirical findings depends on the exchange rate data we employ. We use equations (12) and (13) to specify the profit function as follows:

$$\Pi_t = \varepsilon_t Y_t^{\vartheta_1} S_t^{\vartheta_2} - A_t Y_t^{\delta_1} S_t^{\delta_2} \tag{14}$$

The linear approximation of the profit function in equation (14) is written as follows:

$$\hat{\Pi}_t = (\eta_0 - \phi_0)\hat{y}_t + (\eta_1 - \phi_1)\hat{s}_t + (\lambda_0\hat{\varepsilon}_t - \gamma_0\hat{a}_t) \tag{15}$$

The complex parameters in equation (15) are as follows:

$$\eta_0 = \vartheta_1\lambda_0 \qquad \lambda_0 = \varepsilon_0 Y_0^{\vartheta_1} S_0^{\vartheta_2}/\Pi_0 \qquad \eta_1 = \vartheta_2\lambda_0$$

$$\phi_0 = \delta_1\gamma_0 \qquad \gamma_0 = A_0 Y_0^{\delta_1} S_0^{\delta_2}/\Pi_0 \qquad \phi_1 = \delta_2\gamma_0$$

The coefficients on the output and exchange rate variables are $(\eta_0 - \phi_0)$ and $(\eta_1 - \phi_1)$, respectively. The forces of demand and supply drive the ambiguous sign of these coefficients. However, it is essential to note that the ambiguous sign of the output variable in equation (15) differs from what Blanchard (1981) terms good and bad news cases. We expand on the concept of good news and bad news cases below. To insert the profit equation (15) into the equity price equation (11), we first rewrite it as follows:

$$\hat{\Pi}_t = \lambda_y\hat{y}_t + \lambda_s\hat{s}_t + \hat{\epsilon}_t \tag{16}$$

In equation (16), $\lambda_y = (\eta_0 - \phi_0)$, $\lambda_s = (\eta_1 - \phi_1)$ and $\hat{\epsilon}_t = (\lambda_0\hat{\varepsilon}_t - \gamma_0\hat{a}_t)$. Equation (16) shows that the profit function depends on the output and real exchange rate gaps. Therefore, if $\lambda_y > 0$, shocks that create positive demands will increase profits. Of course, when the firm makes losses, forces that drive the firm's cost of production will make $\lambda_y < 0$, but Blanchard's analysis was done assuming that $\lambda_y > 0$. Similarly, if $\lambda_s > 0$, shocks that lead to a real exchange rate depreciation will increase profits, provided that the depreciation boosts the foreign demand for domestic goods. If the firm depends more on imported inputs, a depreciation of the exchange rate might render $\lambda_s < 0$. Thus, the profit equation (16) confirms the ambiguous effect of the real exchange rate on equity prices, as noted in the existing literature. In other words, the relationship between the real exchange rate and the firm's profit is consistent with the different channels of interlinkages between the real exchange rate and the equity price, especially the goods market channel described in the studies by Pan et al. (2007) and Wong (2017). We now substitute equation (16) into equation (11) to obtain the following real equity price gap equation:

$$\hat{q}_t = -\frac{1}{1+\theta}(\hat{i}_t - \hat{\pi}_t) + \frac{1}{1+\theta}E_t\hat{q}_{t+1} + \frac{\theta\lambda_y}{1+\theta}\hat{y}_t + \frac{\theta\lambda_s}{1+\theta}\hat{s}_t + \hat{\epsilon}_t \tag{17}$$

We further transform equation (17) before explaining the good news and bad news case scenarios in Blanchard (1981). In equation (17), $\frac{1}{1+\theta}$ can be interpreted as the steady state discount factor; this is because at the steady state, if we assume that $\dot{Q}_0 = 0$ then $\frac{\Pi_0}{Q_0} = r_0$ and $\theta = r_0$. With $\theta = r_0$, we know that $\frac{1}{1+\theta} = \frac{1}{1+r_0} = \overline{\beta}$. Using $\frac{1}{1+r_0} = \overline{\beta}$, we know that $1 = (1+r_0)\overline{\beta}$ and $(1-\overline{\beta}) = r_0\overline{\beta}$. We have already shown that $\theta = r_0$, which implies that $(1-\overline{\beta}) = \theta\overline{\beta}$. We use $\frac{1}{1+\theta} = \overline{\beta}$ and $(1-\overline{\beta}) = \theta\overline{\beta}$ to rewrite equation (17) as follows:

$$\widehat{q}_t = -\overline{\beta}(\widehat{i}_t - \widehat{\pi}_t) + \overline{\beta}E_t\widehat{q}_{t+1} + (1-\overline{\beta})\lambda_y\widehat{y}_t + (1-\overline{\beta})\lambda_s\widehat{s}_t + \widehat{\epsilon}_t \tag{18}$$

The equity price gap in equation (18) is standard in the sense that it is similar to the ones that are normally presented in the new Keynesian literature (see, for example, Carlstrom and Fuerst, 2007; Castelnuovo and Nistico, 2010; Funke et al., 2011; Nisticò, 2012; Challe and Giannitsarou, 2014; Milani, 2017; and Alovokpinhou et al., 2024). Blanchard (1981) uses the LM curve approach to the monetary policy rule to examine the total effect of output on equity prices. This study assumes that countries in our sample use a Taylor rule type to conduct monetary policy. There is a vast literature on the Taylor rule, where various issues regarding specification, nonlinearity, estimation techniques, and identification of the policy rule parameters are discussed. A summary of this literature and the most influential works can be found in the study by Caporale et al. (2018).

To illustrate the main objective of this study, we adopt a linear Taylor rule of a small open economy as initially presented by Taylor (2001) and discussed in Caporale et al. (2018), for the case of emerging market economies such as Indonesia, Thailand, Hungary, Philippines, and South Korea. The monetary policy rule takes the following form:

$$\widehat{i}_t = \phi_\pi\widehat{\pi}_t + \phi_y\widehat{y}_t + \phi_s\widehat{s}_t \tag{19}$$

Where $\phi_\pi$, $\phi_y$, $\phi_s$ measure the reaction of the central bank to inflation, the output gap, and the real exchange rate gap, respectively. The policy rule in equation (19) collapses to the closed economy version in Taylor (1993) when $\phi_s = 0$, except that equation (19) has no constant. The difference between the policy rule in equation (19) and the one in Taylor (2001) is the absence of the term $\widehat{s}_{t-1}$. Furthermore, the interpretation of $\widehat{s}_t$ in Taylor (2001) is that an increase in $\widehat{s}_t$ is a real appreciation, and the coefficient $\phi_s$ is expected to be less than zero or $\phi_s < 0$, which implies that an appreciation of the real exchange rate will command a monetary policy expansion while a depreciation will command a policy contraction. By substituting equation (19) into (18), the following equity price gap is obtained:

$$\widehat{q}_t = \overline{\beta}(1-\phi_\pi)\widehat{\pi}_t + \overline{\beta}E_t\widehat{q}_{t+1} + \psi_y\widehat{y}_t + \psi_s\widehat{s}_t + \widehat{\epsilon}_t \tag{20}$$

Where $\psi_y = \left[(1-\overline{\beta})\lambda_y - \overline{\beta}\phi_y\right]$ and $\psi_s = [(1-\overline{\beta})\lambda_s - \overline{\beta}\phi_s]$

The equity price gap in equation (20) includes the current inflation as an additional explanatory variable. That said, the GNC and the BNC in Blanchard (1981) are determined by the coefficient on the output gap variable, $\psi_y$. Compared to Blanchard (1981) or equation (5) above, a country falls under the *Good News Case* if $\psi_y > 0$, which implies that the profit channel dominates. In the *Bad News Case*, we expect $\psi_y < 0$, which implies that the interest rate channel dominates. Holding everything else constant, equation (20) also states that the total effect of the real exchange rate on the real equity price gap is ambiguous. In other words, the coefficient $\psi_s$ can be negative or positive. Although the model in Gavin (1989) explains the relationship between the real equity price and the real exchange rate, the ambiguous sign of this parameter also reflects the channels reveal in the study by Phylaktis and Ravazzolo, (2005), Pan et al. (2007), Tsai, (2012) and Wong (2017). The purpose is to estimate equation (20) and check whether the signs of $\psi_y$ and $\psi_s$ are

**Table 1**
Countries and sample periods.

| Countries | Code | Period without REER | Period with REER | Source |
|---|---|---|---|---|
| United States | USA | 1961 M01 to 2023 M02 | 1979 M01 to 2023 M02 | IMF & FRED |
| United Kingdom | UK | 1961 M01 to 2023 M02 | 1979 M01 to 2023 M02 | IMF & FRED |
| Australia | AUS | 2002 M01 to 2020 M12 | 2002 M01 to 2020 M12 | IMF, FRED, & BA |
| Canada | CAN | 1961 M01 to 2022 M02 | 1979 M01 to 2022 M02 | IMF, FRED, OECD |
| Japan | JAP | 1961 M01 to 2022 M03 | 1979 M01 to 2022 M03 | IMF & FRED |
| Germany | GER | 1961 M01 to 2023 M02 | 1979 M01 to 2023 M02 | IMF & FRED |
| Italy | ITA | 1961 M01 to 2023 M02 | 1979 M01 to 2023 M02 | IMF & FRED |
| Netherlands | NET | 1961 M04 to 2023 M02 | 1979 M01 to 2023 M02 | IMF & FRED |
| Sweden | SWE | 1961 M01 to 2023 M02 | 1979 M01 to 2023 M02 | IMF & FRED |
| South Africa | SA | 1963 M01 to 2023 M01 | 1979 M01 to 2023 M01 | IMF, FRED, SARB |
| Czech Republic | CZE | 1994 M01 to 2023 M02 | 1994 M01 to 2023 M02 | IMF & FRED |
| Mexico | MEX | 1980 M01 to 2021 M10 | 1980 M01 to 2021 M10 | IMF & FRED |
| Chile | CHI | 1997 M01 to 2022 M04 | 1997 M01 to 2022 M04 | IMF & FRED |
| Hungary | HUN | 1991 M01 to 2023 M02 | 1991 M01 to 2023 M02 | IMF & FRED |
| Brazil | BRA | 1996 M01 to 2021 M12 | 1996 M01 to 2021 M12 | IMF & FRED |
| South Korea | SK | 1981 M01 to 2023 M02 | 1994 M01 to 2023 M02 | IMF & FRED |
| Russia | RUS | 1997 M09 to 2021 M12 | 1997 M09 to 2021 M12 | IMF & FRED |
| Turkey | TUR | 1988 M01 to 2023 M02 | 1994 M01 to 2023 M02 | IMF & FRED |

Note: REER stands for the real effective exchange rate. The codes in the second column are used when presenting the empirical estimates.

negative or positive. A positive sign of $\psi_y$ represents a good news case, while a negative sign of $\psi_y$ represents a bad news case.

### 3.2. Data

To present evidence on good news and bad news cases as well as the effect of the real exchange rate on equity prices, we estimate equation (20) for 18 countries; that is, nine advanced economies and nine emerging market economies. The countries included in our sample and the sample period are presented in Table 1. The frequency of the data is monthly, comprising of the industrial production, the equity price, the short-term interest rate, the Real Effective Exchange Rate (REER), and the monthly Consumer Price Index (CPI). The CPI data is used to compute the inflation rate. Using the real effective exchange rate data implies that an increase in $\hat{s}_t$ is a real appreciation and a decrease in $\hat{s}_t$ is a real depreciation; this is considered when interpreting the results. The short-term nominal interest rate is measured using the Treasury bill rate for most countries except the United States. We use the Federal Funds Rate to proxy the short-term interest rate for the USA.

