Can the Philippines attain 6.5-8 Percent Growth During 2023-28? An Assessment Based on the Estimation of the Balance-of-Payments-Constrained Growth Rate

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ABSTRACT

We expand the standard balance-of-payments–constrained (BOPC) growth rate model in three directions. First, we take into account the separate contributions of exports in goods, exports in services, overseas remittances, and foreign direct investment (FDI) inflows. Second, we use state-space estimation techniques to obtain time-varying parameters of the relevant coefficients. Third, we test for the endogeneity of output in the import equation. We apply this framework to assess the feasibility of the target set by the new Philippine administration of President Marcos (elected in 2022) to attain an annual GDP growth rate of 6.5–8 percent during 2024–28. We obtain an estimate of the growth rate consistent with equilibrium in the basic balance of the Philippines of about 6.5 percent in 2021 (and declining during the years prior to it). This BOPC growth rate is below the 6.5–8 percent target. We also find that exchange-rate depreciations will not lead to an improvement in the BOPC growth rate. The Philippines must lift the constraints that impede a higher growth of exports. In particular, it must shift its export structure toward more sophisticated products with a higher income elasticity of demand.

JEL CLASSIFICATIONS: E24, E32, O14, O47, O53

KEYWORDS: Balance-of-Payments–constrained growth rate, Philippines, Kalman filter

I. INTRODUCTION

This paper advances the literature on the estimation of the balance-of-payments–constrained (BOPC) growth rate. This is the rate consistent with dynamic equilibrium in the balance of payments. This concept was put forward originally by Thirlwall (1979). We build on the advances introduced by Felipe and Lanzafame (2020), in particular the estimation of time-varying parameters using the Kalman filter.

The concept of BOPC growth rate is relevant for a developing country because, before achieving its potential growth rate, actual growth performance can be curtailed by macro constraints. For emerging economies, the external constraint associated with the current account balance is particularly significant given the developing countries' dependencies on the availability of foreign exchange to finance their imports. Current account deficits can be sustainable and, indeed, necessary in the short-run—especially when they allow for faster capital accumulation. But countries cannot finance ever-growing current account deficits in the long run as there is a limit beyond which the deficit becomes unsustainable (or is perceived as such by financial markets) and a balance-of-payments crisis ensues. Thus, countries that find themselves in balance-of-payments problems may be forced to constrain growth while the economy still has surplus capacity and surplus labor—that is, while the actual growth rate is still below the potential growth rate.

To formally consider the implications of this argument, we start from the contention that, in the long run, developing countries cannot grow faster than the rate consistent with the current account balance. This rate is the so-called balance-of-payments–constrained (BOPC) growth rate (Thirlwall 1979) and has given rise to a large theoretical and empirical literature (e.g., McCombie and Tharnpanich 2013; Guarini and Porcile 2016; Lanzafame 2014; Mayer 2017; Felipe and Lanzafame 2020).

The paper advances the literature on the estimation of the BOPC growth rate in three directions. First, we disaggregate the components of the current account and specifically consider exports of goods, exports of services, and workers' remittances. Modeling workers' remittances is a significant innovation of the paper. We also introduce foreign direct investment (capital account) as a factor affecting the BOPC growth rate. Second, building on Felipe and Lanzafame (2020), we use state-space modeling techniques to estimate a time-varying BOPC growth rate. Third, we test for endogeneity of GDP in the import equation using the Kim and Nelson (2006) framework.

The framework is applied to estimate the Philippine BOPC growth rate. Two facts make this a very interesting case study. The first is the country's dependence on workers' remittances, a variable not considered in most empirical exercises. Most analyses of the BOPC growth rate only consider exports (and imports) of goods and services, and not remittances. The other is that the recently appointed Administration of President Marcos (elected in May 2022) has targeted a growth rate of 6.5–8 percent for 2024–28. Is this growth rate consistent with the country's BOPC growth rate?

The remainder of the paper is structured as follows. Section 2 summarizes the balance-of-payments equilibrium growth rate, including the extended version with remittances and foreign direct investment (FDI). Section 3 explains the estimation of this model with time-varying coefficients. Section 4 applies it to the Philippines. Section 5 concludes.

2. THE BALANCE-OF-PAYMENTS–CONSTRAINED (BOPC) GROWTH RATE

Thirlwall (1979) proposed a model of BOPC growth based on the idea that persistent current account deficits are not endlessly sustainable, so that output growth must be consistent with a balanced current account in the long-run. As such, the BOPC growth rate approach encapsulates the Keynesian view of growth as being demand-driven, as a country's performance in external markets may ultimately constrain the growth of the economy to a rate below that which domestic supply-side conditions would warrant.

We start by writing the complete balance of payments (BOP) in domestic currency as follows:

$$P_x(X+S)+R+C+FDI+F= \; P_m M^{\$}E \qquad (1)$$

where X is the constant-price value of exports of goods in domestic currency; S is the constant-price value of exports of services in domestic currency; P_x the price of exports (of goods/services) in domestic currency; R is the nominal value of remittances from overseas workers in domestic currency; C is the nominal value of the remaining net-current account (domestic currency); FDI is the nominal value of foreign direct-investment inflows (domestic currency); F is the nominal value of the remaining net-financial flows, including the net change in foreign exchange reserves (domestic currency); $M^{\$}$ is the constant-price value of total imports of goods and services in US dollars; E is the nominal exchange rate (domestic currency per USD), and P_m is the price of imports domestic currency. Therefore, $P_m M^{\$}E$ is the value of total imports in domestic currency.

We focus first on the equilibrium in a section of the current account, specifically on exports of goods and services and imports, and momentarily disregard the rest of the balance of payments (i.e., R, C, FDI, and F) as is done in most exercises that estimate the BOPC growth rate. That is, we focus on $P_x(X+S)= \; P_m M^{\$}E$, on the assumption that this is the part of the BOP that effectively captures the relevant constraint on growth.

In a growing economy, the long-run constraint imposed by BOP equilibrium requires that exports and imports grow at the same rate, that is, $p_{xt}+\theta_{Xt}x_t+\theta_{St}s_t=p_{mt}+m_t^{\$}+e_t$, where lower-case letters denote the growth rates of the relevant variables, and $\theta_{Xt}=(P_{xt}X_t/P_{mt}M_t^{\$}E_t)$ and $\theta_{St}=(P_{xt}S_t/P_{mt}M_t^{\$}E_t)$ are the shares of exports of goods and exports of services in total payments, respectively, such that $\theta_{Xt}+\theta_{St}=1$.

The model assumes the following specifications for the export and import demand functions:

$$X_t=REER^{\eta}Z_t^{\varepsilon} \qquad (2)$$

$$S_t=REER^{\gamma}Z_t^{\lambda} \qquad (3)$$

$$M_t^{\$} = (\frac{1}{REER})^{\delta} Y_t^{\pi} \tag{4}$$

where the subscript t indicates time, Y and Z are, respectively, domestic income and world (trading partners) income (in real terms), and $REER = \frac{P_{xt}}{P_{mt}}$ is the real effective exchange rate measured in domestic currency. $\eta < 0$, $\gamma < 0$, and $\delta < 0$ are the price elasticities (assumed to be negative), while $\varepsilon > 0$, $\lambda > 0$, are the income elasticities of demand for exports and $\pi > 0$ is the income elasticity of demand for imports (assumed to be positive).

