Fiscal-Oil Dominance and the Finance Resource Curse: The Paradoxes of Plenty and Banking*

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Abstract

This article models banking under the condition of fiscal dominance or oil-financed fiscal deficits (oil dominance) and explains why resource-based economies experience a financial resource curse. The evidence shows that commodity price shocks engender premature deindustrialisation, reduce loan-deposit ratios and increase interest rate spreads, among other pathologies. The model demonstrates that commodity price shocks or bigger-than-average non-oil primary fiscal deficits accelerate bank deposits and interest costs. Consequently, these lower the bank's profit margin $\left(\frac{profits}{deposits}\right)$, liquidity $\left(\frac{bonds}{deposits}\right)$, and capital adequacy ratios $\left(\frac{capital}{loans}\right)$. Therefore, the bank raises (lowers) its lending (deposit) rate to satisfy banking regulations without compromising profits. Thus, fiscal-oil dominance reduces (raises) the loan-deposit ratio (interest rate spread). Moreover, the model shows that oil dominance increases the bank's share of consumer loans as a defensive measure against rising interest costs or non-bank competition, and triggers an unstable boom in property prices. Finally, policy requires monetary dominance or sterilised oil financing.

Keywords: banking, financial resource curse, fiscal-oil dominance, bank deposits

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1 Introduction

This paper provides a unified explanation of seven banking pathologies in low- and middle-income resource-based countries, defined as countries with natural resource exports that exceed 25 percent of total merchandise exports (IMF 2012). Newly emerging evidence shows that there is a *financial resource curse* (Umar et al. 2021; Mlachila and Ouedraogo 2020; Beck and Poelhekke 2017; Kurronen 2015; Bhattacharyya and Hodler 2014; Hattendorff 2014; Beck 2011), where periods of *commodity price shocks* cause:

1. Lower credit creation
2. Higher non-performing loans
3. Lower loan-deposit ratios, and
4. Higher stocks of government securities in the banking system.

Three related stylised facts of this class economies are:

1. Premature de-industrialisation due to non-FDI inflows (Botta et al. 2021)
2. Higher interest rate spreads (Gelos 2009; Crowley 2007; Moore and Roland 2002), and
3. Persistent non-borrowed and non-remunerated excess bank reserves (Delechat et al. 2012; Saxegaard 2006).

The Structure-Conduct-Performance (SCP) paradigm is the standard explanation for the observed banking pathologies (Klein 1971; Slovin and Sushka 1983; Hannan 1991; Freixas and Rochet 2008: 79-80). An oligopolistic theory of the banking firm is at the centre of this paradigm, which contends that banks use their market power to raise the interest rate spread and underprovide credit. However, the SCP paradigm has several limitations. First, there is no compelling evidence that banks' market power influences the loan rate. Most empirical studies use the Lerner Index or market share data as proxies for banks' market power. The key problem with the Lerner Index is that it rises with interest income, so it is a biased estimator of the lending rate. Other studies appropriately prefer market share data. But in resource-based economies, a bank with a higher market share of loans is also likely to have a higher market share of deposits, ergo, a higher share of the interest cost. It follows that this indicator does not adequately identify the relationship between the lending rate and market power since it may also reflect a higher share of the interest cost. Mujeri and Younus (2009) and Chirwa and Mlachila (2004) find evidence that a higher market share of deposits increases the interest rate spread in the banking systems in Bangladesh and

Malawi, respectively. Moreover, Chortareas et al. (2012) find that the Herfindahl-Hirschman Index and banks' market share of *assets* have little to no effect on interest rate margins in Latin American countries between 1999-2006. Demirguc-Kunt et al. (2004) arrive at a similar conclusion using data on 1,400 banks across 72 countries. Second, to be consistent with the evidence, the SCP paradigm requires that banks' market power *increases* with commodity price shocks, but this is likely to *decrease* due to stronger non-bank competition, for example, mortgage providers. Third, the SCP thesis does not explain why the banking system is inundated with non-borrowed central bank reserves or why banks hold a larger stock of government securities. Finally, this framework has no convincing explanation for the nexus between banking and premature de-industrialisation. While higher loan rates may contract investment demand, this may be negated by higher profit rates in resource-based countries, particularly during commodity price shocks.

In this article, I develop a medium-run and continuous-time model of banking that coherently explains all the stylised facts. The model consists of a central bank, a commercial bank, and a representative agent of the non-bank private sector. It shows that the stylised facts are better explained by a bigger than average non-resource or non-oil primary fiscal deficit as a share of GDP—consistent with the evidence of commodity price shocks. When the fiscal deficit is money-financed, which is typical of resource-based economies, a regime of fiscal dominance is realised.[1] I show that the public sector's *fountain pen*, that is, the central bank's ability to create reserves *ex nihilo*, floods the banking system with deposits and explains the glut of non-borrowed and non-remunerated excess reserves in the banking system. Similar results hold if the fiscal deficit is financed by oil receipts or other forms of resource wealth, hence, the term fiscal-oil dominance.[2]

The nexus among the public sector's fountain pen, central bank reserves, and bank deposits is a well-established result and the model's starting point (Ihrig et al. 2017; McLeay et al. 2014). The following excerpt describes the banking consequences of the oil boom in Trinidad and Tobago, 1973-1980, and highlights why fiscal-oil dominance explains the stylised facts:

> The money value of commercial bank deposits which had increased from TT $442 million in 1970 to TT $761 million in 1973, rose to TT $1 billion in 1974. By the end of 1982, it had multiplied a further six times. [...] These changes in the level and structure of resource

[1] See Hooley et al. (2021) for recent evidence that fiscal dominance is rising in the Sub-Saharan African region, and IMF (2015: 18) for a discussion on how poor cash flow management and liquidity forecasting ability are prevalent in low-income countries. The latter point implies that there are unplanned changes in the government's deposit balance at the central bank and by extension, fiscal dominance.

