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Shigeto KITANO

Kenya TAKAKU

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Research Institute for Economics and Business Administration

Kobe University

2-1 Rokkodai, Nada, Kobe 657-8501 JAPAN

Financial Repression in a Small Open Economy: The Case of Laos

Shigeto Kitano* Kenya Takaku†

Abstract

Using a DSGE model, we examine the effects of financial repression policies on the Lao economy. Facing a high level of external debt, the Lao government is likely to rely increasingly on domestic financing, thereby creating incentives to use financial repression. We consider two types of financial repression policies: requiring domestic banks to increase their holdings of government bonds and repressing the government's interest payments through a tax on banks' returns on government bonds. Our numerical experiments show that both policies crowd out capital investment, reduce output, and ultimately worsen the government's primary balance. These results suggest that financial repression may worsen the government's fiscal condition despite its intended purpose of easing the fiscal burden.

Keywords: financial repression, crowding out, emerging economies, Laos, DSGE model
JEL Classification: E32, E44, G28, H63, O29

*Professor, RIEB, Kobe University, 2-1, Rokkodai, Nada, Kobe, 657-8501 Japan, E-mail: kitano@rieb.kobe-u.ac.jp.

†Associate Professor, Faculty of International Studies, Hiroshima City University, 3-4-1, Ozuka-Higashi, Asa-Minami-Ku, Hiroshima, 731-3194, Japan, E-mail: takaku@hiroshima-cu.ac.jp.

1 Introduction

Over the past decade, financial repression has re-emerged as a central policy concern in both advanced and emerging economies. The unprecedented fiscal expansions during and after the COVID-19 pandemic, combined with persistently high public-debt ratios, have reignited debates about the use of regulatory and administrative measures that suppress interest rates or channel domestic savings toward government financing (Hoffmann, 2019; Mullin, 2021).

The intellectual foundations of financial repression trace back to the seminal works of McKinnon (1973) and Shaw (1973), who argued that government-imposed restrictions — such as interest rate ceilings, high reserve requirements, and directed credit — distort financial intermediation and hinder economic growth. Building on this perspective, Reinhart and Sbrancia (2015) show that during the post-World War II period, governments relied extensively on financial repression to maintain negative real interest rates and to liquidate large public-debt burdens. Their evidence suggests that the combination of interest-rate caps, capital controls, and captive domestic audiences can generate substantial fiscal savings, albeit at the cost of market distortions.

More recent policy-oriented research highlights the potential unintended consequences and complexity of these measures. Kliem et al. (2024) show that while repression can compress sovereign yields in the short run, its general-equilibrium effects—through bank balance sheets, private investment, and long-run growth—may even increase the debt-to-GDP ratio under certain conditions. Jeanne (2025) models financial repression as a multi-stage response to severe fiscal constraints. Governments may enter an initial phase in which banks are required to absorb a

larger share of sovereign debt than the laissez-faire level (which is called "balance-sheet repression" in the paper). At more acute levels of fiscal stress, governments transition to extracting quasi-fiscal revenue from banks, for instance, by lowering the interest rate on bank reserves or requiring banks to accept below-market interest rates (which is called "quasi-fiscal repression" in the paper).

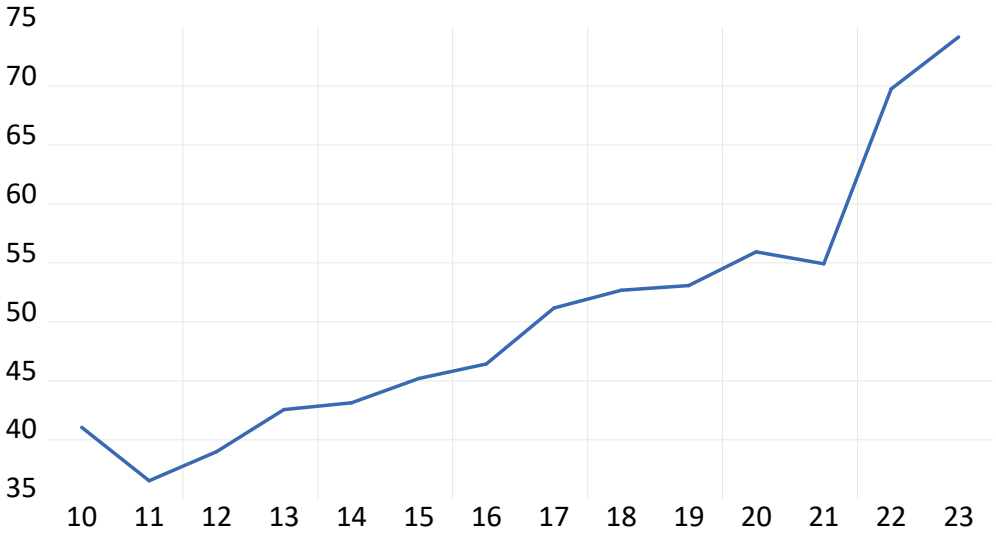
Financial repression has become a central policy concern in Laos (JICA, 2020). Although open information on the Lao financial system is generally limited, JICA (2020) conducted an original survey and showed that the Lao economy has long been characterized by financial repression. They collected information on most of the 37 banks and conducted interviews with 15 banks while constructing a financial statement database for 28 banks for 2013–2018. The financial system of Laos is characterized by financial repression in two ways: (1) commercial banks are required to hold government bonds, and (2) a low-interest-rate policy suppresses the cost of government debt.

Another critical problem facing the Lao economy is the surge in external government debt. Figure 1 depicts the evolution of the external government debt to GDP ratio. The external government debt to GDP ratio, which was about 40% in 2010, has expanded to over 70% in 2022.

The rapid expansion of Lao external government debt reflects the government's heavy reliance on foreign financing. Figure 2 shows foreign financing in the government budget as a ratio to GDP; at its peak, the ratio exceeded 6%.

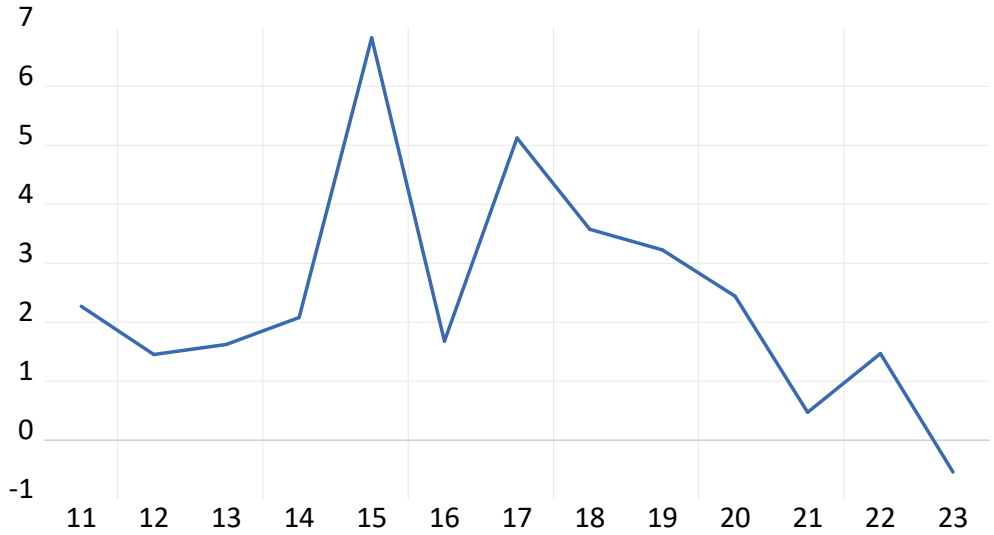
The heavy dependence of fiscal financing on the foreign sector (Figure 2) and the resulting high level of outstanding external debt (Figure 1) have led to a rapid increase in the government's foreign debt repayments. Figure 3 shows that foreign repayment (GDP ratio) has risen rapidly and exceeded 5% in 2023. The

Figure 1: External government debt (GDP ratio)



Note: Outstanding level of external government debt to GDP (%).
Data source: Bank of the Lao PDR's Annual Economic Report, various years.

