The evolution of Cambodian current account: A dynamic general equilibrium analysis

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The Evolution of Cambodian Current Account: A Dynamic General Equilibrium Analysis

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Abstract

This paper develops and estimates a small open economy real-business cycle model to study the dynamics of Cambodian current account. Differing from previous studies, we include net unilateral transfers and net foreign direct investment (FDI) as additional sources of macroeconomic fluctuations. We show that these two sources explain the variations in current account better than the shocks that are widely identified in the literature (i.e. productivity and interest rate). Our model captures Cambodia's saving-and-investment behaviour and matches well the evolution of its current account. Specifically, the measurement error is nearly 4% and the correlation between data and model is around 0.93. As a step further, using our well-fitted model, we predict the future trend of Cambodian current account in the context of negative shocks in productivity, remittance, FDI and COVID-19 pandemic.

Keywords: real business cycle; current account; FDI; unilateral transfer; COVID-19

JEL Classification: F3; F41

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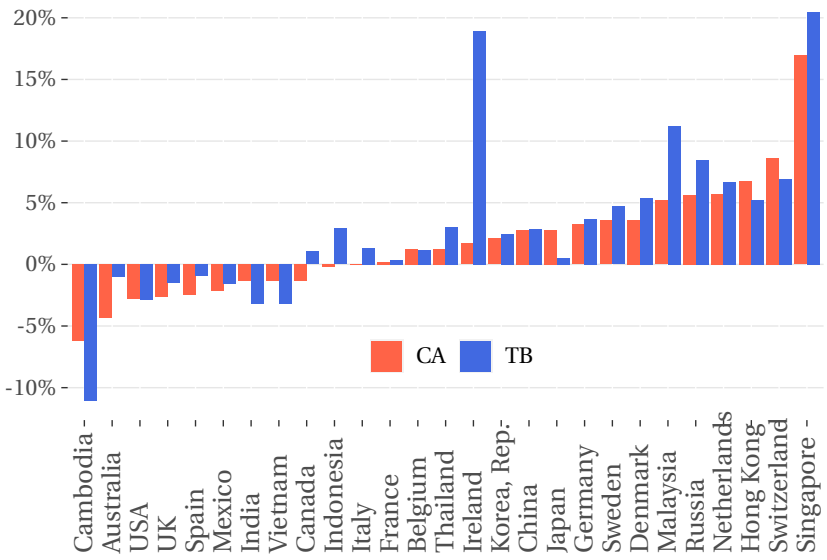
1 Introduction

Cambodia has performed particularly well in recent decades. Robust economic growth averaging 7% per year, making it one of the fastest growing economies in the world; the inflation rate has been stable, around 3%, and the poverty rate has dropped significantly from 47.8% in 2007 to 13.5% in 2014. However, one aspect of Cambodian economic performance appears to raise concerns among policymakers: the country's external balances, shown in Figure 1, have been the worst among its top trading partners.[1] Cambodian trade and current account balance-to-output ratios are around -6% and -11% on average over the period 1993-2018, respectively.

Figure 1: Average of trade balance-to-output ratio (TB) and current account balance-to-output ratio (CA) of Cambodia and its top trading partners over the period 1993–2018



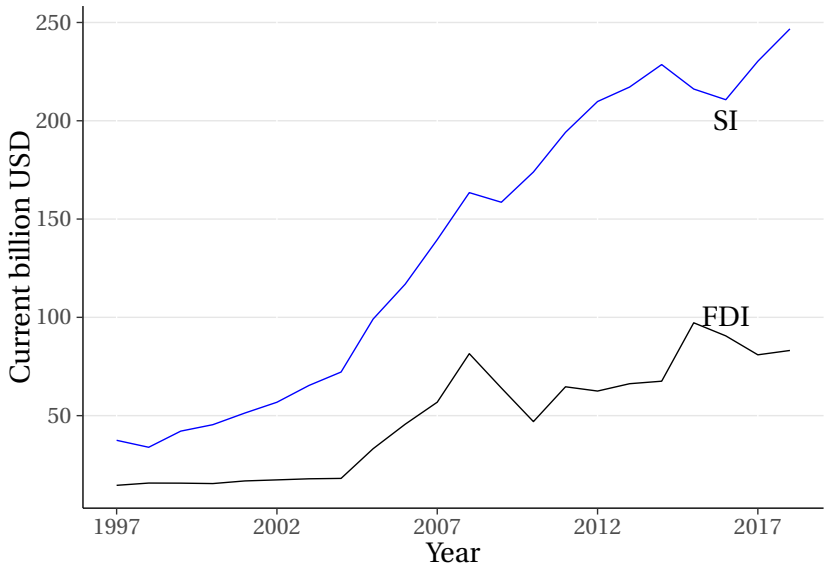
Note: The source of data is the World Development Indicator.

To examine the dynamics of Cambodian current account, this paper develops and estimates a small open economy real-business cycle (SOE-RBC) model. Existing RBC literature, such as Arezki et al. (2017), Chang and Fernández (2013), Choi and Mark (2009) among others, identified shock of productivity, interest rate or both as key sources of macroeconomic fluc-

[1] Whose combined trade (imports + exports) is more than 95% of Cambodia's total trades with the rest of the world.

tuations. In addition to these two shocks, this paper includes net foreign direct investment (FDI) and net unilateral transfer as additional factors in explaining the variations in Cambodian current account. Four observations motivate us to do so: (i) For developing countries, FDI contributes to the economic growth and development in two main ways. It provides host countries with physical capital and new technology. Furthermore, it also improves host countries' human capital through on-the-job training, acquisition and diffusion of technical, managerial and organisational skills (Agbola, 2013; Kheng et al., 2017); (ii) Foreign aid and remittance have a positive effect on growth because they can reduce poverty, smooth consumption and ease capital constraints of the poor (Nwaogu and Ryan, 2015; Catribescu et al., 2009); (iii) The past two decades has witnessed an unprecedented increase in secondary income (or unilateral transfers) and FDI flows to the lower middle-income countries[2] (Figure 2) and (iv) Cambodia, a lower middle-income country today, has received net unilateral transfers around 8% of GDP per year. This statistic is twice as large as its government expenditure. The country has also attracted net FDI around 12% of GDP during the last decade.

Figure 2: Trends of net foreign direct investment (FDI) and net secondary incomes (SI) in low- and middle-income countries over the period 1997-2018



Note: The source of data is the World Development Indicator.

[2]For the current 2021 fiscal year, the World Bank classifies lower middle-income economies as those with a gross national income (GNI) per capita between 1036 USD and 4045 USD.

In line with Chang and Fernández (2013), our model shows that the transitory productivity and interest rate shocks are still primary sources of macroeconomic fluctuations. FDI and unilateral transfer, however, explain the variations in the current account-to-output ratio better. To be more specific, these two sources altogether account almost half of the variations in Cambodian current account. The magnitude might reflect the fact that Cambodia's economy and external imbalance have been supported by external sources since the country had been devastated by regional and civil wars in the 1970s.

We then calibrate our model using the historical data on both key exogenous and endogenous variables[3] and observe the current account choices made by agents to mimic the actual time paths of the data. Our model captures country's saving behaviour and matches well the evolution of Cambodian current account. Furthermore, compared to the models estimated without considering FDI and unilateral transfers, our model is superior because the results are much improved. In particular, the measurement error is around 4% and the correlation between data and model is approximately 0.93.

As a step further, we predict the future trend of Cambodian current account using our well-fitted model in the context of negative shocks in productivity, remittance, FDI and COVID-19 pandemic. Our model predicts that if there are no negative shocks in 2020, Cambodia's current account-to-output ratio will increase by 1-percentage point from -12% in 2019 to around -11% in 2020. Nevertheless, due to the COVID-19 outbreak, the World Bank (2020) expects Cambodia's economy to contract by 1% in 2020. Holding all other factors constant, this implies that Cambodian productivity will also drops by 1%. As a consequence, our model predicts the current account-to-output ratio will increase by 3-percentage points, jumping to -8% in 2020. Moreover, the World Bank forecasts Cambodia's net FDI-to-output ratio will fall by 2-percentage points. Our model predicts that such fall will further lead to a rise in the current account-to-output ratio by 2.5-percentage points in 2020. Sayeh and Chami (2020) estimate the remittance flows to poor and developing countries are expected to drop 20% or more from their 2019 level. The World Bank's economic contraction forecast for Cambodia is pessimistic. Many Cambodian households rely heavily on the income from migrant work remittances to meet basic needs, including food and health expenses.

[3] Output, consumption, investment, trade balance, current account balance, net unilateral transfers, and net foreign direct investment.

With 80,000 migrant workers have returned to Cambodia since the COVID-19 outbreak, many families and communities are likely to face significant income losses. Furthermore, the World Bank projects Cambodian government's revenue and grants (% of GDP) to decline by 8-percentage points. Taking consideration of the three identified negative shocks, our model predicts that Cambodia's current account-to-output ratio will decrease around 8-percentage points. To be more specific, the current account-to-output ratio will be around -14% in 2020, which is consistent with the prediction of 14.1% by the World Bank.

The remainder of this paper is organised as follows. The next section discusses the evolution of Cambodian current account balance and its components. Section 3 reviews related literature from two perspectives of current account balance. Section 4 lays out the small open economy RBC model and conducts model calibration. Section 5 discusses how well our model explains Cambodian current account over the sample period. Section 6 predicts the trend of Cambodian current account-to-output ratio in the context of negative shocks. Section 7 concludes.

2 Cambodian Current Account

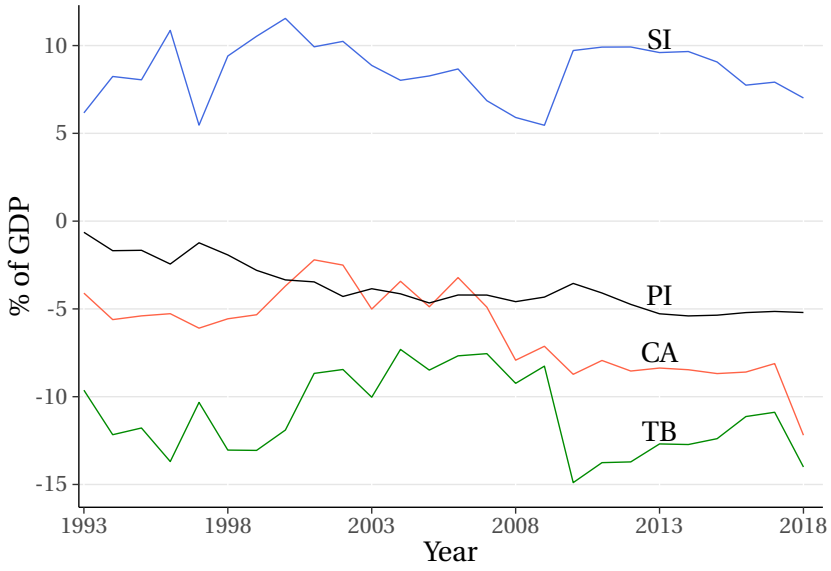
Figure 3 plots the trends of Cambodian current account balance (CA) and its components: trade balance (TB), primary income balance (PI),[4] and secondary income balance (SI).[5] We can observe two striking features of the current account: First, it has a steady downward trend over the period 1993-2018. Second, its balance fluctuated around -5% of GDP from 1993 to 2007 and then declined considerably to -12% of GDP in 2018. Without inflows of net secondary income, which is around 8% of GDP per year, the current account balance would be much worse. To finance the growing current account deficit through attracting capital inflows, Cambodian government implements sound macroeconomic policies and promotes an open investment market. Foreigners are encouraged to buy Cambodian assets and directly invest in the country. Moreover, continued inflows of official loans and grants

[4] Primary income balance (PI) is the income that Cambodian residents earn from, less that they pay to, the rest of the world from working and from financial investments.