[2] See Primus et al. (2014), Saxegaard (2006), and Agenor et al. (2004) for evidence that fiscal deficits and central banks' accumulation of foreign assets generate non-borrowed and non-remunerated excess reserves. Also, see Da Costa and Olivo (2008) for evidence of how oil and fiscal dominance have similar effects on central bank reserves.

> inflows into the banks had several consequences. One was a steep rise in operating costs. The primary influence on total cost was interest cost. (Bourne 1985: 153-155).

This excerpt captures the first-order effect of fiscal or oil dominance: a bigger than average fiscal deficit, funded by, say, commodity price shocks, raises the *trend* of bank deposits and *interest operating cost*. It is worth noting that these results hold for all fiscal deficits or even quantitative easing. The difference is that banks' net income remains *unchanged* in advanced economies through one of two channels: 1. Banks can purchase interest-bearing bonds until their non-borrowed and non-remunerated reserves are *exhausted*, or 2. The banks' reserves are interest-bearing assets. The key idea advanced in this article is that neither of these channels is operationalised in the case of fiscal-oil dominance or most resource-based economies, evidenced by the glut of non-borrowed and non-remunerated excess reserves.

In this framework, there are three regulatory requirements that the representative bank must satisfy: 1. A reserve requirement, 2. A bank liquidity requirement, and 3. A capital adequacy requirement. These banking regulations accommodate cash withdrawals, liquidity shortages, and non-performing loans. Also, the central bank has a fixed exchange rate mandate and sterilises its purchase of foreign exchange, which explains why banks hold excess liquidity as defined as by ratio of bonds to deposits that exceed the minimum requirement. This formulation is consistent with the managed floats and fixed pegs in most resource-based economies (IMF 2008).

Given this set-up, the acceleration in bank deposits has the following effects: 1. It lowers the bank liquidity ratio, and 2. It reduces the bank profit margin, defined as the ratio of bank profits to deposits. The latter is particularly problematic because it also reduces the bank's capital adequacy ratio, which can only be satisfied through profits. It follows that fiscal-oil dominance pushes the banking system off its keel since it must now earn more profits to service an accelerating interest operating cost and satisfy banking regulations.

The commercial bank responds in the following ways. First, the bank attempts to maintain its normal liquidity ratio to accommodate the rising interest cost by increasing its demand for central bank bonds or government securities. However, regimes of fiscal or oil dominance do not provide bonds on demand as the fiscal deficit is either money- or oil-financed. Consequently, the bond rate falls. Note that the overall results are unchanged with the imposition of fixed-price bonds (see Figure 1). Second, the normal bank liquidity ratio is maintained if the deposit interest cost falls. Thus, the bank lowers the current or saving deposit rate. In turn, the latter falls relative to the interest rate on fixed deposits, which earn a premium compared to saving deposits. These changes in deposit rates incentivise the non-bank private sector to save in fixed deposits, and the weighted averaged deposit interest cost rises even further. Third, these adjustments may prove inadequate since political economy factors may impose a lower bound on the saving deposit rate. Consequently, the bank raises its target profits and prime lending rate, which reduces credit creation. Also, since the latter lowers bank deposits, it helps to maintain the normal liquidity ratio. Given the higher lending rate, and lower deposit rate, fiscal-oil dominance increases the interest rate spread. Fourth, the bank cannot find creditworthy borrowers as fast as fiscal deficits pump deposits into the banking system, thus, the loan-deposit ratio falls, and excess bank liquidity is realised.[3] Overall, these results are consistent with the stylised facts highlighted earlier.

The operationalisation of the financial resource curse depends on the structure of loan rates and the extent of non-bank competition. If the economy has a consumption bias, then the prime loan rate is higher than the interest rate on consumer loans. Conversely, the economy has a production bias when the reverse holds. In the latter case, the higher interest consumer loans are more attractive and permit the banking system to service its rising interest cost. Demand for consumer loans is particularly robust, namely, real estate, since bigger than average fiscal deficits appreciate the real exchange rate and wages. Interestingly, even if the economy is consumption-biased, competition from non-bank financial institutions forces the bank to provide lower-interest consumer loans.[4]

I formally demonstrate that fiscal-oil dominance increases the share of consumer loans at the cost of lower production loans. Crucially, as the former rises, so do property prices, and I illustrate that these are saddle-point unstable and engender a property bubble. Property market instability emerges on two counts: 1. Increased competition from the non-bank financial sector, and 2. Higher property prices increase the valuation of collateral, which further increases the demand for consumer loans and real estate. The model shows that the property boom continues until the share of consumer loans reaches its upper limit, which is determined by the bank's diversification strategy. When the bank approaches this upper limit, it begins to ration credit (or rations more extensively) and establishes the peak in property prices. The model does not investigate the dynamics of a property market bust, but it underlines that a regime of fiscal-oil dominance engenders a financial resource curse that supports an unstable boom in real estate prices.[5]

[3]See Gray et al. (2014) for evidence that unsterilised foreign exchange intervention and monetised-fiscal deficits lower the loan-deposit ratio for countries in the Middle East and North Africa.