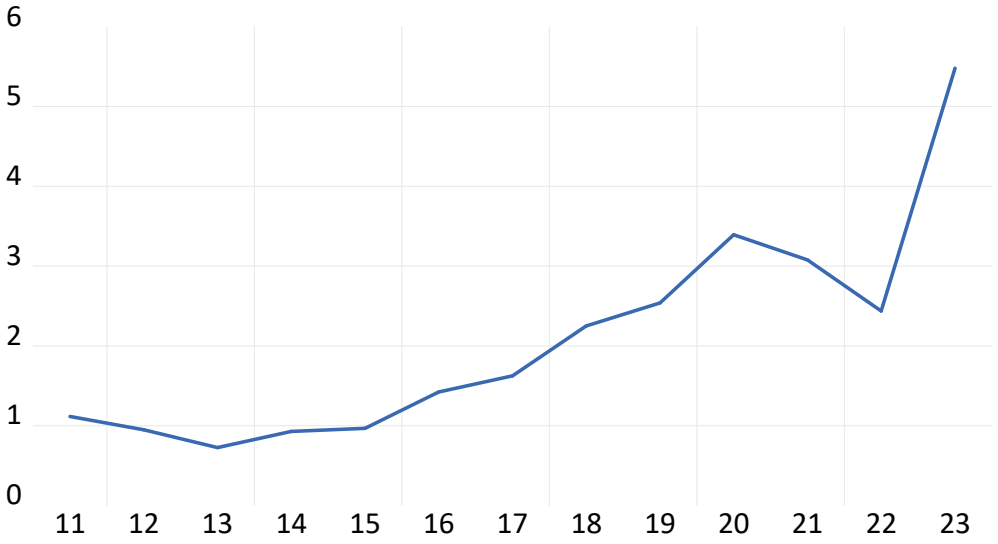
Figure 2: Government foreign financing (GDP ratio)



Note: Foreign financing in government budget (GDP ratio, %)
Data source: Bank of the Lao PDR's Annual Economic Report, various years.

rapid increases in both outstanding level of external debt (Figure 1) and foreign repayment (Figure 3) due to the government's heavy reliance on foreign financing (Figure 2) suggest that it would be difficult for the Lao government to continue to rely on foreign financing.

Figure 3: Government foreign repayment (GDP ratio)



Note: Government foreign repayment (GDP ratio, %).
Data source: Bank of the Lao PDR's Annual Economic Report, various years.

IMF (2023) points out that limited access to external financing creates funding stress and forces the government to rely more on domestic financing. This domestic funding pressure may lead to more severe financial repression. Under financial repression, the government requires the banking sector to hold more government bonds than it would under laissez-faire in order to meet domestic financing needs arising from limited access to external financing. Larger holdings of government bonds by the banking sector reduce the credit available to the economy, crowding out capital investment.

Mieno and Demachi (2024) further point out that the expansion of external

debt and the resulting repayment burden worsen the fiscal deficit and may force the domestic financial system to absorb government bonds. They argue that the government issues bonds in the absence of a functioning bond market and forces commercial banks to hold more government bonds.

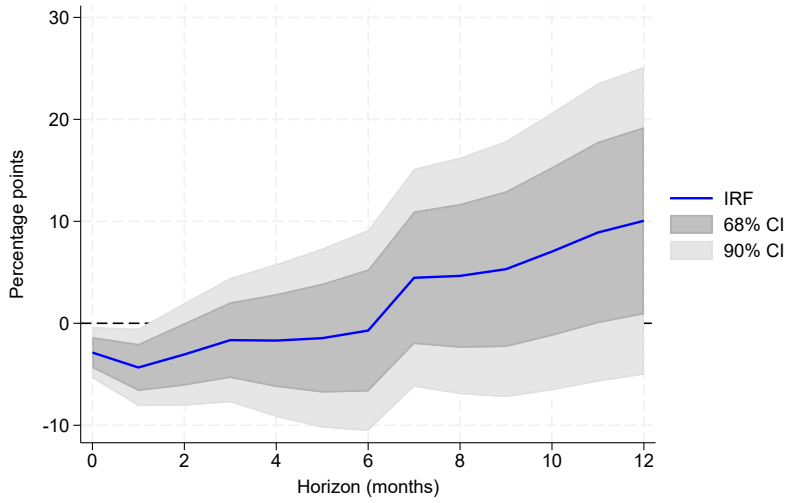
Figure 4 provides empirical motivation for the crowding-out effect in Laos using the local projection method of Jordà (2005). Using monthly data, we estimate the impulse response of the year-on-year growth rate of bank credit to the economy to a one-percentage-point shock in the year-on-year growth rate of banks' claims on the government.

The results show that an acceleration in the growth of banks' claims on the government leads to a significant contraction in the growth rate of credit to the economy. Specifically, in response to a one-percentage-point increase in the growth rate of credit to the government, the growth rate of credit to the economy declines by 2.87 percentage points immediately (Horizon 0) and reaches its peak contraction of approximately 4.33 percentage points one month after the shock (Horizon 1). This crowding-out effect is statistically significant at the 90% confidence level for the first two months, providing strong evidence that the government's reliance on domestic banks for financing directly suppresses credit availability for the economy.

While these monthly local projection results offer meaningful evidence of the crowding-out effect, given the limited availability of macroeconomic and financial data for Laos, the robustness and depth of findings derived from such reduced-form analysis are inevitably constrained. Reduced-form estimates alone cannot fully uncover the structural general-equilibrium mechanisms through which financial repression interacts with bank balance sheets, capital investment, and long-term fiscal outcomes. To address these limitations and provide a more comprehensive

analysis of the macroeconomic transmission channels, the following sections develop a DSGE model that explicitly incorporates the specific institutional features of the Lao economy.

Figure 4: Local Projection: Crowding-out effect of banks' claims on government



Note: The figure shows the impulse response of the year-on-year growth rate of bank credit to the economy to a one-percentage-point shock in the year-on-year growth rate of banks' claims on the government, estimated using monthly data and local projections à la Jordà (2005). The solid line represents the point estimate, and the shaded areas denote the 90% and 68% confidence intervals.

While existing studies and our local projection results provide important institutional and empirical insights into the nature of financial repression in Laos, the macroeconomic transmission mechanisms through which financial repression policies affect the real economy remain less well understood. In particular, how the government's reliance on domestic banks for debt financing affects capital investment and fiscal outcomes through banks' balance sheets has not been fully explored within a general-equilibrium framework.

Motivated by this limitation in the literature, the paper develops a small open economy DSGE model with an explicit banking sector, building on the banking-

sector framework of Gertler and Kiyotaki (2010) and the recent general-equilibrium analysis of financial repression by Kliem et al. (2024). Within the model, financial repression is represented as regulatory and quasi-fiscal interventions that affect banks' portfolio allocation between private capital and government bonds. The model incorporates two institutional features emphasized by IMF (2023) and Mieno and Demachi (2024): first, the requirement that domestic banks absorb government debt amid heightened fiscal pressures; and second, the suppression of returns on government bonds as a means of alleviating the fiscal burden. Using this framework, we examine the macroeconomic implications of financial repression policies for capital investment, output, and fiscal outcomes in the context of Laos.

The remainder of the paper is organized as follows. Section 2 describes the small open economy DSGE model and its calibration based on Lao macroeconomic data. Section 3 presents the numerical experiment results, examining the macroeconomic effects of two types of financial repression: the increased requirement for banks to hold government bonds and the repression of interest payments. Finally, Section 4 concludes the paper with policy implications.

2 Model

A small open economy consists of households, non-financial firms, banks, and the government. The government issues short-term debt. We incorporate a banking sector à la Gertler and Kiyotaki (2010) into a standard real business cycle model of a small open economy (e.g., Aguiar and Gopinath, 2007; Garcia-Cicco et al., 2010). Banks use deposits obtained from households and their net worth to make loans to non-financial firms. As in Gertler and Karadi (2013), banks also purchase government bonds.

2.1 Households

Following Gertler and Kiyotaki (2010) and Gertler and Karadi (2011), we assume that a representative household comprises bankers (f) and workers ($1-f$). Both types of members return wages and dividends to the representative households. Perfect consumption insurance is assumed for households. A banker remains a banker in the next period with probability σ. $(1-\sigma)f$ bankers become workers in the next period, and the same number of workers become bankers. This implies that the fraction of each type of member remains constant over time. Households provide new bankers with start-up funds, and exiting bankers transfer their retained earnings to households.

A household's expected lifetime utility is given by

$$E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left(C_t - \frac{\varsigma}{\varphi} L_t^{\varphi}\right)^{1-\gamma} - 1}{1-\gamma}, \tag{1}$$

where E_0 denotes the mathematical expectation operator conditional on the infor-

mation available at time 0. L_t denotes labor supply. The parameters β, γ, ς, φ denote the discount factor, the inverse of the intertemporal elasticity of substitution, the labor coefficient, and the curvature parameter on labor, respectively. C_t denotes a composite consumption index. Composite consumption is a CES function of domestic goods and imported goods, where $C_t \equiv \left[(1-\varpi)^{\frac{1}{\iota}} C_{H,t}^{\frac{\iota-1}{\iota}} + \varpi^{\frac{1}{\iota}} C_{F,t}^{\frac{\iota-1}{\iota}}\right]^{\frac{\iota}{\iota-1}}$. The parameter $\iota\,(>0)$ is the elasticity of substitution between domestic and imported goods (i.e., trade elasticity), and $\varpi \in (0,1)$ is the degree of trade openness. The implied consumer price index (CPI) is then $P_t \equiv \left[(1-\varpi)P_{H,t}^{1-\iota} + \varpi P_{F,t}^{1-\iota}\right]^{\frac{1}{1-\iota}}$, where $P_{H,t}$ is the domestic price and $P_{F,t}$ is the import price.