[5] Secondary incomes balance (SI) refers to transactions between Cambodian residents and the rest of the world where one party provides something to be consumed by another party without receiving anything in return.

also partially offset the current account deficit. Overall, the Cambodian current account is weakly counter cyclical and its correlation with Hodrick-Prescott (HP) filtered GDP is -0.09.

Figure 3: Trends of Cambodian current account balance and its components over the period 1993–2018

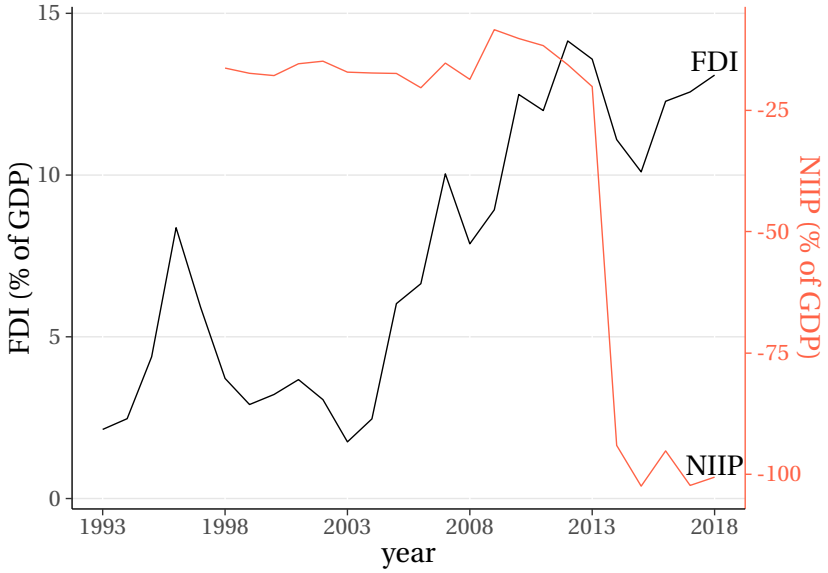


Note: The source of data is the World Development Indicator.

Figure 4 shows net FDI as percentage of GDP has increased significantly from 2% in 1993 to around 14% in 2018. We can also see that the Cambodian net international investment position[6] (NIIP) has posted a deteriorating trend for over the last decade. As of 2018, Cambodia's NIIP reached -100% of its GDP. This stark imbalance validates existing concerns of the financial condition and creditworthiness of Cambodia.

[6]Net international investment position (NIIP) is the difference value between external assets and external liabilities.

Figure 4: Trends of Cambodia net FDI and NIIP over the period 1993–2018



Note: The change in NIIP is the current account balance and the source of data is the World Development Indicator.

3 Two Views on Current Account

Accounting identities provide two ways to look at a current account balance. Either can be expressed as trade flows and related payments, or in terms of saving, investment and international financial flows. Although they are two sides of the same coin, each gives a useful, different insight into a current account issue (Bernanke, 2005).

The elasticity approach[7] views the current account balance as the net trade of a country. Relative prices of traded goods along with their determinants, therefore, play a key role in explaining the evolution of current account. This approach is helpful in assessing the short-run implications of exchange rates on the current account. Its ability to explain the long-run current account balance, however, is limited (Yang, 2011). Economists overcome the limitation by developing the intertemporal approach.

The intertemporal approach to current account analysis extends the elasticity approach

[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).

through its recognition that private saving and investment decisions are the underlying determinants of the evolution of current account. To be more specific, household can smooth consumption by borrowing and saving when facing their unenven income streams (Schmitt-Grohé et al., 2008). Abbasoğlu et al. (2019) use the model developed by Engel and Rogers (2006) to study the trend of Turkish current account. They argue that a country whose income is expected to grow relatively faster to the rest of the world will tend to borrow more to finance their current consumption and run a current account deficit. The intertemporal approach has also been used in the RBC model to examine the effects of shocks in productivity or demand on the current account balance (Calderon et al., 2002). Aguiar and Gopinath (2007) exploit the information in net exports and consumption to identify the persistence of productivity and find that shocks to trend growth – rather than temporary shocks around a stable trend – are the key sources of the fluctuations in emerging countries (i.e. income, consumption, investment and trade balance). The work of García-Cicco et al. (2010), however, lending little support to the hypothesis that the cycle is the trend. In particular, using the data over the period 1990-2005 to estimate the parameters of a small open economy RBC model for Argentina and Mexico, García-Cicco et al. (2010) find that both temporary and permanent productivity shocks do not explain well the fluctuations of trade balances (among other variables) in these two countries. Nevertheless, after augmenting Aguiar and Gopinath's (2007) model by including preference shocks, country-premium shocks, and a debt elasticity of the country premium, their model performs well on explaining the observed business cycles in Argentina and Mexico.

To compare the relative merits of the works between Aguiar and Gopinath (2007) and García-Cicco et al. (2010), using the same data set in Aguiar and Gopinath (2007), Chang and Fernández (2013) establish and estimate an RBC model that encompasses a stochastic productivity trend and interest rate shocks and financial frictions. Their model assigns a major role to financial frictions, but a minor role to trend shocks in amplifying traditional (transitory) productivity shocks to aggregate fluctuations.

Within the standard framework, the current account balance works as a buffer against the transitory shocks in productivity or demand, thus acting as smoothing instrument. The current account therefore is expected to fluctuate around its fixed mean in the long run. The data in some developed and developing countries however does not support this prediction.

To provide an answer for the puzzle, Choi et al. (2008) and Choi and Mark (2009) include an endogenous discount factor in their model to explain the trends of the current account in Japan, 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 uses an exogenous discount factor and is able to mimic the actual paths of the Cambodian current account. This indicates that whether the discount factor is endogenous or exogenous is not a key factor to explain macroeconomic fluctuations. Hence, a model matches the actual data pattern well if it is appropriately specified, calibrated and estimated.

4 The Real-Business-Cycle Model

This section establishes a standard, single-good, single-asset small open economy model to study the evolution of Cambodian current account balance. Our model is developed within the framework of Chang and Fernández (2013) and integrates both permanent productivity shocks as in Aguiar and Gopinath (2007) and financial friction shocks as in García-Cicco et al. (2010). Our paper differs from Chang and Fernández (2013) in terms of including net unilateral transfers and impact of FDI on technological growth. For comparison, we also present the results of the standard model in Appendix A.

4.1 Economy

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

$$Y_t = a_t K_t^{1-\alpha} (\Gamma_t h_t)^{\alpha} \tag{1}$$

where $\alpha \in (0, 1)$ governs labour share of output, Y_t stands for output in period t, K_t refers to

capital in period t, h_t denotes labour input in period t, 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 variation in terms-of-trade.

Notice that lower case and upper case letters denote variables that do not and do contain a trend in equilibrium, respectively. Specifically, a detrended variable $x_t = \frac{X_t}{\Gamma_{t-1}}$. In addition, ρ_x and μ_x denote a persistence and 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 a log form:

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

where ϵ_t^a represents independently and identically distributed draws from a normal distribution with zero mean and standard deviation σ_a ($\epsilon_t^a \overset{i.i.d}{\sim} N(0, \sigma_a^2)$).

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

$$log(g_t/\mu_g) = \rho_g log(g_{t-1}/\mu_g) + \gamma(fdi_{t-1} - \mu_{fdi}) + \epsilon_t^g, \qquad \epsilon_t^g \overset{i.i.d}{\sim} N(0, \sigma_g^2),$$

where fdi_t denotes net foreign direct investment-output ratio at time t, the parameter γ is an effect of the difference of fdi_t from its mean (μ_{fdi}) on the productivity growth, and fdi_t itself is assumed to follow the AR(1) process:

$$fdi_t = (1 - \rho_{fdi})\mu_{fdi} + \rho_{fdi} fdi_{t-1} + \epsilon_t^{fdi}, \qquad \epsilon_t^{fdi}, \overset{i.i.d}{\sim} N(0, \sigma_{fdi}^2).$$

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 in period t, and Φ is the adjustment cost of installing capital and has the quadratic form,

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

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 $t+1$, C_t refers to consumption.

The ratio of net unilateral transfer to output, denoted by nt_t, is assumed to follow the AR(1) process:

$$nt_t = (1-\rho_{nt})\mu_{nt} + \rho_{nt} nt_{t-1} + \epsilon_t^{nt}, \qquad \epsilon_t^{nt} \overset{i.i.d}{\sim} N(0, \sigma_{nt}^2).$$

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

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

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 as-

sumed 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.

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

$$W_t(1 + \theta(R_{t-1} - 1)) = \frac{\alpha}{h_t} Y_t \tag{6}$$

Equation (6) implies that firms hire labour up to the point where the marginal product of labour 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

Being subject to Equations (1) to (3) and 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}, the household seeks to maximise the following lifetime utility function:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(C_t, h_t, \Gamma_{t-1}),$$
$$u(C_t, h_t, \Gamma_{t-1}) = \frac{\left(C_t - \tau\Gamma_{t-1} h_t^{\omega}\right)^{1-\sigma}}{1-\sigma}$$

where σ governs an intertemporal elasticity of substitution, ω governs a labour supply elasticity, and τ is a labour 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):

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

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

$$\begin{aligned} ca_t &= tb_t - (1 - q_{t-1})d_t + nt_t \\ &= -q_t g_t d_{t+1} + q_{t-1} d_t \end{aligned}$$

4.3 Solution, Calibration, and Estimation

Since the system of nonlinear stochastic difference equations does not normally have closed form solutions, our work, like other RBC literature, uses log-linearization to approximate the equilibrium conditions around the stationary steady state.