[4]It is worth highlighting that non-bank financial firms are not major deposit-taking institutions, so they are *not* confronted with accelerating interest costs (see Remark 2.3).

[5]In the case of Trinidad and Tobago, Ramlogan and Ho Sing (2014) documented that real estate prices exploded during the 1970s until they peaked in 1979, thereafter, house prices collapsed by approximately 70 percent until the early 1990s.

Related Literature. Overall, the model yields predictions consistent with the stylised facts and closely relate to the literature on bank pricing behaviour, excess bank liquidity, fiscal dominance, and the financial resource curse. As noted earlier, the SCP paradigm utilises the theory of market structures to explain bank pricing behaviour, but Dong et al. (2021) is a recent departure from this tradition. They formulate a dynamic general equilibrium model with an endogenous number of banks to study how banking structure affects the macroeconomy and welfare. In their set-up, the number of loan officers determines bank size, and there are search and matching frictions in the credit market. The model shows that bank liquidity is a decreasing function of the number of banks through stronger competition for deposits, which raises the deposit rate. Also, transaction costs increase with the number of banks as more loan officers meet fewer clients. In this context, bank competition raises rather than lowers the loan rate. In short, unlike the SCP paradigm, oligopolistic banking is welfare maximising. Other scholars study the interest rate spread and demonstrate that it is necessary to reduce the costs associated with uncertainty, credit risk, and the asymmetrical demand for loans and deposit supplies (Ho and Saunders 1981; Angbazo 1996; Allen 1988).

Related research investigates involuntary excess reserves and bank pricing behaviour. Agenor and El Aynaoui (2010) build a simple macro model and derive a demand function for excess bank reserves motivated by uncertainty about cash withdrawals. In the case of involuntary excess reserves; caused by an under-developed financial system, high monitoring costs, and risk-averse banks, the model shows that lending and deposit rates fall to increase interest income and stabilise profitability. In related research, Khemraj (2014: 69-70) utilises a graphical model and specifies an oligopolistic bank loan rate as a reciprocal function of bank reserves to demonstrate that excess reserves lower the loan rate to a minimum threshold that reflects risk, opportunity cost, and market power. Unlike these studies, De Grauwe (1982) develops a portfolio balance model with a banking sector and demonstrates that the deposit rate (lending rate) rises (falls) when excess reserves are induced by a reduction in reserve requirements. The intuition for the rise in the deposit rate relates to the idea that the bank can operate with a lower profit margin given the reduction in reserve requirements.

In contrast to this literature, I present a banking model under the condition of fiscal or oil dominance, and motivate the interest costs associated with the corresponding bank deposits rather than explore non-remunerated excess reserves and market structure. This difference in focus presents new insights. For example, I show that the lending rate rises, rather than falls, under conditions of fiscal-oil dominance or commodity price shocks and irrespective of market structure. Further, contrary to the crowding-out hypothesis, the model demonstrates that fiscal-oil dominance raises the loan rate to satisfy capital requirements since it lowers the bank's profit margin. The model is also consistent with the literature that connects excess bank reserves to lower deposit rates, unlike Godley and Lavoie (2012)'s banking model that assumes monetary dominance and includes a secondary bond market. In their model, the bank raises the deposit rate when its liquidity ratio falls below a threshold to incentivise the non-bank private sector to sell bonds and hold deposits. But this mechanism is absent in low- and middle-income resource-based economies, which is why the deposit rate falls.

The article also extends the literature on excess bank liquidity and fiscal dominance. Khemraj uses a graphical model to show that the oligopoly loan rate constrains investment demand and engineers excess liquidity as defined by a low ratio of loans to deposits (Khemraj 2014: 40-42). Similar results hold under the condition of competitive banking when imperfect information on creditworthiness leads to credit rationing (Stiglitz and Weiss 1981). This article presents new channels: the extent of fiscal-oil dominance determines the magnitude of excess liquidity by expanding bank deposits and increasing the loan rate. Further, it is well established that fiscal dominance leads to exchange rate crises (Annicchiarico et al. 2011; Dornbusch 1985) and accelerating inflation (Sargent and Wallace 1981). I extend this literature to the banking sector and underline how fiscal dominance induces banking pathologies. By extension, the model presents a new rationale for fiscal rules in resource-based economies beyond the Dutch disease, intergenerational equity, debt sustainability, and short-run stabilisation (Venables 2010; Collier et al. 2009).

Finally, the article contributes to the literature on the financial resource curse. Botta (2017) and Rodrik and Subramanian (2009) propose the idea that open capital accounts may appreciate the real exchange rate and lower manufacturing competitiveness, while Benigno and Fornaro (2014) show that capital inflows lead to a construction boom that reallocates labour to the non-tradable sector and lower productivity growth. Hausmann and Rigobon (2003)'s formulation shows that profits in the non-resource tradable sector are more volatile than in the non-tradable sector, thus, commands a higher sectoral loan rate, which feeds back into higher volatility and interest rates until the sector disappears. In contrast, this article models the banking system and the distribution of its loan portfolio between consumer and production loans. I show that positive commodity price shocks generate an unstable boom in property prices and raise the bank's interest operating cost. Consequently, the bank's share of consumer loans accelerates because of higher collateral values (real estate property bubble) and as a defensive measure to rising interest costs.