A household's budget constraint is given by

$$C_t + T_t + D_t = R_t^d D_{t-1} + w_t L_t + \Pi_t, \tag{2}$$

where D_t is bank deposits, and T_t is a lump-sum tax. Π_t denotes the dividends from banks and non-financial firms. w_t denotes the real wage. R_t^d denotes the return on bank deposits.

The household's first-order optimality conditions with respect to C_t, L_t, and D_t are

$$\left(C_t - \frac{\varsigma}{\varphi} L_t^{\varphi}\right)^{-\gamma} = \rho_t, \tag{3}$$

$$\varsigma\, (L_t)^{\varphi-1} = w_t, \tag{4}$$

and

$$1 = R_t^d E_t\{\Lambda_{t,t+1}\}, \tag{5}$$

where

$$\Lambda_{t,t+1} \equiv \beta \frac{\rho_{t+1}}{\rho_t}, \tag{6}$$

and ρ_t is the Lagrange multiplier on Eq.(2). The household chooses domestic and imported goods to minimize expenditure conditional on total composite demand. The demand functions for domestic and foreign goods are then given by[1]

$$C_{H,t} = (1-\varpi)\left(\frac{P_{H,t}}{P_t}\right)^{-\iota} C_t, \tag{7}$$

and

$$C_{F,t} = \varpi\left(\frac{P_{F,t}}{P_t}\right)^{-\iota} C_t. \tag{8}$$

2.2 Banks

The balance sheet of a bank is given by

$$Q_t^s\, s_t + Q_t^b\, b_t = n_t + d_t. \tag{9}$$

Q_t^s and s_t respectively denote the price and quantity of a bank's financial claims on goods producers. Q_t^b and b_t respectively denote the price and quantity of a bank's holding of government bonds. n_t and d_t denote net worth and deposits from households, respectively.

The bank's net worth evolves according to the difference between earnings on assets and payments on liabilities.

$$n_t = R_t^k\, Q_{t-1}^s\, s_{t-1} + (1-\tau_t)\, R_t^b\, Q_{t-1}^b\, b_{t-1} - R_{t-1}^d\, d_{t-1}, \tag{10}$$

[1]From Eqs. (7), (8), and the CPI, we thus obtain $P_{H,t}\, C_{H,t} + P_{F,t}\, C_{F,t} = P_t\, C_t$.

where R_t^k and R_t^b denote the gross return on asset in the private sector and that in the public sector, respectively. τ_t denotes the tax rate on banks' returns on government bonds, which banks take constant over time. As argued in Section 1, in general, financial repression is characterized by requiring banks to accept below-market interest rates for mitigating the fiscal burden of debt repayment. We examine how an increase in τ_t affects the economy in Section 3.

Considering the probability of exiting the banking industry, the bank maximizes the following value function:

$$V_t = E_t \Lambda_{t,t+1} \left\{ (1-\sigma) n_{t+1} + \sigma V_{t+1} \right\}, \tag{11}$$

where $1-\sigma$ is the probability of exiting the banking industry in the next period.

We introduce an agency problem à la Gertler and Kiyotaki (2010) and Gertler and Karadi (2011), which implies that a bank's ability to expand its balance sheet is limited to a certain level. We assume that a banker can transfer some fraction of "divertable" assets to the household, and a bank becomes bankrupt if it diverts its assets. This introduces an incentive constraint:

$$V_t \geq \theta \left(Q_t^s \, s_t + \Delta \, Q_t^b \, b_t \right). \tag{12}$$

A bank may divert a fraction θ of private-sector assets and a fraction $\Delta\,\theta$ of government bonds, where θ denotes the "divertable" fraction of assets. Following Gertler and Karadi (2013) and Kliem et al. (2024), we assume that $0 < \Delta < 1$, since private-sector assets are likely easier to divert because they are harder for depositors to monitor than public-sector assets. The left-hand side of Eq.(12)

represents the banker's loss from bankruptcy. The right-hand side of Eq.(12) is the banker's gain from diverting assets. To ensure households are willing to lend to a bank, the left-hand side must not be less than the right-hand side. This implies that the incentive constraint (12) limits a bank's ability to expand its balance sheet.

Following Chari et al. (2020) and Kliem et al. (2024), we assume a *regulatory constraint* as follows:

$$Q_t^b \, b_t \geq \tilde{\Gamma}_t (Q_t^s \, s_t + Q_t^b \, b_t), \tag{13}$$

where $\tilde{\Gamma}_t$ denotes the bank's minimum requirement for holding government bonds, which implies that banks are subject to a form of financial repression. For tractability, we transform Eq.(13) to

$$Q_t^b \, b_t \geq \Gamma_t \, Q_t^s \, s_t, \tag{14}$$

where $\tilde{\Gamma}_t = \frac{\Gamma_t}{1+\Gamma_t}$.

As Appendix A2 shows, the bank's optimization problem yields the following first-order conditions:

$$E_t \, \Lambda_{t,t+1} \, \Omega_{t+1} \, \left(R_{t+1}^k - R_t^d \right) = \frac{\theta \, \lambda_t + \Gamma_t \, \mu_t}{1 + \lambda_t}, \tag{15}$$

$$E_t \, \Lambda_{t,t+1} \, \Omega_{t+1} \, \left[(1 - \tau_t) \, R_{t+1}^b - R_t^d \right] = \frac{\theta \, \Delta \, \lambda_t - \mu_t}{1 + \lambda_t}, \tag{16}$$

where $\Omega_{t+1} = 1 - \sigma + \sigma \, \frac{V_{t+1}}{n_{t+1}}$, and

$$Q_t^s \, s_t = \phi_t^s n_t, \tag{17}$$

where

$$\phi_t^s \equiv \frac{E_t \Lambda_{t,t+1}\, \Omega_{t+1}\, R_t^d}{\theta - E_t\, \Lambda_{t,t+1}\, \Omega_{t+1}\, \left(R_{t+1}^k - R_t^d\right) + \Gamma_t\, \left\{\theta\, \Delta - E_t\, \Lambda_{t,t+1}\, \Omega_{t+1}\, \left[(1-\tau_t)\, R_{t+1}^b - R_t^d\right]\right\}}. \tag{18}$$

As ϕ_t^s is independent of bank-specific factors, we can aggregate across banks. Therefore, we have

$$Q_t^s\, S_t = \phi_t^s N_t, \tag{19}$$

where the capital letters of S_t and N_t indicate the aggregate variables. Following Gertler and Karadi (2013) and Kliem et al. (2024), we assume that total net worth evolves as the sum of the retained earnings by the fraction σ of surviving bankers and the transfers that new bankers receive, X, as follows:

$$N_t = \sigma\, \left\{\left(R_t^k - R_{t-1}^d\right)\, Q_{t-1}^s\, S_{t-1} + \left[(1-\tau_t)\, R_t^b - R_{t-1}^d\right]\, Q_{t-1}^b\, B_{t-1} + R_{t-1}^d\, N_{t-1}\right\} + X. \tag{20}$$

2.3 Non-financial firms

2.3.1 Goods producers

Competitive goods producers use capital and labor to produce domestic goods:

$$Y_t = a_t\, K_t^{\alpha}\, L_t^{1-\alpha}, \tag{21}$$

where Y_t is domestic output, a_t is total factor productivity, and K_t is capital. Goods producers purchase capital by obtaining funds from banks:

$$Q_t^s S_t = Q_t^s K_{t+1}. \tag{22}$$

From the firm's first-order condition, we obtain

$$(1-\alpha)\frac{P_{H,t}}{P_t}\frac{Y_t}{L_t} = w_t. \tag{23}$$

Since goods producers are perfectly competitive, the expected gross return on capital is

$$R^k_{t+1} = \frac{\frac{P_{H,t+1}}{P_{t+1}}\alpha\frac{Y_{t+1}}{K_{t+1}} + Q^s_{t+1}(1-\delta)}{Q^s_t}, \tag{24}$$

where δ is the depreciation rate of capital.