Expressing equations (2)–(4) in growth rates and substituting them into the equilibrium condition in growth rates yields:

$$p_{xt} + \eta\theta_{Xt} reer_t + \varepsilon\theta_{Xt} z_t + \gamma\theta_{St}\gamma reer_t + \lambda\theta_{St} z_t = -\delta reer_t + \pi y_t + p_{mt} + e_t \tag{5}$$

If the real effective exchange rate does not change over the long run, i.e., $reer_t = 0$, or if the price elasticities add up to zero, i.e., $(1 + \theta_{Xt}\eta + \theta_{St}\gamma + \delta) = 0$, equation (5) can be rearranged to give:

$$y_{Bt} = (\frac{\varepsilon}{\pi}\theta_{Xt} + \frac{\lambda}{\pi}\theta_{St}) z_t \tag{6}$$

Equation (6) is known as "Thirlwall's Law." It gives what we refer to as the "basic" BOPC growth rate. The simple rule in equation (6), the product of the ratio if the income elasticities of demand for exports and imports of goods and services (appropriately weighted) times the growth rate of world income, represents an upper limit to long-run growth, which becomes binding and, thus, constrains actual growth when a country's y_B is lower than its potential growth rate. As such, the approach is labeled demand-oriented because when y_B is below potential growth, an increase in the growth of exports will increase the growth of output. This is not to say that the supply side is unimportant, since the emphasis on increasing the growth rate of exports inevitably involves supply-side measures. What is argued is that the direction of causation in equation (6) runs from the righthand side to the lefthand side, i.e., from the income elasticities to the growth rate of output, via the BOPC on demand. These income elasticities are largely determined by the non-price characteristics of exports and imports, such as quality, variety, reliability, speed of delivery, or distribution network. All else constant, the better these characteristics, the higher the country's exports for a given growth rate of the world economy (i.e., the higher are ε, λ) and the lower the import content for each component of aggregate demand (i.e., the lower is π). Naturally, what matters from a developmental point of view are the ratios of these elasticities. This implies that if the country imports goods with a high π, this should help produce and export goods and services with higher ε and λ.

In the long run, actual growth that is faster than the BOPC growth rate results in a persistently worsening current-account balance, which puts constant pressure on the exchange rate and the financial system. Evidence shows that flexible exchange rates can support short-run adjustment, but, in the long run, the adjustment process occurs through slower growth to rebalance the current account. Given this, the long-term constraint associated with the BOPC growth rate is not affected by the price elasticities but, rather, depends on the income elasticities for exports and imports. Thus, the BOPC growth rate will be higher the faster exports grow as a result of the growth of the world economy (i.e., the higher the income elasticity of exports) and the slower imports grow as a result of domestic growth (i.e., the lower the income elasticity of imports). Using these insights, an estimate of the BOPC growth rate can be constructed as the product of (trend) world economy growth times the ratio of the exports to imports income elasticities (equation [6]). The latter two can be obtained from the estimation of standard export and import functions.

The thrust of the argument is that economies typically expand at a slower pace than that warranted by their potential growth rate, so that there is excess capacity, supply constraints are not binding, and, thus, their growth rate is determined by the growth of demand. In this framework, therefore, growth rates across countries must differ *because* the growth of demand differs among them. In the case of several East Asian countries in the past, and of China more recently, performance was boosted by the development of their export capabilities (in particular manufactures) to and beyond the threshold associated with the cost of full-employment imports (i.e., the value of imports that would occur if resources were fully utilized). In other words, the growth of exports relaxed the BOPC imposed by the import requirements of rapid growth. For example, up until the 2008–9 global financial crisis, this process led China to run significant current account surpluses—a typical indication of a high BOPC growth rate. This was also the case for countries such as Japan, Germany, Switzerland, and the oil-producing economies of the Middle East in the more distant past.

2.1 The Extended BOPC Growth Rate Model

Next, we extend the basic model in equation (6) by considering remittances and foreign direct investment (see equation [1]). We add the inflow of remittances (R) into the analysis because this is relevant for some economies. We posit the following equation in growth rates:[1]

$$r_t = \omega e_t + \xi(y_t - z_t) + \rho(i_t - i_t^*) \qquad (7)$$

This specification hypothesizes that (the growth of) remittances (r_t) is a function of the growth rate of the nominal exchange rate vis-à-vis the US dollar (e), the GDP growth rate differential between that of the country in question and that of the world ($y_t - z_t$), and the interest rate differential between the country's relevant policy rate and the US Fed funds rate ($i_t - i_t^*$). ω, ξ, and ρ are the corresponding elasticities. We disregard the rest of the current account (denoted C in equation [1]) as it fluctuates significantly, and it is difficult to argue that it is a factor affecting a country's long-run growth.

Second, we consider the role of FDI inflows (capital account). Capital flows allow both short-term deviations of growth from y_{Bt} in equation (6), and also affect the latter—if they influence a country's export performance and/or its income elasticity of imports. This is particularly the case of FDI, whose most important contribution to any developing country is probably the access it provides to advanced technologies and management. Therefore, these flows contribute to a country's development and may have helped relax BOPC in the sense of increasing the BOPC growth rate. Unlike in the case of exports of goods and services and remittances, we do not model inflows of FDI and instead directly impute the contribution to the BOPC growth rate. This

[1] The literature on remittances is extensive and often inconclusive regarding the multiple effects remittances can have on the economy. On the Philippines, see, for example, Bayangos (2012). On Morocco, see Bouhga-Hagbe (2004).

means that, technically speaking, what we calculate is the growth rate consistent with equilibrium of the basic balance. We disregard the rest of the capital account (denoted F in equation [1]) as it fluctuates significantly and it is difficult to argue that it is a factor affecting a country's long-run growth.[2]

Proceeding as above, now the dynamic equilibrium condition (the complete balance of payments in growth rates) becomes $p_{xt} + \theta^*_{xt}x_t + \theta^*_{St}s_t + \theta^*_{Rt}r_t + \theta^*_{FDIt}fdi_t = p_{mt} + m^{\$}_t + e_t$, and the BOPC growth rate is (extended version of equation [6]):

$$y^*_{Bt} = \frac{1}{(\pi - \theta^*_{Rt}\xi)}\{\theta^*_{Xt}\varepsilon z_t + \theta^*_{St}\lambda z_t + \theta^*_{Rt}(\omega e_t - \xi z_t + \rho(i_t - i^*_t) - p_{xt}) + \theta^*_{FDIt}(fdi_t - p_{xt})\} \tag{8}$$

where $\theta^*_{Xt} = (P_{xt}X_t/P_{mt}M^{\$}_tE_t)$, $\theta^*_{St} = (P_{xt}S_t/P_{mt}M^{\$}_tE_t)$, $\theta^*_{Rt} = (R_t/P_{mt}M^{\$}_tE_t)$, $\theta^*_{FDIt} = (FDI_t/P_{mt}M^{\$}_tE_t)$ are the respective shares of exports of goods and services, remittances, and FDI in total payments, now considering remittances and foreign direct investment, with $\theta^*_{Xt} + \theta^*_{St} + \theta^*_{Rt} + \theta^*_{FDIt}$=1. To derive equation (8), likewise as to derive equation (6), we have assumed (imposed) that the price elasticities add up to zero, i.e., $(1 + \theta^*_{Xt}\eta + \theta^*_{St}\gamma + \delta - \theta^*_{Rt}\omega) = 0$ (now including the effect of remittances in the last term).

The first two terms inside the parentheses "{}" in equation (8) capture the effect of exogenous changes in income growth abroad through the impact on the country's exports of goods and services. The third term gives the effect of the real rate of growth of remittances through the combined effect of the growth rate of the nominal exchange rate, income growth abroad, and the interest-rate differential. The fourth term gives the effect of the real rate of growth of foreign direct investment inflows. The numerator is divided by the income elasticity of demand for imports (π), now corrected by the elasticity of the growth-rate differential weighted by the share of remittances ($\theta^*_{Rt}\xi$).

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[2] This is not technically correct since, strictly speaking, this is not the basic balance. The latter is defined as the sum of the current account balance and the net movement of long-term capital (direct and portfolio investments). Hence, we use the term loosely as there is no term in the literature to refer to the current account balance plus foreign direcet investment.

Our approach recognizes that, if the BOPC growth rate is found to be a good approximation of a country's long-run growth rate, the implication is that the price elasticities and the rest of the current account and capital flows (C and F) *do not matter* for long-run growth. Short-term deviations of the actual growth rate from the BOPC growth rate are, of course, possible, and will give rise to current account improvements or deteriorations, associated with corresponding capital flows. These deviations, however, cannot persist in the long run, as deficits will sooner or later be corrected via a slowdown in growth, while current account surpluses will lead to faster growth, at least until the economy's growth becomes constrained by its productive capacity. Empirically, the implication of this argument is that the BOPC growth rate can be expected to approximate an economy's long-run (trend) growth rate, rather than its actual growth rate.

