The role of remittances and FDI for the current account: The case of Cambodia*

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Abstract

This paper develops a small open economy real-business cycle model to examine the dynamics of Cambodian current account. Differing from previous studies, our model incorporates both net foreign direct investment (FDI) and remittances as additional sources of macroeconomic fluctuations. Our results reveal that these two factors, especially FDI, account for more than 50% of the variations in the current account. Additionally, the model mimics well the actual trajectory of the Cambodia's current account, suggesting that the nature of the discount factor — whether endogenous or exogenous — does not play a crucial role in explaining the external balances.

Keywords: real business cycle; current account; FDI; remittance; COVID-19
JEL Classification: F3; F41

*Helpful comments and suggestions on earlier version of this paper from the handling editor Prof. Pok-Sang Lam and two anonymous referees are appreciated. Veasna Kheng is indebted to Horag Choi for his guidance. We thank Alexandre Dmitriev, Timothy Kam and seminar participants at Monash University for helpful comments. The usual disclaimer applies.

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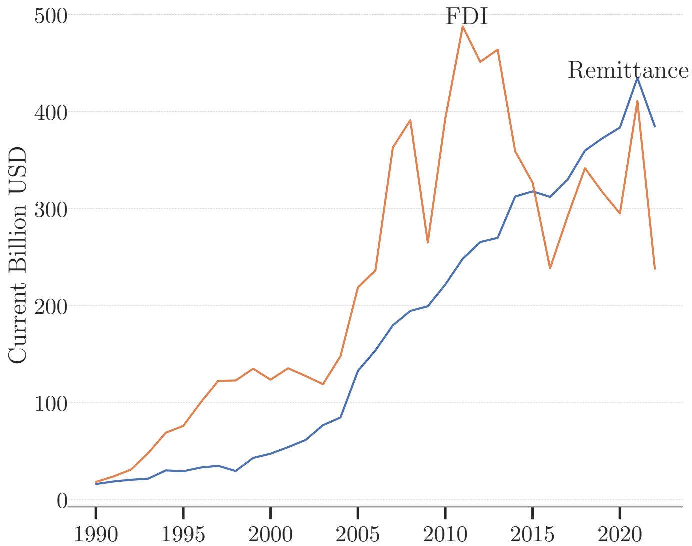
1 Introduction

Recent decades have witnessed an unprecedented surge in foreign direct investment (FDI) flows, with remittances to developing countries experiencing a particularly notable rise, as depicted in Figure 1. Such inflows are indispensable for recipient nations: FDI drives economic growth and development by furnishing the host countries with physical capital, introducing new technology, and facilitating human capital development (Agbola, 2013). Similarly, remittances, complemented by foreign aid, can reduce poverty, smooth consumption and ease capital constraints faced by the impoverished (Catribescu et al., 2009; Nwaogu and Ryan, 2015).

Figure 1: The trends of FDI and remittance in developing economies from 1990 to 2022



Note: The data, sourced from the World Bank Development Indicator (WDI), are for all developing economies. The World Bank classifies these countries as those with a gross national income per capita less than 13,845 USD.

Despite the significant contributions of remittances and FDI, there has been limited exploration into their effects on macroeconomic fluctuations in developing countries. The recent COVID-19 pandemic has left both developed and developing economies grappling with its repercussions. However, for many fragile and less-developed nations, the economic impact is magnified by the decline in external funding sources (Sayeh and Chami, 2020). For instance, the ramifications of the pandemic, among other factors, thrust Sri Lanka — a major remittance recipient — into its worst-ever crisis in 2022 (Raiser, 2023). Using a panel data analysis, Barajas et al. (2012) show that remittance significantly sway the business cycles of recipient countries.[1] In contrast, our study adopts adopts a

[1]Remittance consists of personal transfers and compensation of employees, contributing to the primary

dynamic general equilibrium approach to examine macroeconomic variations while integrating both FDI and remittances as additional economic shocks. We select Cambodia as our primary focus due to its three distinctive features: i) its susceptibility to external shocks, ii) its pressing need for external capital, and iii) its alignment with the standard economic theory on the: "intertemporal theory of the current account."[2]

For over a decade, Cambodia has experienced a persistently high degree of dollarization (as depicted in Figure A1 of Online Appendix). This has increased it vulnerability to both external and internal shocks, such as capital flight and changes in the global economy. In addition, Cambodia essentially started from ground zero between 1975 to 1979 — a period devoid of institutions like banks, schools, and hospitals, characterized predominantly by work and death (O'kane, 1993). Emerging from this dark era, Cambodia witnessed a surge in remittances and FDI as a percentage of GDP: from 1% and 2% in 1994 to 10% and 13.5% in 2020, respectively. These figures are notably high among developing countries, as illustrated in Figure A2 of Online Appendix. Benefiting from these sources, Cambodia's economic growth has averaged around 6% annually, ranking it among the world's fastest-growing economies.[3]

Abbasoğlu et al. (2019), applying Engel and Rogers (2006)'s model to study the trend of Turkish current account, show that a country whose income is expected to grow relatively faster than the global average will tend to borrow more to finance their current consumption, leading to a current account deficit. Cambodia resonates with this pattern. Its income growth had been consistently projected at around 7% annually (see Table A1 of Online Appendix), and as a consequence, its current account (along with most of its peers') has deteriorated. From 2000 to 2020, its average current account-to-output ratio stood at approximately -7.5%, as shown in Figure 2.

Given these features, we develop and estimate a small open economy real-business cycle (SOE-RBC) model to scrutinize the dynamics of Cambodia's current account. As our model is anchored in the intertemporal theory, it can be generalized to examine other similar economies, as shown in Figure 2. Existing RBC literature, including works by Arezki et al. (2017), Chang and Fernández (2013), Choi and Mark (2009), and others, identified productivity and interest rate shocks as pivotal sources of macroeconomic fluctuations.

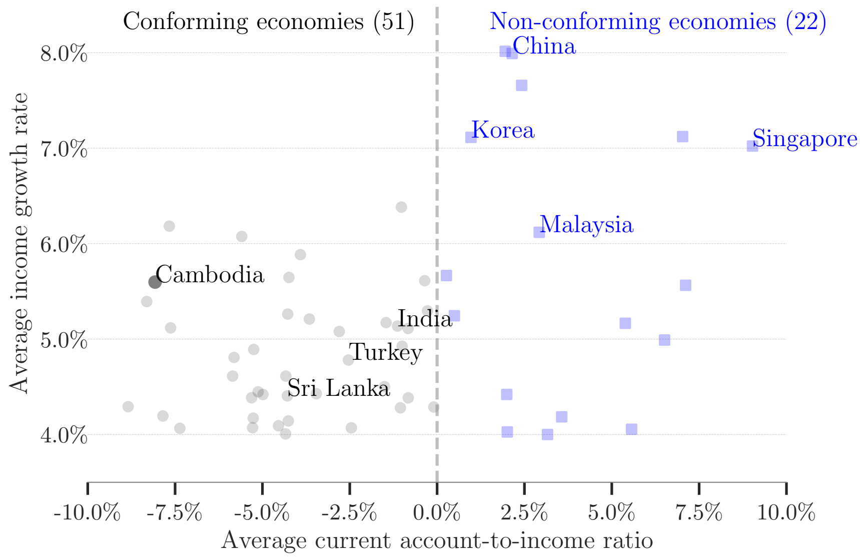
income in trade balance. While Barajas et al. (2012) use the narrow definition of remittance, "personal transfers," in their analysis. We use both terms interchangeably in this paper.