2.3.2 Capital producers

As in C_t, investment I_t is composed of domestic and imported goods, where $I_t \equiv \left[(1-\varpi)^{\frac{1}{\iota}} I_{H,t}^{\frac{\iota-1}{\iota}} + \varpi^{\frac{1}{\iota}} I_{F,t}^{\frac{\iota-1}{\iota}}\right]^{\frac{\iota}{\iota-1}}$.[2] The capital producer's objective is

$$\max_{I_t} \; E_t \sum_{i=0}^{\infty} \Lambda_{t,t+i}\left\{Q^s_{t+i} I_{t+i} - \left[1 + f\left(\frac{I_{t+i}}{I_{t+i-1}}\right)\right] I_{t+i}\right\}, \tag{25}$$

where $f\left(\frac{I_{t+i}}{I_{t+i-1}}\right) I_{t+i}$ reflects convex adjustment costs, with $f(1) = f'(1) = 0$ and $f''(I_{t+i}/I_{t+i-1}) > 0$. From the first-order condition for I_t, we obtain

$$Q^s_t = 1 + f\left(\frac{I_t}{I_{t-1}}\right) + \frac{I_t}{I_{t-1}} f'\left(\frac{I_t}{I_{t-1}}\right) - E_t \Lambda_{t,t+1}\left(\frac{I_{t+1}}{I_t}\right)^2 f'\left(\frac{I_{t+1}}{I_t}\right). \tag{26}$$

[2] As in C_t, from the optimal expenditure allocation between domestic and imported goods, we obtain the demand functions of domestic goods, $I_{H,t} = (1-\varpi)\left(\frac{P_{H,t}}{P_t}\right)^{-\iota} I_t$, and foreign goods, $I_{F,t} = \varpi\left(\frac{P_{F,t}}{P_t}\right)^{-\iota} I_t$. From $I_{H,t}$, $I_{F,t}$, and the CPI, we obtain $P_{H,t}\, I_{H,t} + P_{F,t}\, I_{F,t} = P_t\, I_t$.

The capital stock evolves according to

$$K_{t+1} = (1-\delta)K_t + I_t. \tag{27}$$

2.4 Government

The government's budget constraint is given by

$$Q_t^b\, B_t + e_t\, F_t = (1-\tau_t)\, R_t^b\, Q_{t-1}^b\, B_{t-1} - PB_t + R_t^f\, e_{t-1}\, F_{t-1}, \tag{28}$$

where

$$PB_t \equiv T_t - G_t. \tag{29}$$

In Eq.(28), $G_t(=G)$ is constant government spending and $T_t(=\frac{T}{Y}\,Y_t)$ is the lump-sum tax on households, which moves proportionally with GDP, where G, T, and Y denote the steady state levels of G_t, T_t, and Y_t, respectively.[3] PB_t denotes the government's primary balance. τ_t is the tax rate on the bank's return on government bond. F_t denotes foreign debt, R_t^f denotes the gross interest rate on foreign debt, and e_t denotes the real exchange rate.

[3]As in C_t and I_t, we have $G_t \equiv \left[(1-\varpi)^{\frac{1}{\iota}} G_{H,t}^{\frac{\iota-1}{\iota}} + \varpi^{\frac{1}{\iota}} G_{F,t}^{\frac{\iota-1}{\iota}}\right]^{\frac{\iota}{\iota-1}}$, where $G_{H,t} = (1-\varpi)\left(\frac{P_{H,t}}{P_t}\right)^{-\iota} G_t$ and $G_{F,t} = \varpi\left(\frac{P_{F,t}}{P_t}\right)^{-\iota} G_t$. From the demand functions and the CPI, we have $P_{H,t}\, G_{H,t} + P_{F,t}\, G_{F,t} = P_t\, G_t$.

2.5 Equilibrium

To close the model, we require market clearing for private securities. The supply of private securities at the end of period t is equal to K_{t+1}:

$$S_t = K_{t+1}. \tag{30}$$

The link between the government bond price Q_t^b and its gross return R_t^b holds as follows:

$$\frac{1 + Q_{t+1}^b}{Q_t^b} = (1 - \tau_t) R_{t+1}^b. \tag{31}$$

This implies that the government bond price equals the discounted present value of future bond returns:

$$Q_t^b = \sum_{j=0}^{\infty} \frac{1}{\prod_{k=0}^{j}(1 - \tau_{t+k}) R_{t+1+k}^b}. \tag{32}$$

The terms of trade are defined as

$$q_t \equiv \frac{P_{F,t}}{P_{H,t}} = \frac{P_t^*}{P_{H,t}}, \tag{33}$$

where P_t^* is the price index in the foreign country.[4] From the definition of the real exchange rate and that of the CPI, we can express the real exchange rate e_t as a

[4]Without loss of generality, we assume that $P_{F,t} = P_t^*$, since the home country is small enough not to affect the price in the foreign country.

function of the terms of trade q_t:[5]

$$e_t \equiv \frac{P_t^*}{P_t} = \frac{q_t}{g(q_t)}, \tag{34}$$

where

$$g(q_t) \equiv \frac{P_t}{P_{H,t}} = [(1-\varpi) + \varpi q_t^{1-\iota}]^{\frac{1}{1-\iota}}. \tag{35}$$

For the functional form of the investment adjustment cost, we adopt a quadratic function:

$$f\left(\frac{I_t}{I_{t-1}}\right) = \frac{\eta}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2. \tag{36}$$

Demand for domestic goods consists of consumption, investment, its adjustment cost, government expenditure, and exports. The domestic goods market clearing thus requires that

$$Y_t = (1-\varpi)\; g(q_t)^{\iota} \left[I_t + C_t + G_t + I_t \frac{\eta}{2} \left(\frac{I_t}{I_{t-1}} - 1\right)^2 \right] + q_t\, EX_t \tag{37}$$

where EX_t is the exogenous demand for exports.

The trade balance (in terms of the CPI) is

$$TB_t = \frac{Y_t}{g(q_t)} - C_t - G_t - I_t - I_t \frac{\eta}{2} \left(\frac{I_t}{I_{t-1}} - 1\right)^2. \tag{38}$$

From Eq.(38), the foreign debt position F_t evolves according to

$$F_t = F_{t-1}\, R_t^{f*} - \frac{TB_t}{e_t}, \tag{39}$$

[5] Assuming a small open economy (i.e., the home country is small enough not to affect the price in the foreign country) implies asymmetric home bias in preference, so purchasing power parity does not hold (i.e., $e_t \neq 1$).

where

$$R_t^{f*} = R_t^* + \psi \left[\exp\left(\frac{F_t\, q_t}{Y_t} - \frac{F_{SS}}{Y_{SS}} \right) - 1 \right]. \tag{40}$$

The interest rate on foreign borrowing R_t^{f*} consists of two parts: the exogenous world interest rate R_t^* and the country premium on foreign debt which is increasing in the ratio of foreign debt to output. As in many related studies, we assume that the country premium is an increasing function of foreign debt in order to induce the stationarity of foreign debt.[6] Since R_t^{f*} is in terms of foreign price and R_t^f in Eq.(28) is in terms of domestic price, we have the relationship between R_t^f and R_t^{f*} as follows:

$$R_t^f = \frac{e_t\, R_t^{f*}}{e_{t-1}}. \tag{41}$$

Regarding the government's budget constraint, in equilibrium, R_t^b and R_t^f must be equal due to arbitrage:

$$R_t^b = R_t^f. \tag{42}$$

From the evolution of foreign debt (39), we obtain the current account CA_t as follows:

$$CA_t = F_{t-1} - F_t. \tag{43}$$

2.6 Calibration

For calibration, we set the main parameters to ensure consistency with Lao macroeconomic data. For the other conventional parameters, we follow the related literature and adopt the commonly used values.

We set the parameter $\Gamma(= \frac{1}{1/\tilde{\Gamma}-1})$ to 0.09, which implies that banks' govern-

[6] See Schmitt-Grohé and Uribe (2003) for details.

ment bond holdings, $\tilde{\Gamma}$, equal 8% of total bank assets, consistent with Lao data.[7] We set the steady-state level of the (quarterly) lending return R^k to 1.0293, calculated from Lao data.[8] We set the steady-state level of the (quarterly) government bond return R^b to 1.0163, obtained from Lao data.[9] We set the steady-state level of the (quarterly) deposit return R^d to 1.0057, calculated from Lao data.[10] In accordance with the deposit return R^d calculated from Lao data, we set the (quarterly) discount factor $\beta(= 1/R^d)$ to 0.9943. We set the degree of trade openness $\varpi(= \frac{M}{C+I+G})$ to 0.41, calculated from Lao data.[11] The steady-state ratio of government expenditure to GDP, G/Y, is set to 0.106, obtained from Lao data.[12] We set the steady-state ratio of government external debt to GDP, F/Y, to 0.504, obtained from Lao data.[13] The steady-state tax-to-GDP ratio, T/Y, is calibrated to 0.1231 so that the government's budget constraint (28) is satisfied, given the other calibrated values.