The remainder of the article is organised as follows. Section 2 introduces the theoretical model and presents the key results. Section 3 concludes and omitted proofs are presented in the Appendix.

2 Model

This section presents a medium-run and continuous-time model of banking under the condition of fiscal-oil dominance.

2.1 Environment

This sub-section introduces the key ingredients of the environment. The economy is small and open and consists of a central bank, a commercial bank, and the non-bank private sector, where the latter includes households and firms.

Central Bank. The central bank is the fiscal agent of the government, and infrequently purchases government securities but may provide an advance or overdraft facility to fund any shortfall in tax receipts (Hooley et al. 2021). This implies that the central bank holds few government securities for effective liquidity management and instead issues central bank bonds ($\bar{B}$). This leads to the following assumption.

Assumption 2.1 (Central Bank Bonds)**.** *(a) Monetary policy of liquidity management is undertaken through the sale of central bank bonds.*

(b) Central bank bonds are also issued to finance the fiscal deficit.

This is a simplifying assumption to narrow the focus on domestic securities irrespective of how monetary policy and domestic debt financing are undertaken. The implication of this assumption is that $\bar{B}$ is a central bank liability whether it is issued for monetary or fiscal purposes.[6]

Macro-prudential policy specifies that the representative bank satisfies minimum requirements to accommodate cash withdrawals, liquidity shortages, and non-performing loans. These requirements are summarised in the following assumption.

Assumption 2.2 (Banking Regulation)**.** *The representative bank is required to hold a minimum ratio of: (a) Central bank reserves to deposits, where $k < 1$ is the required reserve ratio,*

(b) Liquid assets ($\bar{B}$) to deposits, where $z < 1$ is the required bank liquidity ratio, and

(c) Capital to loans, where $v < 1$ is the required capital adequacy ratio.

[6] See Nyawata (2013) for an excellent discussion on the choice between treasury bills or central bank bonds for liquidity management. Overall, this study shows that the distinction does not matter for the substance of liquidity management or the owner of the liability, as interest costs are directly accounted for in the treasury's budget or indirectly through reduced profit transfers from the central bank.

In addition to management of the payments system and bank supervision, the central bank maintains a fixed exchange rate ($\bar{S}$) relative to the US dollar, where an increase in $\bar{S}$ indicates a nominal devaluation. To maintain this exchange rate mandate, the central bank's stock of net foreign assets evolves as follows, where F^T is the central bank's target stock of net foreign assets consistent with the exchange rate peg, and $1 < \gamma < 0$ is an adjustment parameter.

$$\dot{F}_{cb} = \gamma(F^T - F_{cb}) \tag{1a}$$

Equation (1b) indicates that the central bank's target stock of net foreign assets is determined by the market's expectation of a nominal devaluation (S^e), and other determinants such as external debt obligations are reflected in the constant. When there is a shortage of foreign assets on the local market; there is an expectation of a nominal devaluation ($\Uparrow S^e$) and the central bank reduces its target reserve balances by selling foreign assets to the local market until the market's expectation is well anchored to the peg ($\bar{S} = S^e$).

$$F^T = a_0 - a_1(S^e) \tag{1b}$$

In turn, Equation (1c) specifies that the market expects a nominal devaluation when the government incurs a primary fiscal deficit ($G - T$), and the constant captures other factors such as the stock of net foreign assets held by the private sector. The intuition is straightforward. An increase in the primary fiscal deficit raises the demand for foreign assets due to the openness of the economy, and generates an expectation of a nominal devaluation.

$$S^e = b_0 + b_1(G - T) \tag{1c}$$

Substitution of Equations (1b) and (1c) into (1a) yields the central bank's stock of net foreign assets that is consistent with its exchange rate peg (F_{cb*}) when $\dot{F}_{cb} = 0$, where $\chi_1 = a_0 - a_1 b_0$.

$$F_{cb*} = \chi_1 + a_1 b_1 (T - G) \tag{2}$$

Equation (2) captures the basic operation of a fixed exchange rate regime: the central bank must *decrease* its stock of net foreign assets when the government increases its primary fiscal deficit. This well-established result is the price of the central bank's exchange rate policy, which is summarised below.

Assumption 2.3 (Exchange Rate Policy)**.** *The central bank maintains a fixed nominal exchange* *rate relative to the US Dollar ($\bar{S}$).*

The basic justification for this assumption is that most resource-based economies have a fixed exchange rate system or a managed float.[7]

Representative Bank. The production structure of the economy is relatively narrow, that is, it has a dominant natural resource sector (oil and minerals), a traditional or narrow non-resource tradable sector (light manufacturing and agriculture), and a non-tradable sector (real estate and other consumer durables). It follows that the bank's asset portfolio must necessarily reflect this narrow production base. Moreover, there is a high degree of information asymmetry on credit-worthiness between banker and potential borrower as there are no credit rating institutions, and low human capital compromises the quality of loan applications. Ergo, the bank has limited asset choices beyond traditional or established borrowers. These points are summarised in the following assumption.