To generate the cyclical components of the variables, we compare two filtering approaches: the Hodrick and Prescott Filter (HP-

**Table 2**
Business cycle properties for advanced economies.

| Results based on the HP-Filter | | | | | | | |
|---|---|---|---|---|---|---|---|
| Countries | $\rho_{qy}$ | $\rho_{qs}$ | $\rho_{q\pi}$ | $\sigma_q$ | $\sigma_y$ | $\sigma_s$ | $\sigma_\pi$ |
| United States | 0.29* | −0.36* | −0.056 | 7.84 | 2.28 | 3.41 | 2.69 |
| | (0.000) | (0.000) | (0.123) | | | | |
| United Kingdom | 0.08** | 0.09** | −0.10* | 9.11 | 2.69 | 3.38 | 4.46 |
| | (0.026) | (0.032) | (0.005) | | | | |
| Australia | 0.34* | 0.51* | 0.01 | 7.44 | 3.24 | 4.36 | 5.34 |
| | (0.000) | (0.000) | (0.866) | | | | |
| Canada | 0.33* | 0.49* | 0.005 | 8.51 | 2.66 | 2.73 | 2.88 |
| | (0.000) | (0.000) | (0.876) | | | | |
| Japan | 0.33* | −0.13* | −0.06*** | 10.96 | 3.67 | 5.95 | 3.89 |
| | (0.000) | (0.003) | (0.097) | | | | |
| Germany | 0.36* | −0.09** | −0.053 | 9.86 | 2.99 | 2.05 | 1.80 |
| | (0.000) | (0.028) | (0.146) | | | | |
| Italy | 0.31* | −0.01 | −0.01 | 13.98 | 3.87 | 2.28 | 5.08 |
| | (0.000) | (0.814) | (0.743) | | | | |
| Netherlands | 0.30* | −0.18* | −0.057 | 9.05 | 2.30 | 1.85 | 2.53 |
| | (0.000) | (0.000) | (0.116) | | | | |
| Sweden | 0.20* | 0.087** | −0.07*** | 11.04 | 2.95 | 3.26 | 3.58 |
| | (0.000) | (0.043) | (0.0054) | | | | |
| **Average** | **0.282** | **0.045** | **−0.043** | **9.754** | **2.961** | **3.252** | **3.583** |

| Results based on the Full Sample Asymmetric CF-Filter | | | | | | | |
|---|---|---|---|---|---|---|---|
| Countries | $\rho_{qy}$ | $\rho_{qs}$ | $\rho_{q\pi}$ | $\sigma_q$ | $\sigma_y$ | $\sigma_s$ | $\sigma_\pi$ |
| United States | 0.43* | −0.22* | −0.06*** | 9.41 | 2.99 | 4.31 | 2.69 |
| | (0.000) | (0.000) | (0.074) | | | | |
| United Kingdom | 0.19* | 0.27* | −0.15* | 11.58 | 2.31 | 3.82 | 4.46 |
| | (0.000) | (0.000) | (0.000) | | | | |
| Australia | 0.36* | 0.19* | −0.12*** | 8.54 | 3.03 | 4.66 | 5.34 |
| | (0.000) | (0.000) | (0.066) | | | | |
| Canada | 0.48* | 0.31* | 0.02 | 9.92 | 3.65 | 2.97 | 2.88 |
| | (0.000) | (0.000) | (0.574) | | | | |
| Japan | 0.34* | 0.10** | −0.056 | 11.83 | 4.11 | 6.72 | 3.89 |
| | (0.000) | (0.021) | (0.123) | | | | |
| Germany | 0.51* | −0.19* | −0.05 | 13.38 | 3.35 | 2.37 | 1.80 |
| | (0.000) | (0.000) | (0.153) | | | | |
| Italy | 0.37* | −0.22* | 0.015 | 17.08 | 3.61 | 2.82 | 5.08 |
| | (0.000) | (0.000) | (0.669) | | | | |
| Netherlands | 0.47* | −0.28* | −0.039 | 12.18 | 2.12 | 2.20 | 2.53 |
| | (0.000) | (0.000) | (0.276) | | | | |
| Sweden | 0.24* | 0.079*** | −0.047 | 14.15 | 3.05 | 3.89 | 3.58 |
| | (0.000) | (0.068) | (0.190) | | | | |
| **Average** | **0.376** | **0.004** | **−0.054** | **12.007** | **3.135** | **3.751** | **3.583** |

***Note***: * is significance at 1 %, ** is significance at 5 %, and *** is significance at 10 %, respectively. The values in parentheses are the probabilities associated with the coefficients of correlation. $\rho_{qy}$ is the correlation between the equity price gap and the output gap, $\rho_{qs}$ is the correlation between the real equity price gap and the real exchange rate, and $\rho_{q\pi}$ is the correlation between the real equity price gap and the inflation rate. $\sigma_q$ is the standard deviation of the real equity price, $\sigma_y$ is the standard deviation of the output gap, $\sigma_s$ is the standard deviation of the real effective exchange rate, and $\sigma_\pi$ is the standard deviation of the inflation rate.

Filter) and the Full Sample Asymmetric Christiano and Fitzgerald filtering method (CF-Filter). The HP-Filter is widely used in the existing literature; however, this filtering method has been criticized for suffering from the end-point problem (Borio et al., 2017). Nonetheless, Nilsson and Gyomai (2011) argue that the Phased-Average Trend method (PAT) used by the OECD performs no better than the HP-Filter and the CF-Filter. Therefore, it is important to compare the findings based on the HP-Filter to the ones based on the CF-Filter to avoid misleading conclusions. In presenting the results, all the variables in equation (20) are de-trended except the inflation variable, which is consistent with the new Keynesian literature.

## 4. Empirical results

This section consists of five main subsections. In the first subsection, we discuss the business cycle properties of the variables, where we mainly focus on the correlation between each variable on the right side of equation (20) and the real equity price variable, as well as the standard deviation of each variable in the baseline equation (20). The business cycle properties are presented for the selected two de-trending methods. The second subsection presents the estimates for equation (20). The estimation technique used is the Generalized Method of Moments (GMM). The GMM estimation technique has been widely used in estimating the hybrid New Keynesian Phillips Curve (NKPC). Studies such as those by Galí and Gertler (1999), Galí et al. (2005), Batini et al. (2005), Lubik and Teo (2012), and Malikane (2014, 2023) have estimated the NKPC using the GMM approach.

One of the standard terms in the hybrid NKPC and the equity pricing equation (20) is the forward-looking term on the RHS of the

**Table 3**
Business cycle properties for emerging economies.

Results based on the HP-Filter

| Countries | $\rho_{qy}$ | $\rho_{qs}$ | $\rho_{q\pi}$ | $\sigma_q$ | $\sigma_y$ | $\sigma_s$ | $\sigma_\pi$ |
|---|---|---|---|---|---|---|---|
| South Africa | 0.16* | 0.28* | −0.03 | 10.88 | 3.96 | 6.47 | 4.29 |
| | (0.000) | (0.000) | (0.000) | | | | |
| Czech Republic | 0.33* | 0.26* | −0.009 | 12.74 | 3.88 | 2.60 | 3.64 |
| | (0.000) | (0.000) | (0.866) | | | | |
| Mexico | 0.19* | 0.185* | −0.01 | 17.82 | 3.16 | 7.84 | 22.26 |
| | (0.000) | (0.000) | (0.769) | | | | |
| Chile | 0.22* | 0.51* | −0.22* | 9.19 | 2.55 | 4.04 | 1.87 |
| | (0.000) | (0.000) | (0.000) | | | | |
| Hungary | 0.29* | 0.38* | −0.038 | 15.08 | 4.69 | 3.72 | 7.93 |
| | (0.000) | (0.000) | (0.447) | | | | |
| Brazil | 0.52* | 0.057 | −0.18* | 13.62 | 3.76 | 7.81 | 3.11 |
| | (0.000) | (0.308) | (0.001) | | | | |
| South Korea | 0.55* | 0.54* | −0.09** | 13.64 | 4.25 | 3.39 | 3.33 |
| | (0.000) | (0.000) | (0.040) | | | | |
| Russia | 0.67* | 0.21* | 0.27* | 20.99 | 3.02 | 14.42 | 13.12 |
| | (0.000) | (0.000) | (0.000) | | | | |
| Turkey | 0.34* | 0.39* | −0.01 | 23.56 | 4.56 | 6.38 | 22.68 |
| | (0.000) | (0.000) | (0.830) | | | | |
| **Average** | **0.302** | **0.312** | **−0.035** | **15.280** | **3.758** | **6.296** | **9.137** |

Results based on the Full Sample Asymmetric CF-Filter

| Countries | $\rho_{qy}$ | $\rho_{qs}$ | $\rho_{q\pi}$ | $\sigma_q$ | $\sigma_y$ | $\sigma_s$ | $\sigma_\pi$ |
|---|---|---|---|---|---|---|---|
| South Africa | 0.31* | 0.02 | 0.02 | 14.08 | 3.40 | 8.81 | 4.29 |
| | (0.000) | (0.574) | (0.530) | | | | |
| Czech Republic | 0.39* | −0.065 | −0.035 | 15.82 | 3.61 | 2.86 | 3.64 |
| | (0.000) | (0.224) | (0.514) | | | | |
| Mexico | 0.28* | 0.26* | −0.01 | 21.88 | 3.23 | 8.95 | 22.26 |
| | (0.000) | (0.000) | (0.698) | | | | |
| Chile | 0.34* | 0.65* | −0.26* | 11.52 | 2.06 | 5.88 | 1.87 |
| | (0.000) | (0.000) | (0.000) | | | | |
| Hungary | 0.18* | 0.21* | −0.03 | 17.81 | 4.95 | 4.25 | 7.93 |
| | (0.000) | (0.000) | (0.520) | | | | |
| Brazil | 0.69* | 0.02 | −0.29* | 14.96 | 3.12 | 8.46 | 3.11 |
| | (0.000) | (0.720) | (0.000) | | | | |
| South Korea | 0.72* | 0.65* | −0.001 | 18.39 | 4.69 | 6.08 | 3.33 |
| | (0.000) | (0.000) | (0.981) | | | | |
| Russia | 0.77* | 0.16* | −0.37* | 23.47 | 3.14 | 20.65 | 13.12 |
| | (0.000) | (0.007) | (0.000) | | | | |
| Turkey | 0.48* | 0.39* | −0.04 | 28.05 | 4.79 | 5.93 | 22.68 |
| | (0.000) | (0.000) | (0.379) | | | | |
| **Average** | **0.462** | **0.255** | **−0.113** | **18.442** | **3.665** | **7.985** | **8.76** |

***Note***: * is significance at 1 %, ** is significance at 5 %, and *** is significance at 10 %, respectively. The values in parentheses are the probabilities associated with the coefficients of correlation.

equation. Therefore, this study follows the same estimation technique for the equity price equation (20). In the third subsection, we test an alternative specification of the equity price equation by defining a Taylor rule with the interest rate smoothing. For robustness analysis, the fourth subsection presents results for two additional subsamples: the results for the period before the COVID-19 crisis and the period before the Global Financial Crisis (GFC) of 2007–2009. These robustness tests are necessary to judge the validity of the findings. Finally, we verify our findings by adopting country-specific instruments for the baseline equation (20). The fifth subsection presents the results generated using the country-specific instruments.