The calibrated parameters are presented in Table 1. Most of them 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 set at 1.6 so that the labour supply elasticity is 1.67; τ is 1.72 to make working time one third in the long run; the depreciation rate, δ, is 0.10 per year; 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 1.0543 according to Damodaran (2015). 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 percentage of GDP from 1998 to 2018. Finally, the parameter α is 0.4018, based on Cambodian labour share data from 2004 to 2017. Notably, this number is not exactly equal to labour share. As Equation (6) shows, it is calibrated as the labour share[8] times $[1 + \theta(R - 1)]$. This implies that α has a distribution determined by the posterior distribution of θ.

[8] As an average of 38.9% from 2004 to 2017 estimated by the International Labour Organisation (2019).

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 labour input at steady state is 1/3	1.72
δ	Depreciate rate of capital	0.10
ψ	Debt elastic interest rate parameter	0.001
$\bar{R}^*$	Gross world interest rate	1.01
S	Long-run gross country interest rate premium	1.0543
$\bar{d}$	Debt-to-GDP ratio	0.16
α	Parameter governing income labour share	0.4018

The remaining parameters are estimated using the Bayesian Markow Chain Monte Carlo method. These include parameters of the exogenous shocks and three other parameters: capital adjustment cost (ϕ), elasticity of the spread with respect to the expected productivity (η), and working capital requirement (θ). We estimate the model using log differences of Y, C and I; and levels of TB/Y, CA/Y, NT/Y and FDI/Y over the period 1993–2018. The data,[9] expressed in real local currency per capita, are retrieved from the World Bank Development Indicator.

Table 2 reports prior and posterior distributions of the estimated parameters. We use Cambodian data to obtain the prior distributions of the three parameters: ρ_{nt}, ρ_{fdi} and γ. In regards to the rest of estimated parameters, their prior values are the same as those in Chang and Fernández (2013). The parameters in bold are those posterior means significantly different from their prior values at 10% level.

[9] Appendix B presents the business cycle moments and graphs of variables.

Table 2: Distributions of estimated parameters.

Parameter	Description	Prior distribution			Posterior distribution		
		Density	Mean	STD	Mode	Mean	90% Conf. Interval
ρ_a	AR(1) coef. transitory productivity process	Beta	0.95	0.02	0.94	0.91	[0.87, 0.95]
ρ_g	AR(1) coef. permanent productivity process	Beta	0.72	0.02	0.73	0.72	[0.69, 0.76]
ρ_R	AR(1) coef. world interest rate process	Beta	0.83	0.05	0.80	0.87	[0.78, 0.93]
ρ_{nt}	**AR(1) coef. transfer-output ratio process**	Beta	0.31	0.19	0.00	0.15	[0.01, 0.26]
ρ_{fdi}	coef. FDI-output ratio process	Beta	0.89	0.09	0.93	0.92	[0.86, 0.98]
ϕ	**Capital adjustment cost parameter**	Gamma	6.00	3.46	7.40	15.76	[8.17, 23.31]
η	Spread elasticity	Gamma	1.00	0.10	0.92	0.93	[0.77, 1.08]
θ	Working capital parameter	Beta	0.50	0.22	0.50	0.50	[0.14, 0.88]
γ	Effect of FDI-output ratio on productivity growth	Normal	0.10	0.07	0.05	0.08	[0.02, 0.14]
σ_a	STD(%) of coef. transitory productivity shock	Gamma	0.74	0.56	0.25	0.45	[0.08, 0.76]
σ_g	STD(%) of coef. permanent productivity shock	Gamma	0.74	0.56	0.33	0.65	[0.03, 1.24]
σ_R	**STD(%) of coef. world interest rate shock**	Gamma	0.72	0.31	0.31	0.37	[0.15, 0.59]
σ_{nt}	STD(%) of transfer-output ratio shock	Gamma	0.72	0.31	1.38	1.35	[1.01, 1.68]
σ_{fdi}	**STD(%) of FDI-Y output shock**	Gamma	0.72	0.31	1.14	1.17	[0.78, 1.56]
σ_{CA}	STD(%) of measurement error in CA-Y ratio	Gamma	2.00	1.00	2.82	2.30	[1.59, 2.94]
σ_{TB}	STD(%) of measurement error in TB-Y ratio	Gamma	2.00	1.00	3.85	3.28	[1.95, 4.56]
σ_Y	**STD(%) of measurement error in Y**	Gamma	2.00	1.00	10.61	11.09	[9.28, 12.84]
σ_C	**STD(%) of measurement error in C**	Gamma	2.00	1.00	0.60	0.66	[0.31, 1.04]
σ_I	**STD(%) of measurement error in I**	Gamma	2.00	1.00	0.39	0.52	[0.18, 0.86]
σ_{NT}	**STD(%) of measurement error in NT-Y ratio**	Gamma	2.00	1.00	0.48	0.63	[0.27, 0.98]
σ_{FDI}	STD(%) of measurement error in FDI-Y ratio	Gamma	2.00	1.00	1.32	1.51	[0.94, 2.04]

4.4 Variance and Shock Decomposition

Table 3 presents the results on variance decomposition, that is, how much exogenous shocks contribute to variations in macroeconomic variables. Overall, the shocks of world interest rate and transitory productivity play more important roles than the shock of permanent productivity growth in explaining macroeconomic fluctuations. This finding is in line with the study of Chang and Fernández (2013) and is robust when the model is estimated without FDI and and unilateral transfers. Furthermore, the shock of FDI appears to have the same role as the interest rate shock in explaining the observed business cycle in Cambodia. This highlights the fact that developing countries, see FDI as an important element in their overall strategy for economic development. In terms of the current account-to-output ratio, FDI and unilateral transfers explain its variations better than the shocks of productivity and interest rate. In particular, the two factors account for around 50 percent of variations in Cambodian current account-to-output ratio.

Table 3: Variance decomposition

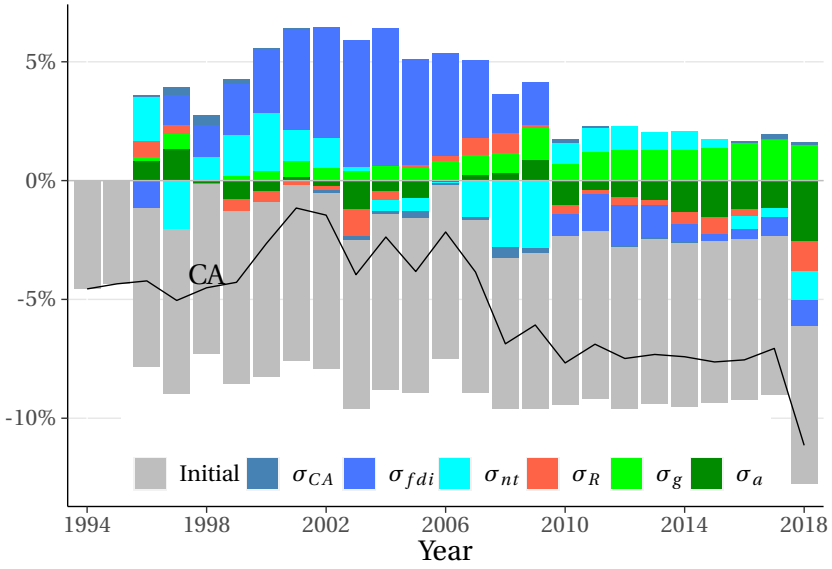
Variable	σ_a	σ_g	σ_R	σ_{nt}	σ_{fdi}	σ_{CA}	σ_{TB}
y: output	50.93	13.04	28.16	0.00	4.71	0.00	0.00
c: consumption	38.70	11.38	23.76	0.01	17.42	0.00	0.00
i: investment	40.59	14.95	16.61	0.01	19.75	0.00	0.00
tb/y: trade balance-output ratio	28.69	6.60	25.34	0.02	30.74	0.00	7.98
ca/y: current account balance-output ratio	23.04	5.19	20.66	26.58	23.43	4.12	0.00

Note: σ_{CA} and σ_{TB} are the measurement errors in current account-to-output ratio and trade balance-to-output ratio, respectively.

Figure 5 shows the shock decomposition of current account-to-output ratio over the period 1994–2018. The black line depicts the deviations of the current account-to-output ratio from its steady state. The colored bars refer to the contribution of the shocks to those deviations. For more than first half of the period, FDI and unilateral transfers contribute more to current account-to-output ratio than productivity, while during the later period, productivity contributes more to the ratio. This might explain the fact that for developing countries, capital plays an important role in the early stage of economic growth and development, but as economies become more developed, productivity becomes the dominant factor. Throughout the whole period, however, a large part of the deviations in current account-to-output

ratio is not explained by the smoothed shocks, but rather by the unknown initial value of the state variables.

Figure 5: Shock decomposition



Note: The black line depicts the deviations of the current account-to-output ratio from its steady state. The colored bars correspond to the contribution of the respective shocks to those deviations. “Initial value" refers to the part of those deviations not explained by the shocks.

4.5 Impulse Responses

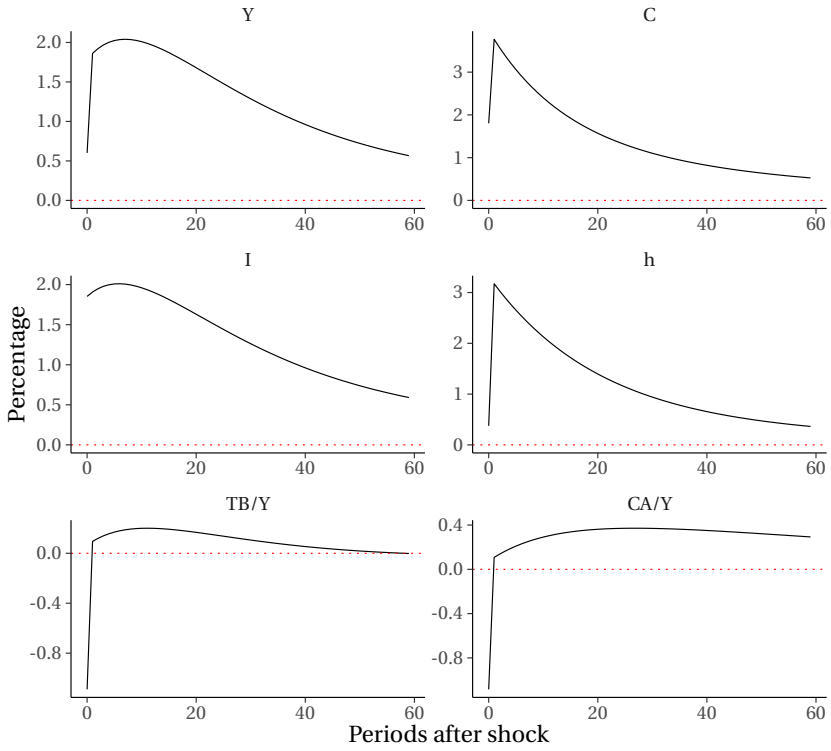
This section discusses how output, consumption, investment, labour, trade balance and current account-to-output ratio respond to a 1-percent positive shock of each of the five exogenous variables: transitory productivity, permanent productivity, world interest rate, unilateral transfers, and FDI.