3. TIME-VARYING BOPC GROWTH RATE

Empirical studies in the literature consider the BOPC growth rate in equation (6) as constant and, typically computed as the product of the average growth of the country's trading partners z (over a certain time span) times the ratio of the income elasticities of demand for exports and imports (with exports of goods and services aggregated so that the share θ is one). However, unless z_t is constant, the BOPC growth rate will change over time as a result of changes in the trend growth rate of this variable (income of the main importers of the Philippines' exports). More importantly, the long-run value of the BOPC growth rate will also be time-varying if the income elasticities of exports and imports are not fixed parameters but, in fact, are subject to changes over time. Since these elasticities capture non-price competitiveness and, more generally, are determined by the economy's structural characteristics and the import content of the components of aggregate demand, their values are very likely to be time-varying. This is particularly true for economies whose economic, trading, and structural features have undergone and/or are still undergoing substantial change. Empirically, therefore, the use of a time-varying parameter approach seems appropriate in this case.[3]

[3] Since the methodology is implemented to estimate a long-run growth rate, it does raise questions regarding the tension between the empirical and theoretical definitions implicit in the BOPC growth approach. Empirically, the

This section provides time-varying estimates of the following nine parameters: η_t, γ_t, and δ_t (respectively, the time-varying price elasticities of exports of goods, exports of services, and imports); ω_t, ξ_t, and ρ_t (the time-varying elasticities of remittances with respect to the nominal exchange rate, the growth rate differential, and the interest rate differential); and ε_t, λ_t, and π_t (the time-varying income elasticities of demand for exports of goods, exports of services, and imports). These are used to calculate the BOPC growth rate, relying on Kalman filtering techniques.[4] Models with time-varying parameters can accommodate and take into account changes in an economy's structural features, which may have an impact on the trade elasticities. Since the log-levels of exports and imports are non-stationary, we take their growth rates, and these are what we use in the Kalman filter.[5] This approach provides optimal estimates of the state variables based on the information from the measurement and state equations. The estimation of the time-varying elasticities is facilitated by state-space modeling. Equations (2), (3), and (4), are log-linearized and expressed in growth rates, resulting in measurement equations (9), (10), and (12) with time-varying elasticities, while equation (7) is also translated into a time-varying parameter model in equation (11). The time-varying elasticities are assumed to be random walks, expressed as the state equations (13)–(21). This results in the following set of equations:

$$x_t^T = \eta_t reer_t^T + \varepsilon_t z_t^T + u_{1t} \tag{9}$$

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estimation of static exports and imports equations produces coefficient estimates that reflect both the short- and long-run relations between the variables: the BOPC growth theory requires imposing the long-run condition of a balanced current account to get a long-run growth rate, i.e., the BOPC growth rate, consistent with that condition and the static-model estimates. However, if the underlying parameters of the export- and import-demand functions are different in the short- and long-run, then the model should be specified in dynamic form by introducing lags of the dependent variable as additional regressors (e.g., in an autoregressive distributed lag model). This yields estimates of both the short- and long-run price and income elasticities, and will use the estimated long-run elasticities to produce an estimate of the BOPC growth rate. The time-varying estimation framework we adopt in this paper extends this reasoning, allowing for the elasticities to be changing all the time. Note, however, that even though the time-varying approach produces a time-varying BOPC growth rate, what we obtain is still an estimate of a long-run growth rate: this is because our (time-varying) BOPC growth rate estimate is retrieved by imposing the long-run BOP equilibrium condition.

[4] The Kalman filter is a tool very frequently used in the literature to estimate long-run time-varying trends, because the evidence shows it performs well at this task. For instance, a number of contributions have found evidence of time variation in the trend growth rate of output or productivity (e.g., Roberts 2001; Gordon 2003), energy prices (e.g., Pindyck 1999), and unemployment (Richardson et al. 2000).

[5] A wide variety of time-series models can be written and estimated as special cases of a state-space specification. Extensive examples of applications of state-space models can be found in Harvey (1989).

$$s_t^T = \gamma_t reer_t^T + \lambda_t z_t^T + u_{2t} \tag{10}$$

$$r_t^T = \omega_t e_t^T + \xi_t (y_t^T - z_t^T) + \rho_t (i_t^T - i_t^{*T}) + u_{3t} \tag{11}$$

$$m^{\$}{}_t^T = -\delta_t reer_t^T + \pi_t y_t^T + u_{4t} \tag{12}$$

$$\eta_t = \eta_{t-1} + u_{5t} \tag{13}$$

$$\varepsilon_t = \varepsilon_{t-1} + u_{6t} \tag{14}$$

$$\gamma_t = \gamma_{t-1} + u_{7t} \tag{15}$$

$$\lambda_t = \lambda_{t-1} + u_{8t} \tag{16}$$

$$\omega_t = \omega_{t-1} + u_{9t} \tag{17}$$

$$\xi_t = \xi_{t-1} + u_{10t} \tag{18}$$

$$\rho_t = \rho_{t-1} + u_{11t} \tag{19}$$

$$\delta_t = \delta_{t-1} + u_{12t} \tag{20}$$

$$\pi_t = \pi_{t-1} + u_{13t} \tag{21}$$

As above, the lowercase letters in the measurement equations denote growth rates. To estimate equations (9)–(21), we rely on x_t^T, s_t^T, r_t^T, z_t^T, $m^{\$}{}_t^T$, y_t^T, e_t^T, i_t^T, i_t^{*T}, which denote the trend growth rates of the respective variables. $reer_t^T$ is the trend growth rate of the real effective exchange rate, and z_t^T is the trend growth rate of the weighted average of the output growth rates of the country's main trade partners.[6]

The trend growth rates were obtained via the Hodrick-Prescott filter. Several methods to estimate the trend growth rates were applied for sensitivity analysis. This is because the estimates are sensitive to the extraction of the long-term trend and the time horizon. The filtering and time horizon were selected given the reasonableness of results: (i) we applied the HP filter to the growth rates of the series, then took the extracted trends to be the trend growth rates; (ii) we applied the HP filter to the log levels to estimate the trend, then obtained the growth rate of the extracted trend; (iii) we applied the Christiano-Fitzgerald (CF) filter to the growth rates of the series as in (i); (iv) we applied the CF filter to the log levels as in (ii); and (v) we used the actual growth rates of the variables instead of the trend growth rates. We decided to use approach (i) because it gave us what we considered to be the most reasonable results. We also tested two different time horizons for the analysis, one up to 2019 (before the COVID-19 pandemic), and another up to 2021. Finally, we also tested different starting points between 1985 and 1995, as well as ending years, i.e., 2019, 2020, and 2021. We decided to use the data for 1988–2021. The starting year includes the significant downturn in the 1980s (economic-political crisis) and the end year includes the COVID-19 pandemic that started in early 2020.

The terms u_{it} are independent, normally distributed errors, with zero mean and constant variance. Even though equation (8) describes a long-run equilibrium condition consistent with relative prices not changing in the long run, relative price changes need to be included in equations (9), (10), and (12) to control for their short-term effects on exports and imports—if that were not the case, the export and import demand functions would be mis-specified and the estimated income elasticities would be biased. To capture possible level breaks or trend patterns, we impose a unit root in the state equations—this is a standard procedure in the literature on state-space modelling (e.g., Harvey 1989).

To obtain time series for the state variables, we applied the Kalman Smoothing procedure, which

[6] Imports are estimated in US dollars and not in pesos in equation (12). We estimated both and the time-varying income elasticity of demand for imports (π_t) we obtained with the imports in pesos was unreasonably high.

uses all the information in the sample to provide smoothed state estimates.[7] This procedure differs from the Kalman filter in the construction of the state series, as the latter technique uses only the information available up to the beginning of the estimation period. Smoothed series tend to produce more gradual changes than filtered ones and, as discussed by Sims (2001), provide more precise estimates of the actual time variations in the data.