### 4.1. Business cycle properties

Table 2 displays the business cycle properties for advanced economies, and Table 3 shows the business cycle properties for emerging market economies, where we mainly focus on the correlations of the variables with the real equity price and the standard deviations of the variables. The results show that the output gap positively and significantly correlates with the real equity price gap in all the advanced and emerging economies. The average estimate of the coefficient of correlation between the two variables is 0.282 for advanced economies when the HP-Filter is used and 0.376 when the CF-Filter is used. The estimates for emerging markets are 0.302

**Table 4**
Estimates of equation (20) for advanced economies.

| Panel A | Results based on the HP-Filter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *With the real effective exchange rate* | | | | | | *Without the real effective exchange rate* | | | | |
| Countries | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| USA | 1.13* | 0.86* | 0.31* | 0.01 | 0.75 | 0.21 | 1.10* | 0.88* | 0.36* | 0.79 | 0.81 |
| | (0.04) | (0.05) | (0.08) | (0.06) | | (0.64) | (0.02) | (0.04) | (0.07) | | (0.36) |
| UK | 1.17* | 0.82* | 0.63 | −0.006 | 0.59 | 0.52 | 1.14* | 0.86* | 0.59** | 0.75 | 0.36 |
| | (0.06) | (0.06) | (0.41) | (0.07) | | (0.47) | (0.04) | (0.04) | (0.25) | | (0.54) |
| AUS | 1.13* | 0.84* | 0.24 | −0.12 | 0.78 | 0.09 | 1.08* | 0.88* | 0.29*** | 0.79 | 0.06 |
| | (0.08) | (0.10) | (0.17) | (0.08) | | (0.75) | (0.07) | (0.09) | (0.16) | | (0.80) |
| CAN | 1.16* | 0.88* | 0.25* | −0.21** | 0.73 | 0.04 | 1.12* | 0.89* | 0.24* | 0.74 | 0.16 |
| | (0.04) | (0.07) | (0.08) | (0.10) | | (0.84) | (0.03) | (0.05) | (0.07) | | (0.68) |
| JAP | 1.13* | 0.84* | 0.11*** | −0.07 | 0.77 | 0.01 | 1.11* | 0.86* | 0.18* | 0.80 | 0.36 |
| | (0.03) | (0.09) | (0.06) | (0.05) | | (0.90) | (0.03) | (0.04) | (0.05) | | (0.54) |
| GER | 1.11* | 0.87* | 0.21** | 0.01 | 0.79 | 0.04 | 1.09* | 0.88* | 0.27* | 0.81 | 0.12 |
| | (0.03) | (0.08) | (0.10) | (0.11) | | (0.84) | (0.02) | (0.05) | (0.07) | | (0.72) |
| ITA | 1.09* | 0.92* | 0.22* | 0.05 | 0.82 | 0.02 | 1.10* | 0.91* | 0.198* | 0.81 | 0.004 |
| | (0.02) | (0.06) | (0.06) | (0.12) | | (0.89) | (0.02) | (0.04) | (0.06) | | (0.95) |
| NET | 1.10* | 0.84* | 0.35*** | −0.17 | 0.78 | 0.79 | 1.10* | 0.87* | 0.46* | 0.79 | 0.46 |
| | (0.05) | (0.09) | (0.21) | (0.11) | | (0.37) | (0.03) | (0.04) | (0.13) | | (0.49) |
| SWE | 1.08* | 0.92* | 0.47* | −0.028 | 0.84 | 0.006 | 1.08* | 0.91* | 0.47* | 0.83 | 0.03 |
| | (0.02) | (0.06) | (0.10) | (0.09) | | (0.93) | (0.02) | (0.04) | (0.08) | | (0.86) |

| Panel B | Results based on the CF-Filter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *With the real effective exchange rate* | | | | | | *Without the real effective exchange rate* | | | | |
| Countries | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| USA | 0.99* | 1.00* | 0.23* | −0.036 | 0.98 | 0.08 | 0.99* | 0.99* | 0.26* | 0.98 | 0.34 |
| | (0.01) | (0.03) | (0.05) | (0.028) | | (0.77) | (0.01) | (0.02) | (0.03) | | (0.56) |
| UK | 1.02* | 0.95* | 0.17** | −0.00 | 0.98 | 0.90 | 1.01* | 0.98* | 0.27* | 0.98 | 0.07 |
| | (0.01) | (0.02) | (0.07) | (0.03) | | (0.34) | (0.01) | (0.02) | (0.07) | | (0.79) |
| AUS | 0.99* | 1.01* | 0.24* | 0.008 | 0.97 | 0.39 | 1.00* | 1.01* | 0.23* | 0.97 | 0.36 |
| | (0.02) | (0.04) | (0.07) | (0.03) | | (0.53) | (0.02) | (0.03) | (0.07) | | (0.55) |
| CAN | 1.02* | 0.98* | 0.17* | −0.11* | 0.97 | 0.17 | 1.01* | 0.98* | 0.16* | 0.97 | 0.35 |
| | (0.02) | (0.04) | (0.05) | (0.04) | | (0.68) | (0.01) | (0.03) | (0.05) | | (0.55) |
| JAP | 1.02* | 0.94* | 0.11* | −0.06** | 0.97 | 0.02 | 1.00* | 0.96* | 0.18* | 0.98 | 0.39 |
| | (0.01) | (0.06) | (0.03) | (0.02) | | (0.87) | (0.01) | (0.02) | (0.03) | | (0.53) |
| GER | 1.00* | 0.96* | 0.21* | 0.13 | 0.98 | 0.12 | 0.99* | 0.98* | 0.23* | 0.98 | 0.01 |
| | (0.016) | (0.06) | (0.06) | (0.08) | | (0.72) | (0.01) | (0.04) | (0.04) | | (0.92) |
| ITA | 1.01* | 0.99* | 0.12*** | −0.06 | 0.98 | 0.08 | 1.01* | 0.98* | 0.14* | 0.98 | 0.01 |
| | (0.01) | (0.05) | (0.066) | (006) | | (0.77) | (0.01) | (0.04) | (0.04) | | (0.93) |
| NET | 0.98* | 0.99* | 0.40* | −0.03 | 0.98 | 0.29 | 0.98* | 0.99* | 0.44* | 0.99 | 0.13 |
| | (0.01) | (0.04) | (0.08) | (0.07) | | (0.59) | (0.01) | (0.02) | (0.06) | | (0.79) |
| SWE | 1.01* | 0.99* | 0.35* | −0.02 | 0.98 | 0.03 | 1.01* | 0.98* | 0.31* | 0.98 | 0.05 |
| | (0.01) | (0.05) | (0.06) | (0.05) | | (0.86) | (0.01) | (0.03) | (0.05) | | (0.82) |

***Note***:* is significance at 1%, ** is significance at 5%, and *** is significance at 10%. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. ***Instruments***: we use one lag of each variable plus a constant.

and 0.462 for the HP-Filter and the CF-Filter, respectively. Although the results differ for the two filtering methods, the conclusion is that equity prices are procyclical to output.

Mixed evidence is found on the correlation between the real equity price and the real effective exchange rate; however, the average estimate is 0.045 for advanced economies when the HP-Filter is used and 0.004 when the CF-Filter is used. More precisely, the real effective exchange rate displays a negative and significant correlation coefficient with the equity price in the USA, Japan, Germany, and the Netherlands. The results differ when the CF-Filter is used; the coefficient of correlation is still negative and significant for the USA, Germany, and Netherlands, but it is positive and significant for Japan. The correlation coefficient is positive and significant for the UK, Australia, Canada, and Sweden when the HP-Filter is used. These results are consistent when the CF-Filter is used. For Italy, the correlation coefficient is negative and only significant when the CF-Filter is used.

In emerging economies, the average correlation coefficient estimate between the REER gap and the equity price gap is 0.312 when the HP-Filter is used and 0.255 when the CF-Filter is used. The coefficients of correlation are all positive and significant when the HP-Filter is used, and only the Czech Republic changes to negative but not significant when the CF-Filter is used. Although the correlation coefficient between the equity price gap and the inflation rate is negative, it is weak for most countries. The results under the CF-Filter are much more robust in emerging economies than in advanced economies. More precisely, the average estimate under the CF-Filter is

**Table 5**
Estimates of equation (20) for emerging economies.

| Panel A | Results based on the HP-Filter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *With the real effective exchange rate* | | | | | | *Without the real effective exchange rate* | | | | |
| Countries | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| SA | 1.13* | 0.88* | 0.21* | 0.007 | 0.76 | 0.55 | 1.12* | 0.88* | 0.22** | 0.78 | 0.47 |
| | (0.04) | (0.04) | (0.09) | (0.04) | | (0.45) | (0.03) | (0.04) | (0.09) | | (0.49) |
| CZE | 1.12* | 0.77* | 0.16 | 0.20 | 0.81 | 3.69 | 1.13* | 0.73* | 0.16 | 0.81 | 3.07 |
| | (0.04) | (0.08) | (0.12) | (0.15) | | (0.05) | (0.04) | (0.08) | (0.11) | | (0.08) |
| MEX | 1.14* | 0.87* | 0.50 | 0.03 | 0.75 | 0.20 | 1.14* | 0.87* | 0.53** | 0.75 | 0.17 |
| | (0.08) | (0.08) | (0.31) | (0.08) | | (0.65) | (0.08) | (0.07) | (0.24) | | (0.68) |
| CHI | 1.08* | 0.86* | 0.71** | −0.00 | 0.77 | 2.50 | 1.08* | 0.86* | 0.69** | 0.77 | 2.42 |
| | (0.05) | (0.10) | (0.29) | (0.09) | | (0.11) | (0.04) | (0.09) | (0.29) | | (0.12) |
| HUN | 1.12* | 0.87* | 0.16 | 0.12 | 0.80 | 0.34 | 1.13* | 0.86* | 0.17 | 0.79 | 0.15 |
| | (0.05) | (0.06) | (0.11) | (0.17) | | (0.55) | (0.04) | (0.06) | (0.12) | | (0.69) |
| BRA | 1.09* | 0.89* | 0.57* | −0.12*** | 0.73 | 0.51 | 1.09* | 0.89* | 0.55* | 0.73 | 0.34 |
| | (0.05) | (0.08) | (0.19) | (0.07) | | (0.47) | (0.05) | (0.08) | (0.19) | | (0.55) |
| SK | 1.06* | 1.03* | 0.50*** | 0.04 | 0.82 | 2.86 | 1.15* | 0.84* | −0.009 | 0.79 | 0.55 |
| | (0.06) | (0.18) | (0.26) | (0.14) | | (0.09) | (0.04) | (0.09) | (0.25) | | (0.46) |
| RUS | 0.98* | 0.99* | 0.96** | 0.25* | 0.85 | 2.01 | 1.11* | 0.93* | 0.63 | 0.79 | 1.82 |
| | (0.07) | (0.07) | (0.44) | (0.06) | | (0.16) | (0.09) | (0.08) | (0.59) | | (0.18) |
| TUR | 1.14* | 0.87* | 0.24 | 0.16 | 0.74 | 0.00 | 1.13* | 0.88* | 0.30*** | 0.78 | 0.013 |
| | (0.05) | (0.04) | (0.15) | (0.12) | | (0.92) | (0.03) | (0.03) | (0.16) | | (0.91) |