[2]People tend to smooth consumption by borrowing and saving when facing uneven income streams (Schmitt-Grohé et al., 2022). If they expect their income growth to be temporary, they want to save it and run a current account surplus, but if they believe it is permanent, they want to consume more and thus run a deficit. However, a number of countries deviate from this typical pattern. The precautionary motive, as discussed by Bernanke (2005), Carroll (1997), and Choi et al. (2017), is the underlying source of high saving rates in Asian countries.

[3]We refer fast-growing economies as those with an income growth rate exceeding 4%. The global average growth rate hovered around 3% from 2000 to 2020).

We enrich this perspective by integrating both FDI and remittances as supplementary drivers to elucidate variations in the current account. This is because remittances directly modulate external balances based on accounting identities, while FDI propels an economy via labor-augmenting productivity growth.[4]

Figure 2: Scatter plot between GDP growth rate and current account balance-to-output ratio, on average from 2000 to 2020, in the fast growing economies.



Note: We classify fast growing economies as conforming or non-conforming based on "an intertemporal theory of the current account" with the assumptions that for conforming economies, people expect their income growth to be permanent, whereas for non-conforming economies, people save more because of the precautionary motive. Data are sourced from the World Bank Development Indicators (WDI).

Consistent with Chang and Fernández (2013), our model underscores the pivotal role transitory productivity and interest rate shocks play in macroeconomic fluctuations. Furthermore, it also illuminates how FDI and remittances effectively account for variations in external account balances. Combined, these two elements explain approximately half of the variations in Cambodia's current account and trade balances. This substantial impact likely stem from the increasing reliance of Cambodia's economy on external sources, particularly since its devastation by regional and civil wars in the 1970s.

We then calibrate our model using the historical data on both key exogenous and endogenous variables, examining the current account decisions made by agents to emulate the actual data trajectories. The model adeptly captures Cambodia's saving behaviours

[4]The contributions of FDI to developing economies are well documented. In particular, FDI bolsters human capital development, instigates technology spillovers, facilitates international trade integration, and fosters a more competitive environment conducive to innovation (see, for example, Dong et al. (2021), Haskel et al. (2007), Kheng et al. (2017), and Liu (2008), among others).

and aligns closely with the evolution of the current account. Furthermore, when juxtaposed against the comprehensive model by Chang and Fernández (2013) — which was estimated without considering FDI and remittances — our model offers a superior fit. The correlations between our model and actual data are approximately 0.94 for the current account and and 0.72 for trade balances. The precision of our model suggests that the nature of the discount factor — be it endogenous or exogenous — does not play an important role in explaining external balances.

The rest of this paper is organized as follows. Section 2 delves Cambodia's current account balance and its net international investment position, followed by a brief review of related literature on the current account in Section 3. Section 4 proposes a small open economy RBC model, and then we discuss how well the model fits the actual data in Section 5. Section 6 concludes.

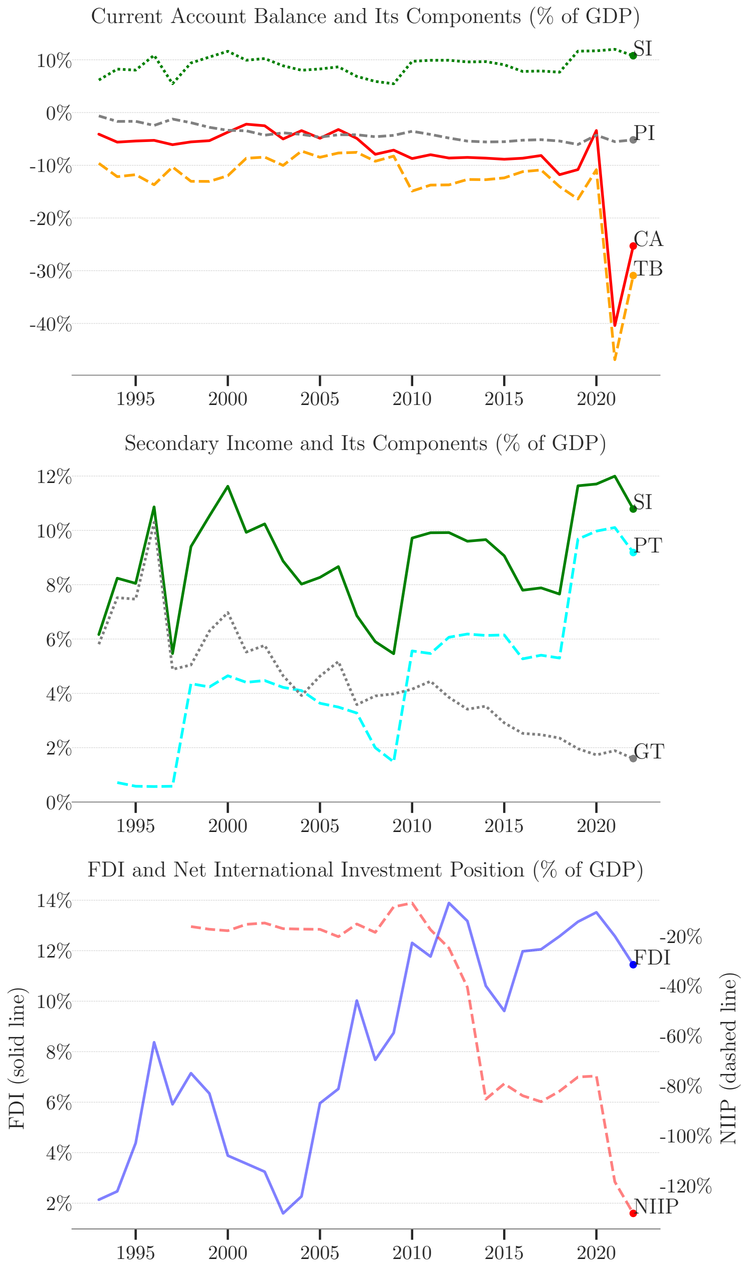
2 Cambodia's Current Account and Its International Investment Position

The first panel of Figure 3 illustrates the trends of Cambodia's current account balance (CA) and its components: trade balance (TB), primary income balance (PI),[5] and secondary income balance (SI).[6] Two key characteristics emerge from the Cambodian current account. Firstly, after hovering around -5% of GDP from 1993 to 2007, it dipped to -10% of GDP by 2019. This decline resonates with findings by Abbasoğlu et al. (2019) and Engel and Rogers (2006). Cambodia's anticipated annual income growth of 7% encouraged greater consumption and a consequent deficit. Secondly, following a temporary rise to -3.5% in 2020 (partly attributed to export growth and import decline), there was a drastic downturn to -40% and -25% of GDP in 2021 and 2022, respectively. Recent adversities, including the COVID-19 pandemic, the Russia-Ukraine conflict, and global financial tightening, severely impacted Cambodia's primary export — garment (over 80% of Cambodia's total exports) — and tourism sector (about 20% of Cambodia's GDP), further emphasizing Cambodia's vulnerability to shocks.