Regarding the other parameters not mentioned above, we choose standard values from the related literature. The inverse of the intertemporal elasticity of substitution γ is set to 2 (as in Aguiar and Gopinath (2007)). Following Kitano and Takaku (2020), we set the labor coefficient ς and the curvature parameter on labor φ to 4.060 and 1.455, respectively. Following Gertler and Kiyotaki (2010),

[7]We obtain this number from the average in Table 3 in Mieno and Demachi (2024).

[8]We calculate the average between 2010M1 and 2024M8 using CEIC database. The data source of CEIC is the Bank of the Lao PDR.

[9]The average between 2008 and 2015 is calculated due to data limitations. We use CEIC database, the original data source of which is the Bank of the Lao PDR.

[10]We calculate the average between 2010M1 and 2024M8 using CEIC database. The data source of CEIC is the Bank of the Lao PDR.

[11]We calculate the annual average number of $\varpi(= \frac{M}{C+I+G})$ between 2000 and 2016. The data for C, I, G, and M are from the World Bank.

[12]The average between 2000 and 2016 is calculated due to data limitations. We use CEIC database, the original data source of which is the World Bank.

[13]The average between 2010 and 2023 is calculated due to data limitations. We use CEIC database, the original data source of which is the World Bank.

we set the capital share in production α, the depreciation rate of capital δ, and the parameter for adjustment cost on investment η to 0.33, 0.025, and 1.5, respectively. We set the elasticity of substitution between domestic and imported goods ι to 1.5 (as in, e.g., Ravenna and Natalucci (2008)). We set the fraction of divertable assets θ for the private sector to 0.4, which is standard in the literature (e.g., 0.383 in Gertler and Kiyotaki (2010) and 0.406 in Kitano and Takaku (2020)). We also set Δ, which is related to θ, to 0.5, following Gertler and Karadi (2013) and Kliem et al. (2024). To match the steady-state values of R^k, R^b, and R^d obtained from Lao data, we set the survival rate of banks σ, and the transfers to entering bankers X, to 0.789 and 0.0527, respectively. We set the steady-state ratio of banks' capital to net worth, K/N (or S/N), to 4.5, which is standard in the literature (e.g., 4 in Gertler and Kiyotaki (2010) and 4.5 in Kitano and Takaku (2020)). We set the parameter for country-specific interest rate premium ψ to 4, which is higher than 2.8 for Argentina estimated by Garcia-Cicco et al. (2010). Although Argentina has experienced several financial crises, the Emerging Market Bond Index (EMBI) is available for Argentina. By contrast, no EMBI is available for Laos. This may be interpreted as indicating that Laos has a less developed international bond market than Argentina. Accordingly, we assign a somewhat higher value to the country-specific interest rate premium for Laos than for Argentina, as a parsimonious way to capture relatively stronger financial frictions.

Table 1: Parameterization

	Description	**Value**
Parameters related to households		
γ	Inverse of intertemporal elasticity of substitution	2
β	Discount factor	0.9943
ς	Labor coefficient	4.060
φ	Curvature parameter on labor	1.455
Parameters related to production		
α	Capital share in production	0.33
δ	Depreciation rate of capital	0.025
η	Parameter for adjustment cost on investment	1.5
Parameters related to open economies		
ϖ	Degree of trade openness	0.41
ι	Elasticity of substitution between domestic and imported goods	1.5
ψ	Parameter for country-specific interest rate premium	4
Parameters related to banks		
Γ	Steady-state ratio of banks' holding of government bond to total asset	0.09
R^k	Steady-state (quarterly) lending return	1.0293
R^b	Steady-state (quarterly) government bond return	1.0163
R^d	Steady-state (quarterly) deposit return	1.0057
θ	Fraction of divertable assets (private sector funding)	0.4
Δ	Parameter related to θ: Relative ratio of government bond	0.5
σ	Survival rate of banks	0.789
X	Transfer to entering bankers	0.0527
K/N	Steady-state ratio of private capital to net worth	4.5
Parameters related to the government		
G/Y	Steady-state ratio of government expenditure to GDP	0.106
F/Y	Steady-state ratio of government external debt to GDP	0.504
T/Y	Steady-state ratio of tax to GDP	0.1231

3 Numerical Experiment Results

3.1 Higher Government Bond Holding Requirements for the Banking Sector

This section presents numerical experiments that shed light on the effects of financial repression on the Lao economy. Facing external financing problems, the Lao government is likely to increase its reliance on domestic financing (IMF, 2023). More specifically, in such a case, the government may require the domestic banking sector to absorb more government bonds than before, which can be interpreted as a form of financial repression.

In our numerical experiments, we consider the government's action of requiring the banking sector to increase its holdings of government bonds as an exogenous shock. Specifically, we examine the case in which Γ increases on impact from its steady-state level, $\bar{\Gamma} = 0.09$, to 0.1, and then gradually returns to its steady-state level. Since $\tilde{\Gamma}$ denotes the implied ratio of banks' government bond holdings to total assets, whereas Γ is the corresponding model parameter, this experiment corresponds to a temporary increase in $\tilde{\Gamma}$ from 8% to 9%. The size of the financial repression shock examined here is therefore quite modest. We set the persistence of the financial repression shock to 0.95, implying that the shock is highly persistent despite its small size.

Figure 5 shows the requirement shock Γ_t. The increase in Γ_t is intended to raise the banking sector's holdings of government bonds B_t. As shown in Figure 5, B_t increases as intended in response to the shock. The government bond price Q_t^b increases as well.

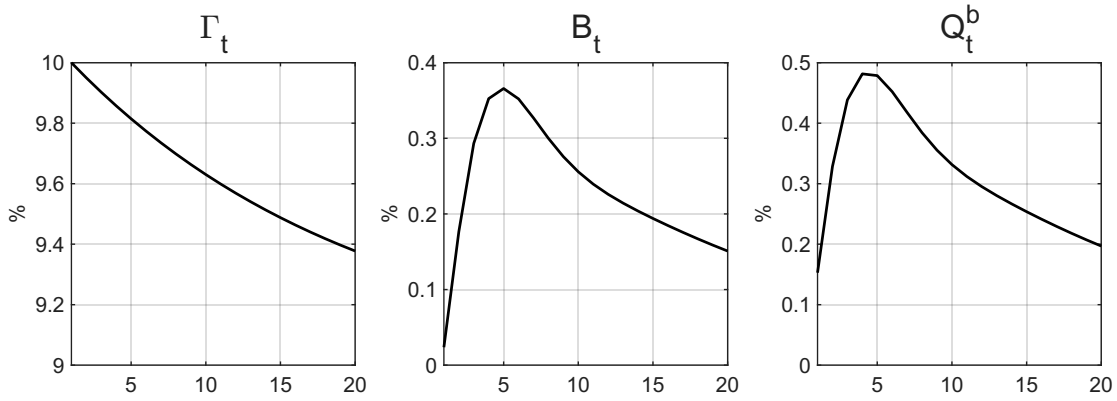


Figure 5: Impulse responses of government bond holding B_t and its price Q_t^b to the requirement shock Γ_t

Since both B_t and Q_t^b increase (Figure 5), $Q_t^b B_t$ also increases, as shown in Figure 6. A rise in Γ requires banks to hold more government bonds relative to private capital, thereby increasing $Q_t^b B_t$ and reducing $Q_t^s K_t$ (Eq. (14)). Accordingly, $Q_t^s K_t$ decreases, as do Q_t^s and K_t, as shown in Figure 6. As K_t falls, investment I_t also declines. In other words, a higher government bond holding requirement crowds out private investment.