Our estimate of the time-varying BOPC growth rate is therefore constructed as follows—again imposing $(1 + \theta_{Xt}^{*}\eta_t + \theta_{St}^{*}\gamma_t + \delta_t - \theta_{Rt}^{*}\omega_t) = 0$:

$$y_{Bt}^{*} = \frac{1}{(\hat{\pi}_t - \theta_{Rt}^{*}\hat{\xi}_t)}\left\{(\theta_{Xt}^{*}\hat{\varepsilon}_t + \theta_{St}^{*}\hat{\lambda}_t)z_t^T + \theta_{Rt}^{*}\left(\hat{\omega}_t e_t^T - \hat{\xi}_t z_t^T + \hat{\rho}_t(i_t^T - i_t^{*T}) - p_{xt}^T\right) + \theta_{FDIt}^{*}\left(fdi_t^T - p_{xt}^T\right)\right\} \quad (22)$$

where $\hat{\varepsilon}_t$, $\hat{\lambda}_t$, and $\hat{\pi}_t$ are the time-varying estimates (denoted, ^) of the income elasticities of demand for exports and imports, and $\hat{\omega}_t$, $\hat{\xi}_t$, and $\hat{\rho}_t$ are the time-varying estimates of the elasticities of remittances with respect to the nominal exchange rate, the growth rate differential, and the interest rate differential, all obtained from the state-space model in (9)–(21). The shares $\theta_i^{*}, i = X, S, R, FDI$ are calculated without including the rest of the current account and the rest of the capital account (i.e., variables C and F in equation [1]), as these two components of the BOP are very volatile and, conceptually, do not affect what we have defined as the BOPC growth rate. They are also calculated from the trend series.

4. ESTIMATION RESULTS OF THE PHILIPPINES' TIME-VARYING BOPC GROWTH RATE

The Philippine economy is an appropriate case study to estimate the BOPC growth rate equation (22). Though it has registered positive growth during the last decades (significant just before the 2020 pandemic), it is still a lower middle-income economy. It managed to get into the electronics

[7] Suppose we observe the sequence of data up to time period n: the process of using all this information to form expectations at any time period up to n is known as *smoothing*.

cluster in the 1990s, but it has not developed advanced domestic production capabilities, with the consequence that most of what the sector does is to assemble. The economy depends significantly on workers' remittances not to run a current account deficit. Incoming remittances represent about 10 percent of the Philippine GDP.

The analysis is carried out using annual data from 1988 to 2021. BOP data are from the IMF, and exports and imports prices are from the Philippine Statistics Authority.[8] Nominal exchange rate (E), real effective exchange rate ($REER$), Philippine GDP (Y), and reverse repurchase rate (i) are from the Bangko Sentral ng Pilipinas.

4.1 Testing for Endogeneity Using Kalman Filter Estimation

Recall the form of the import demand function with time-varying effects, equations (12), (20), and (21):

$$m^{\$}{}_t = -\delta_t \, reer_t + \pi_t y_t + u_{4t}, \quad u_{4t}|\mathbf{I}_{t-1} \sim N(0, \sigma_{ut}^2) \qquad (23a)$$

$$\delta_t = \delta_{t-1} + u_{12t} \qquad (23b)$$

$$\pi_t = \pi_{t-1} + u_{13t} \qquad (23c)$$

GDP growth, y_t, is potentially endogenous in equation (23a). To test this possibility, we follow Kim and Nelson (2006) and assume the following relationship between y_t and the instrumental-variable vector $\boldsymbol{z}_t = (reer_t, y_{t-1})'$:

$$y_t = \beta_0 + \beta_1 reer_t + \kappa_t y_{t-1} + \nu_t, \quad \nu_t \sim N(0, \sigma_{\nu t}^2) \qquad (24)$$

where κ_t is assumed to be a random walk. In the context of the instrumental-variable regression, equation (24) is called the first-stage regression. The one-step-ahead standardized residuals, $u_t^* =$

[8] BOP data collected from the IMF use different reporting standards. Data for 1985–99 use the BPM4; BMP5 for 1999–2005; and BPM6 from 2005 ownwards. Observations prior to 2005 were harmonized to the BPM6 by backcasting the series using the historical growth rates of the earlier standards. Only the relevant BOP components for modeling are adjusted, and the rest of the BOP are treated as residuals to maintain balance.

$E(u_t|I_{t-1})$ from equation (24), are extracted and included as regressors in the import-demand equation, akin to a Heckman-type two-step procedure:

$$m^{\$}{}_t = -\delta_t \, reer_t + \kappa_t y_t + \mu \sigma_{ut} \widehat{w}_t^* + \vartheta_t^*, \quad \vartheta_t^* \sim N(0, (1-\rho^2)\sigma_{vt}^2) \quad (25)$$

A statistically significant μ in equation (25) indicates that y_t is endogenous. We assume a stochastic volatility model for the variances of v_t, instead of the GARCH(1,1) specification used by Kim and Nelson (2006). Moreover, the variance of u_{mt} is assumed to be homoscedastic for simplicity. The first-stage equation becomes:

$$y_t = \beta_0 + \beta_1 reer_t + \kappa_t y_{t-1} + \sigma_w \exp\left(\frac{1}{2} h_t\right) w_t, \quad w_t \sim N(0,1) \qquad (26a)$$

$$\kappa_t = \kappa_{t-1} + \tau_t, \quad \tau_t \sim N(0, \sigma_{1v}^2) \qquad (26b)$$

$$h_t = a_0 + a_1 h_{t-1} + v_{2t}, \quad v_{2t} \sim N(0, \sigma_h^2) \qquad (26c)$$

We implemented the Bayesian estimation of the model by using the nimble (de Valpine et al., 2017) and nimble SMC (Michaud et al. 2021) packages in R. Particle filter or sequential Monte Carlo was used to estimate the filtered state variables due to the non-linear nature of the first-stage equation (Gordon, Salmond, and Smith1993; Kitagawa 1996; Doucet, Freitas, and Gordon 2001; Durbin and Koopman 2012). The particle filter was also simultaneously performed with a MCMC to estimate the top-level parameters of the model, known as the particle MCMC (Andrieu, Doucet, and Holenstein 2010). Given the values of the estimated parameters, the first-stage model was then simulated to obtain estimates of the one-step-ahead standardized residuals, w_t^*. Particle MCMC was again used for the estimation of the import-demand equation with the Heckman-type correction.

The estimated parameters are given in Table 1. The estimated value of μ is 0.49 with a standard error of 0.89. The large standard error resulted in a wide 90 percent interval spanning almost the whole range of possible values for a correlation coefficient. The inclusion of zero in this interval implies that μ is statistically insignificant. Therefore, no sufficient evidence is available to conclude the endogeneity of the Philippine GDP growth in the import-demand equation.

Table 1. Second-Stage Parameter Estimates

Parameter	Posterior Mean	Posterior SD	Lower 90%	Upper 90%
μ	0.490	0.890	-0.9998	0.9998
σ_η	0.508	1.536	0.1658	1.2794
σ_π	0.657	1.455	0.1598	2.2287
σ_u	1.490	3.260	0.1390	7.6960

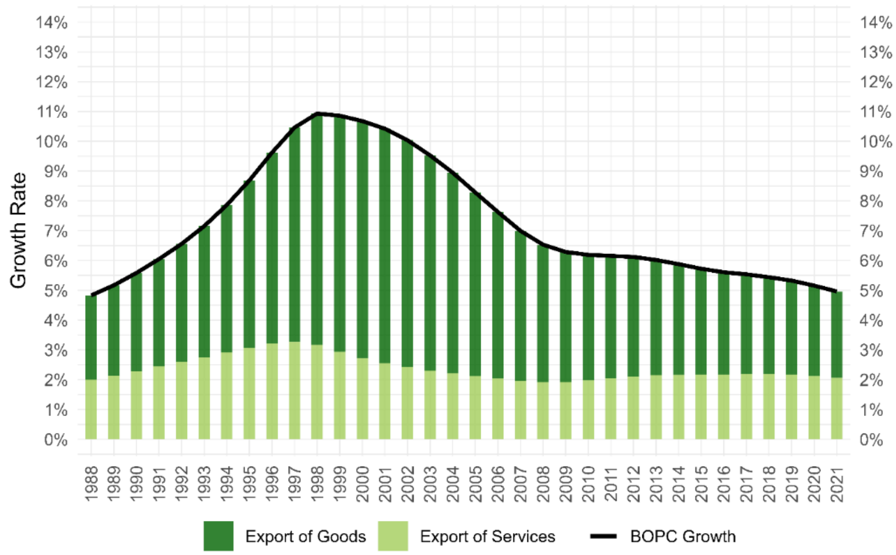
Source: Authors

Given this result, we proceeded with the estimation of the parameters of equations (9)–(21) and the state variables using a Kalman filter.