| Panel B | Results based on the CF-Filter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Without the real effective exchange rate* | | | | | | *Without the real effective exchange rate* | | | | |
| Countries | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| SA | 1.01* | 0.99* | 0.18* | −0.03 | 0.98 | 0.36 | 1.00* | 0.98* | 0.22* | 0.98 | 0.73 |
| | (0.01) | (0.03) | (0.06) | (0.02) | | (0.54) | (0.01) | (0.02) | (0.05) | | (0.39) |
| CZE | 1.01* | 0.88* | 0.25* | −0.07 | 0.98 | 3.40 | 1.01* | 0.88* | 0.25* | 0.98 | 3.90 |
| | (0.01) | (0.05) | (0.08) | (0.07) | | (0.06) | (0.02) | (0.05) | (0.08) | | (0.05) |
| MEX | 1.01* | 0.98* | 0.39* | −0.02 | 0.97 | 0.36 | 1.01* | 0.98* | 0.35* | 0.97 | 0.41 |
| | (0.02) | (0.03) | (0.13) | (0.05) | | (0.55) | (0.02) | (0.03) | (0.11) | | (0.52) |
| CHI | 0.99* | 0.98* | 0.58* | −0.007 | 0.98 | 0.46 | 0.98* | 0.98* | 0.57* | 0.99 | 0.52 |
| | (0.01) | (0.04) | (0.08) | (0.03) | | (0.49) | (0.01) | (0.04) | (0.07) | | (0.47) |
| HUN | 1.03* | 0.96* | 0.25* | −0.05 | 0.97 | 0.05 | 1.02* | 0.96* | 0.24* | 0.97 | 0.14 |
| | (0.02) | (0.03) | (0.07) | (0.10) | | (0.83) | (0.02) | (0.03) | (0.07) | | (0.71) |
| BRA | 0.98* | 1.02* | 0.34* | −0.12* | 0.97 | 0.02 | 0.98* | 1.04* | 0.37* | 0.97 | 0.51 |
| | (0.02) | (0.04) | (0.10) | (0.03) | | (0.89) | (0.02) | (0.05) | (0.13) | | (0.47) |
| SK | 0.95* | 1.04* | 0.69* | −0.22* | 0.98 | 0.76 | 0.99* | 0.98* | 0.22* | 0.98 | 0.29 |
| | (0.02) | (0.09) | (0.15) | (0.07) | | (0.38) | (0.02) | (0.05) | (0.08) | | (0.59) |
| RUS | 0.95* | 1.05* | 0.67* | 0.12* | 0.98 | 0.07 | 0.95* | 1.02* | 0.74* | 0.97 | 2.66 |
| | (0.02) | (0.02) | (0.18) | (0.01) | | (0.78) | (0.03) | (0.05) | (0.19) | | (0.10) |
| TUR | 1.02* | 0.97* | 0.19* | −0.03 | 0.97 | 0.06 | 1.02* | 0.97* | 0.15 | 0.97 | 0.16 |
| | (0.03) | (0.03) | (0.09) | (0.079) | | (0.79) | (0.02) | (0.02) | (0.10) | | (0.68) |

***Note***:* is significance at 1 %, ** is significance at 5 %, and *** is significance at 10 %. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square, and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. ***Instruments***: we use one lag of each variable plus a constant.

−0.113 for emerging economies and −0.054 for advanced economies. In terms of volatility, the results show that the macroeconomic variables are more volatile in emerging economies than in advanced economies. These findings are consistent with the literature on the business cycle properties of emerging market economies (see, for example, Neumeyer and Perri, 2005; Aguiar and Gopinath, 2007; Horvath, 2018; Rothert, 2020).

In summary, although the results based on the CF-Filter differ from those of the HP-Filter, we find consistency. We find that equity prices are procyclical to output, and the real effective exchange rate is, on average, more positively correlated with the equity price in emerging economies than in advanced economies. The coefficients of correlation based on the HP-filter for Australia and Chile are 0.51 for both countries and 0.19 and 0.65, respectively, for the results based on the CF-filter. The coefficient of correlation for South Africa is 0.28 for the HP-filter-based results and 0.02 for the CF-filter. According to the UNCTAD (2023) report on the state of commodity dependence, Australia, Chile, and South Africa are classified as dependent on the exports of minerals, ores, and metals.

Brazil is classified as dependent on the exports of agricultural products, while Russia is classified as dependent on the exports of mineral fuels, lubricants, and related materials. The coefficients of correlation, although significant for Russia, are weak for Brazil. For other non-commodity exporting countries, the coefficients of correlation are pretty average. The correlation between the equity price gap and the inflation rate is negative but weak, and the average estimate in emerging markets is higher than the estimate for advanced economies when the CF-Filter is used. The following section presents the estimates of equation (20) and the robustness results.

### 4.2. Empirical findings

The estimates based on the baseline model are presented in Tables 4 and 5. The results presented are the results for the model with and without the real effective exchange rate. The tables' top panel (Panel A) presents the results based on the HP-Filter, while the bottom panel (Panel B) presents the results based on the CF-Filter. Starting from advanced economies, seven of the nine advanced economies display a significant effect of the output gap on the equity price gap in the model with the real effective exchange rate when the HP-Filter is used. In the model without the REER variable, we find that the output gap variable is highly significant for all the advanced economies. Only Canada shows a significant effect of the real effective exchange rate on the real equity price, where a real appreciation leads to a decline in the real equity price. However, it is important to point out that the results are based on the same set of instruments for all countries, and these might change when country-specific instruments are used. We present additional results using country-specific instruments in the robustness section.

The estimates of $\phi_\pi$ fluctuate around 0.86 in the model with the real exchange rate and 0.88 without the real exchange rate variable when the HP-Filter is used. For the results based on the CF-Filter, these estimates fluctuate around 0.98 for both the models with and without the real exchange rate. Furthermore, we note that the estimates of $\phi_\pi$ are significant in both models and for all countries, regardless of the filtering method. The main difference between the results based on the HP-Filter and the CF-Filter is i) the coefficient on the output gap is positive and significant in all the advanced economies when the CF-Filter is used; this holds true in the model with and without the real effective exchange rate; ii) the real effective exchange rate is significant for both Canada and Japan when the CF-Filter is used; and iii) the discount factors are overestimated when the HP-Filter is used but almost precisely estimated when the CF-Filter is used. For instance, in the model with the REER, the discount factor ($\bar{\beta}$) estimated for the USA based on the HP-Filter is 1.13 but 0.99 when the CF-Filter is used. Estimates of ($\bar{\beta}$) in the model with the REER are 1.17 and 1.02 for the UK, 1.13 and 0.99 for Australia, and 1.10 and 0.98 for the Netherlands, to list a few. Furthermore, the model without the REER also overestimates the discount factor when the HP-Filter is used. However, the discount factors estimated based on the CF-Filter are consistent with what is expected.

In the case of emerging economies, and considering the model with the REER, we find that the coefficient on the output gap is positive and strongly significant for South Africa, Chile, Brazil, and Russia but weakly significant for South Korea when the HP-Filer is used. In the model without the REER, only South Africa, Mexico, Chile, and Brazil show a strong and significant positive effect of the output gap on the real equity price gap when the HP-Filter is used. The results show that the REER only plays a significant role in Brazil and Russia. More specifically, a real appreciation is associated with a decline in Brazil's real equity price gap but a positive reaction in Russia. For the results based on the CF-Filter, we find that the model with the REER generates a positive and significant effect of the output gap on the equity price gap for all emerging economies. This finding holds for the model without the REER variable except for Turkey.

The estimates of $\phi_\pi$ are significant for all emerging economies. The values of $\phi_\pi$ fluctuate around 0.89 in the model with the real exchange rate but 0.86 without the real exchange rate variable when the HP-Filter is used. These estimates fluctuate around 0.98 for the results based on the CF-Filter. The main difference between the results based on the HP-Filter and the CF-Filter is that the discount factor estimates are higher than those based on the CF-Filter. The results also show that only three countries (Brazil, South Korea, and Russia) exhibit a significant effect of the real effective exchange rate on equity prices when the CF-Filter is used.

In summary, the results for both advanced and emerging economies indicate that the good news case dominates the data. More specifically, for the results based on the HP-Filter, the output gap exhibits a positive and significant effect on the real equity price gap in many of the countries. For the results based on the CF-Filter, the output gap exhibits a positive and significant effect in all the advanced and emerging economies when the real effective exchange rate is present and 94.44 % of the countries when the real effective exchange rate is absent. We found no evidence in support of the bad news case. Our findings regarding the effect of the output gap on the real equity price gap are consistent with the findings of Cooper and Priestley (2009), Atanasov (2018), and Dladla and Malikane (2019).

We also find that the real effective exchange rate plays a significant role in three countries (Canada, Brazil, and Russia) when the HP-Filter is used and in five countries (Canada, Japan, Brazil, South Korea, and Russia) when the CF-Filter is used. Among these five countries, we note that a real appreciation leads to a decline in the real equity price in Canada, Japan, Brazil, and South Korea but a

**Table 6**
Estimates of equation (22) for advanced economies (HP-Filter).

| Countries | *With the real effective exchange rate* | | | | | | | *Without the real effective exchange rate* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\delta_i$ | $\bar{\beta}$ | $\eta_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\delta_i$ | $\beta$ | $\eta_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| USA | 0.08 | 1.13* | 0.77* | 0.30* | 0.026 | 0.75 | 0.08 | 0.07 | 1.11* | 0.79* | 0.36* | 0.79 | 0.28 |
| | (0.06) | (0.04) | (0.09) | (0.08) | (0.06) | | (0.77) | (0.05) | (0.02) | (0.06) | (0.07) | | (0.59) |
| UK | 0.068 | 1.17* | 0.75* | 0.66 | −0.003 | 0.58 | 0.11 | 0.015 | 1.14* | 0.85* | 0.63** | 0.75 | 0.28 |
| | (0.05) | (0.06) | (0.08) | (0.43) | (0.075) | | (0.73) | (0.05) | (0.049) | (0.06) | (0.27) | | (0.59) |
| AUS | 0.02 | 1.14* | 0.82* | 0.22 | −0.13 | 0.78 | 0.10 | 0.01 | 1.09* | 0.86* | 0.27 | 0.79 | 0.09 |
| | (0.08) | (0.08) | (0.12) | (0.19) | (0.08) | | (0.74) | (0.08) | (0.07) | (0.11) | (0.17) | | (0.76) |
| CAN | −0.03 | 1.16* | 0.94* | 0.25* | −0.22** | 0.73 | 0.08 | −0.01 | 1.12* | 0.90* | 0.25* | 0.74 | 0.25 |
| | (0.07) | (0.05) | (0.14) | (0.08) | (0.10) | | (0.77) | (0.05) | (0.03) | (0.08) | (0.07) | | (0.61) |
| JAP | 0.03 | 1.12* | 0.81* | 0.11*** | −0.07 | 0.77 | 0.001 | 0.067 | 1.11* | 0.82* | 0.18* | 0.80 | 0.057 |
| | (0.15) | (0.03) | (0.21) | (0.06) | (0.04) | | (0.97) | (0.08) | (0.028) | (0.07) | (0.05) | | (0.81) |
| GER | −0.01 | 1.11* | 0.89* | 0.22*** | 0.008 | 0.79 | 0.05 | −0.03 | 1.09* | 0.93* | 0.27* | 0.81 | 0.25 |
| | (0.08) | (0.04) | (0.15) | (0.10) | (0.11) | | (0.81) | (0.07) | (0.026) | (0.12) | (0.07) | | (0.61) |
| ITA | −0.06 | 1.09* | 1.00* | 0.23* | 0.038 | 0.83 | 0.004 | −0.04 | 1.09* | 0.98* | 0.22* | 0.83 | 0.01 |
| | (0.09) | (0.02) | (0.14) | (0.06) | (0.12) | | (0.94) | (0.08) | (0.02) | (0.14) | (0.06) | | (0.90) |
| NET | −0.006 | 1.11* | 0.84* | 0.34 | −0.16 | 0.78 | 1.66 | 0.004 | 1.11* | 0.80* | 0.37 | 0.78 | 2.32 |
| | (0.06) | (0.05) | (0.11) | (0.21) | (0.12) | | (0.20) | (0.06) | (0.05) | (0.10) | (0.22) | | (0.12) |
| SWE | 0.02 | 1.07* | 0.89* | 0.47* | −0.002 | 0.84 | 0.005 | 0.02 | 1.07* | 0.89* | 0.47* | 0.85 | 0.005 |
| | (0.07) | (0.02) | (0.12) | (0.10) | (0.10) | | (0.94) | (0.07) | (0.02) | (0.11) | (0.10) | | (0.94) |

***Note***:* is significance at 1%, ** is significance at 5%, and *** is significance at 10%. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. ***Instruments***: we use one lag of each variable plus a constant.