[5]Primary income balance (PI) encompasses the net income earned by Cambodian residents from global labor and financial investments.

[6]Secondary incomes balance (SI), also known as unilateral transfers, refers to non-reciprocal transactions between Cambodian and the world. SI consists of government transfers and personal transfers.

Figure 3: Trends of Cambodian balance of payment, and net international investment position (NIIP) from 1993 to 2022.



Note: NIIP and the transfers are sourced from the IMF, and data for FDI is obtained from the World Bank Development Indicators (WDI). For the abbreviations, SI: secondary income balance, PI: primary income balance, CA: current account balance, TB: trade balace, PT: net personal transfers, GT: net government transfers, NIIP: net international investment position.

Without the influx of secondary income, amounting to about 9% of the GDP annually — increasingly from remittances and decreasingly from foreign aid — the current account balance would be considerably more adverse. The second panel of Figure 3 shows a marked decline in net government transfers (GT) from 6% in 1993 to a mere 2% in 2022, whereas net personal transfers (PT) increased almost 9 percentage points over the same period. This can be attributed to Cambodian 1975-79 genocide survivors migrating to advanced countries such as Australia, France, and the U.S. and recently more Cambodian youths working abroad, mainly in South Korea and Thailand. Moreover, two global crises — the 2007-2009 Global Financial Crisis (GFC) and the COVID-19 pandemic — prompted a drop in remittances, emphasizing both its significance and vulnerability to global shocks.

To counteract the swelling current account deficit, the Cambodian government initiated macroeconomic policies such as dollarizing the economy to mitigate currency risk and fostering an open investment market to attract capital inflows. Foreigners are encouraged to buy and wholly own Cambodian assets and directly invest in the country. As demonstrated in the third panel of Figure 3, net FDI (as a percentage of GDP) surged from 2% in 1993 to approximately 12% in 2022. Nonetheless, during this period, the FDI also experienced four downturns due to varied shocks: i) the 1997 Cambodian coup d'état, ii) the 2007-2009 GFC, iii) the political deadlock over Cambodia's disputed election in 2013, and iv) the COVID-19 pandemic. The first and third shocks highlight the country's vulnerability to capital flight. The dollarized economy, however, does offer a buffer against exchanging rate risk.

Additionally, a steady inflows of official loans and grants helped counterbalance the current account deficit. As can be seen in the third panel of Figure 3, the net international investment position (NIIP), representing the disparity between external assets and liabilities, has been on a decline over the past decade. As of 2022, Cambodia's NIIP plummeted to -131% of its GDP, leading to a steady decline in primary income (PI) from about 1% in 1993 to -5% of GDP in 2022.

The escalating deterioration of the current account heightens concerns regarding Cambodia's financial health and creditworthiness. Being a perennial net debtor, its sustained external balance deficits are not tenable in the long run. Consequently, Cambodia will eventually need to establish a trade balance surplus to service its accruing debt (Schmitt-Grohé et al., 2022).

3 Two Views on Current Account

Accounting identities offer two perspectives on the current account balance: trade flows with related payments or, alternatively, through saving, investment, and international financial flows. Although these are essentially two sides of the same coin, each perspective provides distinct insights into current account dynamics (Bernanke, 2005).

The elasticity approach, which interprets the current account balance as a country's net trade, posits that the relative prices of traded goods and their determinants are critical in accounting for the evolution of the current account.[7] This approach is particularly useful for understanding the short-term impacts of exchange rates on the current account. However, its utility diminishes when trying to explain long-term current account trends (Yang, 2011). To bridge this gap, economists have conceptualized the intertemporal approach.

This approach augments the elasticity method, positing that private saving and investment decisions fundamentally drive the evolution of the current account. The foundational idea is that households can smooth consumption by borrowing and saving in responses to income fluctuation (Schmitt-Grohé et al., 2022). This sentiment is echoed by Abbasoğlu et al. (2019), who utilized Engel and Rogers' (2006) model to scrutinize the Turkish current account trend, emphasizing that nations with income projected to grow faster than global averages tend to increase consumption, leading to a current account deficit.

Building on this, the intertemporal approach has also been incorporated into the RBC model to examine the effects of productivity or demand shocks on the current account balance (Calderon et al., 2002). Aguiar and Gopinath (2007) leverage net exports and consumption data to identify the persistent effects of productivity. They find that shocks to trend growth — rather than temporary shocks around a stable trend — are the primary sources of fluctuations in emerging countries' income, consumption, investment and trade balance. In contrast, the work of García-Cicco et al. (2010) challenges the notion that the business cycle is synonymous with the trend. Analyzing data from 1990 to 2005, they argue that both temporary and permanent productivity shocks do not adequately explain fluctuations in trade balances, among other variables, in Argentina and Mexico. However, by augmenting Aguiar and Gopinath (2007)'s model with preference shocks, country-premium shocks, and a debt elasticity of the country premium, García-Cicco et al. (2010) finds better alignment with observed business cycles in these two countries.

To compare the contributions of Aguiar and Gopinath (2007) and García-Cicco et al. (2010), Chang and Fernández (2013) establish and estimate a comprehensive RBC model using the same dataset as in Aguiar and Gopinath (2007). Their model attributes a significant role to financial frictions but a minor role to trend shocks in amplifying traditional (transitory) productivity shocks to aggregate fluctuations.

In the standard framework, the current account balance serves as a buffer against tran-

[7] This approach is developed by Charles Bickerdike, Joan Robinson, and Lloyd Metzler, thus commonly known as Bickerdike-Robinson-Metzler Condition (Dornbusch, 1975). This condition is satisfied when a country's currency depreciation helps improve its trade balance (Bleaney and Tian, 2014).

sitory shocks in productivity or demand, smoothing out these fluctuations. As such, the current account is expected to gravitate around a fixed mean in the long run. However, data from various developed and developing countries does not support this prediction. Choi et al. (2008) and Choi and Mark (2009) address this puzzle by introducing an endogenous discount factor into their model to explain current account trends in Japan, the UK and the U.S. For instance, by allowing societal consumption to affect the subjective discount factor, Choi et al. (2008) are able to account for the evolution of the U.S. current account from 1975 to 2005.

The RBC model developed in the next section still employs an exogenous discount factor but successfully replicates the actual path of the Cambodian current account. This suggests that whether the discount factor is endogenous or exogenous is not a critical factor in explaining macroeconomic fluctuations. Instead, a model's accuracy in matching the actual data patterns hinges on proper specification, calibration, and estimation.