4.2 The Philippines Balance-of-Payments–Constrained Growth Rate

We start by showing the basic BOPC growth rate given by equation (6), that is, under the assumption that only exports (and imports) of goods and services determine this growth rate. Price and income elasticties in equations (2)–(4) have been estimated in state-space form and using the Kalman filter. This way we obtain time-varying estimates. This is shown in Figure 1. Results indicate that, between 1988, the late 1990s, and early 2000s, the Philippines BOPC growth rate doubled from 5 to about 10 percent. During these years, the share of exports of goods in total exports (θ_x) increased significantly, reaching about 75 percent of total receipts. At the same time, the ratios of the income elasticities of demand for exports of goods and exports of services to the income elasticity of demand for imports (ε/π and λ/π, respectively) increased significantly (Figure 2), with (ε/π) > (λ/π). Finally, the growth rate of the trading partners (z) shows a steady decline since 1988. Summing up, the significant increase in the BOPC growth rate up to about 10 percent in the late 1990s and early 2000s, was mostly driven by $(\varepsilon/\pi)\theta_x$—the increasing contribution of exports of goods.

Figure 1. The Philippines' Basic BOPC Growth Rate



Source: Authors

It is difficult to know without further research why the BOPC growth rate increased so much during these years, well above the actual growth rate. If this were true, it would imply that the Philippines could have grown faster during those years without running into BOP problems. If it did not grow faster, it was because it ran into a supply (factors of production) constraint. While it may be plausible that the BOPC growth rate increased, e.g., as a result of an increase in the income elasticity of exports of electronics, we doubt it reached 10 percent. Hence, it is possible that this is an overestimate due to the estimation method.[9] Our estimates also indicate that, after reaching that peak, the BOPC growth rate declined steadily and has returned to its 1988 value, about 5 percent, a value below the actual growth rate.

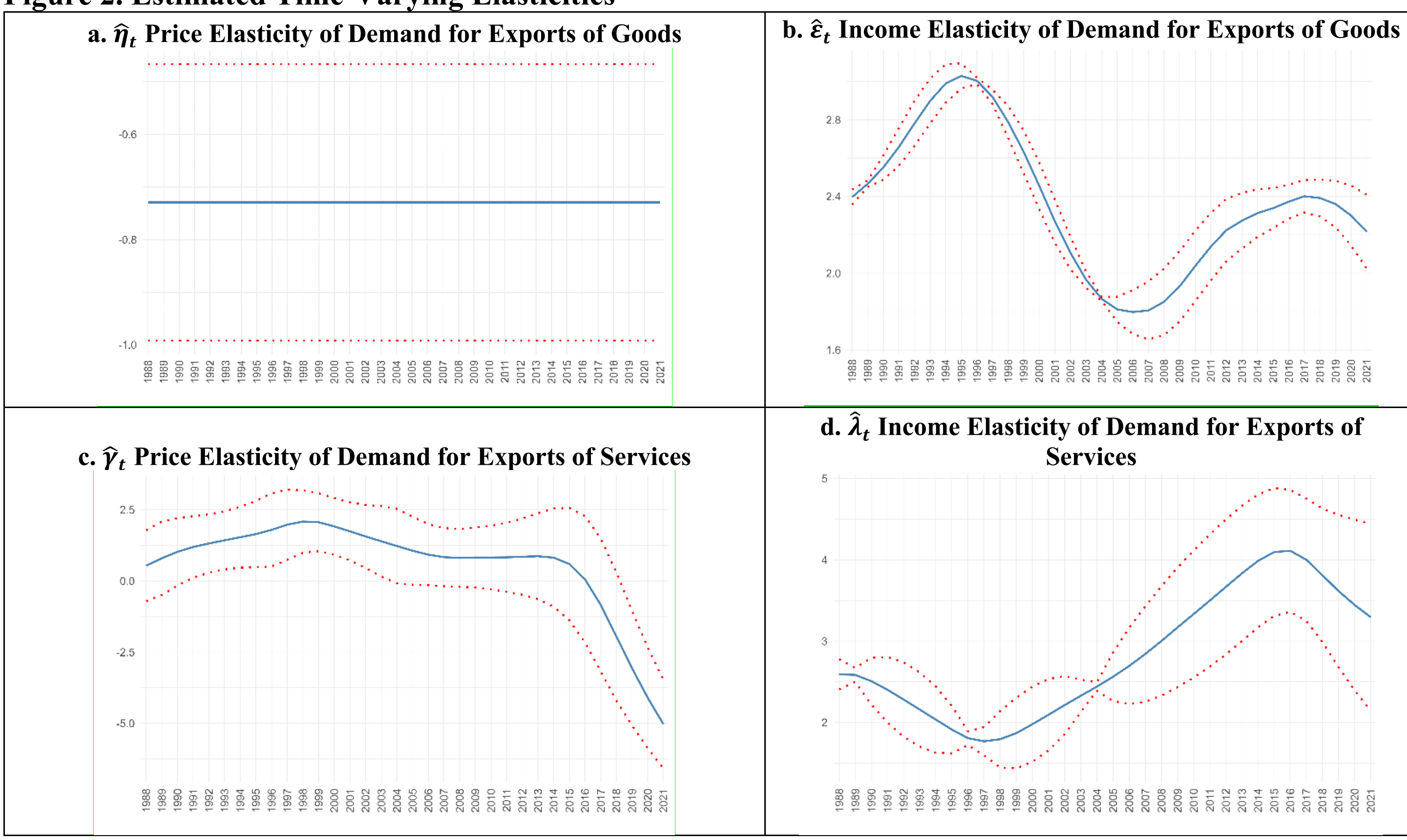
We now discuss the results of the extended model, equation (22), incorporating remittances and foreign direct investment. Figure 2 shows the nine estimated (denoted ^), time-varying elasticities with their respective 95 percent confidence intervals: $\hat{\eta}_t$, $\hat{\gamma}_t$, and $\hat{\delta}_t$ are, respectively, the time-varying price elasticities of exports of goods, exports of services, and imports; $\widehat{\omega}_t$, $\hat{\xi}_t$, and $\hat{\rho}_t$ are the time-varying elasticities of remittances with respect to the nominal exchange rate, the growth rate differential, and the interest rate differential; $\hat{\varepsilon}_t$ and $\hat{\lambda}_t$ are the time-varying

[9] We used other estimation methods to souble our estimates, such as recursive regression, and obtained similar results.

elasticities of demand for exports of goods and exports of services, with respect to foreign demand; and $\hat{\pi}_t$ is the time-varying elasticity of demand for imports with respect to domestic income.

The price elasticities are either zero or negative. The elasticities of remittances with respect to the income-growth differential, with respect to the interest-rate differential, and with respct to the nominal-exchange rate, are positive (the last being an exception in the first few periods). Finally, the three income elasticities are positive. The income elasticity of demand for imports declined significantly (from about 2 to about 1), which partly explains the increase in the BOPC growth rate. Likewise, the income elasticity of demand for exports of services has increased (with a small decline at the start of the estimation period) significantly. The income elastity of demand for exports of goods first increased, then declined, and finally recovered somewhat.