**Table 7**
Estimates of equation (22) for advanced economies (CF-Filter).

| Countries | *With the real effective exchange rate* | | | | | | | *Without the real effective exchange rate* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\delta_i$ | $\bar{\beta}$ | $\eta_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\delta_i$ | $\bar{\beta}$ | $\eta_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| USA | 0.04 | 0.99* | 0.95* | 0.23* | −0.03 | 0.98 | 0.02 | 0.038 | 0.99* | 0.95* | 0.26* | 0.98 | 0.11 |
| | (0.04) | (0.016) | (0.06) | (0.05) | (0.03) | | (0.88) | (0.04) | (0.01) | (0.05) | (0.03) | | (0.74) |
| UK | 0.029 | 1.02* | 0.91* | 0.17** | 0.003 | 0.98 | 0.46 | −0.03 | 1.01* | 1.01* | 0.27* | 0.98 | 0.73 |
| | (0.03) | (0.01) | (0.04) | (0.07) | (0.03) | | (0.49) | (0.038) | (0.01) | (0.05) | (0.07) | | (0.39) |
| AUS | −0.04 | 0.99* | 1.03* | 0.25* | 0.001 | 0.97 | 0.23 | −0.04 | 0.99* | 1.03* | 0.25* | 0.97 | 0.23 |
| | (0.05) | (0.02) | (0.04) | (0.07) | (0.03) | | (0.63) | (0.06) | (0.02) | (0.07) | (0.07) | | (0.63) |
| CAN | −0.04 | 1.02* | 1.05* | 0.17* | −0.12* | 0.97 | 0.34 | −0.029 | 1.01* | 1.01* | 0.16* | 0.97 | 0.80 |
| | (0.06) | (0.02) | (0.08) | (0.05) | (0.04) | | (0.56) | (0.04) | (0.04) | (0.05) | (0.05) | | (0.36) |
| JAP | 0.079 | 1.02* | 0.84* | 0.11* | −0.05** | 0.97 | 0.02 | 0.06 | 1.009* | 0.91* | 0.19* | 0.98 | 0.01 |
| | (0.10) | (0.01) | (0.14) | (0.038) | (0.02) | | (0.87) | (0.05) | (0.01) | (0.04) | (0.03) | | (0.91) |
| GER | −0.02 | 1.00* | 0.99* | 0.21* | 0.13 | 0.98 | 0.20 | −0.04 | 0.99* | 1.04* | 0.23* | 0.98 | 0.09 |
| | (0.07) | (0.01) | (0.14) | (0.058) | (0.089) | | (0.65) | (0.06) | (0.01) | (0.11) | (0.04) | | (0.75) |
| ITA | −0.08 | 1.01* | 1.11* | 0.14** | −0.06 | 0.98 | 0.01 | −0.07 | 1.01* | 1.08* | 0.14** | 0.98 | 0.06 |
| | (0.08) | (0.01) | (0.12) | (0.06) | (0.07) | | (0.93) | (0.07) | (0.01) | (0.11) | (0.06) | | (0.80) |
| NETH | −0.02 | 0.99* | 1.01* | 0.39* | −0.005 | 0.98 | 0.96 | −0.02 | 0.99* | 1.01* | 0.40* | 0.98 | 0.90 |
| | (0.05) | (0.01) | (0.08) | (0.09) | (0.08) | | (0.33) | (0.05) | (0.01) | (0.07) | (0.09) | | (0.34) |
| SWE | 0.01 | 1.00* | 0.96* | 0.36* | −0.005 | 0.98 | 0.02 | 0.01 | 1.00* | 0.96* | 0.35* | 0.98 | 0.02 |
| | (0.06) | (0.01) | (0.10) | (0.06) | (0.06) | | (0.88) | (0.05) | (0.01) | (0.09) | (0.06) | | (0.87) |

***Note***:* is significance at 1%, ** is significance at 5%, and *** is significance at 10%. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square, and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. ***Instruments***: We use one lag of each variable plus a constant.

**Table 8**
Estimates of equation (22) for emerging economies (HP-Filter).

| Countries | *With the real effective exchange rate* | | | | | | | *Without the real effective exchange rate* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\delta_i$ | $\beta$ | $\eta_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\delta_i$ | $\beta$ | $\eta_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| SA | −0.04 | 1.12* | 0.94* | 0.23* | −0.01 | 0.78 | 1.76 | −0.027 | 1.11* | 0.92* | 0.24* | 0.79 | 0.83 |
| | (0.05) | (0.02) | (0.08) | (0.08) | (0.05) | | (0.18) | (0.05) | (0.02) | (0.06) | (0.09) | | (0.36) |
| CZE | 0.13 | 1.11* | 0.62* | 0.15 | 0.23 | 0.81 | 3.25 | 0.13 | 1.14* | 0.64* | 0.14 | 0.80 | 2.65 |
| | (0.12) | (0.04) | (0.12) | (0.12) | (0.16) | | (0.07) | (0.11) | (0.04) | (0.13) | (0.11) | | (0.10) |
| MEX | 0.047 | 1.17* | 0.78* | 0.57 | 0.018 | 0.73 | 0.005 | 0.047 | 1.17* | 0.79* | 0.60** | 0.73 | 0.01 |
| | (0.05) | (0.09) | (0.11) | (0.36) | (0.11) | | (0.94) | (0.05) | (0.09) | (0.09) | (0.29) | | (0.92) |
| CHI | 0.028 | 1.12* | 0.78* | 0.39 | −0.02 | 0.78 | 4.87 | 0.02 | 1.12* | 0.80* | 0.36 | 0.78 | 4.89 |
| | (0.13) | (0.06) | (0.23) | (0.33) | (0.10) | | (0.03) | (0.13) | (0.05) | (0.21) | (0.33) | | (0.03) |
| HUN | −0.07 | 1.12* | 0.95* | 0.18 | 0.09 | 0.80 | 0.55 | −0.08 | 1.12* | 0.96* | 0.19 | 0.79 | 0.38 |
| | (0.13) | (0.05) | (0.16) | (0.11) | (0.17) | | (0.45) | (0.13) | (0.04) | (0.16) | (0.12) | | (0.54) |
| BRA | −0.007 | 1.09* | 0.92* | 0.57** | −0.11 | 0.73 | 0.47 | −0.01 | 1.09* | 0.94* | 0.56* | 0.73 | 0.45 |
| | (0.05) | (0.05) | (0.14) | (0.19) | (0.07) | | (0.49) | (0.06) | (0.05) | (0.15) | (0.19) | | (0.50) |
| SK | 0.42 | 1.07* | 0.39 | 0.45 | 0.18 | 0.80 | 3.05 | −0.06 | 1.14* | 0.96* | 0.08 | 0.79 | 1.51 |
| | (0.28) | (0.06) | (0.38) | (0.28) | (0.19) | | (0.08) | (0.11) | (0.04) | (0.14) | (0.15) | | (0.21) |
| RUS | 0.08 | 1.01* | 0.93* | 0.83*** | 0.23* | 0.85 | 2.07 | −0.25** | 1.03* | 1.11* | 1.17** | 0.80 | 0.19 |
| | (0.11) | (0.07) | (0.11) | (0.48) | (0.08) | | (0.15) | (0.11) | (0.07) | (0.11) | (0.48) | | (0.66) |
| TUR | 0.01 | 1.14* | 0.85* | 0.24 | 0.17 | 0.74 | 0.001 | −0.003 | 1.13* | 0.88* | 0.29*** | 0.83 | 0.01 |
| | (0.04) | (0.05) | (0.06) | (0.15) | (0.11) | | (0.97) | (0.04) | (0.06) | (0.07) | (0.17) | | (0.89) |

***Note***:* is significance at 1%, ** is significance at 5%, and *** is significance at 10%. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. ***Instruments***: we use one lag of each variable plus a constant.

**Table 9**
Estimates of equation (22) for emerging economies (CF-Filter).

| | *With the real effective exchange rate* | | | | | | | *Without the real effective exchange rate* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Countries | $\delta_i$ | $\bar{\beta}$ | $\eta_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\delta_i$ | $\bar{\beta}$ | $\eta_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| SA | −0.02 | 1.01* | 1.02* | 0.19* | −0.04*** | 0.97 | 1.34 | 0.005 | 1.01* | 0.98* | 0.22* | 0.98 | 0.64 |
| | (0.05) | (0.02) | (0.06) | (0.06) | (0.021) | | (0.24) | (0.036) | (0.01) | (0.04) | (0.05) | | (0.42) |
| CZE | 0.15*** | 1.01* | 0.74* | 0.23* | −0.02 | 0.98 | 2.93 | 0.16** | 1.01* | 0.73* | 0.23* | 0.98 | 3.02 |
| | (0.079) | (0.02) | (0.10) | (0.07) | (0.079) | | (0.09) | (0.07) | (0.02) | (0.10) | (0.07) | | (0.08) |
| MEX | 0.01 | 1.02* | 0.96* | 0.39* | −0.02 | 0.97 | 0.18 | 0.013 | 1.02* | 0.96* | 0.35* | 0.97 | 0.22 |
| | (0.038) | (0.02) | (0.05) | (0.14) | (0.05) | | (0.67) | (0.038) | (0.02) | (0.06) | (0.12) | | (0.64) |
| CHI | 0.019 | 0.99* | 0.93* | 0.48* | −0.001 | 0.98 | 1.55 | 0.02 | 0.99* | 0.93* | 0.48* | 0.98 | 1.34 |
| | (0.08) | (0.02) | (0.09) | (0.07) | (0.037) | | (0.21) | (0.08) | (0.01) | (0.08) | (0.067) | | (0.24) |
| HUN | −0.11 | 1.02* | 1.08* | 0.26* | −0.07 | 0.97 | 0.13 | −0.08 | 1.02* | 1.05* | 0.25* | 0.97 | 0.33 |
| | (0.09) | (0.02) | (0.11) | (0.07) | (0.10) | | (0.71) | (0.08) | (0.02) | (0.10) | (0.078) | | (0.57) |
| BRA | −0.00 | 0.99* | 1.02* | 0.34* | −0.12* | 0.97 | 0.06 | −0.016 | 0.98* | 1.07* | 0.38* | 0.97 | 0.49 |
| | (0.04) | (0.02) | (0.10) | (0.11) | (0.03) | | (0.80) | (0.046) | (0.03) | (0.10) | (0.13) | | (0.48) |
| SK | −0.18*** | 0.94* | 1.37* | 0.76* | −0.26* | 0.98 | 0.19 | −0.06 | 0.99* | 1.07* | 0.21** | 0.98 | 1.53 |
| | (0.10) | (0.02) | (0.19) | (0.14) | (0.07) | | (0.66) | (0.06) | (0.02) | (0.09) | (0.08) | | (0.22) |
| RUS | −0.10 | 0.95* | 1.11* | 0.79* | 0.086* | 0.98 | 0.07 | −0.22* | 0.97* | 1.18* | 0.75* | 0.98 | 0.86 |
| | (0.03) | (0.02) | (0.03) | (0.16) | (0.02) | | (0.78) | (0.04) | (0.03) | (0.03) | (0.19) | | (0.35) |
| TUR | −0.04* | 1.01* | 1.02* | 0.25* | −0.04 | 0.97 | 0.14 | −0.05* | 1.02* | 1.04* | 0.19* | 0.97 | 0.35 |
| | (0.01) | (0.02) | (0.03) | (0.08) | (0.07) | | (0.70) | (0.01) | (0.02) | (0.04) | (0.10) | | (0.55) |