4.5.1 Responses to a positive transitory technology shock

Figure 6 presents the impulse response functions of six variables of interest to a transitory technological shock of 1 percent in period 0. In response to the 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 labour. Furthermore, the higher wage increases the price of leisure, hence consumption increases. Because the technological shock is more persistent ($\rho_a = 0.91$), households expect their income to increase for several periods. As a consequence, consumption-smoothing households have less incentive to save their increased income, but 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.

Figure 6: Responses to a 1-percent transitory productivity 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 deviation from the steady state.

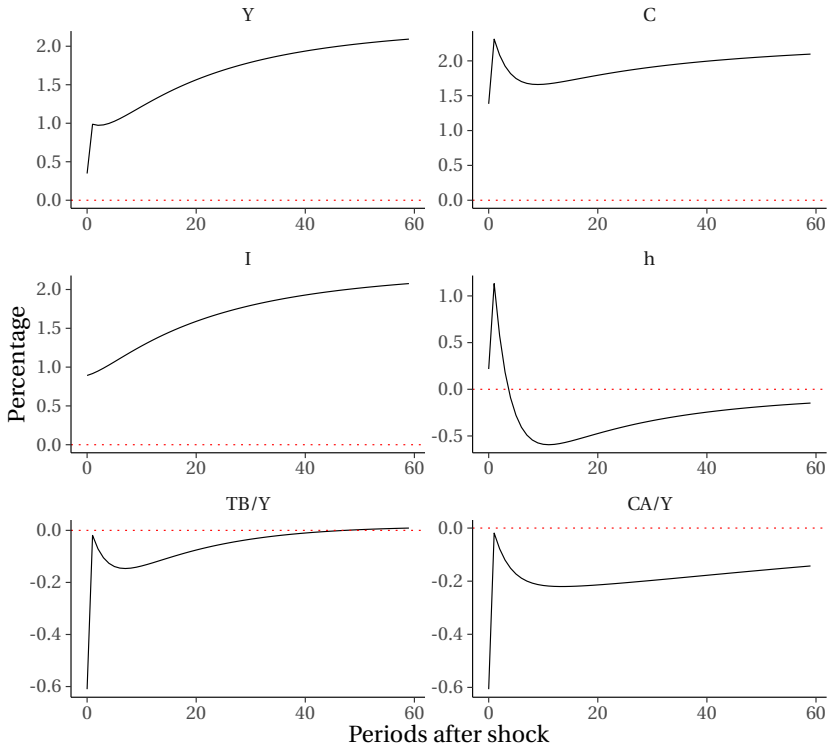
In period 1, as the increase in investment in period 0 goes into production, output increases sharply around 1.3-percent points, consumption rises about 2-percent points, investment however increases marginally around 0.1-percent point. The rise of trade balance and current account-to-output ratio from -1.08% to 0.1% implies that an increase in output is greater than that of domestic absorption. This indicates that agents start to save more of their in-

creased income due to transitory productivity shock.

4.5.2 Responses to a positive permanent technology shock

As displayed in Figure 7, the impulse response functions of the variables of interest to a permanent technological shock of 1 percent in period 0 are similar to those in Figure 6. The improvement of technology raises capital productivity, thus increases investment. The improvement also raises wage which encourages more labour supply. Because of permanent technological shock, households expect their income to rise over time. Therefore, households are inclined to borrow to finance their current consumption. This causes the initial expansion in domestic absorption to exceed that in output, thus worsening the trade balance and current account-to-output ratio.

Figure 7: 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. The impulse responses of TB/Y and CA/Y are percentage-point deviation from the steady state.

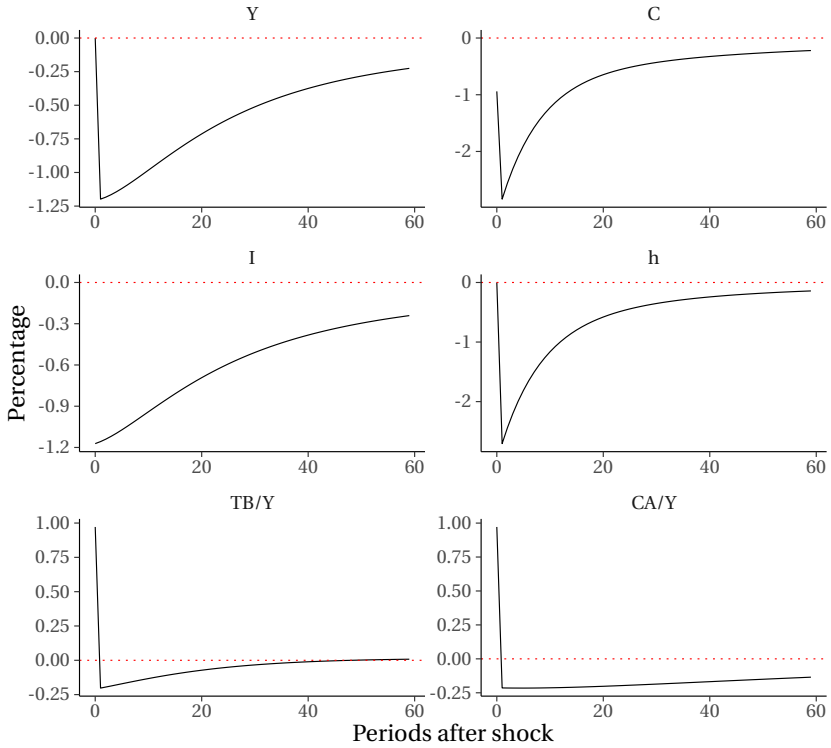
In period 1, while output and consumption increases around 0.7% point, investment re-

mains largely the same. Hence, trade balance and current account-to-output ratio increase, but they are still below their steady states. Thereafter, both of the statistics are on a steady decline over many periods. This deterioration is driven by rising capital and slowly falling consumption as a result of positive permanent productivity shock.

4.5.3 Responses to a positive world interest rate shock

Figure 8 presents the impulse response functions of the interested variables to a 1-percent shock of world interest rate in period 0. Initially, consumption and investment decrease about 1-percentage point while output is not affected. Higher interest rate encourages households to save more but discourages firms to invest due to higher costs of borrowing. As a result, trade balance and current current-to-output ratio increase around 1-percentage point at the initial stage.

Figure 8: Responses to a 1-percent world interest rate 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 deviation from the steady state.

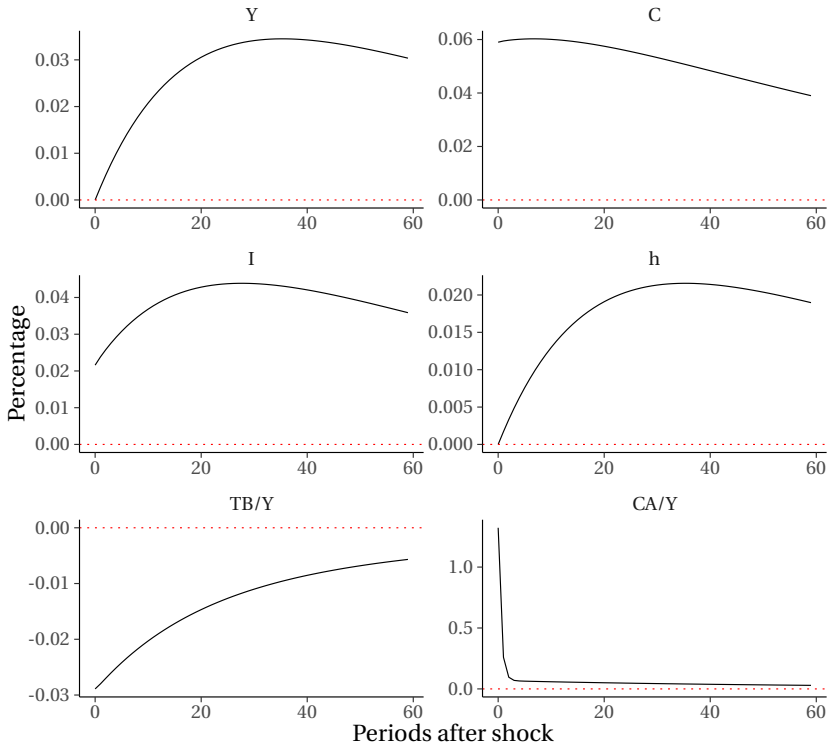
In period 1, output falls sharply due to the lower capital in period 0. The decreased output together with more persistent interest rate ($\rho_R = 0.87$) causes consumption to decline even further (almost 2-percentage point drop). Investment however rises slightly because of the gradually declining interest rate. Trade balance and current account-to-output ratio decrease to around -0.25-percentage point below their steady states, which indicates that output is less than domestic absorption. Thereafter, investment output and consumption gradually increase. Although trade balance-to-output ratio grows steadily, current account-to-output ratio remains around 0.25 percentage point below the steady state as the higher interest raises debt payments.

4.5.4 Responses to a positive unilateral transfer shock

One-percent shock of unilateral transfer on the variables of interest is presented in Figure 9. Initially, consumption, investment and current account-to-output ratio respond positively but insignificantly to the innovation, whereas output and trade balance-to-output ratio are not affected. The initial increased source of income leads to rise in consumption. However, since the source is transitory ($\rho_{nt} = 0.15$), consumption-smoothing households save more of their increased income. Hence, less amount of debt and lower interest rate, which further results in higher investment. Lower debt, by definition, implies an improvement in current account.

In period 1, while output and investment increase slightly, consumption remains about the same as in the previous period. Due to the low persistent unilateral transfer, current account-to-output ratio declines sharply back to almost its steady state level. Capital and output continue to accumulate thereafter because of the high persistent interest rate ($\rho_R = 0.87$). The higher output and saving altogether allow households to maintain a similar level of their consumption over time.