Figure 2. Estimated Time-Varying Elasticities



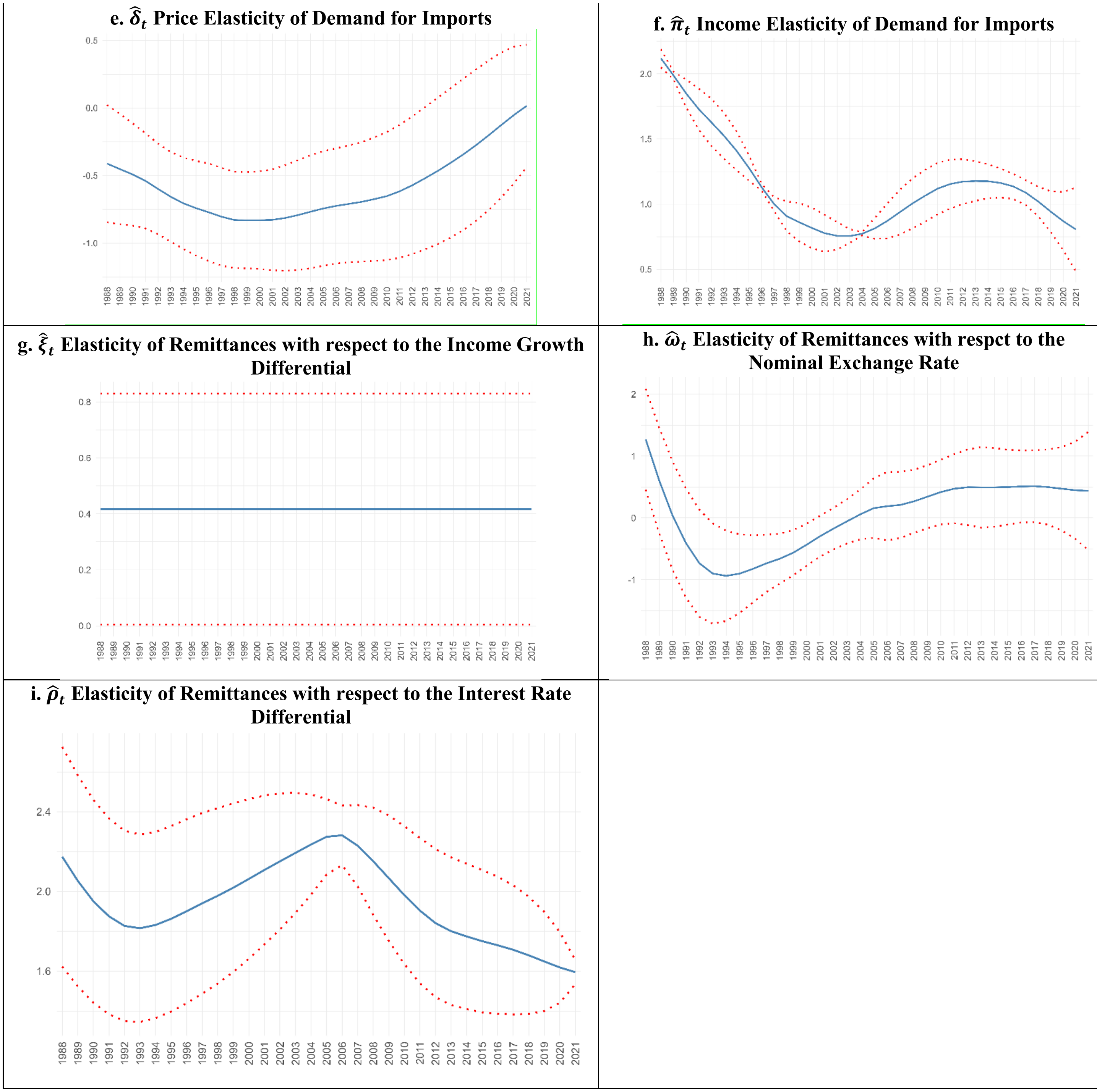
e. $\hat{\delta}_t$ Price Elasticity of Demand for Imports

f. $\hat{\pi}_t$ Income Elasticity of Demand for Imports

g. $\hat{\xi}_t$ Elasticity of Remittances with respect to the Income Growth Differential

h. $\hat{\omega}_t$ Elasticity of Remittances with respct to the Nominal Exchange Rate

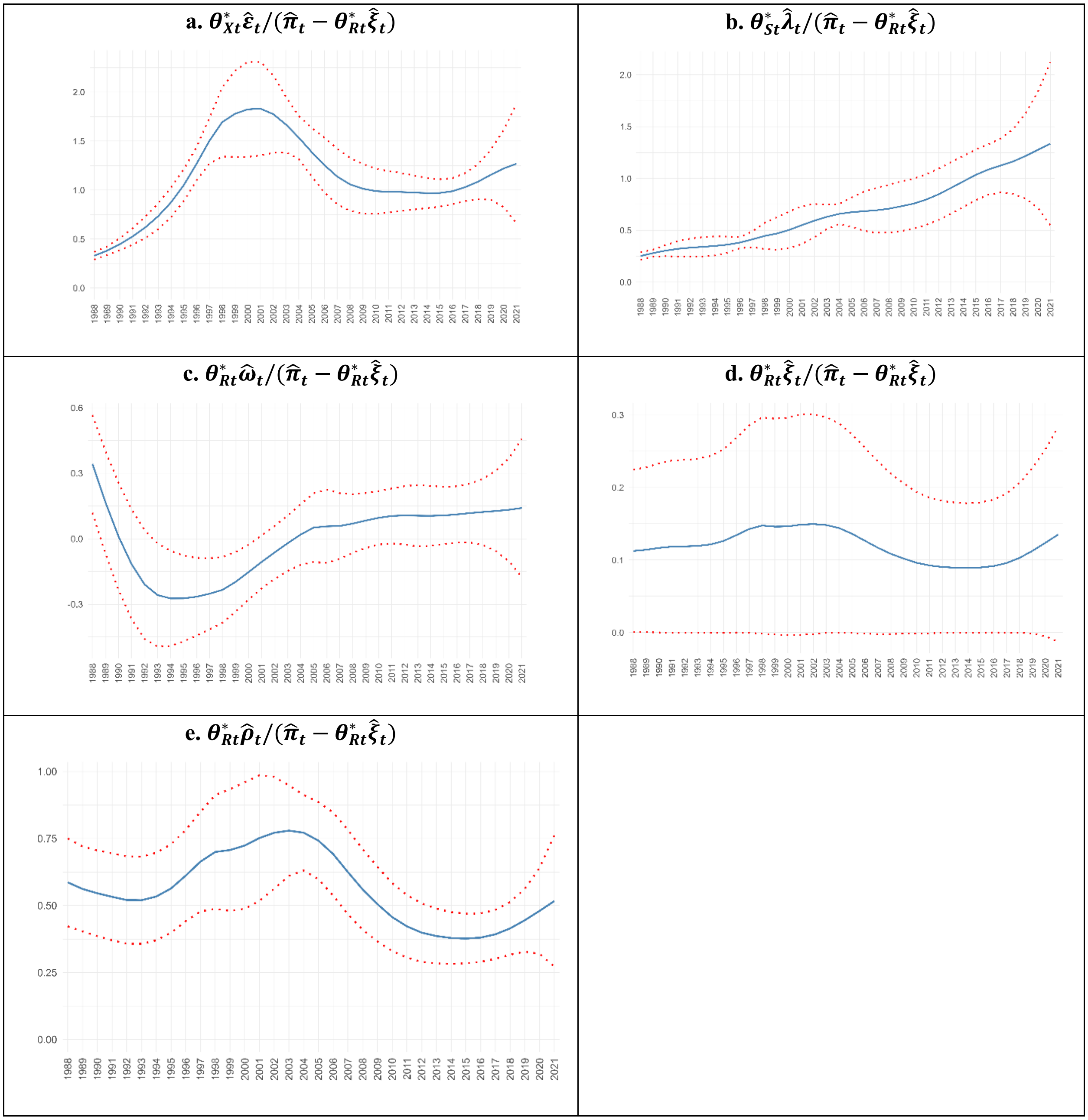
i. $\hat{\rho}_t$ Elasticity of Remittances with respect to the Interest Rate Differential



Source: Authors. Estimated elasticities and 95% confidence interval.