***Note***:* is significance at 1%, ** is significance at 5%, and *** is significance at 10%. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. ***Instruments***: we use one lag of each variable plus a constant.

positive reaction in Russia. The results in terms of the effect of the real exchange rate on equity prices are consistent with the findings of Moore and Wang (2014), Wong (2017), and Sikhosana and Aye (2018).

### 4.3. An alternative specification

In deriving equation (20), we employed a Taylor rule without the interest rate smoothing. This section assumes that the central bank smooths the interest rate, which allows us to test whether the interest rate significantly affects the equity price gap. The Taylor rule equation can be specified as follows:

$$\widehat{i}_t = \phi_i \widehat{i}_{t-1} + \eta_\pi \widehat{\pi}_t + \eta_y \widehat{y}_t + \eta_s \widehat{s}_t \tag{21}$$

In equation (21), $\phi_i$ is the interest smoothing parameter where $\eta_\pi = (1-\phi_i)\phi_\pi$, $\eta_y = (1-\phi_i)\phi_y$, and $\eta_s = (1-\phi_i)\phi_s$. Using equation (21), we may reformulate equation (18) as follows:

**Table 10**
Results before the Covid-19 (CF-Filter).

| Panel A | Advanced economies | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *With the real effective exchange rate* | | | | | | *Without the real effective exchange rate* | | | | |
| Countries | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| USA | 0.99* | 1.01* | 0.21* | −0.04 | 0.98 | 0.00 | 0.98* | 1.00* | 0.25* | 0.98 | 0.13 |
| | (0.01) | (0.03) | (0.05) | (0.03) | | (0.97) | (0.01) | (0.02) | (0.03) | | (0.71) |
| UK | 1.01* | 0.95* | 0.27* | 0.005 | 0.98 | 0.74 | 1.01* | 0.98* | 0.34* | 0.98 | 0.03 |
| | (0.01) | (0.02) | (0.06) | (0.028) | | (0.39) | (0.01) | (0.03) | (0.07) | | (0.84) |
| AUS | 0.99* | 1.02* | 0.26* | 0.01 | 0.98 | 0.17 | 0.99* | 1.01* | 0.25* | 0.98 | 0.14 |
| | (0.02) | (0.04) | (0.07) | (0.03) | | (0.67) | (0.02) | (0.04) | (0.07) | | (0.70) |
| CAN | 1.02* | 0.99* | 0.17* | −0.11* | 0.97 | 0.22 | 1.01* | 0.98* | 0.16* | 0.97 | 0.34 |
| | (0.02) | (0.05) | (0.06) | (0.04) | | (0.64) | (0.05) | (0.04) | (0.05) | | (0.56) |
| JAP | 1.02* | 0.95* | 0.11* | −0.06** | 0.97 | 0.00 | 1.01* | 0.96* | 0.18* | 0.98 | 0.37 |
| | (0.01) | (0.06) | (0.03) | (0.02) | | (0.98) | (0.01) | (0.02) | (0.03) | | (0.54) |
| GER | 1.00* | 1.01* | 0.23* | 0.18** | 0.98 | 0.03 | 0.99* | 1.01* | 0.25* | 0.98 | (0.02 |
| | (0.01) | (0.06) | (0.06) | (0.09) | | (0.86) | (0.01) | (0.04) | (0.04) | | (0.88) |
| ITA | 1.01* | 0.99* | 0.18* | −0.03 | 0.98 | 0.06 | 1.01* | 0.99* | 0.17* | 0.98 | 0.01 |
| | (0.01) | (0.05) | (0.07) | (0.07) | | (0.80) | (0.01) | (0.04) | (0.05) | | (0.91) |
| NET | 0.98* | 0.97* | 0.39* | −0.025 | 0.98 | 0.63 | 0.98* | 0.99* | 0.44* | 0.98 | 0.20 |
| | (0.01) | (0.04) | (0.09) | (0.08) | | (0.43) | (0.01) | (0.02) | (0.07) | | (0.65) |
| SWE | 1.00* | 1.00* | 0.36* | −0.01 | 0.98 | 0.04 | 1.01* | 0.98* | 0.31* | 0.98 | 0.02 |
| | (0.01) | (0.05) | (0.06) | (0.06) | | (0.83) | (0.01) | (0.03) | (0.05) | | (0.87) |
| **Panel B** | **Emerging market economies** | | | | | | | | | | |
| | *With the real effective exchange rate* | | | | | | *Without the real effective exchange rate* | | | | |
| Countries | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| SA | 1.01* | 0.99* | 0.20* | −0.03 | 0.97 | 0.44 | 1.00* | 0.98* | 0.24* | 0.98 | 0.82 |
| | (0.02) | (0.03) | (0.07) | (0.02) | | (0.50) | (0.01) | (0.03) | (0.06) | | (0.36) |
| CZE | 1.01* | 0.92* | 0.35* | −0.06 | 0.98 | 3.20 | 1.01* | 0.92* | 0.35* | 0.98 | 3.31 |
| | (0.02) | (0.07) | (0.07) | (0.06) | | (0.07) | (0.02) | (0.07) | (0.07) | | (0.07) |
| MEX | 1.01* | 0.98* | 0.47* | −0.04 | 0.97 | 0.41 | 1.01* | 0.98* | 0.39* | 0.97 | 0.49 |
| | (0.02) | (0.03) | (0.14) | (0.05) | | (0.52) | (0.02) | (0.03) | (0.12) | | (0.48) |
| CHI | 0.98* | 0.99* | 0.57* | 0.001 | 0.98 | 0.16 | 0.98* | 0.99* | 0.57* | 0.98 | 0.13 |
| | (0.01) | (0.05) | (0.08) | (0.03) | | (0.68) | (0.01) | (0.04) | (0.07) | | (0.71) |
| HUN | 1.02* | 0.96* | 0.28* | −0.056 | 0.97 | 0.12 | 1.02* | 0.96* | 0.27* | 0.97 | 0.21 |
| | (0.02) | (0.04) | (0.07) | (0.12) | | (0.72) | (0.02) | (0.04) | (0.08) | | (0.64) |
| BRA | 0.98* | 1.03* | 0.36* | −0.12* | 0.98 | 0.27 | 0.97* | 1.06* | 0.44* | 0.97 | 0.70 |
| | (0.02) | (0.05) | (0.12) | (0.03) | | (0.60) | (0.03) | (0.04) | (0.13) | | (0.40) |
| SK | 0.94* | 1.02* | 0.76* | −0.24* | 0.98 | 0.55 | 0.99* | 0.99* | 0.19** | 0.98 | 0.06 |
| | (0.02) | (0.09) | (0.18) | (0.08) | | (0.46) | (0.02) | (0.05) | (0.08) | | (0.81) |
| RUS | 0.94* | 1.06* | 0.72* | 0.12* | 0.99 | 0.012 | 0.94* | 1.06* | 0.83* | 0.97 | 2.96 |
| | (0.03) | (0.04) | (0.22) | (0.02) | | (0.91) | (0.03) | (0.05) | (0.21) | | (0.09) |
| TUR | 1.01* | 0.98* | 0.32* | −0.089 | 0.97 | 0.24 | 1.02* | 0.97* | 0.19* | 0.97 | 0.39 |
| | (0.03) | (0.03) | (0.10) | (0.07) | | (0.62) | (0.02) | (0.02) | (0.12) | | (0.53) |

***Note***:* is significance at 1%, ** is significance at 5%, and *** is significance at 10%. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. ***Instruments***: we use one lag of each variable plus a constant.

$$\widehat{q}_t = -\delta_i \widehat{i}_{t-1} + \bar{\beta}(1-\eta_\pi)\widehat{\pi}_t + \bar{\beta}E_t\widehat{q}_{t+1} + \psi_y\widehat{y}_t + \psi_s\widehat{s}_t + \widehat{\xi}_t \tag{22}$$

where $\delta_i = \bar{\beta}\phi_i$, $\psi_y = (1-\bar{\beta})\lambda_y - (1-\phi_i)\bar{\beta}\eta_y$ and $\psi_s = (1-\bar{\beta})\lambda_s - (1-\phi_i)\bar{\beta}\eta_s$. The purpose is to estimate equation (22) for the selected advanced and emerging economies to see whether the interest rate significantly impacts the real equity price gap.

The results for the advanced economies are presented in Tables 6 and 7, and those of the emerging economies are presented in Tables 8 and 9. In the case of advanced economies, and considering the results based on the HP-Filter, we find that the model with the real effective exchange rate exhibits a positive and strongly significant effect of the output gap on the real equity price gap in the USA, Canada, Italy, and Sweden. The effect is weakly significant for Japan and Germany. Canada is still the only advanced economy with a significant effect of the real effective exchange rate on equity prices.

In the model without the real effective exchange rate, the output gap exhibits a positive and significant effect for all advanced economies except Australia and the Netherlands. Regarding the effect of the interest rate variable, and considering the results based on the HP-Filer, we find that the coefficient on the interest rate variable has the wrong sign in some of the countries and is not significant in any of the countries. This finding holds for the model with and without the real effective exchange rate. The estimates of $\eta_\pi$ are consistent with the estimates in the models without the interest rate variable, and the estimated discount factors are similar to the ones in the model without the interest rate variable or the results presented in the previous section.

For the results based on the CF-Filter, we note consistency with the results presented in the previous section. That is, the coefficient on the output gap variable is positive and significant for all countries in both the model with and without the real exchange rate variable. The estimates of $\eta_\pi$ and the discount factors are consistent with the results in the previous section. Furthermore, only Canada and Japan display a significant effect of the real exchange rate on the equity price gap. Consistent with the results based on the HP-Filter, we find no significant effect of the interest rate on the equity price gap.