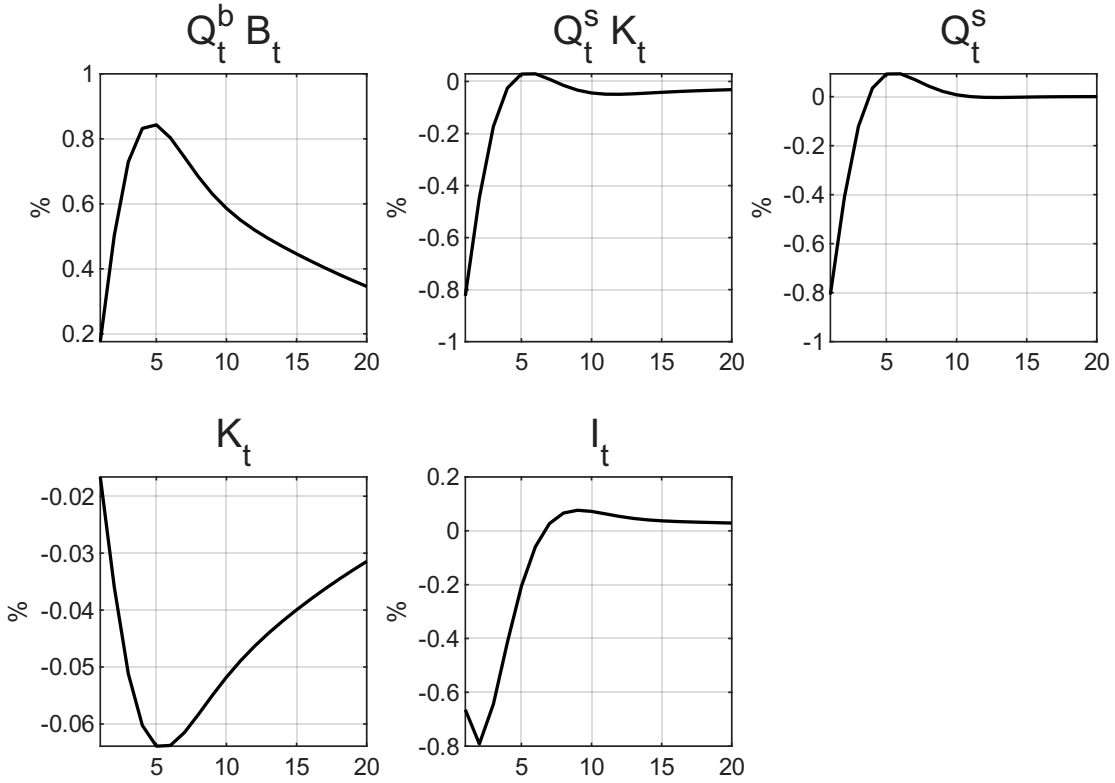


Figure 6: Impulse responses of $Q_t^b B_t$, $Q_t^s K_t$, private capital K_t, its price Q_t^s, and capital investment I_t

The crowding out of private investment I_t leads to a contraction in output Y_t. Since tax revenue T_t moves proportionally with output, the decline in Y_t reduces T_t and thereby worsens the government's primary balance $PB_t \equiv T_t - G_t$, as shown in Figure 7.

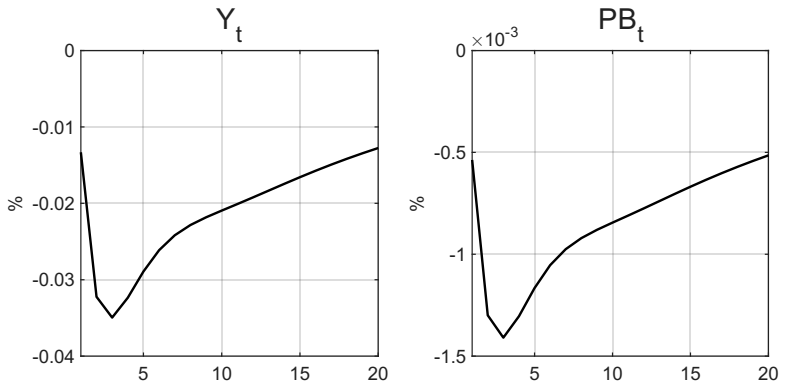


Figure 7: Impulse responses of output Y_t and the government's primary balance PB_t

3.2 Repression of Interest Payments to the Banking Sector

We next examine another typical form of financial repression, under which the government attempts to reduce interest payments to the banking sector in order to mitigate the fiscal burden of debt repayment. Specifically, we introduce into the model an exogenous increase in the tax rate on banks' returns on government bonds, τ_t (Eq. (10)), and examine how this tax increase affects the economy. We assume that τ_t increases from 0 to 0.01, or 1%, on impact and then gradually returns to its steady-state level of 0. The persistence parameter of the shock is set to 0.95.

Figure 8 shows the impulse responses of government bond holdings B_t, their price Q_t^b, and the after-tax return on government bonds, $(1-\tau_t)R_t^b$, to the increase in τ_t. The policy reduces the after-tax return on government bonds, $(1-\tau_t)R_t^b$, as intended. While Q_t^b increases, reflecting the reduction in the government's effective interest payments (Eq. (31)), B_t falls, as shown in Figure 8.

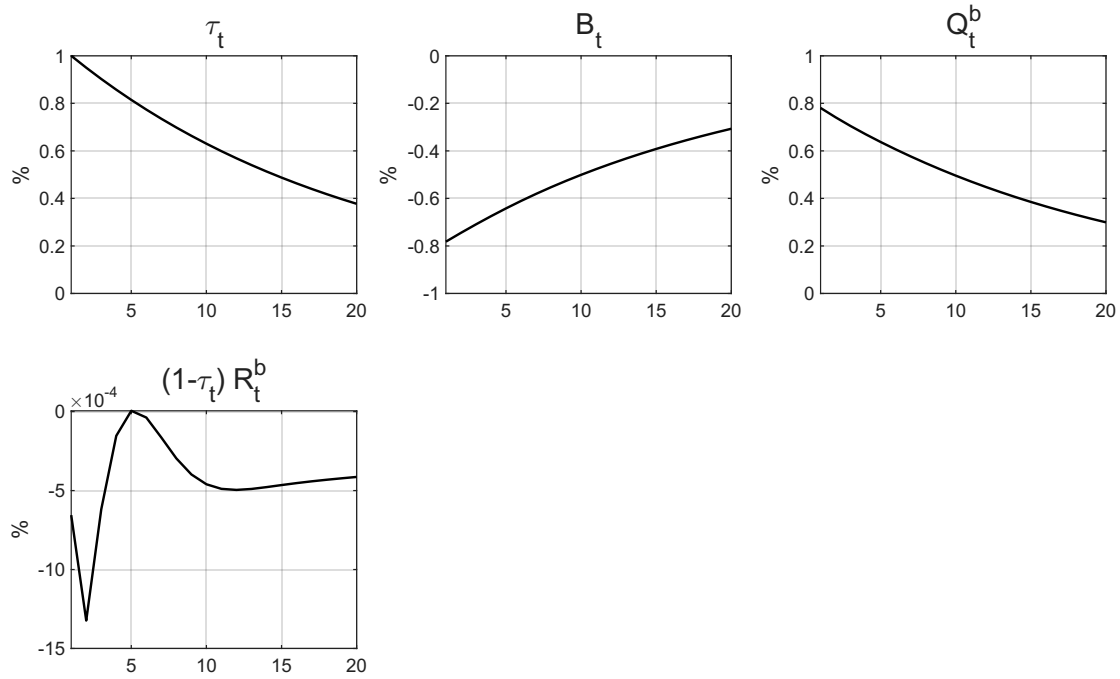


Figure 8: Impulse responses of government bond holdings B_t, their price Q_t^b, and the after-tax return on government bonds, $(1-\tau_t)R_t^b$, to the increase in τ_t

The decline in B_t more than offsets the increase in Q_t^b. As a result, $Q_t^b B_t$ decreases, as shown in Figure 9. This is because a decrease in the after-tax return on government bonds, $(1-\tau_t)R_t^b$, reduces banks' returns on assets allocated to the government sector. In equilibrium, returns on assets allocated to the private and government sectors are equalized. Therefore, the return on assets allocated to the private sector also decreases, and banks' asset allocation to the private sector, $Q_t^s K_t$, declines, as shown in Figure 9. This also leads to a reduction in K_t. As K_t falls, investment I_t declines as well. In other words, the repression of interest payments crowds out private investment I_t.

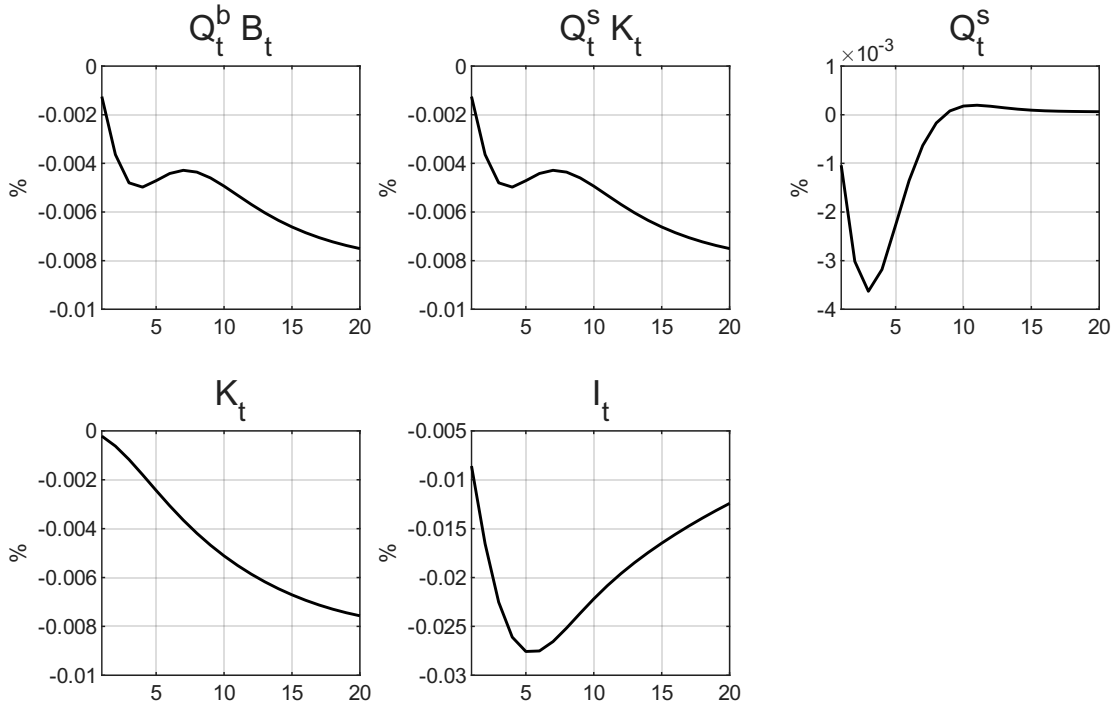


Figure 9: Impulse responses of $Q_t^b B_t$, $Q_t^s K_t$, capital K_t, its price Q_t^s, and private investment I_t to the increase in τ_t