4 The Real-Business-Cycle Model

We develop a standard single-good, single-asset small open economy model, drawing inspiration from the comprehensive model by Chang and Fernández (2013), which integrates both permanent productivity shocks as in Aguiar and Gopinath (2007) and financial friction shocks as in García-Cicco et al. (2010). A key departure from Chang and Fernández (2013) in our model is the inclusion of remittances and the effects of FDI on technological growth. For the sake of clarity and comparison, we also present the outcomes derived from the original encompassing model.

4.1 Economy

Time is discrete and indexed by $t = 0, 1, 2, \ldots$. At each period, the single-final good is produced with the Cobb-Douglas technology as follows,

$$Y_t = a_t K_t^{1-\alpha} \left[\Gamma_t h_t\right]^{\alpha}, \tag{1}$$

where $\alpha \in (0, 1)$ governs the labor share of output, Y_t stands for output, K_t refers to capital, h_t denotes labor input, and a_t and Γ_t represent a transitory productivity shock and a permanent productivity shock, respectively. The sources of these shocks are not limited to exogenous changes in technology but other disturbances as well, such as variations in terms of trade.

Throughout the paper we use upper case letters, X_t, to denote variables that contain a trend and lower case letters for de-trended variables in equilibrium, $x_t = \frac{X_t}{\Gamma_{t-1}}$. In addition, ρ_x and μ_x denote the persistence parameter and the long-run mean of variable x, respectively. These two notations are used in the following reduced-form stochastic equations.

The transitory productivity shock a_t is assumed to follow a first-order autoregressive process (AR[1]) in the log form:

$$log(a_t) = \rho_a log(a_{t-1}) + \epsilon_t^a,$$

where ϵ^a is an independently and identically distributed (i.i.d.) error term draws from a normal distribution with zero mean and standard deviation of σ_a ($\epsilon^a \overset{iid}{\sim} N[0,\ \sigma_a^2]$). The i.i.d. assumption applies to all the following error terms as well.

The variable Γ_t is the cumulative product of permanent productivity growth, g. That is, $\Gamma_t = g_t\Gamma_{t-1} = \prod_{s=0}^{t} g_s$. The permanent productivity growth is assumed to follow an autoregressive distributed one lag (ADL[1,1]) process as follows:

$$log(g_t/\mu_g) = \rho_g log(g_{t-1}/\mu_g) + \gamma[fdi_t - \mu_{fdi}] + \epsilon_t^g,$$

where fdi_t denotes the net foreign direct investment-to-output ratio, the parameter γ is the effect of fdi_t on the permanent productivity growth, and fdi_t itself is assumed to follow an AR[1] process:

$$fdi_t = [1 - \rho_{fdi}]\mu_{fdi} + \rho_{fdi} fdi_{t-1} + \epsilon_t^{fdi}$$

The stock of capital accumulates according to the following law of motion:

$$K_{t+1} = [1 - \delta]K_t + I_t - \Phi(K_{t+1}, K_t), \tag{2}$$

where δ is the constant rate of depreciation, I_t denotes gross investment, and Φ is the adjustment cost of installing capital and has a quadratic form below:

$$\Phi(K_{t+1}, K_t) = \frac{\phi}{2}\left[\frac{K_{t+1}}{K_t} - \mu_g\right]^2 K_t,$$

where ϕ is the capital adjustment cost parameter.

The economy is populated by a large number of infinitely lived, identical households who face the period-by-period budget constraint:

$$W_t h_t + u_t K_t + NT_t + q_t D_{t+1} = C_t + I_t + D_t, \tag{3}$$

where W_t is the wage rate, u_t represents the rental rate of capital, NT_t denotes the net unilateral transfers with the rest of the world, D_t denotes the level of debt due in period t, q_t stands for the time t price of debt due in period $t+1$, and C_t refers to consumption.

The ratio of net unilateral transfer to output, denoted by nt, is assumed to follow an AR[1] process:

$$nt_t = [1 - \rho_{nt}]\mu_{nt} + \rho_{nt} nt_{t-1} + \epsilon_t^{nt}$$

The price of debt, q_t is sensitive to the level of outstanding debt and takes the form of:

$$\frac{1}{q_t} = R_t + \psi \left[\exp\left(\frac{D_{t+1}}{\Gamma_t} - \bar{d} \right) - 1 \right], \tag{4}$$

where ψ is the elasticity of the interest rate to variations in indebtedness, $\bar{d}$ denotes the steady-state level of normalized debt, and R_t, a country-specific gross interest rate, is assumed to equal the product of the world gross interest rate (R_t^*) and a country-specific spread (S_t):

$$R_t = S_t R_t^* \tag{5}$$

The world interest rate is random and fluctuates around its long-run mean $\bar{R}^*$ according to:

$$log(R_t^*/\bar{R}^*) = \rho_R log(R_{t-1}^*/\bar{R}^*) + \epsilon_t^R$$

The deviations of the country spread from its long-run level, S, depend on expected future productivity as follows:

$$log(S_t/S) = -\eta E_t log(a_{t+1} g_{t+1}^{\alpha} / \mu_g^{\alpha}),$$

where η is the elasticity of the spread to the future productivity, and E_t is the expectation operator at period t.

Moreover, competitive firms are assumed to finance a portion of their wage bill in advance. In particular,

$$W_t \left[1 + \theta[R_{t-1} - 1]\right] = \frac{\alpha}{h_t} Y_t \tag{6}$$

Equation (6) implies that firms hire labor up to the point where the marginal product of labor is equal to the wage rate including financial costs. Furthermore, firms borrow from households and pay a fraction θ of the wage bill in advance.

4.2 Equilibrium

Subject to Equations (1)–(3), the no-Ponzi game constraint, $lim_{j\to\infty}E_t(D_{t+j}\prod_{s=0}^{j}q_s) \leq 0$, and taking as given the process a_t, Γ_t, R_t, and the initial condition K_0 and D_{-1}, household seeks to maximize the following lifetime utility function:

$$
\begin{aligned}
&E_0 \sum_{t=0}^{\infty} \beta^t u(C_t, h_t, \Gamma_{t-1}),\\
&u(C_t, h_t, \Gamma_{t-1}) = \frac{[C_t - \tau\Gamma_{t-1}h_t^{\omega}]^{1-\sigma}}{1-\sigma},
\end{aligned}
$$

where σ is an intertemporal elasticity of substitution, ω is a labor supply elasticity, and τ is a labor parameter. The optimal conditions are given by:

$$w_t = \tau\omega h_t^{\omega-1}, \tag{7}$$

$$\left[1 + \phi\left[\frac{g_t k_{t+1}}{k_t} - \mu_g\right]\right] = q_t\left[u_{t+1} + 1 - \delta + \frac{\phi}{2}\left[\left[\frac{g_{t+1}k_{t+2}}{k_{t+1}}\right]^2 - \mu_g^2\right]\right], \tag{8}$$

$$q_t\left[c_t - \tau h_t^{\omega}\right]^{-\sigma} = \beta g_t^{-\sigma} E_t\left[c_{t+1} - \tau h_{t+1}^{\omega}\right]^{-\sigma} \tag{9}$$