Figure 3 shows the five ratios of the relevant elasticities that appear in equation (22), which matter for the construction of the BOPC growth rate. Panels (3a)–(3b) show that both exports of goods and of services (divided by the import elasticity) help explain the path of the BOPC growth rate.

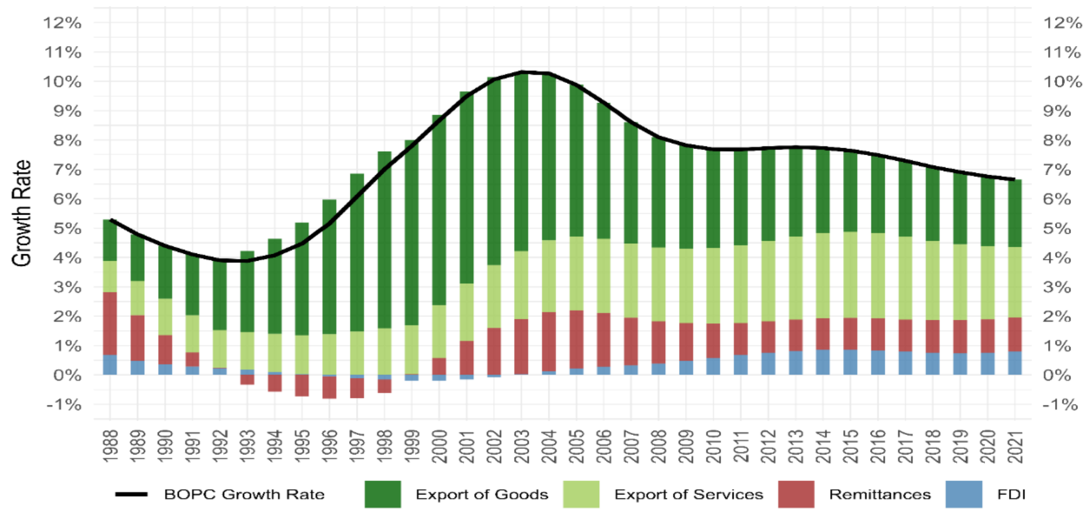
Figure 3. Ratios of the relevant elasticties



Source: Authors. Computed ratios and 95 percent confidence interval.

Figure 4 shows the extended BOPC growth rate and its components. Starting from a value of about 5 percent in 1988, the BOPC growth rate declined to about 4 percent in 1992–93, mostly as a result of a smaller contribution of the growth of remittances (in real terms). Then it increased significantly, reaching 10–10.5 percent in 2002–5. As discussed above, this appears to be a very high BOPC growth rate, far from actual growth. During 1993–98, the contrubtion of the growth of remittances was negative. During a significant part of the period covered (1988–2021), the largest contributor to the BOPC growth rate came from the growth of exports of goods, while in recent years the contribution of the growth of services became larger. After 2005, the BOPC growth rate slowly declined, and in 2021 it settled at about 6.5 percent. During 2009–15 it was close to 8 percent but it has declined since. We also note that the growth of remittances contributes slightly above of 1 percentage point, and that of the growth of FDI contributes slightly less than 1 percentage point.

Figure 4. The Philippines' Extended BOPC Growth Rate and Its Components

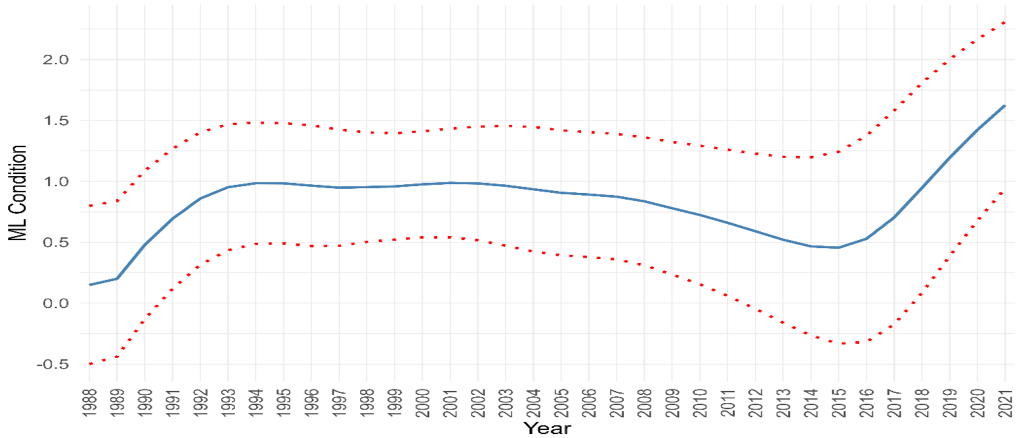


Source: Authors

We can take the derivative of the BOPC growth rate with respect to the nominal exchange rate to analyze the effect of a devaluation ($e > 0$). This is $\frac{\partial y_{Bt}^*}{\partial e} = -(1 + \theta_{Xt}^* \eta_t + \theta_{St}^* \gamma_t + \delta_t - \theta_{Rt}^* \omega_t)/(\pi_t - \theta_{Rt}^* \xi_t)$.[10] A continuous devaluation ($e > 0$) will improve the BOPC growth rate if $|\theta_{Xt}^* \eta_t + \theta_{St}^* \gamma_t + \delta_t - \theta_{Rt}^* \omega_t| > 1$. This is the well-known Marashall-Lerner (ML) condition. Figure 5 graphs $|\theta_{Xt}^* \eta_t + \theta_{St}^* \gamma_t + \delta_t - \theta_{Rt}^* \omega_t|$. The ML condition appears to not be met for most periods if one looks at the point estimate. Only during 2019–21 is the value of the expression geater than 1. This indicates that depreciations of the Philippine peso do not increase the BOPC growth rate.

[10] This derivative is taken on the general expression from which equation (22) is derived, which includes $(1 + \theta_{Xt}^* \eta_t + \theta_{St}^* \gamma_t + \delta_t - \theta_{Rt}^* \omega_t)$.

Figure 5. Sum of the Price Elasticities—The Marshall-Lerner Condition

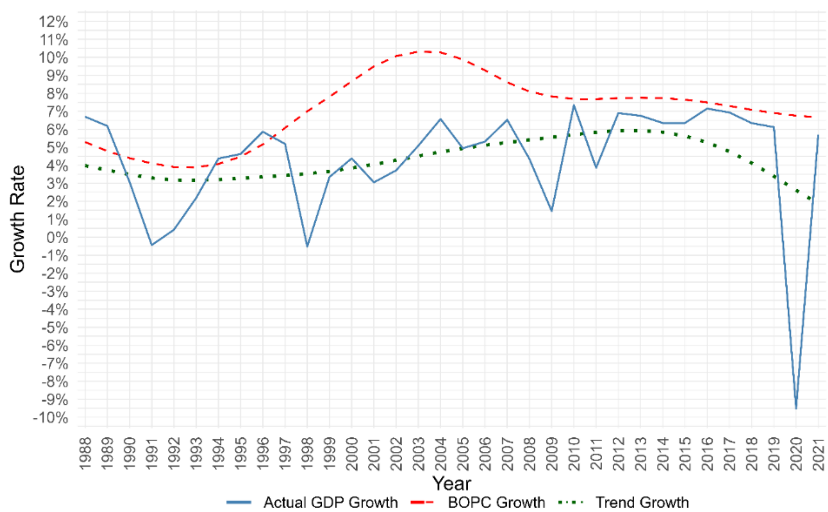


Source: Authors

4.3 Test of Whether Actual Growth Equals the Balance-of-Payments–Constrained Growth Rate

We now provide tests of whether actual and BOPC growth rates differ. Figure 6 shows the actual growth rate (y_t), its trend (y_t^T), and the BOPC growth rate (y_{Bt}).