In the case of emerging economies (results are presented in Tables 8 and 9), the results are not different from the ones presented using the model without the interest rate variable. When the results are generated using the HP-Filter, only a few countries have a positive and significant effect of the output gap on the real equity price gap. However, the results based on the CF-Filter show that the coefficient on the output gap is positive and highly significant for all the emerging economies in both the model with and without the real effective exchange rate. Regarding the role of the real exchange rate, it significantly explains equity price fluctuations in Russia when the HP-Filter is used and in Brazil, South Korea, and Russia when the CF-Filter is used. The negative effect of the real exchange rate shown in the case of South Africa is significant but weak.

The estimates of $\eta_\pi$ and the discount factors are consistent with the baseline model results. Consistent with the results for advanced economies, the coefficient on the interest rate variable is only significant for the Czech Republic; it is not significant for other countries and has the wrong sign in some countries. In summary, the results for both the advanced and emerging economies are not different from those documented using the model without the interest rate variable. The most important remark is that we do not find a significant effect of the interest rate on equity prices except for the Czech Republic.

### 4.4. Robustness analysis

We present results for two additional sub-samples to validate the findings presented for the baseline model. However, we only report the results for the baseline model in equation (20). Furthermore, since the discount factor is almost precisely estimated when the CF-Filter is used, we have decided only to report the results based on the CF-Filter. The results based on the HP-Filer can be obtained from the authors upon a reasonable request. The following subsections discuss the results of the sub-samples considered.

#### 4.4.1. Results for the period before the COVID-19 crisis

We re-estimate equation (20) before the COVID-19 crisis. The end of the sample period for each country is, therefore, set to 2019 M12. The results are presented in Table 10, where the top panel (Panel A) of the table presents the results for the advanced economies, and the bottom panel (Panel B) the results for emerging market economies. The results show a positive and significant effect of the output gap on the real equity price gap in all the countries for both the models with and without the real effective exchange rate. Similar to the results based on the full sample, we find that Canada, Japan, and Germany display a significant effect of the real effective exchange rate on the real equity price gap, where a real appreciation leads to a decline in the equity price gap in Canada and Japan but a positive reaction in Germany. Furthermore, we find that the estimates of $\phi_\pi$ and discount factors for the period before COVID-19 are consistent with the full sample estimates.

The results for the emerging market economies are similar to the ones documented for the advanced economies. For the emerging countries, we find that the output gap has a positive and significant effect on the real equity price gap for all the emerging economies and in both the models with and without the real effective exchange rate. Similar to the full sample results, the real effective exchange rate affects the real equity price in only three countries: Brazil, South Korea, and Russia. In summary, the results of the sample before COVID-19 are consistent with those obtained using the full sample.

#### 4.4.2. Results for the period before the global financial crisis of 2007–2009

We also test whether the results are consistent if we consider the sample period before the 2007–2009 global financial crisis. The end of the sample period for each country is, therefore, set to 2006 M12. Most countries possess enough observations for this analysis except Australia since the data for Australia starts in 2002. Therefore, the results presented exclude Australia. The results are presented in Table 11, where the top panel of the Table (Panel A) presents the results for advanced economies, and the bottom panel (Panel B) presents the results for the emerging economies.

In the case of advanced economies, five of the eight countries display a positive and significant effect of the output gap on the real equity price gap when the model with the real exchange rate is considered. The coefficient on the output gap is positive and significant for all advanced countries when the model without the real exchange rate is considered. We still note a significant effect of the real effective exchange rate in Canada, Japan, and Germany, where a real appreciation leads to a decline in the real equity price gap in Canada and Japan but a positive reaction in Germany. The estimates of $\phi_\pi$ are consistent with the full sample estimates. Furthermore, the estimated discount factors are consistent with the full sample estimates. In the case of emerging economies, seven out of the nine countries still display a positive and significant effect of the output gap on the equity price gap in the model with the real exchange rate. Eight of these countries show the same effect in the model without the real exchange rate. The emerging countries that exhibit a significant effect of the real exchange rate on the equity price gap are still Brazil, South Korea, and Russia. The estimated values of $\phi_\pi$ and the discount factors are consistent with the full sample estimates. Thus, we may conclude that our findings are consistent across different sub-samples.

### 4.5. *Estimates based on country-specific instruments*

As noted in the study by Rumler and Valderrama (2010), estimating forward-looking single equations using the GMM method requires carefully selecting instruments. The existing literature has relied on internal as well as external instruments in estimating the new Keynesian Phillips Curve (NKPC) (see, for example, Galí et al., 2005; Rumler and Valderrama, 2010) or estimating the forward-looking Taylor rule (see for instance, Carvalho et al., 2021). Furthermore, the literature notes that valid instruments must at least

**Table 11**
Results for the period before the 2007–2009 financial crisis (CF-Filter).

| Panel A | Advanced Economies | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *With the real effective exchange rate* | | | | | | *Without the real effective exchange rate* | | | | |
| Countries | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| USA | 1.01* | 1.00* | 0.23* | −0.04 | 0.98 | 0.08 | 0.99* | 0.99* | 0.26* | 0.98 | 0.11 |
| | (0.01) | (0.03) | (0.07) | (0.03) | | (0.77) | (0.01) | (0 l02) | (0.03) | | (0.74) |
| UK | 1.01* | 0.96* | 0.22* | −0.01 | 0.98 | 0.71 | 1.01 | 0.98* | 0.33* | 0.98 | 0.03 |
| | (0.02) | (0.03) | (0.06) | (0.04) | | (0.39) | (0.01) | (0.03) | (0.08) | | (0.86) |
| AUS | – | – | – | – | – | – | – | – | – | – | – |
| CAN | 1.02* | 0.98* | 0.12 | −0.14* | 0.97 | 0.06 | 1.02* | 0.98* | 0.13** | 0.97 | 0.29 |
| | (0.02) | (0.05) | (0.07) | (0.04) | | (0.79) | (0.01) | (0.03) | (0.05) | | (0.58) |
| JAP | 1.05* | 0.95* | 0.08 | −0.09** | 0.97 | 0.003 | 1.01* | 0.96* | 0.22* | 0.98 | (0.61 |
| | (0.01) | (0.06) | (0.06) | (0.04) | | (0.95) | (0.01) | (0.03) | (0.04) | | (0.43) |
| GER | 1.01* | 1.00* | 0.24** | 0.202** | 0.98 | 0.00 | 0.99* | 1.00* | 0.29* | 0.98 | 0.00 |
| | (0.02) | (0.06) | (0.09) | (0.10) | | (0.99) | (0.01) | (0.03) | (0.05) | | (0.98) |
| ITA | 1.01* | 0.99* | 0.11 | −0.05 | 0.98 | 0.04 | 1.01* | 0.98* | 0.14** | 0.98 | 0.04 |
| | (0.01) | (0.05) | (0.16) | (0.08) | | (0.84) | (0.01) | (0.04) | (0.06) | | (0.85) |
| NET | 0.99* | 0.97* | 0.31* | 0.01 | 0.98 | 0.72 | 0.98* | 0.99* | 0.39* | 0.98 | 0.27 |
| | (0.01) | (0.05) | (0.08) | (0.08) | | (0.39) | (0.01) | (0.02) | (0.06) | | (0.60) |
| SWE | 1.01* | 1.02* | 0.53* | 0.046 | 0.98 | 0.05 | 1.01* | 0.98* | 0.36* | 0.98 | 0.05 |
| | (0.02) | (0.05) | (0.10) | (0.08) | | (0.81) | (0.01) | (0.03) | (0.07) | | (0.81) |
| Panel B | Emerging economies | | | | | | | | | | |
| | *With the real effective exchange rate* | | | | | | *Without the real effective exchange rate* | | | | |
| Countries | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| SA | 1.01* | 0.99* | 0.24** | −0.005 | 0.97 | 1.05 | 1.01* | 0.98* | 0.28* | 0.98 | 0.32 |
| | (0.02) | (0.03) | (0.10) | (0.02) | | (0.30) | (0.01) | (0.02) | (0.07) | | (0.57) |
| CZE | 1.05* | 0.89* | 0.72* | 0.078 | 0.98 | 0.33 | 1.04* | 0.89* | 0.64* | 0.98 | 0.37 |
| | (0.02) | (0.07) | (0.18) | (0.10) | | (0.56) | (0.02) | (0.07) | (0.13) | | (0.54) |
| MEX | 1.01* | 0.98* | 0.59* | −0.08 | 0.97 | 0.70 | 1.01* | 0.99* | 0.42* | 0.97 | 0.85 |
| | (0.02) | (0.03) | (0.17) | (0.06) | | (0.39) | (0.02) | (0.03) | (0.14) | | (0.36) |
| CHI | 0.97* | 1.07* | 0.65* | 0.04 | 0.97 | 0.12 | 0.98* | 1.05* | 0.66* | 0.97 | 0.11 |
| | (0.03) | (0.08) | (0.16) | (0.05) | | (0.72) | (0.02) | (0.07) | (0.17) | | (0.73) |
| HUN | 1.05* | 0.93* | 0.24** | −0.13 | 0.97 | 0.23 | 1.05* | 0.93* | 0.22*** | 0.97 | 0.80 |
| | (0.02) | (0.04) | (0.09) | (0.12) | | (0.62) | (0.02) | (0.04) | (0.12) | | (0.37) |
| BRA | 0.98* | 1.04* | 1.01* | −0.24* | 0.99 | 2.20 | 0.96* | 1.14* | 0.77* | 0.98 | 3.55 |
| | (0.02) | (0.04) | (0.16) | (0.04) | | (0.14) | (0.03) | (0.04) | (0.26) | | (0.06) |
| SK | 0.97* | 1.00* | 0.82* | −0.24** | 0.98 | 1.41 | 0.99* | 0.99* | 0.18*** | 0.98 | 0.05 |
| | (0.02) | (0.10) | (0.20) | (0.10) | | (0.23) | (0.02) | (0.05) | (0.098) | | (0.81) |
| RUS | 0.99* | 0.99* | 0.28 | 0.15* | 0.99 | 0.004 | 0.99* | 1.08* | 0.69*** | 0.96 | 5.50 |
| | (0.03) | (0.04) | (0.43) | (0.01) | | (0.95) | (0.04) | (0.06) | (0.40) | | (0.02) |
| TUR | 1.02* | 0.96* | 0.31 | −0.15 | 0.97 | 1.62 | 1.04* | 0.95* | −0.01 | 0.97 | 1.91 |
| | (0.03) | (0.03) | (0.24) | (0.13) | | (0.20) | (0.03) | (0.02) | (0.18) | | (0.17) |