Given the equilibrium processes of consumption, capital, hours, and debt, output can be obtained from Equation (1), investment from Equation (2), price of debt from Equation (4), and interest rate from Equation (5). The equilibrium process of the trade balance then can be obtained from the definition and Equation (3):

$$
\begin{aligned}
tb_t &= y_t - c_t - i_t\\
&= d_t - q_t g_t d_{t+1} - nt_t,
\end{aligned} \tag{10}
$$

where tb_t denotes the trade balance. Finally, the equilibrium process of the current account, denoted by ca_t, is given by the sum of the trade balance, net investment income, and net unilateral transfer, or equals to the net foreign assets. That is,

$$
\begin{aligned}
ca_t &= tb_t - [1 - q_{t-1}]d_t + nt_t\\
&= -q_t g_t d_{t+1} + q_{t-1}d_t
\end{aligned} \tag{11}
$$

Equations (10) and (11) show that the transfer directly influences the external balances, but FDI indirectly affects these balances through the permanent productivity growth.

4.3 Solution, calibration, and estimation

Since the system of nonlinear stochastic difference equations typically lacks closed form solutions, our work, like other RBC literature, uses log-linearization to approximate the equilibrium conditions around the stationary steady state and then estimate the models. We use the same calibrated parameters for both models: the encompassing model of Chang and Fernández (2013) and our model, which is essentially the encompassing model augmented with personal transfers and FDI.

Table 1: Calibrated parameters

Parameter	Description	Value
σ	Intertemporal elasticity of substitution $(1/\sigma)$	2
β	Subjetive discount factor	0.96
ω	Labor supply elasticity $(1/[\omega - 1])$	1.6
τ	Labor parameter so that labor input at steady state is 1/3	1.72
δ	Depreciate rate of capital	0.04
ψ	Debt elastic interest rate parameter	0.001
$\bar{R}^*$	Gross world interest rate	1.01
S	Long-run gross country interest rate premium	1.0835
$\bar{d}$	Debt-to-GDP ratio	0.16
α	Parameter governing income labor share	0.4227

Table 1 presents the calibrated parameters, most of which are set at conventional values. The coefficient of relative risk aversion, σ, is 2; the subjective discount factor, β, is 0.96; the parameter, ω, is 1.6 so that the labor supply elasticity is 1.67; τ is 1.72 to make working time one third in the long run; the depreciation rate, δ, is 0.04 per year, sourced from Penn World Table 10.01 (Feenstra et al., 2015); the debt elastic interest rate, ψ, is 0.001; and the gross world interest rate, $\bar{R}^*$, is 1.01 per year in the long run. The long-run gross country interest rate premium is 1.0835, based on Damodaran (2022). The long-run debt-to-GDP ratio, $\bar{d}$, is 0.16 based on the initial value of data availability of net international investment position as a percentage of GDP from 1998 to 2022. Finally, the parameter α is 0.4227, matching Cambodia's average labor share from 2004 to 2019, based the International Labor Organisation (2023). Note that this number is not exactly equal to the labor share. As Equation (6) shows, it is calibrated as the labor share times $[1+\theta(R-1)]$. However, as $\theta(R-1)$ is relatively small, we approximate α as labor share. This implies that α has a distribution determined by the posterior distribution of θ.

The remaining parameters are estimated using the Bayesian Markov Chain Monte Carlo method with one hundred thousand draws. These include parameters of the exogenous shocks and three other parameters: capital adjustment cost (ϕ), the elasticity of the spread with respect to the expected productivity (η), and working capital requirement (θ).

Table 2: Posterior distributions of estimated parameters and shocks for the encompassing model and the model with transfers and FDI

Para. & shock	Description	Prior distribution			Encompassing model			Model with NT and FDI		
		Density	Mean	STD	Mode	Mean	90% C.I.	Mode	Mean	90% C.I.
ρ_a	AR(1) coef. transitory productivity process	Beta	0.95	0.02	0.95	0.96	[0.93, 0.98]	0.95	0.92	[0.88, 0.98]
ρ_g	AR(1) coef. permanent productivity process	Beta	0.72	0.02	0.72	0.72	[0.68, 0.75]	0.72	0.71	[0.68, 0.75]
ρ_R	AR(1) coef. world interest rate process	Beta	0.83	0.05	0.83	0.79	[0.71, 0.90]	0.79	0.80	[0.74, 0.85]
ρ_{nt}	AR(1) coef. NT–Y ratio process	Beta	0.82	0.16				0.89	0.86	[0.75, 0.99]
ρ_{fdi}	coef. FDI–Y ratio process	Beta	0.87	0.10				0.98	0.95	[0.90, 0.99]
ϕ	Capital adjustment cost parameter	Gamma	6.00	3.46	6.00	13.78	[5.69. 21.28]	7.4	19.90	[11.18, 28.69]
η	Spread elasticity	Gamma	1.00	0.10	0.96	0.97	[0.81, 1.13]	0.96	0.94	[0.78, 1.10]
θ	Working capital parameter	Beta	0.50	0.22	0.50	0.50	[0.12, 0.85]	0.50	0.50	[0.12, 0.85]
γ	Effect of FDI–Y ratio on productivity growth	Normal	0.07	0.25				0.07	0.11	[0.04, 0.18]
σ_a	STD(%) of coef. transitory productivity shock	Gamma	0.74	0.56	0.10	0.24	[0.07, 0.40]	0.10	0.25	[0.01, 0.51]
σ_g	STD(%) of coef. permanent productivity shock	Gamma	0.74	0.56	0.20	0.50	[0.02, 0.98]	0.31	0.56	[0.03, 1.05]
σ_R	STD(%) of coef. world interest rate shock	Gamma	0.72	0.31	0.20	0.33	[0.13, 0.54]	0.39	0.42	[0.18, 0.64]
σ_{nt}	STD(%) of NT–Y ratio shock	Gamma	0.72	0.31				0.94	1.02	[0.66, 1.37]
σ_{fdi}	STD(%) of FDI–Y output shock	Gamma	0.72	0.31				0.97	1.01	[0.65, 1.36]
σ_{CA}	STD(%) of measurement error in CA–Y ratio	Gamma	2.00	1.00	0.84	1.00	[0.39, 1.61]	0.58	0.74	[0.24, 1.21]
σ_{TB}	STD(%) of measurement error in TB–Y ratio	Gamma	2.00	1.00	4.11	4.02	[3.04, 4.92]	1.45	1.47	[0.96, 2.02]
σ_Y	STD(%) of measurement error in Y	Gamma	2.00	1.00	2.26	2.56	[1.87, 3.23]	2.24	2.28	[1.65, 2.85]
σ_C	STD(%) of measurement error in C	Gamma	2.00	1.00	3.12	2.91	[1.96, 3.84]	2.25	2.21	[1.13, 3.26]
σ_I	STD(%) of measurement error in I	Gamma	2.00	1.00	10.24	10.40	[8.66, 12.16]	10.28	10.51	[8.72, 12.24]
σ_{NT}	STD(%) of measurement error in NT–Y ratio	Gamma	2.00	1.00				0.83	0.89	[0.39, 1.31]
σ_{FDI}	STD(%) of measurement error in FDI–Y ratio	Gamma	2.00	1.00				1.50	1.58	[10.09, 2.07]