Figure 6. Philippine Balance-of-Payments-Constrained (BOPC) Growth Rate, Actual Growth Rate, and Trend Growth Rate



Source: Authors

The intuition underlying the tests is that actual growth will not deviate from the BOPC growth rate in the long run, that is, the difference between actual and BOPC growth rate is zero. Following Felipe and Lanzafame (2020), we apply two tests to determine if the actual growth follows the BOPC growth:

Test I. We test whether the difference between actual and BOPC growth rates ($ydiff_t = y_t - y_{Bt}$) is a zero-mean process, i.e., $E(ydiff_t) = 0$. $ydiff_t$ is modeled as an AR process with drift. Mean-reversion requires the non-rejection of the null hypothesis that the drift parameter, ζ, is insignificant in the model, i.e., $H_0: \zeta = 0$:

$$ydiff_t = \zeta + \sum_{i=1}^{l} \psi_i \, ydiff_{t-i} + \varpi_t \qquad (27)$$

Estimation results are shown in Table 2. Three AR variants of equation (27) are estimated to account for serial correlation. Results indicate that the drift parameter, ζ, is statistically significant in the three models, indicating the the long-run difference between the actual growth and the BOPC growth rate is not a zero-mean process.

Table 2. Estimated Models for Test I

Variable	AR(1)	AR(2)	AR(3)
Drift ζ	-0.024***	-0.021***	-0.022***
	(-0.006)	(-0.006)	(-0.006)
$ydiff_{t-1}$	0.135	0.113	0.113
	(0.172)	(0.176)	(0.175)
$ydiff_{t-2}$		0.131	0.153
		(0.251)	(0.278)
$ydiff_{t-3}$			-0.049
			(-0.258)
Log-likelihood	63.70	67.63	64.75
BIC	-124.62	-121.36	-117.87

Source: Authors

Test II. We test whether the BOPC growth rate (y_{Bt}) differs significantly from the trend growth rate (y_t^T). The test is operationalized by estimating the regression $y_{Bt} = \alpha + \beta y_t^T + u_t$ and testing the joint null hypothesis: $\alpha = 0$ and $\beta = 1$, with β statistically significant. We also run the same test with the acutal growh rate (y_t) instead of the trend growth rate, that is, $y_{Bt} = \alpha + \beta y_t + u_t$. Table 3 shows the two models estimated. In Model 1, the null $\beta = 1$ is not rejected, while the join null hypothesis $(\alpha, \beta) = (0,1)$ is rejected. In Model 2, both the null $\beta = 1$, and the joint test of the null hypothesis $(\alpha, \beta) = (0,1)$, are rejected. Thus, the evidence using Test II suggests that the Philippine actual growth rate deviates from the BOPC growth rate.

Table 3. Estimated Models for Hypothesis II

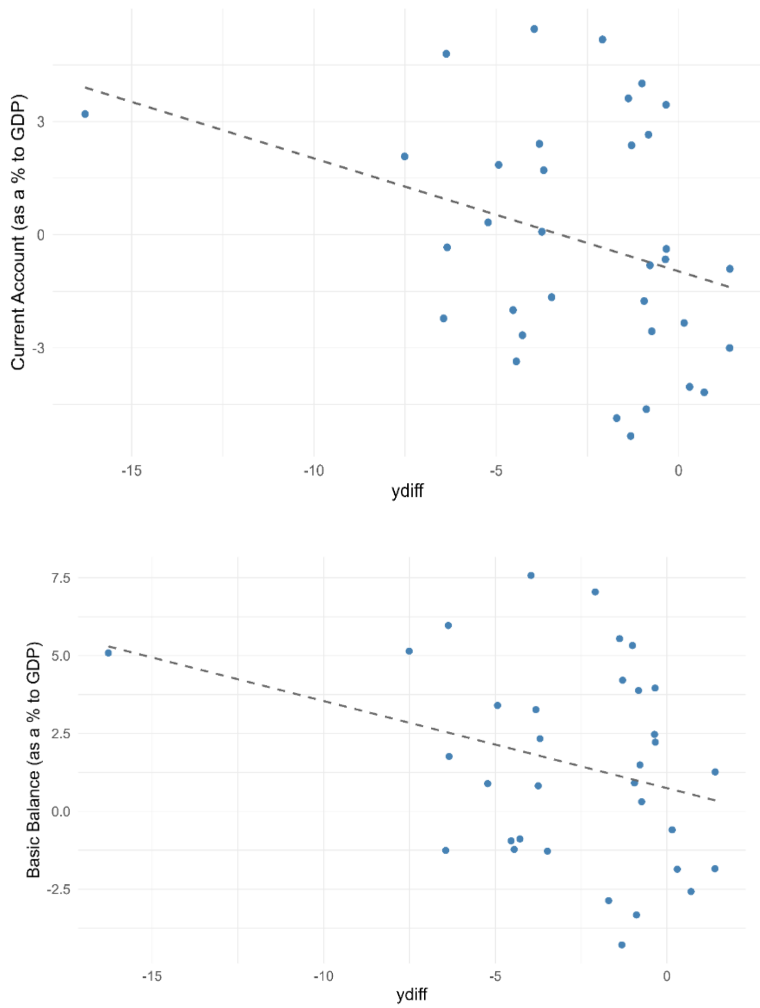
Variable	**Model 1**	**Model 2**
y_t^T	0.970***	
	(0.271)	
y_t		0.131
		(0.103)
Constant	0.029**	0.065***
	(0.012)	(0.006)
R-squared	0.301	0.048
F-statistic on H_0*:* $\beta = 1$	0.01	71.8***
F-statistic on H_0*:* $(\alpha, \beta) = (0,1)$	50.32***	72.28***

Source: Authors

These results are perhaps not surprising. Indeed, Figure 5 indicates that the difference between both actual and trend growth rates and the BOPC growth rate, increased between (approximately) 1997 and 2002–5, a gap of up to about 5 percentage points. Afterwards, the gap declined due to a combination of decline in the BOPC growth rate and slight increase in the actual growth rate.

We note, however, that the BOPC growth theory predicts that actual growth rates above (below) the BOPC growth rate in the short-term should give rise to negative (positive) changes in the current (basic) account. For the Philippines, regressions of both the current account balance and basic balance on the difference between actual and BOPC growth rates (controlling for 2020, although the dummy is insignificant in both regressions) give negative point estimates (statistically significant at the 12 percent and 20 percent significance levels, respectively). They are shown in Figure 7. The coefficients obtained are consistent with the current account share falling by about 0.35 percentage points for each percentage point of actual growth higher than the BOPC growth rate; and with the basic balance share falling by about 0.29 percentage points for each percentage point of actual growth higher than the BOPC growth rate.

Figure 7. Relation Between the Current Account and the Basic Balance (as a Share of GDP) and Deviations of Actual Growth from the BOPC Growth Rate in the Philippines, 1988–2021



Source: Authors.
Note: Current account regression: CABSHARE = -1.07 - 0.35*ydiff - 1.42*D20, R2=0.11; Basic Balance regression: BASICSHARE = 0.71 - 0.29*ydiff - 0.42*D20. R2=0.09

5. CONCLUSIONS

This paper has advanced the literature on the balance-of-payments equilibrium growth rate by adding remittances to the model (and foreign direct investment, though not modeled). Second, we have used state-space estimation methods to obtain time-varying parameters of the relevant elasticities. Third, we test of endogeneity in the context of the Kalman filter. These refinements offer an avenue to better understand the relevance of this model—in particular, for developing countries.

The model has been estimated with data for the Philippines. Results indicate that the major contributors to the BOPC growth rate are exports of goods and services. Remittances also contribute significantly. FDI contributes less. We obtain an estimate of the Philippine BOPC growth rate (consistent with equilibrium in the basic balance) of about 6.5 percent in 2021, below the current administration's stated objective of attaining an actual growth rate of 6.5–8 percent until 2028. This indicates that achieving and maintaining the administration's growth objective, while the BOPC growth rate is about 6.5 percent, will be very difficult. If actual growth goes above 6.5 percent, it will return to about that rate. Other than through more FDI, remittances, and a higher growth rate of the trading partners, the BOPC growth rate will increase if the ratios of the income elasticities of demand for Philippine exports of goods and services to the income elasticity of demand for imports, increase.

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