Assumption 2.4 (Bank-based Financial System)**.** *(a) The economy is dominated by a bank-based financial system and financial markets are negligible or absent.*

(b) The banking sector is poorly diversified across the resource sector, non-resource tradable, and non-tradable sectors.

Assumptions A 2.5.(a-e) are consistent with the evidence in low- and some middle-income countries, where the banking sector is the dominant holder of central bank securities and secondary bond markets are either non-existent or poorly developed (Nyawata 2013; Schaechter 2001). These works also demonstrate that domestic assets account for the larger share of commercial banks' portfolio, and central bank reserves are not interest-bearing assets.

Assumption 2.5 (Banking System's Asset Portfolio)**.** *(a) Domestic assets account for the majority of the bank's portfolio: loans, central bank bonds and reserves.*

(b) The bank's assets held as central bank reserves are not interest-bearing assets.

(c) There is no secondary bond market and the representative bank holds bonds ($\bar{B}$) until maturity.

(d) There is no inter-bank money market.

(e) The representative bank is the principal intermediary in the local foreign exchange market.

[7] See IMF (2008) for a classification of countries by exchange rate system.

Periodically, the central bank purchases foreign assets from the banking sector in exchange for non-remunerated central bank reserves to maintain a satisfactory stock of net foreign assets per its exchange rate peg. These purchases are *always* sterilised and raises the bank's liquidity ratio ($\bar{B}/Deposits$) beyond the minimum requirement.[8] The following assumption summarises this stylised fact.

Assumption 2.6 (Excess Bank Liquidity)**.** *The bank's liquidity ratio is beyond the minimum requirement due to sterilised foreign exchange intervention.*

Non-bank private sector. Following Assumptions A 2.4.(a) and A 2.5.(c), households and firms have limited domestic asset choices beyond bank deposits. Moreover, the greater share of economic transactions are cash based. These features lead to the following assumption.

Assumption 2.7 (Liquidity Preference)**.** *The non-bank private sector has a relatively high liquidity preference.*

This assumption implies that the non-bank private sector's saving behaviour is interest rate inelastic. Several factors produce this result. First, economic transactions are largely cash based, so liquidity preference is insensitive to interest rate changes. Second, both bond and stock markets are illiquid and do not serve as alternatives to bank deposits when there are interest rate adjustments. Third, while the non-bank private sector can save in the form of foreign assets, this may compromise a fundamental objective of monetary policy—a credible peg—and the central bank may impose capital controls, which prevent households and firms from adjusting their assets when interest rate changes.

2.2 Fiscal-Oil Dominance, Deposits, and Non-Borrowed Excess Reserves

This sub-section formally defines fiscal and oil dominance, and underlines how these generate bank deposits and non-borrowed and non-remunerated excess reserves.

Fiscal and oil dominance are defined as follows:

Definition 2.1 (Fiscal and Oil Dominance)**.** *(a) When the central bank finances the primary fiscal deficit through the outright purchase of government securities, central bank advances to the government, the provision of an overdraft facility, or there are unexpected reductions in the government's deposit balance at the central bank; a fiscally dominant regime is realised. This is formally*

[8] Consult Aizenman and Glick (2009) for evidence of persistent foreign exchange sterilisation in Asian and Latin American economies.

illustrated below, where G, T, CG, and D_g are government outlay, tax revenue, central bank's claims on the government, and the government's deposit balance at the central bank, respectively.

$$G - T = \dot{CG} - \dot{D}_g \tag{3}$$

(b) When the non-oil primary deficit is financed by the local currency equivalent of oil receipts (T^{oil}), an oil dominant regime is realised, where the following holds: $\dot{T}^{oil} \equiv \dot{D}_g$.

$$G - T = \dot{CG} - \dot{T}^{oil} \tag{4}$$

Note that a dot indicates the time derivative of a variable, so Definition 2.1a underlines that a primary deficit is funded by the central bank's accumulation of government assets, and/or continuous reduction in the government's deposit balance at the central bank. In an oil dominant regime, Definition 2.1b specifies that a non-oil primary deficit is funded by the central bank's accumulation of government assets, and/or the continuous reduction of the local currency equivalent of its oil receipts deposited at the central bank.

The following result indicates that fiscal-oil dominance have similar effects on non-borrowed reserves in the banking system.

Lemma 2.1 (Fiscal-Oil Dominance and Non-Borrowed Excess Reserves)**.** *Under a fixed exchange rate system, fiscal-oil dominance engenders non-borrowed excess bank reserves, if and only if, the sum of the required reserve ratio and the weighted marginal propensity to import is less than one.*

Next I provide an illustration, which is useful to develop the intuition for the result. Consider the stylised balance sheets of the central bank, commercial bank, and the non-bank private sector in Table 1. In this example, the latter's marginal propensity to import (or save in foreign assets) is 0.4, the required reserve ratio is 0.2, and the exchange rate is \$1 = 2 local currency units (LCU). Suppose that the government finances its non-oil primary deficit by spending 100 LCU of its oil receipts, then, it debits its deposit account at the central bank and credits the bank with non-borrowed reserves of an equivalent value. By accounting, the central bank increases its reserve liabilities to the bank by 100 LCU, and when the government's check is cleared, deposit assets in the non-bank private sector also increases by 100 LCU. Note, that these are also recorded as an increase in deposit liabilities to the bank. This result leads to the following Axiom of money and banking.