Figure 9: Responses to a 1-percent unilateral transfer-to-output shock

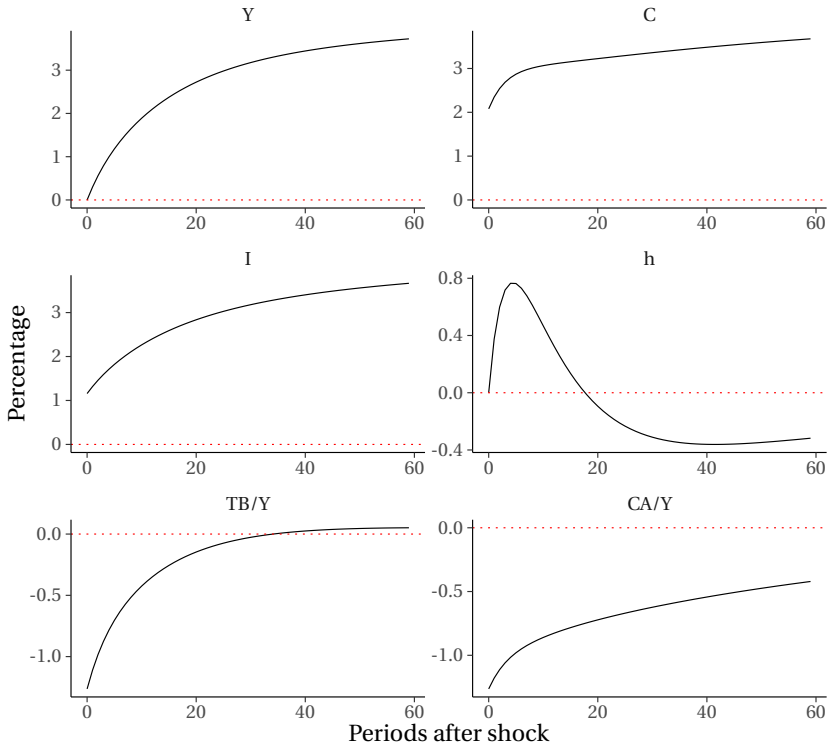


Note: The impulse responses of Y, C, I, and h are expressed in percentage deviations from the steady state. The impulse responses of TB/Y and CA/Y are percentage-point deviation from the steady state.

4.5.5 Responses to a positive net foreign direct investment

Figure 10 displays the impulse response functions of the interested variables to 1-percent shock of FDI in period 0. Initially, consumption and investment increase while output remains unaffected, thus reducing trade balance and current account-to-output ratios. We can see that FDI has a positive impact on permanent technological growth. The technology advance raises capital productivity and wage, therefore, increases 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 steady states. This suggests that domestic absorption remains larger than output, their difference however approaches to zero over time. The reason is that FDI and productivity trends are quite persistent ($\rho_{fdi} = 0.87$ and $\rho_g = 0.72$): agents increase consumption and investment at slower rates.

Figure 10: 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 deviation from the steady state.

5 An Explanation of Current Account

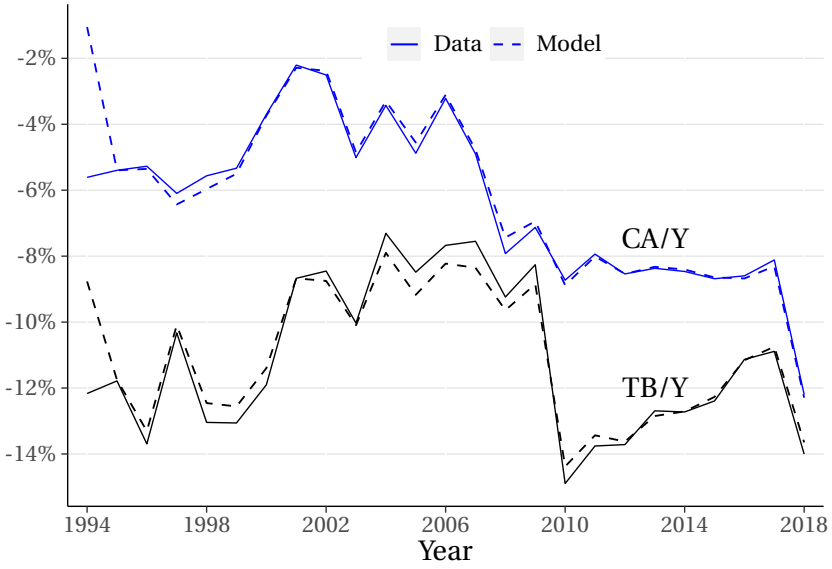
This section discusses how well the model explains Cambodian current account over the period 1993–2018. First, we run the economy by fitting the agents in our model using the historical data of output, consumption, investment, trade balance-to-output ratio, current account balance-to-output ratio, net unilateral transfer-to-output ratio, and net foreign direct investment-to-output ratio. We then compare the trend of current account-to-output ratio produced by our model to that of the observed one.

Figure 11 shows the results of this experiment. Our model captures the evolution of Cambodian current account-to-output ratio well[10] — the measurement error in current account-to-output ratio (σ_{CA}) is only 4.12%. Initially, the model over-predicts about 5-percentage

[10] Our model also closely mimics the dynamics of trade balance-to-output ratio. The measurement error in trade balance-to-output ratio (σ_{TB}) is around 8% and the correlation of both time series is 0.92.

points. It thereafter almost overlaps the observed data over the sample period. The correlation of both time series is 0.93. Our estimated model is superior than the model estimated without considering FDI and unilateral transfers where the measurement error is around 58% and the correlation is around 0.80. We use our well-fitted model in the next section to predict the future trend of current account-to-output ratio.

Figure 11: Trends of current account and trade balance

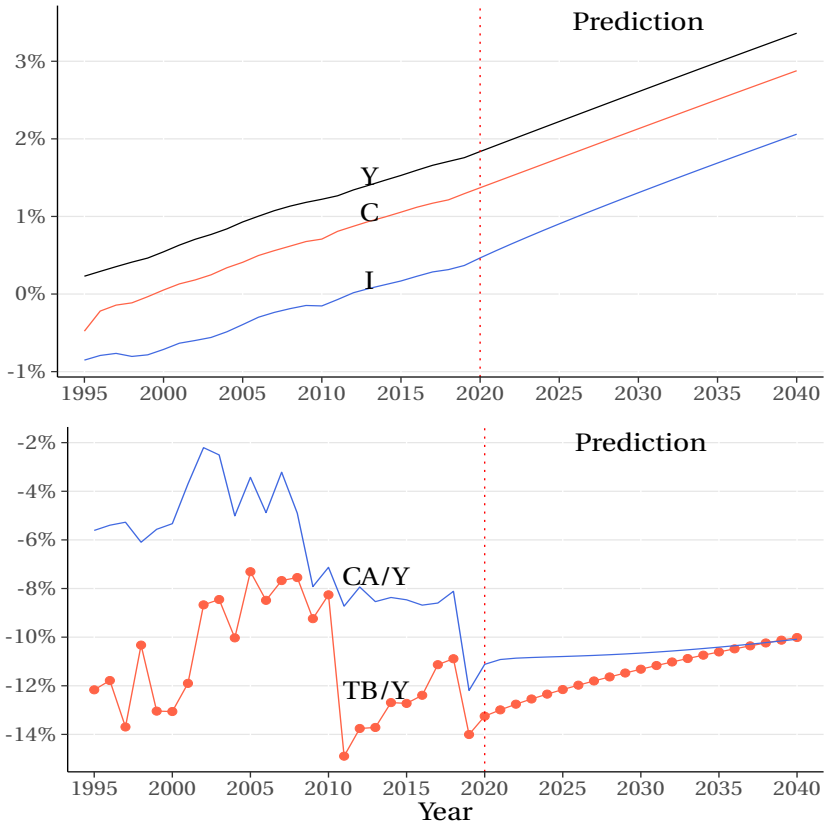


Note: The solid lines represent the empirical ratios of current account balance-to-GDP and trade balance-to-GDP ratios. The dashed lines represent the ratios predicted by our model.

6 Prediction

This section simulates the negative effects of shocks in temporary productivity, unilateral transfers, and foreign direct investment on Cambodian current account starting in 2020. We first present the prediction of a scenario in which no shocks hit the Cambodian economy in 2020. As shown in Figure 12, trade balance-to-output and current account-to-output ratios are expected to improve around 1-percentage point from -14% and -12% in 2019 to -13% and -11% in 2020, respectively.

Figure 12: No shocks hit the Cambodian economy in 2020



Three negative shocks hit the Cambodian economy

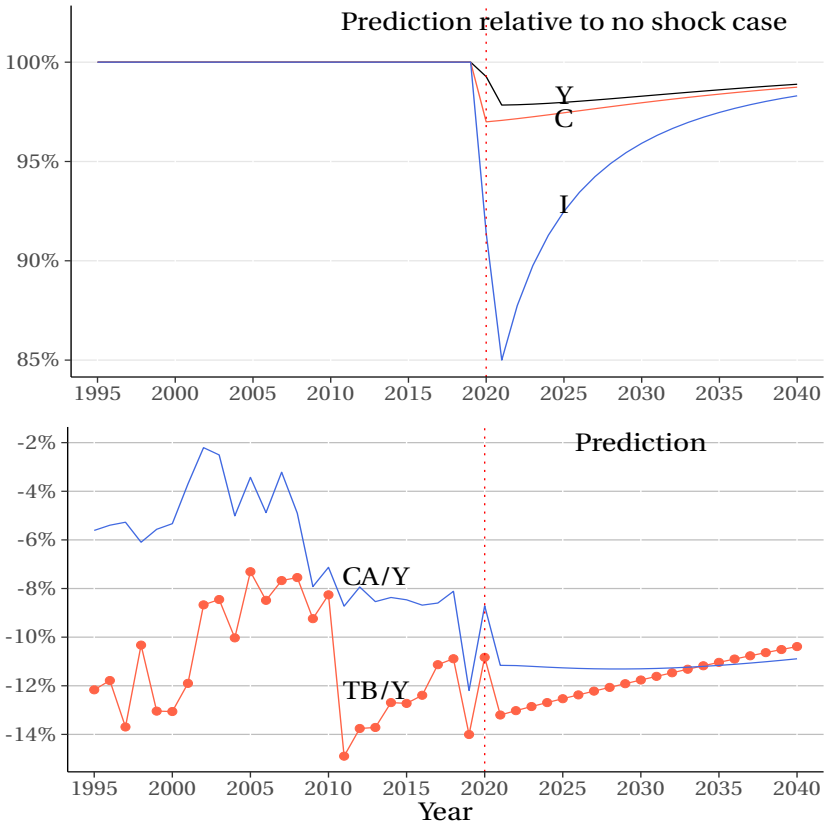
At least three extreme events have adversely impacted Cambodia's economy. First and foremost, COVID-19 negatively affects FDI, unilateral transfers, and temporary productivity. Specifically, one of the biggest industries in Cambodia (accounts 20% of Cambodia's GDP in 2018), tourism, is being destroyed during the global pandemic. International visitors are now avoiding Cambodia as COVID-19 infections continue to spread and countries implement far-reaching travel restrictions. Second, the European Union (EU) has partially suspended Cambodia's trade preferences (Everything But Arms), causing a temporary shock to Cambodia's key exporting sector, garment industry (accounts 80% of Cambodia's total exports). Many western clothing brands have canceled orders or are ordering far less garment products than before. Hence, lowering transitory productivity in Cambodia. Third, EU also lists Cambodia among high-risk nations for money laundering. The resulting negative image along with the two discussed extreme events appear to discourage FDI in Cambodia.