We estimate the model using log differences of Y, C, I, and levels of TB/Y, CA/Y, NT/Y and FDI/Y over the period 1993–2019. As in Chang and Fernández (2013), we also add the measurement errors to all of these variables because of the measurement issues concerning with macroeconomic data in developing economies, especially those with lower incomes. We obtain the data for NT/Y, measured by the personal transfers as in Barajas et al. (2012), from the IMF, but for the rest of the variables—in real local currency—from the World Bank Development Indicator. We also use the Penn World Table 10.01 from 1993 to 2019 to estimate the total factor productivity (TFP) and the effect of fdi on the productivity growth (γ).

Table 2 reports prior and posterior distributions of the estimated parameters. We use Cambodian data to obtain the prior distributions of three parameters: ρ_{nt}, ρ_{fdi} and γ. In regards to the rest of the estimated parameters, their prior values are the same as those in Chang and Fernández (2013).

4.4 Variance decomposition

Table 3 presents the results on variance decomposition (i.e. how much exogenous shocks contribute to variations in macroeconomic variables) of the encompassing model and our model that incorporates personal transfers (NT) and FDI.

Table 3: Variance decomposition (in percent)

Variable	Encompassing Model			Model with NT and FDI				
	σ_a	σ_g	σ_R	σ_a	σ_g	σ_R	σ_{nt}	σ_{fdi}
y: output	32.39	29.08	37.54	27.00	26.24	45.03	0.01	10.07
c: consumption	49.73	22.11	28.14	23.44	14.38	24.15	2.67	38.58
i: investment	60.73	19.69	20.10	25.23	18.36	19.57	0.07	40.43
$\frac{tb}{y}$: trade balance-output ratio	58.12	9.57	32.11	14.31	5.46	27.40	2.07	54.12
$\frac{ca}{y}$: current account-output ratio	56.23	9.63	34.01	11.53	4.57	24.15	13.05	43.40

Overall, the shocks of world interest rate and transitory productivity play more pronounced roles than the shock of permanent productivity growth in explaining macroeconomic fluctuations. This finding reinforces the study of Chang and Fernández (2013) and is robust when the model is estimated without FDI and personal transfers. Intriguingly, the impact of FDI mirrors the significance of the interest rate shock in accounting for the observed business cycle in Cambodia. This underscores the emphasis placed by developing countries on FDI as a pivotal component in their broader economic development strategy. When assessing the current account-to-output ratio, FDI and personal transfers together explain its variations better than the shocks of productivity and interest rate:

combined, these two elements account for roughly 55 percent of the total variations. This result should not be surprising as it reflects the fact that Cambodia's deteriorating current account has been increasingly supported by personal transfers and FDI.

4.5 Impulse responses

This section discusses how output, consumption, investment, labor, trade balance and current account-to-output ratios respond to a 1-percent positive shock of three exogenous variables: permanent productivity, personal transfers, and FDI. We leave the well-known impulse responses of transitory productivity and world interest rate in Figures A3 and A4 of Online Appendix, respectively.

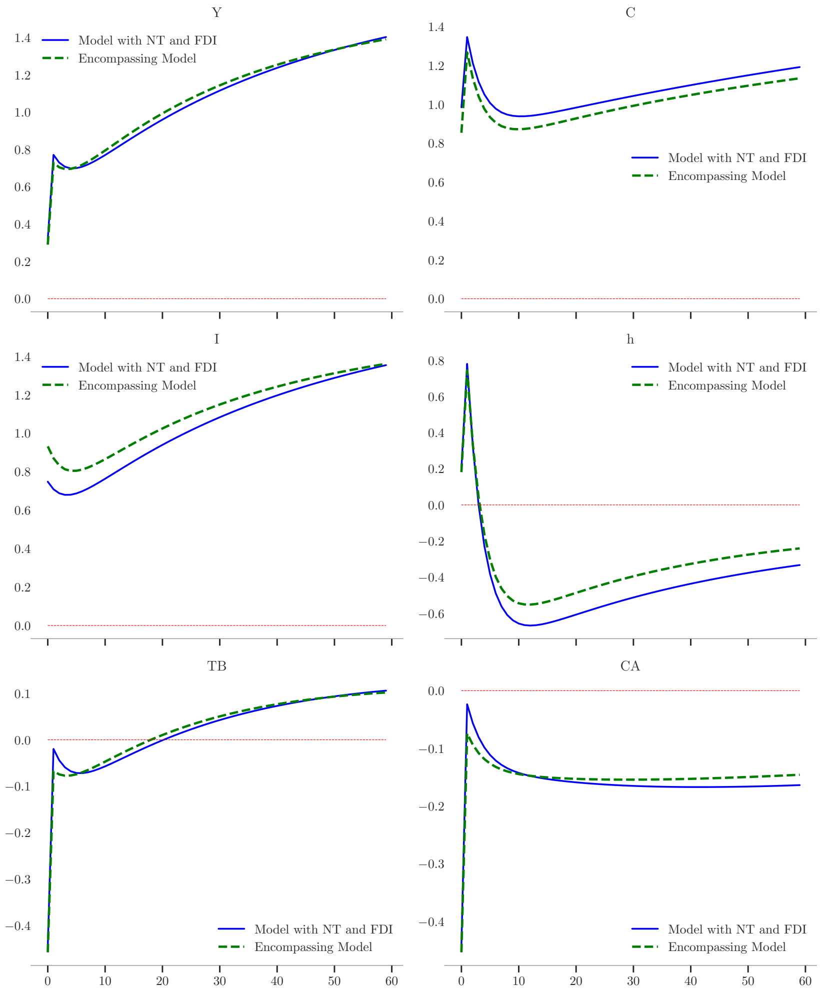
4.5.1 Responses to a positive permanent technology shock

Figure 4 presents the impulse response functions of six variables of interest to a permanent technological shock of 1-percent in period 0 for both models: the encompassing model is shown by the dashed line, and the model including personal transfers and FDI is by the solid line. The impulse response functions for both models are almost identical for each variable.

In response to this technological innovation, our model predicts an expansion in output, consumption and investment, but a deterioration in trade balance and current account-to-output ratio. The initial improvement in technology raises capital productivity which leads to increased investment. The technological improvement also raises the real wage which encourages workers to supply more labor. Furthermore, the higher wage increases the price of leisure, hence consumption increases. Because the technological shock is more persistent ($\rho_g = 0.71$), households expect their income to increase for several periods. Consequently, consumption-smoothing households have less incentive to save their increased income; instead, they tend to borrow against future income to finance their current consumption. This suggests that the initial increase in domestic absorption ($C_0 + I_0$) is larger than the initial increase in output, thus worsening the trade balance and current account-to-output ratio.