Axiom 2.1 (Fiscal Deficits and Bank Deposits)**.** *Fiscal deficits increase deposits in the banking system.*

Table 1: Stylised Balance Sheets

Central Bank	
Assets	Liabilities
NFA	CB. Bonds
CG	Reserves
	G. Deposits

Commercial Banking System	
Assets	Liabilities
Reserves	Deposits
NFA	
CB. Bonds	
Loans	

Non-Bank Private Sector	
Assets	Liabilities
Deposits	Loans

Notes: Net foreign assets and claims on government are *NFA* and *CG*, respectively. CB. Bonds refer to central bank bonds and G. Deposits denote government deposits.

Since the marginal propensity to import or save in foreign assets is 0.4, the non-bank private sector sells 40 LCU to the bank in exchange for foreign currency—\$20 given the exchange rate. Thus, the net increase in bank deposits is now 60 LCU.

In turn, the higher import demand or foreign savings (induced by the primary deficit) engenders an expectation of a nominal devaluation (Equation (1c)), and the central bank sells \$20 to the bank in exchange for 40 LCU of central bank reserves to maintain its fixed peg. Therefore, the bank now holds 60 LCU of non-borrowed and non-remunerated reserves as assets. By accounting, the central bank credits the government's deposit account with 40 LCU of reserves from the sale of foreign exchange, and reduce its reserve liabilities by an equivalent value. It is transparent that the net change in the government's deposit balance at the central bank is negative 60 LCU. Since the required reserve ratio is 0.2, the bank must hold 12 LCU to satisfy its reserve requirements. Thus, the primary fiscal deficit—funded by a fiscal or oil dominant regime—generates non-borrowed and non-remunerated *excess reserves* in the banking system equivalent to 48 LCU.

It is instructive to compare this result with bond-financed fiscal deficits. In this case, the central bank sells bonds to the bank in exchange for the 48 LCU of excess reserves, which leads to another Axiom of money and banking.

Axiom 2.2 (Bond-Financed Fiscal Deficits and Bank Reserves)**.** *Bond-financed fiscal deficits have no net effect on reserves in the banking system.*

This Axiom leads to the following result.

Theorem 2.1 (Excess Reserves, Bank Liquidity and Risk)**.** *Persistent non-borrowed and non-remunerated excess bank reserves are only realised in regimes of fiscal or oil dominance, and do not indicate the banking sector's preference for risk or liquidity.*

At this stage, it is worth reminding the reader that the central bank reserve currency only facilitates transactions between the central bank and the representative commercial bank—the non-bank private sector does not undertake transactions using central bank reserves. It follows that the latter *cannot* be loaned out to the non-bank private sector. Therefore, persistent non-borrowed and non-remunerated excess reserves do *not* signal the banking system's appetite for risk, rather, it underscores the *degree* of fiscal or oil dominance—the supply-side (Lemma 2.1).

There are several reasons why the banking system is unable to eliminate its non-borrowed and non-remunerated excess reserves. First, from Assumption A 2.1., the marketable stock of central bank bonds may be too few to exhaust the stock of excess reserves. Second, the same may be true in the local foreign exchange market, where an inadequate supply of foreign assets engenders excess bank reserves.[9] Moreover, the banker may exercise caution even when there is an abundant supply of foreign currency on the local market. In a small open economy, the performance of the banking system's loan portfolio depends on the availability of foreign currency to facilitate the importation of key intermediate and final goods and services. To ensure that clients have adequate access to scarce foreign assets, the bank will not extinguish its excess reserves by hoarding foreign assets—lest it runs the risk of undermining its clients and loan portfolio. Third, the representative bank may refuse to part with non-remunerated excess reserves to satisfy any unexpected demand for cash or deposit withdrawals (Maehle 2020).[10] Fourth, banks may maintain excess reserves to forgo the cost of borrowing reserves from the central bank when loans are created (Caprio and Honohan 1993). Finally, there are important interest rate adjustments that incentivise the banker to hold non-borrowed and non-remunerated excess reserves—see sub-sections 2.3 and 2.4.

Due to the popular misunderstanding that (excess) reserves create loans, I have omitted a discussion on the bank's loan portfolio as a potential exit option for its excess reserves, until now. Define excess reserves (ER) as the difference between total reserves in the banking system (R) less required reserves (kD): $ER = R - kD$. Note that whenever the bank creates a new loan asset it

[9] The bank can accumulate foreign assets and reduce its excess reserve balances in two ways: 1. It can purchase foreign assets from the central bank with its excess reserves, and/or 2. It can purchase foreign assets from the non-bank private sector in exchange for bank deposits. By definition, the latter raises the required reserves and thereby, lowers excess reserves in the bank.