The World Bank (2020) predicts that Cambodia's economy to contract 1% in 2020. Holding all other factors constant, Equation (1) also suggests that transitory productivity falls by 1%. The World Bank also forecasts the net FDI-to-output ratio to drop around 2-percentage points in 2020. Sayeh and Chami (2020) estimate the remittance flows to poor and developing countries are expected to decline 20% or more from their 2019 levels. For Cambodia in particular, the World Bank (2020) projects the remittance flows are expected to slow down substantially as migrant workers have returned (and those who living abroad may have less income due to the global economic recession) to Cambodia. Government's revenue and grants (% of GDP) are expected to fall around 8-percentage points. Our following predictions therefore are based on these numbers.

(a) Transitory productivity drops 1 percentage point

Figure 13 presents the effect of a 1-percentage point drop of transitory productivity. The initial decline of productivity lowers capital productivity which further lowers investment. The productivity drop also reduces real wage and a lower level of labour supply. From the labour-leisure choice Euler equation, we can get that consumption also decreases. Since the shock is more persistent, households tend to save more for lower future income. As a consequence, the fall of output is smaller than that of domestic absorption, leading to improvement in both trade balance-to-output and current account-to-output ratios: around 2-percentage points above their levels without any shocks occur in 2020. The trade balance and current account however decline sharply in 2021 because output drops, and by the nature of temporary shock, consumption starts to increase to its previous level. Thereafter, while trade balance gradually improves, current account continues to fall steadily because of the increasingly accumulated debts over time.

Figure 13: 1-percent drop in transitory productivity



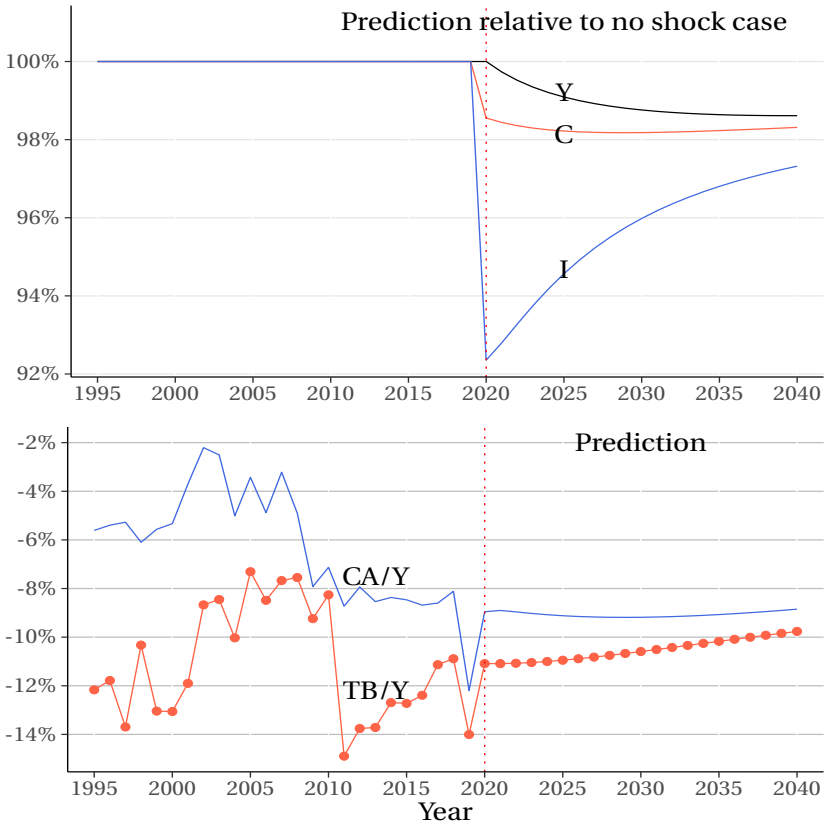
Note: The top panel shows a relative value of output, consumption, and investment to their values when no shocks hit the economy.

(b) FDI-to-output ratio drops 2 percentage points

Figure 14 displays the effect of a 2-percentage point drop of FDI. The initial effect is similar to that of the fall of temporary productivity shock. The reduction in FDI slows permanent technology, which further lowers capital and labour productivity. Hence, consumption and investment fall, improving both trade balance and current current around 2-percentage points in 2020. The two statistics gradually decrease for several periods afterwards. Such gradual fall is a result of households adjusting their behaviours in respond to permanent shock of productivity trend.[11]

[11] The general principle of how consumption-smoothing agents respond to shock is "finance temporary output shocks by running current account deficits or surpluses without much change in spending and adjust to permanent output shocks by changing spending without much change in the current account" (Schmitt-Grohé et al., 2008).

Figure 14: 2-percentage point drop in FDI-to-output ratio

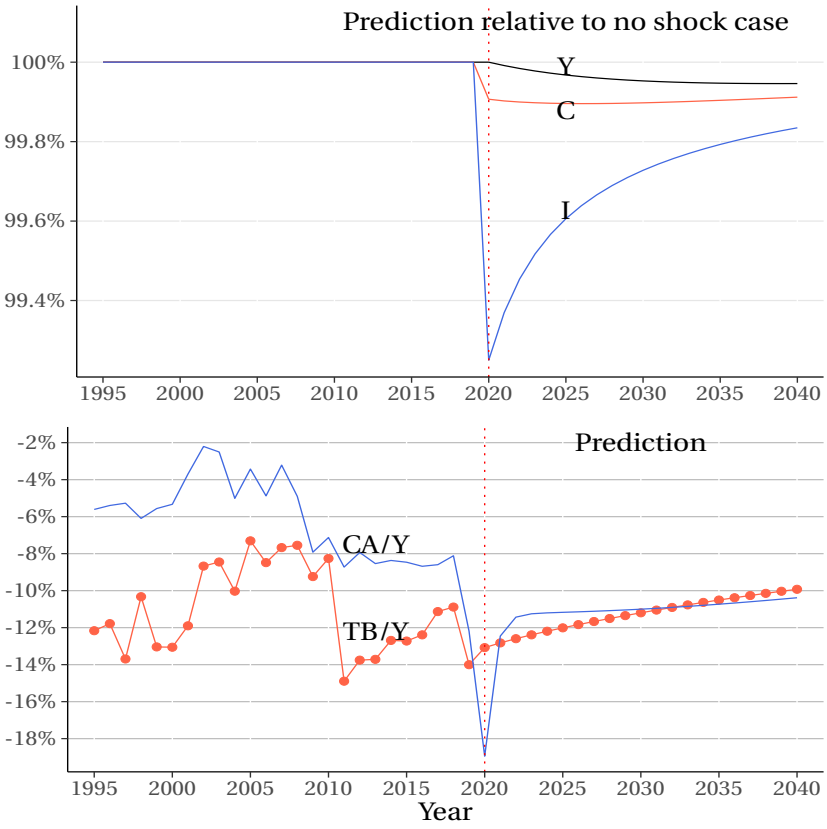


Note: The top panel shows a relative value of output, consumption, and investment to their values when no shocks hit the economy.

(c) Net unilateral transfer-to-output ratio drops 8 percentage points

Figure 15 presents the effect of a 8-percentage point drop of net unilateral transfers. Since this shock is much less persistent, and household's consumption behaviour is driven by permanent income rather than temporary income, the initial decline of the source of income can hardly affect consumption, investment, output and trade balance as shown by variance decomposition in Table 3. However, it has, by definition, one-to-one positive relation with current account. Therefore, the 8-percentage point drop of unilateral transfer implies that the current account-to-output ratio also declines around 8-percentage points. Thereafter, it quickly rises to its previous level as the shock is short-lived.

Figure 15: 8-percentage point drop in net neutral transfers



Note: The top panel shows a relative value of output, consumption, and investment to their values when no shocks hit the economy.

7 Concluding Remarks

To explain the dynamics of Cambodian current account, we develop and estimate a small open economy real-business cycle (SOE-RBC) model. Differing from the standard model, we includes two additional sources of macroeconomic fluctuations: net unilateral transfers and net foreign direct investment (FDI). Our model demonstrates that these two sources can explain the variation in current account better than productivity and interest rate. To be more specific, net unilateral transfers and net FDI account for 50% variations in current account-to-output ratio. We fit the model using historical observations on both exogenous and endogenous variables and compare the current account implied by the model with the empirical data. Our model generates households' saving and investment behaviour that matches well the evolution of Cambodian current account. We then use our well-

fitted model to predict the future trend of Cambodian current account in the context of negative shocks hit the economy in 2020. With 1-percent drop of transitory productivity, 2-percentage point drop of FDI-to-output ratio, and 8-percentage point drop of unilateral transfer-to-output ratio, our model predicts that the current account-to-output ratio will be -14%, which is almost the same as the forecast of -14.1% by the World Bank (2020).

Declaration of interest: None.

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Appendix A

Table A1: Variance decomposition

Variable	σ_a	σ_g	σ_R	σ_{CA}	σ_{TB}
y: output	41.09	30.49	33.35	0.00	0.00
c: consumption	40.98	23.06	43.59	0.00	0.00
i: investment	38.25	41.45	26.74	0.00	0.00
ca/y: current account balance-output ratio	15.19	6.66	18.57	58.31	0.00
tb/y: trade balance-output ratio	4.26	1.88	5.22	0.00	88.47

Notes: σ_{CA} and σ_{TB} are the measurement errors in current account-to-output ratio and trade balance-to-output ratio, respectively.