In period 1, as the increase in investment in period 0 goes into production, output increases sharply around 0.5 percentage points; consumption rises about 0.4 percentage points; investment, however, decreases marginally around 0.1 percentage point. The rise of trade balance and current account-to-output ratio from -0.5% to almost 0% implies that an increase in output is greater than that of domestic absorption. This indicates that agents start to save more of their increased income due to permanent productivity shock.

Figure 4: Responses to a 1-percent permanent productivity shock

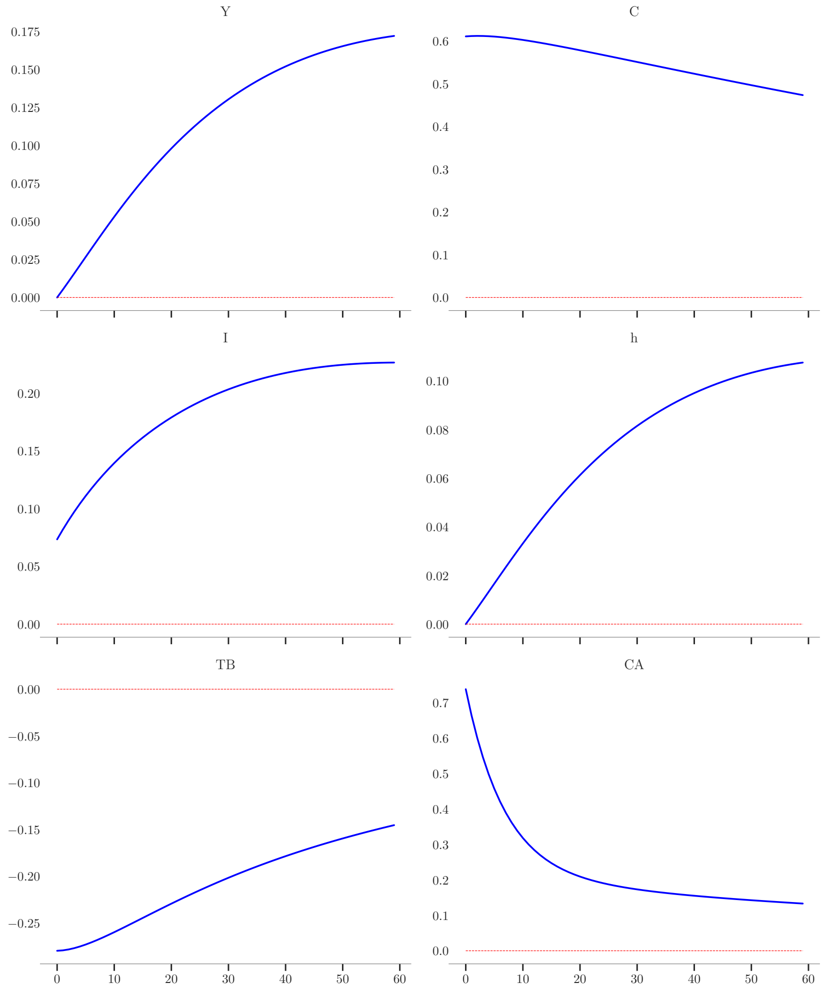


Note: The impulse responses of Y, C, I, and h are expressed in percentage deviations from the steady state. For example, $\hat{Y}_t = \hat{y}_t + \hat{\Gamma}_{t-1} = \hat{y}_t + \sum_{s=1}^{t-1} log(g_s)$, where the hatted variable $\hat{x_t} = log(x_t/x_0)$ is the percentage deviation from the steady state at time 0. The impulse responses of TB/Y and CA/Y are percentage-point deviations from the steady state.

4.5.2 Responses to a positive personal transfer shock

Figure 5 illustrates the impact of a one-percent shock of personal transfer on key variables. Initially, consumption, investment and current account-to-output ratio respond positively to the innovation, whereas output and labor supply remain largely unchanged. The initial increased source of income leads to a rise in consumption and investment, thus leading to a decline in trade balance. However, because the growth of consumption and investment (0.67%) is less than that of personal transfer (1%), the current account balance improves, indicating that the households save more of their increased income. In period 1, while output and investment increase slightly, consumption and trade balance remain about the same as in the previous period due to the high persistence in personal transfers ($\rho_{nt} = 0.86$). As a result, although the current account-to-output ratio remains in the positive domain, it starts to exhibit a gradual decline.

Figure 5: Responses to a 1-percent personal transfer-to-output shock

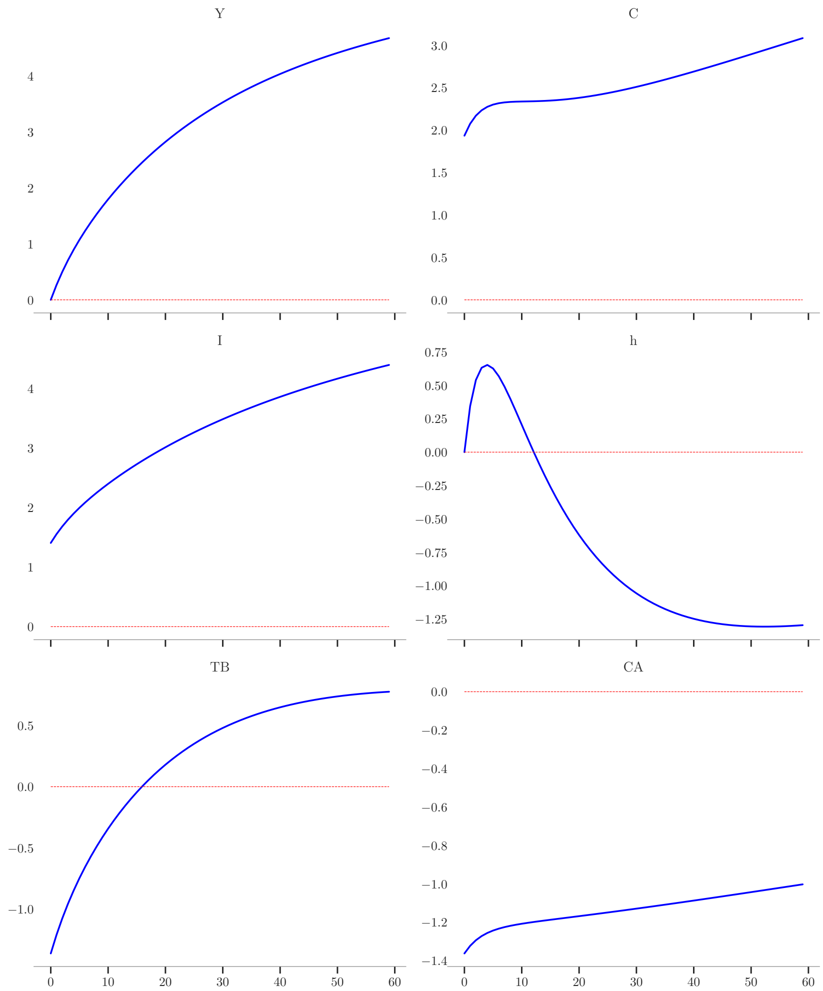


Note: The impulse responses of Y, C, I, and h are expressed in percentage deviations from the steady state. The impulse responses of TB/Y and CA/Y are percentage-point deviations from the steady state.