[10] See Primus et al. (2014), Saxegaard (2006), and Agenor et al. (2004) for evidence that the volatility of currency withdrawals and default risk are important determinants of bankers' choice to hold precautionary excess reserves.

simultaneously creates a new deposit liability in the loan recipient's deposit account. Ergo, excess reserves are reduced with credit creation by definition. Crucially, there is no central bank reserve constraint on loan creation—the bank extends loans to all creditworthy borrowers (or creates loans for projects with risk profiles it can adequately assess and monitor)—irrespective of its reserve balance.[11] If the latter does not satisfy the required reserves due to the new loan creation, the bank simply borrows the necessary reserves from the central bank. In short, the constraints to credit creation are the extent of creditworthiness and the bank's ability to assess risk—the presence of excess reserves do not relax these constraints. Thus, the bank's loan portfolio is not an exit option for its excess reserves as these are not loaned out, though they may encourage imprudent banking by lowering credit standards (Agenor and El Aynaoui 2010; Saxegaard 2006).

In the following sub-sections, the creation of non-borrowed and non-remunerated excess reserves, and bank deposits—by way of fiscal or oil dominance—serve as the driving factor for monetary equilibria in the bond, deposit, and loan markets.

2.3 Bond and Deposit Markets

This sub-section analyses how fiscal or oil dominance affects the bond and deposit markets.

Bond Market. Recall Assumption A 2.6 that there is excess bank liquidity due to sterilised foreign exchange intervention, then, there is a normal bank liquidity ratio (BLR^N):

$$BLR^N = \frac{\bar{B}}{\text{Deposits}}.$$

Definition 2.2 (Normal Bank Liquidity Ratio)**.** *The normal bank liquidity ratio refers to the historical mean of excess bank liquidity.*

The bank maintains this normal ratio when the volume of bank deposits increases with its trend. In this case, the routine sterilised foreign exchange intervention and periodic liquidity management are sufficient to obtain the normal bank liquidity ratio. A stable ratio is important because it permits the bank to accommodate the predictable increase in its interest operating cost without adversely affecting bank profitability. However, if the trend of bank deposits increases, then, deposits and the associated interest costs are *accelerating* and the normal bank liquidity ratio falls at an increasing

[11] The Bank of England has most recently explained the process of credit creation, where the latter is not constrained by reserves or deposits (McLeay et al. 2014). Also, see Godley and Lavoie (2012: ch.7) for an earlier exposition of credit creation and Werner (2014) for recent evidence.

rate. The bank has two options to maintain its normal liquidity ratio: 1. Increase its purchase of central bank bonds, and/or 2. Lower the total interest cost of bank deposits.

Equation (5a) indicates the bank's demand for central bank bonds, which increases with the bond rate (r_B) and the trend of bank deposits (D^{tr}), but decreases as the risk-free foreign interest rate (r_F) increases.

$$B_D = c_0 + c_1 r_B + c_2 D^{tr} - c_3 r_F \tag{5a}$$

This specification deviates from portfolio balance models and omits the loan rate as an argument since the representative bank is *not* constrained to either make loans or purchase bonds. Given Lemma 2.1, the bank can purchase bonds with non-borrowed excess reserves without affecting its loan portfolio (Worrell 1997: 39, 49). It follows that the bond market does not reflect the opportunity cost of banking due to its illiquidity and limited supply of bonds.

The following formulation shows that the volume of deposits accelerates when the bank expects deposits (D^e) to exceed its trend, where $0 < \varepsilon < 1$ is an adjustment parameter.

$$\dot{D} = \varepsilon(D^e - D^{tr}) \tag{5b}$$

Equation (5c) states that the bank's expectation is driven by the size of the non-resource primary fiscal deficit as a share of GDP (Θ) relative to its mean ($\bar{\Theta}$), and the long-run rate of economic growth (y_n).[12] In the latter case, it is intuitive that an increase in the long-run growth rate raises average income in the non-bank private sector, and therefore, the bank's expectation about the volume of deposits relative to its trend. The same holds when the primary fiscal deficit exceeds its historical mean, for example, when the non-oil fiscal deficit increases due to an influx of oil receipts.

$$D^e = d_0 + d_1(\Theta - \bar{\Theta}) + d_2 y_n \tag{5c}$$

Substitution of Equation (5c) into (5b) solves for the trend of bank deposits:

$$D^{tr} = d_0 + d_1(\Theta - \bar{\Theta}) + d_2 y_n. \tag{5d}$$

[12]Note that the bank's own actions do not determine its expectation about the volume of deposits relative to its trend. When the bank creates a loan and/or purchases foreign assets from the non-bank public, it also expands bank deposits. But there is no reason to expect deposit creation by the bank to exceed the trend of bank deposits. Moreover, the associated interest costs on these deposits are accommodated by the interest income on loans and foreign assets. Therefore, the bank omits its own actions when forming expectations.

The following result explains that an increase in the fiscal deficit raises the trend of bank deposits.

Lemma 2.2 (Fiscal Deficit and the Trend of Bank Deposits)**.** *When the fiscal deficit rises above its mean, such that $\Theta > \bar{\Theta}$, it raises the trend of bank deposits and accelerates the volume of deposits.*

Remark 2.1 (Trend of Bank Deposits and Speed of Adjustments)**.** The bank does not generate price and/or quantity adjustments for every continuous change in bank deposits, otherwise, there are continuous fluctuations in the price and quantity of its assets, which are not consistent with the observed facts. However, when there is a change in the *trend* of bank deposits, discrete changes and some continuous fluctuations are observed in key prices and quantities, for example, the deposit rate. The basic rationale for this behaviour is to maintain stable expectations on the part of households and firms regarding key interest rates, and shareholders; regarding bank profitability.