The crowding out of private investment I_t leads to a contraction in output Y_t. Since tax revenue declines with output, the contraction in Y_t worsens the

government's primary balance PB_t, as shown in Figure 10. Thus, although the government raises the tax rate on banks' returns on government bonds in order to mitigate the fiscal burden of debt repayment, the policy ultimately worsens the government's fiscal position.

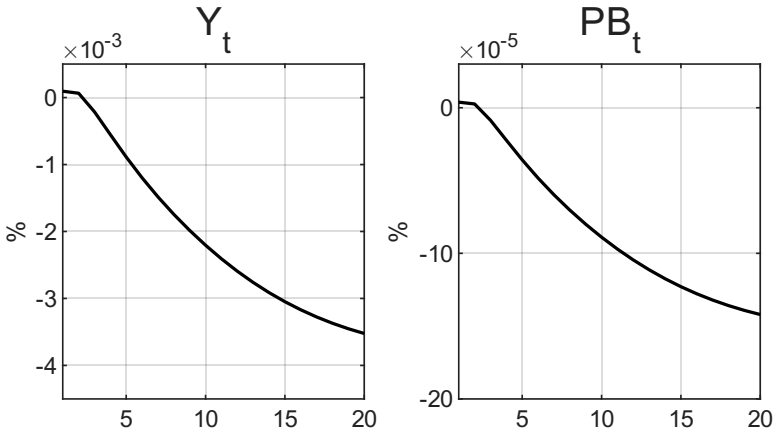


Figure 10: Impulse responses of output Y_t and the government's primary balance PB_t

4 Conclusion

Using a DSGE model calibrated to macroeconomic data for Laos, this paper examined the macroeconomic effects of financial repression policies in the Lao economy. The analysis is motivated by the possibility that, faced with a high level of external debt and limited access to external financing, the Lao government may increasingly rely on domestic financing through the banking sector.

We considered two forms of financial repression. First, we examined a policy that requires domestic banks to increase their holdings of government bonds. The numerical experiment shows that such a requirement increases banks' allocation to government bonds, but it crowds out private capital investment. The resulting decline in capital accumulation reduces output. Since tax revenue moves with output in the model, the contraction in output lowers tax revenue and worsens the government's primary balance.

Second, we analyzed a policy that suppresses the government's interest payments by increasing the tax rate on banks' returns on government bonds. This policy reduces the after-tax return on government bonds as intended. However, the lower return reduces banks' incentives to hold government bonds and lowers the equilibrium return on private capital as well. As a result, private investment declines, output contracts, and the government's primary balance deteriorates.

Taken together, the two numerical experiments suggest that financial repression may have adverse general-equilibrium effects that offset its intended fiscal benefits. Although such policies are designed to ease the government's financing burden, they weaken the banking sector's ability to support private capital accumulation and thereby erode the tax base. This result is consistent with Kliem et al. (2024)

in that financial repression can worsen the government's fiscal position contrary to its original purpose.

The policy implication of our analysis is that financial repression should not be viewed as a costless substitute for fiscal adjustment or debt management. For a government facing limited access to external financing, requiring domestic banks to absorb more government bonds or lowering the effective return on those bonds may appear to ease financing pressures in the short run. However, our results suggest that such policies can weaken the banking sector's ability to finance private capital accumulation and thereby reduce the future tax base. This result should not be interpreted as suggesting that domestic financing itself is undesirable. Rather, the problem arises when domestic financing is achieved by requiring banks to hold more government bonds or by suppressing the returns on those bonds. Such policies reallocate banks' balance sheets away from lending to the private sector and toward financing the government. In a small bank-based financial system such as that of Laos, this reallocation can have sizable real effects because it reduces the availability of credit for private investment.

Several limitations remain. The analysis is based on stylized numerical experiments rather than an estimated DSGE model, reflecting the limited availability of macroeconomic and financial data for Laos. In addition, the model abstracts from several institutional features that may be important in the Lao economy, such as state-owned enterprises, hydropower-related investment projects, on-lending arrangements, BOT-type financing schemes, and the currency composition of public debt. Incorporating these elements into the framework would be a useful direction for future research, especially for evaluating how external debt problems and domestic financial repression interact in a small, financially constrained economy.

Appendix

A1 Local Projection Evidence on the Crowding-Out Effect of Banks' Claims on Government

To analyze the dynamic impact of banks' claims on government on bank credit to the economy (i.e., the crowding-out effect), we employ the local projection method following Jordà (2005). The analysis uses monthly data for the period from 2007M01 to 2026M01.

The variables used in the estimation include bank credit to the economy, quasi-money, the one-year loan rate, and banks' claims on government. The one-year loan rate is measured as the year-on-year difference, while the other three variables are measured as year-on-year growth rates. All data are obtained from the website of the Bank of the Lao P.D.R. [14]

For each horizon $h = 0, 1, \ldots, 12$, we estimate the following regression model:

$$y_{t+h} = \alpha_h + \beta_h S_t + \mathbf{\Phi}_h \mathbf{Z}_t + \sum_{j=1}^{12} \mathbf{\Gamma}_{h,j} \mathbf{X}_{t-j} + \varepsilon_{t+h}, \quad h = 0, 1, \ldots, 12 \tag{A1}$$

where y_{t+h} is the bank credit to the economy at time $t + h$, S_t represents the shock variable (banks' claims on government) at time t, and $\mathbf{Z}_t$ is a vector of contemporaneous control variables, including quasi-money and the loan rate. The vector $\mathbf{X}_{t-j}$ contains 12 lags of all endogenous variables to account for historical dynamics. The coefficient β_h captures the impulse response of bank credit to the

[14] In the original data source, the corresponding variable names are "Credit to the economy" , "Quasi-money," "Commercial Banks Interest Rates: LOAN ACCOUNTS: Type of Customers: A: KIP ACCOUNTS: Short term (1 year)," and "Claims on Govt."

economy at horizon h to an unexpected shock in government claims held by banks, providing an empirical measure of the crowding-out effect.

A2 Derivation of Equations in Section 2.2

We conjecture and verify that the value function (11) is linear:

$$V_t = \nu_t^s \, Q_t^s \, s_t + \nu_t^b \, Q_t^b \, b_t + \nu_t^n \, n_t, \tag{A2}$$

where ν_t^s is the marginal value of assets in the private sector, ν_t^b is the marginal value of assets in the public sector, and ν_t^n is the marginal value of net worth. Maximizing the value function (A2) subject to the incentive constraint (12) and the regulatory constraint (13) yields the following first-order conditions:

$$\nu_t^s = \frac{\theta \, \lambda_t + \Gamma_t \, \mu_t}{1 + \lambda_t}, \tag{A3}$$

$$\nu_t^b = \frac{\theta \, \Delta \, \lambda_t - \mu_t}{1 + \lambda_t}. \tag{A4}$$

It follows from Eqs. (A2), (12), and (13) that

$$Q_t^s s_t = \phi_t^s n_t, \qquad (17)$$

where

$$\phi_t^s \equiv \frac{\nu_t^n}{\theta - \nu_t^s + \Gamma_t \, \left(\theta \, \Delta - \nu_t^b \right)}. \tag{A5}$$

Substituting Eqs. (13) and (17) into (A2) gives

$$V_{t+1} = (\nu^s_{t+1}\phi^s_{t+1} + \nu^b_{t+1}\Gamma_t\phi^s_{t+1} + \nu^n_{t+1})n_{t+1}. \tag{A6}$$