Figure A.1: Trends of current account and trade balance

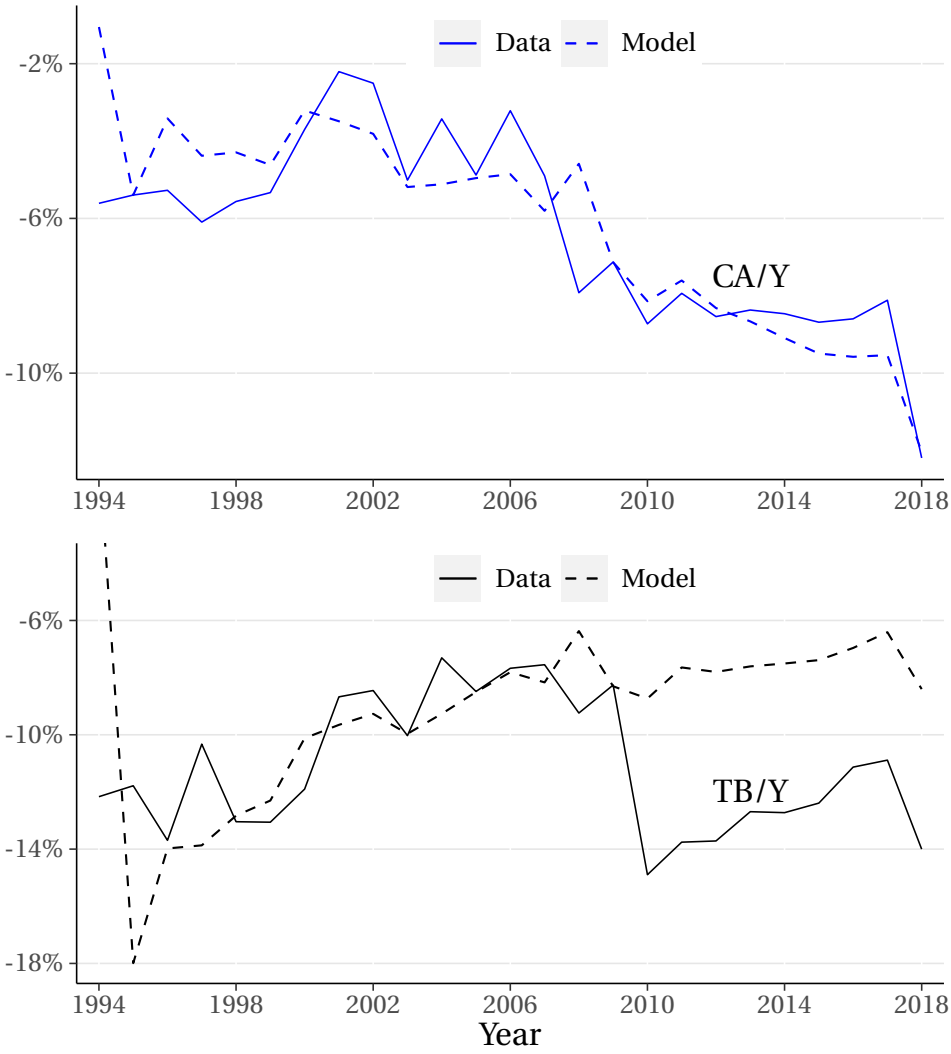
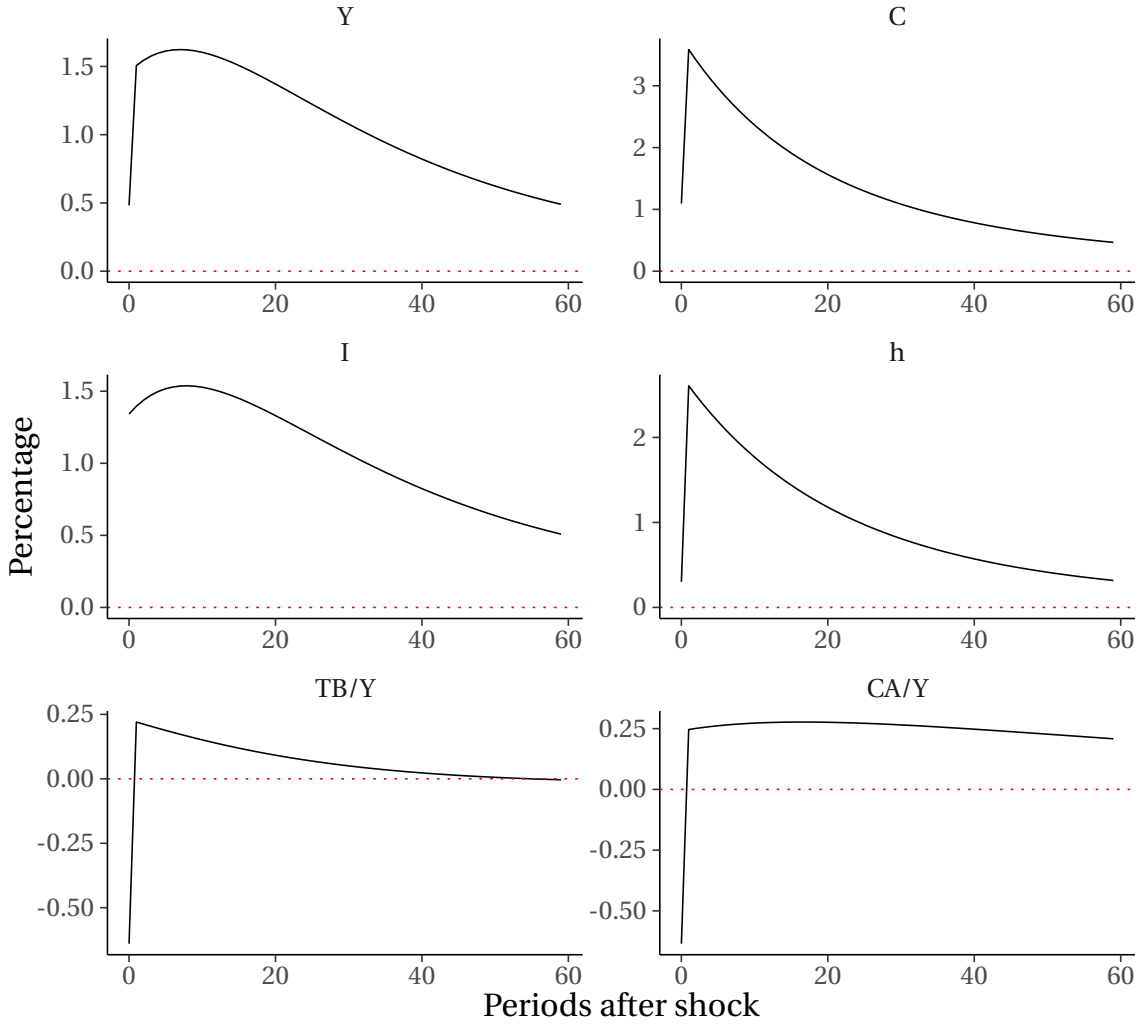
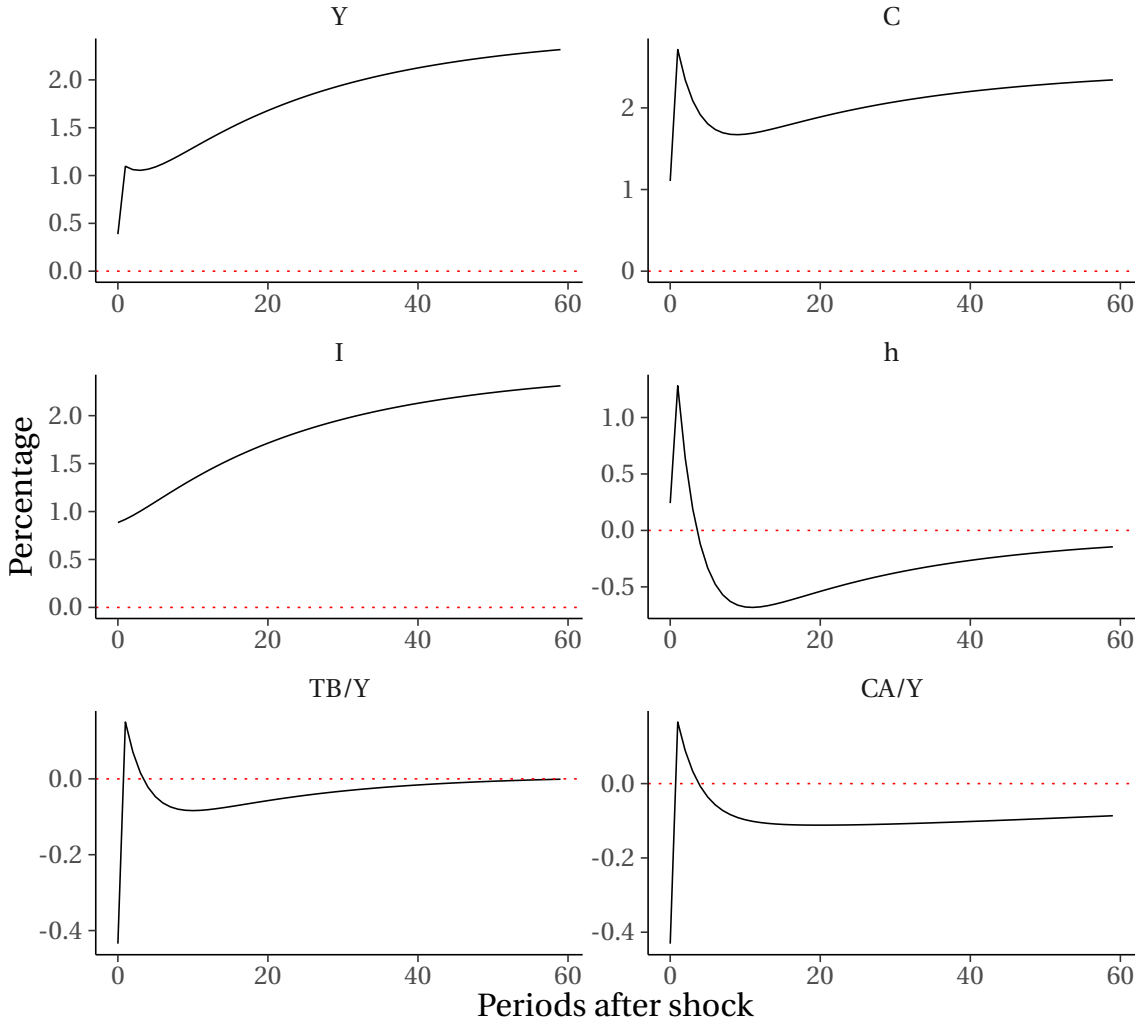