4.5.3 Responses to a positive net foreign direct investment

Figure 6 displays the impulse response functions of the interested variables to a 1-percent shock of FDI in period 0. Initially, consumption and investment increase while output remains unaffected. This leads to a contraction in both the trade balance and the current account-to-output ratios. Evidently, FDI has a positive impact on permanent technological growth. The technology advance raises capital productivity and wage rates, thereby stimulating both investment and consumption. Thereafter, investment, output and consumption continue to grow. Nevertheless, trade balance and current account-to-output ratio start to improve gradually towards their respective steady states. This suggests that, while domestic absorption outpaces output, their difference between them narrows over time. The reason is that FDI and productivity trends are quite persistent ($\rho_{fdi} = 0.95$ and $\rho_g = 0.71$): agents increase consumption and investment at slower rates.

Figure 6: Responses to a 1-percent FDI to-output shock



Note: The impulse responses of Y, C, I, and h are expressed in percentage deviations from the steady state. The impulse responses of TB/Y and CA/Y are percentage-point deviations from the steady state.

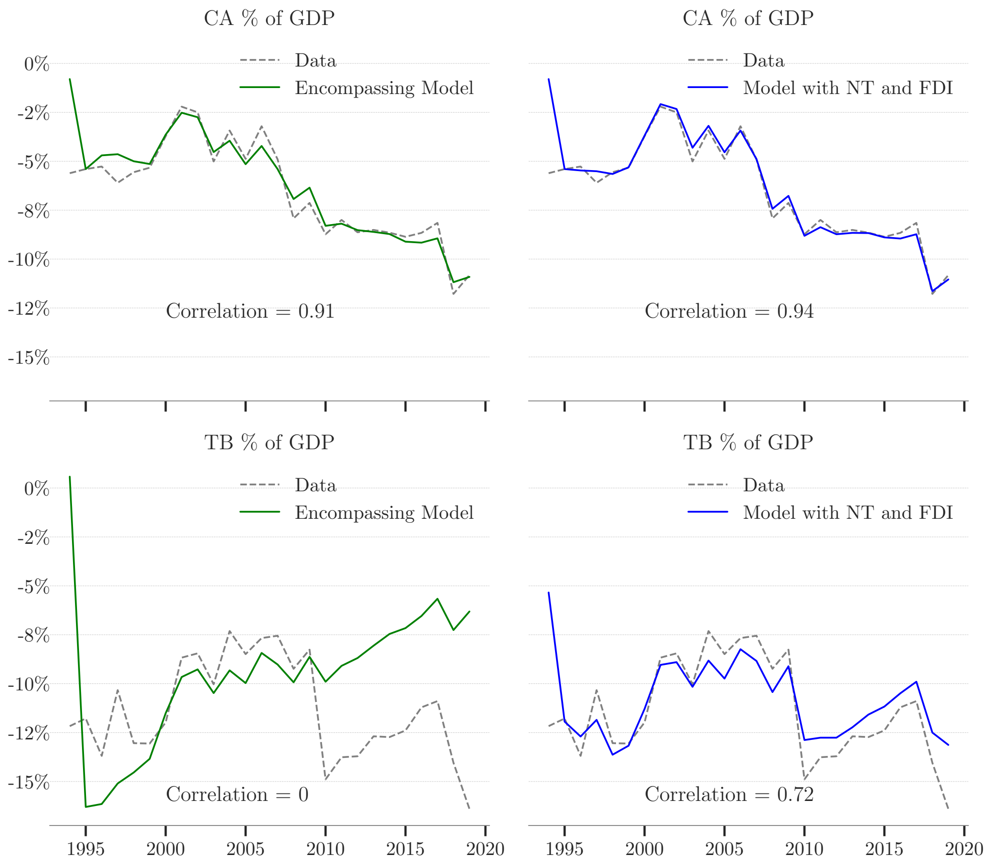
5 An Explanation of the External Balances

This section evaluates the models' fit against historical data for Cambodia's external balances. Figure 7 presents the trends of the current account and trade balance-to-output ratios. The dashed lines represent actual data, whereas the solid lines depict predictions from two distinct models: the encompassing model and our model that integrates both personal transfers and FDI. Given that our models account for measurement errors, the proximity between the observed data and the model's prediction indicates a better fit. Specifically, when we feed the models with the actual observations (Y, C, I, TB/Y, CA/Y, NT/Y & FDI/Y), we obtain the output, for example,

$$log(Y_t/Y_{t-1}) = log(y_t/y_{t-1}) + g_t + e_t^Y,$$

where the terms on the right-hand side are in the models, and e_t^Y is the measurement error.

Figure 7: Trends of current account and trade balance with actual data and model-generated data



Our model, which incorporates both personal transfers and FDI, aligns more closely with the evolution of the external balances than its encompassing counterpart. It aptly replicates the dynamics of the current account and trade balance-to-output ratios. The correlations between the actual data and model-generated data for both time series are 0.94 and 0.72, respectively. This is in contrast to the encompassing model's values of 0.90 and 0.

The enhanced alignment can be attributed to the inclusion of two additional variables — personal transfers and FDI — along with their associated measurement errors in our model, as compared to the encompassing one. Chang and Fernández (2013) highlight the non-trivial nature of variable selection and the inclusion of measurement errors during model estimation. Given that DSGE models are often estimated using Bayesian methods, the posterior distributions can vary considerably based on the chosen observation sets (Guerron-Quintana, 2010). For instance, omitting the measurement errors of output and investment, as shown in Figure A5, results in significant deviations in the model outputs. However, acknowledging measurement challenges prevalent in low-income countries, our approach incorporates measurement errors for all observations.

6 Concluding Remarks

In this study, we develop and estimate a small open economy real-business cycle model to elucidate the nuances of Cambodia's current account dynamics. Differing from the existing literature, we emphasize the roles of remittances and foreign direct investment, given their substantial impact on developing economies. Our findings indicate that these two elements, particularly FDI, collectively account for roughly half the observed variations in both the current account and trade balance.

By aligning the model with historical data for both exogenous and endogenous variables, we draw parallels between the current account trajectories predicted by the model and the empirical data. The model aptly replicates the saving and investment behavior of households, aligning closely with the empirical trajectory of Cambodia's external balances.

Significantly, Cambodia seems to resonate with the "intertemporal theory of the current account." Given that our model is grounded in this theory, it holds potential applicability for other economies that exhibit adherence to this theoretical framework.

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