We can rewrite Eq.(11) as

$$V_t = E_t\Lambda_{t,t+1}\Omega_{t+1}n_{t+1}, \tag{A7}$$

where

$$\Omega_t \equiv 1 - \sigma + \sigma\frac{V_t}{n_t}. \tag{A8}$$

Substituting (A6) into (A8) yields

$$\Omega_t = 1 - \sigma + \sigma(\nu^s_t\phi^s_t + \nu^b_t\Gamma_t\phi^s_t + \nu^n_t). \tag{A9}$$

Substituting Eq.(9) into (10) gives

$$n_t = \left(R^k_t - R^d_{t-1}\right)\, Q^s_{t-1}\, s_{t-1} + \left[(1-\tau_t)\, R^b_t - R^d_{t-1}\right]\, Q^b_{t-1}\, b_{t-1} + R^d_{t-1}\, n_{t-1}. \tag{A10}$$

Substituting Eq.(A10) into (A7), we have

$$V_t = E_t\Lambda_{t,t+1}\Omega_{t+1}\left\{(R^k_{t+1} - R^d_t)Q^s_t s_t + [(1-\tau_t)\, R^b_{t+1} - R^d_t]Q^b_t b_t + R^d_t n_t\right\}. \tag{A11}$$

Comparing Eq.(A11) with (A2), we obtain

$$\nu^s_t = E_t\Lambda_{t,t+1}\Omega_{t+1}(R^k_{t+1} - R^d_t), \tag{A12}$$

$$\nu_t^b = E_t \Lambda_{t,t+1} \Omega_{t+1} [(1 - \tau_t) R_{t+1}^b - R_t^d], \tag{A13}$$

and

$$\nu_t^n = E_t \Lambda_{t,t+1} \Omega_{t+1} R_t^d. \tag{A14}$$

From Eqs. (A3) and (A12), we obtain (15). From Eqs. (A4) and (A13), we obtain (16). Substituting Eqs. (A12), (A13), and (A14) into (A5), we obtain Eq.(18).

A3 Steady-State Computations

This appendix collects the steady-state relationships used for calibration and for constructing the steady state levels of main variables. All parameters and calibrated steady-state targets are taken as given from Section 2.6.

A3.1 Discounting and returns

From the household Euler equation (5) (and (6)),

$$\Lambda = \frac{1}{R^d}, \tag{A15}$$

$$\beta = \Lambda. \tag{A16}$$

With the calibrated quarterly deposit return $R^d = 1.0057$ (Section 2.6), this yields $\beta = 0.9943$.

A3.2 Asset prices and foreign interest rate

Normalize the steady-state price of private securities:

$$Q^s = 1. \tag{A17}$$

Using the bond pricing condition Eq.(31) with $\tau = 0$, we have

$$Q^b = \frac{1}{R^b - 1}, \tag{A18}$$

given the calibrated quarterly government bond return $R^b = 1.0163$ (Section 2.6). It follows from Eq. (42) that

$$R^f = R^b. \tag{A19}$$

With $e = 1$ at the steady state, Eq. (41) gives

$$R^{f*} = R^f. \tag{A20}$$

At the steady state, the country premium in Eq. (40) vanishes (since $F/Y = F_{SS}/Y_{SS}$), so the world interest rate equals the government bond return:

$$R^* = R^{f*}. \tag{A21}$$

A3.3 Production block

Given the calibrated values $R^k = 1.0293$, $\alpha = 0.33$, and $\delta = 0.025$ (Section 2.6), the steady-state output–capital ratio satisfies

$$\frac{Y}{K} = \frac{1}{\alpha}\left(R^k - (1-\delta)\right). \tag{A22}$$

Therefore, we obtain

$$\frac{K}{L} = \left(\frac{Y}{K}\right)^{-\frac{1}{1-\alpha}}, \qquad \frac{Y}{L} = \left(\frac{K}{L}\right)^{\alpha}. \tag{A23}$$

From Eqs. (4) and (23) (and using $q = g(q) = 1$ in the steady state), we have

$$L = \left(\frac{(1-\alpha)}{\varsigma}\frac{Y}{L}\right)^{\frac{1}{\varphi-1}}, \tag{A24}$$

with the calibrated labor coefficient $\varsigma = 4.060$ and curvature parameter $\varphi = 1.455$ (Section 2.6). It follows from Eq.(23) that

$$w = (1-\alpha)\frac{Y}{L}. \tag{A25}$$

It also follows that

$$K = \frac{L}{\left(\frac{Y}{K}\right)^{\frac{1}{1-\alpha}}}, \qquad Y = K^{\alpha}L^{1-\alpha}. \tag{A26}$$

A3.4 Absorption and external balance

From Eq.(27), investment is given by

$$I = \delta K, \tag{A27}$$

with the calibrated depreciation rate $\delta = 0.025$ (Section 2.6). Government spending and external debt are given by

$$G = \left(\frac{G}{Y}\right) Y, \qquad F = \left(\frac{F}{Y}\right) Y, \tag{A28}$$

with the calibrated targets $G/Y = 0.106$ and $F/Y = 0.504$ (Section 2.6). From Eq.(39) and using $e = 1$ in the steady state, we have

$$\frac{TB}{Y} = (R^{f*} - 1)\frac{F}{Y}, \qquad TB = \left(\frac{TB}{Y}\right) Y. \tag{A29}$$

From Eq.(38), we obtain

$$\frac{C}{Y} = 1 - \frac{I}{Y} - \frac{G}{Y} - \frac{TB}{Y}, \qquad C = \left(\frac{C}{Y}\right) Y. \tag{A30}$$

It follows from Eq.(37) that

$$EX = Y - (1 - \varpi)(C + I + G), \tag{A31}$$

with the calibrated degree of trade openness $\varpi = 0.41$ (Section 2.6). From Eq.(43), we have

$$CA = 0. \tag{A32}$$

A3.5 Marginal utility of consumption

The steady-state marginal utility of consumption is given by

$$\rho = \left(C - \frac{\varsigma}{\varphi} L^{\varphi} \right)^{-\gamma}. \tag{A33}$$

A3.6 Bank's balance sheet

The bank net worth target K/N implies

$$N = \frac{K}{K/N}, \tag{A34}$$

with the calibrated target $K/N = 4.5$ (Section 2.6). From Eqs. (19) and (22),

$$Q^s K = \phi^s N \quad \Rightarrow \quad \phi^s = \frac{Q^s K}{N}. \tag{A35}$$

Given the steady-state regulatory requirement $\Gamma = 0.09$ (equivalently $\tilde{\Gamma} = 0.08$, i.e. government bonds are 8% of total bank assets; Section 2.6), the steady-state holding of government bonds follows from Eq.(14):

$$B = \Gamma \frac{Q^s K}{Q^b}. \tag{A36}$$

From Eq.(9), the steady-state level of deposits is given by

$$D = Q^s\, S + Q^b\, B - N. \tag{A37}$$

A3.7 Government budget and primary balance

From the steady-state government budget constraint Eq.(28), lump-sum taxes satisfy

$$T = R^b Q^b B + G + R^f eF - eF - Q^b B. \tag{A38}$$

The primary balance is

$$PB = T - G. \tag{A39}$$

A3.8 Bank-related values and multipliers

Using (A5), (A12), (A13), and (A14), the steady-state marginal value of net worth is pinned down by

$$\nu^n = \frac{\phi^s\, \theta(1 + \Gamma\Delta)}{1 + \phi^s \left(\frac{R^k - R^d}{R^d} + \Gamma \frac{R^b - R^d}{R^d} \right)}, \tag{A40}$$

with the calibrated divertable fraction $\theta = 0.4$ and the relative ratio of government bond $\Delta = 0.5$ (Section 2.6). From (A12), (A13), (A14), and (A15), the marginal

values of assets in the private and public sectors are

$$\nu^s = \left(\frac{R^k - R^d}{R^d}\right)\nu^n, \qquad \nu^b = \left(\frac{R^b - R^d}{R^d}\right)\nu^n, \tag{A41}$$

and

$$\Omega = \nu^n. \tag{A42}$$

From (A9), the bank survival rate is obtained as

$$\sigma = \frac{\Omega - 1}{\left(\phi^s \frac{R^k - R^d}{R^d} + \Gamma\phi^s \frac{R^b - R^d}{R^d} + 1\right)\nu^n - 1}. \tag{A43}$$

From Eq.(20), transfers to entering bankers X are obtained as

$$X = N - \sigma\left[(R^k - R^d)Q^s K + (R^b - R^d)Q^b B + R^d N\right]. \tag{A44}$$

From Eqs.(A3) and (A4), we obtain the steady-state bank multipliers:

$$\lambda = \frac{\nu^s + \Gamma\nu^b}{\theta(1 + \Gamma\Delta) - \Gamma\nu^b - \nu^s}, \tag{A45}$$

$$\mu = (\theta\Delta - \nu^b)\lambda - \nu^b. \tag{A46}$$

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