**Table 12**
Estimates of equation (20) based on country-specific instruments for advanced economies (CF-Filter).

| Advanced Economies | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instruments | *With the real effective exchange rate* | | | | | | Instruments | *Without the real effective exchange rate* | | | | |
| Countries | $(q), (\pi), (y), (s)$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $(q), (\pi), (y)$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| USA | (1), (1–6), (1–4), (-) | 0.95* | 1.07* | 0.24* | −0.47** | 0.94 | 6.07 | (1), (1–6), (1) | 0.99* | 0.99* | 0.26* | 0.98 | 1.71 |
| | | (0.02) | (0.07) | (0.08) | (0.20) | | (0.64) | | (0.01) | (0.02) | (0.03) | | (0.94) |
| UK | (1), (1–6), (1), (1–6) | 1.01* | 0.96* | 0.17* | 0.01 | 0.98 | 7.53 | (1), (1–6), (1) | 1.01* | 0.98* | 0.30* | 0.98 | 1.74 |
| | | (0.01) | (0.02) | (0.07) | (0.03) | | (0.75) | | (0.01) | (0.02) | (0.07) | | (0.94) |
| AUS | (1), (1–6), (1–4), (1) | 1.00* | 1.03* | 0.25* | 0.06* | 0.97 | 13.55 | (1), (1–6), (1–4) | 1.00* | 1.00* | 0.23* | 0.98 | 14.37 |
| | | (0.02) | (0.03) | (0.05) | (0.05) | | (0.14) | | (0.02) | (0.03) | (0.05) | | (0.11) |
| CAN | (1), (1–6), (1), (1) | 1.02* | 1.00* | 0.18* | −0.12* | 0.97 | 2.32 | (1), (1–6), (1) | 1.01* | 0.99* | 0.16* | 0.97 | 1.66 |
| | | (0.02) | (0.04) | (0.05) | (0.04) | | (0.89) | | (0.01) | (0.03) | (0.05) | | (0.95) |
| JAP | (1), (1–6), (1), (1–2) | 1.02* | 0.95* | 0.12* | −0.05** | 0.97 | 1.59 | (1), (1–6), (1) | 1.00* | 0.95* | 0.19* | 0.98 | 1.73 |
| | | (0.01) | (0.05) | (0.04) | (0.023) | | (0.98) | | (0.01) | (0.02) | (0.03) | | (0.94) |
| GER | (1), (1–6), (1), (1–2) | 1.00* | 0.94* | 0.20* | 0.19** | 0.98 | 2.29 | (1), (1–6), (1) | 0.99* | 0.99* | 0.22* | 0.98 | 0.49 |
| | | (0.01) | (0.06) | (0.05) | (0.08) | | (0.94) | | (0.01) | (0.04) | (0.04) | | (0.99) |
| ITA | (1), (1–6), (1), (1) | 1.02* | 0.96* | 0.14** | −0.05 | 0.98 | 1.75 | (1), (1–6), (1) | 1.01* | 0.97* | 0.15* | 0.98 | 1.02 |
| | | (0.01) | (0.04) | (0.06) | (0.06) | | (0.94) | | (0.01) | (0.04) | (0.05) | | (0.98) |
| NET | (1), (1–6), (1), (1) | 0.98* | 0.99* | 0.41* | −0.07 | 0.98 | 1.98 | (1), (1–6), (1) | 0.98* | 1.00* | 0.45* | 0.98 | 4.44 |
| | | (0.01) | (0.04) | (0.08) | (0.06) | | (0.92) | | (0.01) | (0.02) | (0.06) | | (0.62) |
| SWE | (1), (1–6), (1–6) | 1.02* | 0.94* | 0.21* | 0.33** | 0.97 | 8.93 | (1), (1–6), (1) | 1.01* | 0.98* | 0.30* | 0.98 | 1.98 |
| | | (0.02) | (0.04) | (0.07) | (0.14) | | (0.54) | | (0.01) | (0.03) | (0.05) | | (0.92) |

***Note***:* is significance at 1%, ** is significance at 5%, and *** is significance at 10%. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square, and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. A constant is added to the instruments for each country.

**Table 13**
Estimates of equation (20) based on country-specific instruments for emerging economies (CF-Filter).

| Emerging economies | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instruments | *With the real effective exchange rate* | | | | | | Instruments | *Without the real effective exchange rate* | | | | |
| Countries | $(q), (\pi), (y), (s)$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\psi_s$ | $\bar{R}^2$ | $J$ | $(q), (\pi), (y)$ | $\bar{\beta}$ | $\phi_\pi$ | $\psi_y$ | $\bar{R}^2$ | $J$ |
| SA | (1), (1–6), (1), (1–4) | 0.98* | 1.01* | 0.25* | −0.04** | 0.98 | 12.19 | (1), (1–6), (1) | 1.01* | 0.98* | 0.21* | 0.98 | 1.53 |
| | | (0.02) | (0.02) | (0.06) | (0.02) | | (0.20) | | (0.01) | (0.02) | (0.06) | | (0.96) |
| CZE | (1), (1–4), (1–6), (1–2) | 1.03* | 0.90* | 0.23* | −0.11** | 0.97 | 12.73 | 1), (1–4),(1–6) | 1.03* | 0.90* | 0.26* | 0.97 | 11.71 |
| | | (0.02) | (0.05) | (0.08) | (0.053) | | (0.24) | | (0.02) | (0.05) | (0.08) | | (0.23) |
| MEX | (1), (1–4), (1–6), (1) | 1.00* | 0.99* | 0.36* | −0.01 | 0.97 | 2.85 | (1), (1–6), (1) | 1.00* | 1.00* | 0.35* | 0.97 | 2.72 |
| | | (0.02) | (0.03) | (0.12) | (0.048) | | (0.83) | | (0.02) | (0.03) | (0.11) | | (0.84) |
| CHI | (1–4), (1–6), (1–3), (1–3) | 0.93* | 0.99* | 0.55* | 0.09* | 0.98 | 19.70 | (1), (1–2), (1–2) | 0.98* | 0.97* | 0.56* | 0.98 | 4.86 |
| | | (0.01) | (0.03) | (0.069) | (0.03) | | (0.10) | | (0.01) | (0.04) | (0.07) | | (0.18) |
| HUN | (1), (1–6), (1), (1) | 1.02* | 0.95* | 0.26* | −0.03 | 0.97 | 1.79 | (1), (1–6), (1) | 1.02* | 0.96* | 0.24* | 0.97 | 1.41 |
| | | (0.02) | (0.03) | (0.07) | (0.10) | | (0.94) | | (0.02) | (0.03) | (0.07) | | (0.96) |
| BRA | (1), (1–6), (1), (1–2) | 0.99* | 1.02* | 0.36* | −0.11* | 0.97 | 2.72 | (1), (1–6), (1) | 0.98* | 1.03* | 0.40* | 0.97 | 0.93 |
| | | (0.02) | (0.05) | (0.10) | (0.03) | | (0.91) | | (0.02) | (0.05) | (0.12) | | (0.99) |
| SK | (1), (1–6), (1), (1–6) | 0.96* | 1.04* | 0.47* | −0.11** | 0.98 | 9.71 | (1), (1–6), (1) | 0.99* | 0.97* | 0.16** | 0.98 | 3.68 |
| | | (0.01) | (0.08) | (0.09) | (0.047) | | (0.56) | | (0.02) | (0.05) | (0.078) | | (0.72) |
| RUS | (1), (1–6), (1), (1) | 0.91* | 1.10* | 0.73* | 0.12* | 0.99 | 5.75 | (1), (1–6), (1) | 0.94* | 1.03* | 0.75* | 0.97 | 2.60 |
| | | (0.02) | (0.03) | (0.17) | (0.02) | | (0.45) | | (0.02) | (0.036) | (0.18) | | (0.86) |
| TUR | (-), (1–6), (1–4), (1) | 0.77* | 1.27* | 0.56* | 0.29** | 0.97 | 2.38 | (-), (1–6), (1–4) | 0.77* | 1.30* | 0.84* | 0.94 | 4.60 |
| | | (0.06) | (0.10) | (0.08) | (0.13) | | (0.89) | | (0.09) | (0.16) | (0.31) | | (0.59) |

***Note***:* is significance at 1%, ** is significance at 5%, and *** is significance at 10%. Standard errors are reported in parentheses underneath the coefficients. $\bar{R}^2$ is the adjusted R-square, and $J$ is the $J$-statistic. The probabilities of the $J$-statistics are reported in parentheses underneath the $J$-statistic. A constant is added to the instruments for each country.

satisfy two important conditions: the order condition (or the instruments must not be correlated with the GMM residuals) and the relevance condition (Nason and Smith, 2008). Satisfying these two conditions is important since weak instruments can make it hard to identify the structural parameters. Although our choice of instruments satisfies the necessary condition for identification, we re-estimate equation (20) by considering country-specific instruments. To save space, we only present the results based on the CF-filter. The results for advanced economies are presented in Table 12, and those for emerging economies are presented in Table 13.

The instruments used are presented in the result tables. We note that the discount factor and parameter $\phi_\pi$ estimates are still consistent with the estimates presented using the same instruments for all countries. The coefficients estimated for the output gap are still positive, significant, and similar in size to those estimated using the same instruments for all countries. The main difference between the results in Tables 12 and 13 and the previous findings is the estimated coefficients for the real exchange rate variable. The real exchange rate is now significant in 13 of the 18 countries. More specifically, a real appreciation leads to a decline in the equity price in the US, Canada, Japan, South Africa, the Czech Republic, Brazil, and South Korea. In contrast, it increases the real equity price in Australia, Germany, Sweden, Chile, Russia, and Turkey. However, it is essential to point out that, even with country-specific instruments, countries that showed a significant effect of the real exchange rate on equity prices for the estimates based on the same instruments still keep the same sign and size when we used country-specific instruments.

## 5. Conclusion

This study uses a standard equity price equation to empirically test the prevalence of the good news case (GNC) and bad news case (BNC) scenarios explained in Blanchard (1981) in a closed economy and extended by Gavin (1989) to consider the dynamics of the real exchange rate, and the relationship between the stock market and the exchange rate in a small, open economy. We accomplish the objectives of this paper by extending the stock price equation in Blanchard (1981) to incorporate the role of the real exchange rate. The good news case arises when the effect of the output gap on equity prices is positive, and the bad news case arises when the effect of the output gap on equity prices is negative. The results show that the good news case dominates in advanced and emerging market economies. The evidence of a good news case is much stronger when the CF-Filter is used, and the discount factors are more accurately estimated when we use the CF-Filter to detrend the variables. We find no evidence in support of the bad news case.

In terms of the effect of the real exchange rate on the equity price, and considering the results based on the HP-Filter, only Canada, Brazil, and Russia exhibit a significant real exchange rate effect on the real equity price when we use the same instruments for all countries. The results based on the CF-Filter and across the different specifications and sub-sample analyses show that Canada, Japan, Germany, Brazil, South Korea, and Russia display a significant effect of the real exchange rate on the equity price. We note that a real appreciation leads to a decline in the equity price gap in Canada, Japan, Brazil, and South Korea but a positive reaction in Germany and Russia. However, with country-specific instruments, we find that, for the results based on the CF-Filter, 13 out of the 18 countries display a significant effect of the real exchange rate on equity prices. More precisely, a real exchange rate appreciation leads to a decline in the real equity price gap in the US, Canada, Japan, South Africa, the Czech Republic, Brazil, and South Korea. In contrast, it increases the real equity price in Australia, Germany, Sweden, Chile, Russia, and Turkey.

We extend our analysis to consider the potential effect of the interest rate on the real equity price. The results show that the short-term interest rate variable has no significant effect on the real equity price, and the coefficient is wrongly signed in many of the countries in our sample. We are aware that our study is based on a partial equity model. Therefore, we recommend that future studies explain the GNC and BNC scenarios using general equilibrium models. Furthermore, countries differ in what drives their respective financial markets. For example, some countries are commodity exporters, some are importers, some are borrowing in domestic currency, some are borrowing in foreign currency, some have negative current accounts, and some have positive current accounts. Thus, we recommend that future studies extend our findings by considering the role of macroeconomic variables such as commodity prices.

### CRediT authorship contribution statement

**Sedjro Aaron Alovokpinhou:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Writing – original draft, Writing – review & editing. **Christopher Malikane:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Data will be made available on request.

### Acknowledgements

We thank the editor and reviewers for providing detailed comments on the initial version of the manuscript. We also thank **Ms. Teresa Sibongisani Tshuma** for her excellent research assistance.

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