Figure A.2: Responses to a 1-percent transitory productivity shock



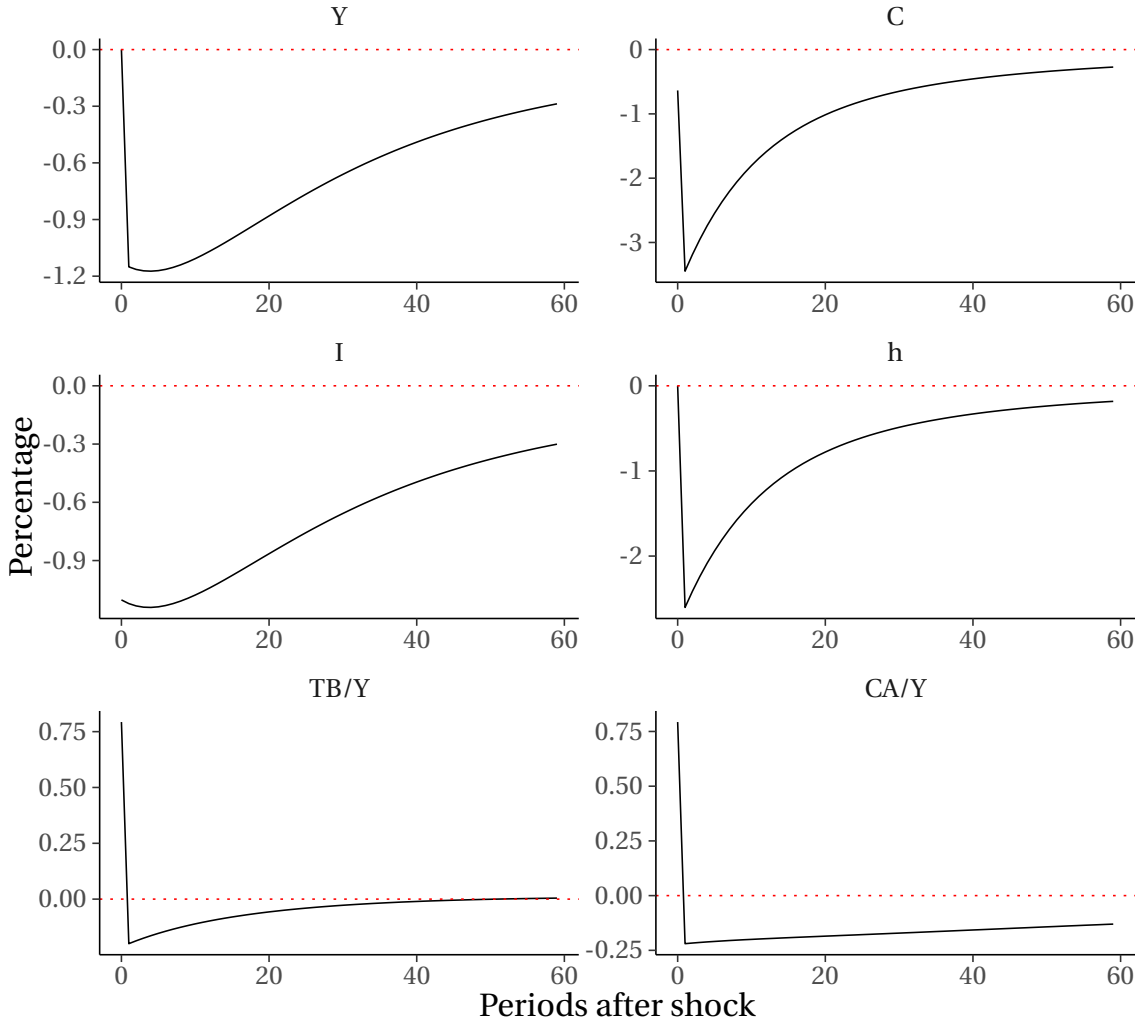
Notes: The impulse responses of Y, C, I, and h are expressed in percentage deviations from the steady state. The impulse responses of TB/Y and CA/Y are percentage-point deviation from the steady state.

Figure A.3: Responses to a 1-percent permanent productivity shock



Notes: Notes: 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 deviation from the steady state.

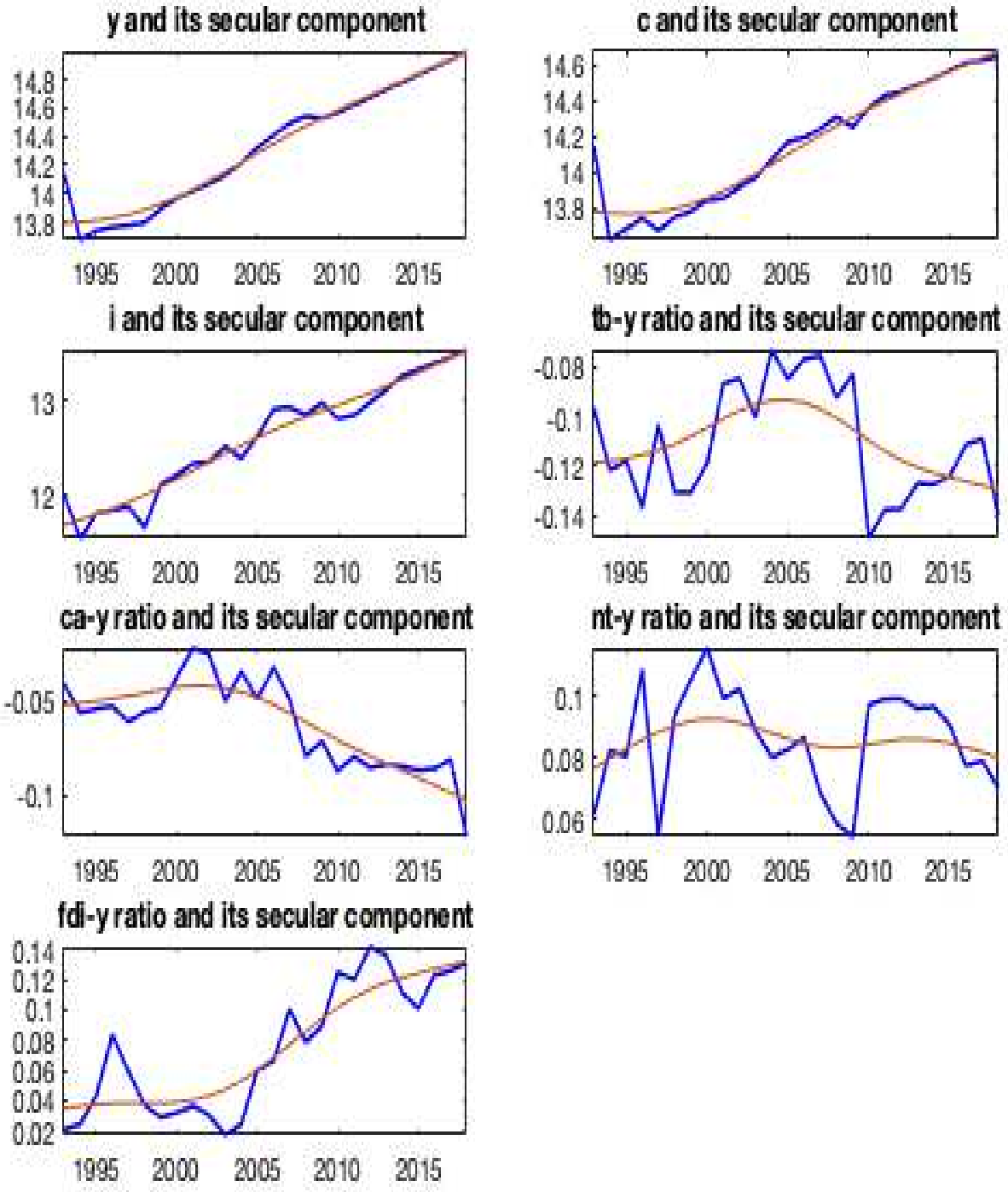
Figure A.4: Responses to a 1-percent world interest rate shock



Notes: 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 deviation from the steady state.

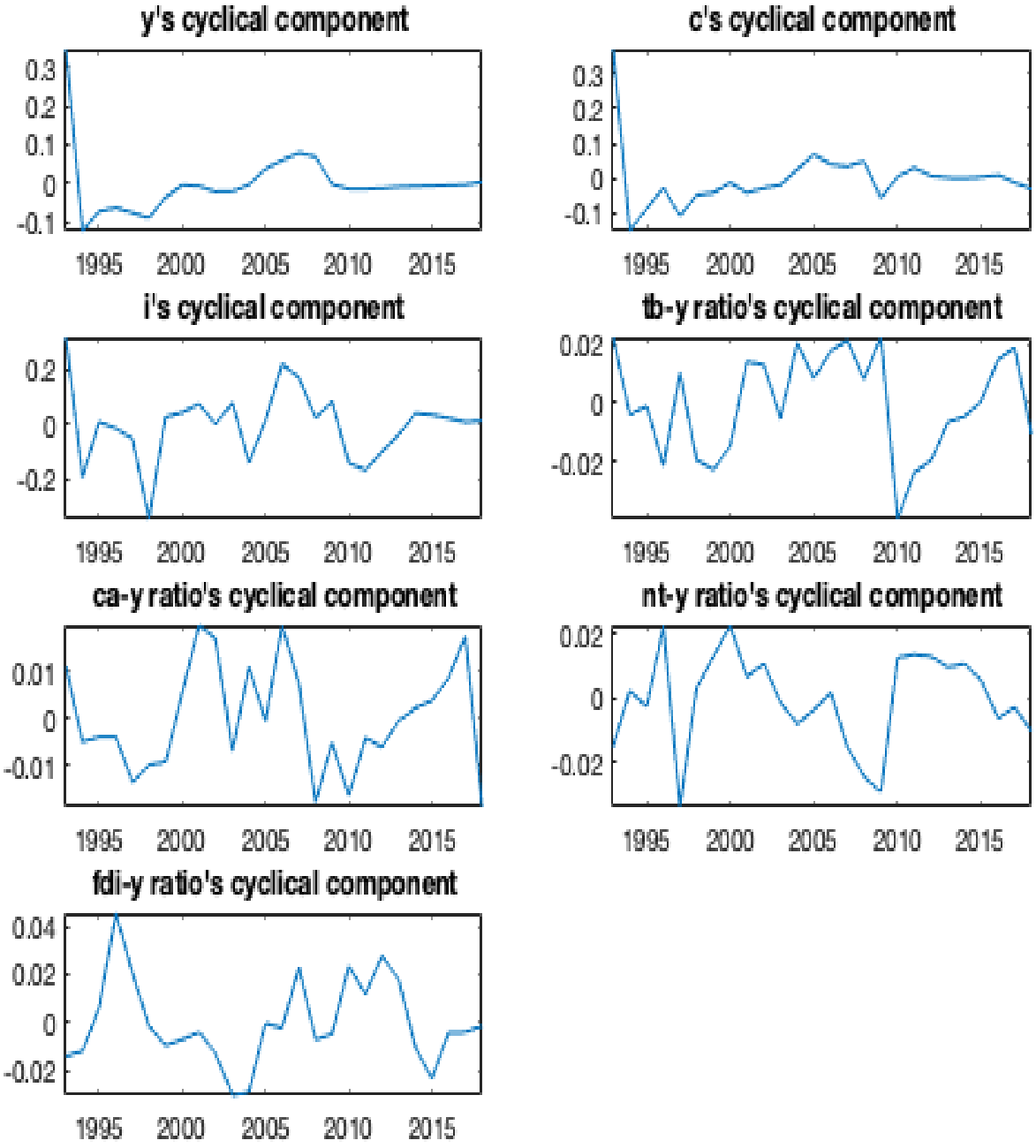
Appendix B

Figure B.1: Cambodian data and their secular component as logarithm values



Notes: The data are HP filtered with the smoothing parameter value of 100.

Figure B.2: Cyclical component of Cambodian data as logarithm values



Notes: The data are HP filtered with the smoothing parameter value of 100.

Table B1: Business cycle moments of Cambodian data

Variable	STD	STD relative to y's STD	Correlation with y	Autocorrelation
y: output	0.08	1.00	1.00	-0.01
c: consumption	0.09	1.06	0.95	-0.21
i: investment	0.13	1.58	0.71	0.04
ca/y: current account balance-output ratio	0.02	0.21	0.43	0.26
tb/y: trade balance-output ratio	0.01	0.14	0.31	0.20
nt/y: net unilateral transfers-output ratio	0.01	0.17	-0.28	0.18
fdi/y: net FDI-output ratio	0.02	0.21	-0.17	0.47