Suppose that the time derivative of the bond rate ($\dot{r_B}$) is a positive function of the excess supply of bonds, that is, an exogenous increase in $\bar{B}$ lowers its price and accelerates the bond rate. This relationship is illustrated by Equation (5e), where B_D captures the demand for bonds, and $0 < \psi < 1$ is an adjustment parameter.

$$\dot{r_B} = \psi(\bar{B} - B_D) \tag{5e}$$

This specification demonstrates that the bond rate is market determined rather than exogenously formulated by the monetary authority, which is consistent with the traditional reserve monetary targeting framework in low- and some middle-income countries (IMF 2015; Schaechter 2001). Indeed, the bond rate is usually a fixed-rate in some countries but this is re-fixed when the bond matures or is rolled-over (Nyawata 2013). In the context of this article, a change in the bond rate refers to floating rates or new fixed-rates at the end of maturity.[13] A key implication of the flexible-price bond is that the bond rate does not serve as an anchor or a reference rate for the banking sector, or an indication of the stance of monetary policy, which is the standard result under fiscal or oil dominance.[14] Also, note that the flexible-price bond formulation is subsequently relaxed and the imposition of fixed-price bonds do not alter the overall results.

[13] Based on Nyawata (2013)'s survey evidence, the majority of sterilisation bonds in low- and some middle-income countries are short-term, that is, one year or less, so that the bond rate is re-negotiated with some frequency to reflect market conditions.

[14] See Da Costa and Olivo (2008) for evidence of how oil dominance undermines the independence and effectiveness of monetary policy in the case of Venezuela. Also, there is a well-established empirical literature that non-borrowed (or involuntary) reserves undermine the monetary transmission mechanism. It follows that fiscal or oil dominance weakens monetary policy by generating non-borrowed reserves (Lemma 2.1). Consult Mishra and Montiel (2013) for

Substitution of Equations (5a) and (5d) into (5e) derives the steady-state bond rate (r_B^*), where $\chi_2 = c_0 + c_2 d_0$:

$$r_B^* = \frac{\bar{B} - \chi_2 + c_2 d_1(\bar{\Theta} - \Theta) - c_2 d_2 y_n + c_3 r_F}{c_1}. \tag{5f}$$

This result is consistent with the literature, where an increase in the supply of bonds and foreign interest rate raise the domestic bond rate. However, it also shows that a faster long-run growth rate, and an increase in the primary fiscal deficit above its historical mean lower the bond rate. The following Proposition summarises this result.

Proposition 2.1 (Fiscal-Oil Dominance and the Bond Rate)**.** *An increase in the primary fiscal deficit above its mean lowers the steady-state bond rate.*

This result is intuitive. An increase in the average fiscal deficit accelerates deposits and the bank's interest operating cost (Lemma 2.2). Consequently, the bank increases its demand for interest-bearing assets (bonds) to accommodate the rising interest costs, and the excess demand increases the bond price and lowers the bond rate.

Deposit Market. Consider the differential Equation below, which shows the evolution of the interest rate on demand deposits or current deposit account (r_{Dc}).

$$\dot{r}_{Dc} = \delta(r_{Dc}^T - r_{Dc}) \tag{6a}$$

The bank has a target interest rate (r_{Dc}^T) it plans to pay on the current deposit account, and this is principally determined by the trend of bank deposits as shown below.

$$r_{Dc}^T = e_0 - e_1 D^{tr} \tag{6b}$$

The intuition for this specification relates to the following mechanism. When the trend of deposits rises, the bank increases its demand for central bank bonds but this may be unsatisfied due to an exogenously given supply of bonds ($\bar{B}$). This forces the bank to lower its interest costs by *reducing* the interest rate it pays on demand deposits. In plain terms, the maintenance of the normal bank liquidity ratio regulates the deposit rate on current deposit accounts.

a useful survey of the empirical evidence on the weak monetary transmission mechanism in low-income countries, Haughton and Eglesias (2012) for evidence of how involuntary bank reserves produce asymmetric interest rate pass through in the Caribbean, and Hooley et al. (2021) for evidence of how fiscal dominance depreciates the nominal exchagne rate and accelerates inflation in Sub-Saharan Africa.

Substitution of Equations (6b) and (5d) into (6a) derives the steady-state current account deposit rate (r^*_{Dc}), where $\chi_3 = e_0 - e_1 d_0$. This result demonstrates that an increase in the average fiscal deficit and a faster long-run growth rate lower the steady-state current account deposit rate, which is summarised in the following proposition.

$$r^*_{Dc} = \chi_3 + e_1 d_1 (\bar{\Theta} - \Theta) - e_1 d_2 y_n \tag{6c}$$

Proposition 2.2 (Fiscal-Oil Dominance and the Current Account Deposit Rate)**.** *The steady-state current account deposit rate falls when the primary fiscal deficit rises above its mean.*

It is worth noting that a lower steady-state deposit rate does not undermine the mobilisation of deposits in the banking system, even if Assumption 2.7 of high liquidity preference is relaxed. Note that if households decide to spend all their income due to an extremely low current account deposit rate, these expenditures generate income and *bank deposits* for firms in the non-bank private sector.

The next presentation disaggregates bank deposits, and analyses how its composition evolves and influences total interest costs.

Current and Time Deposits. Suppose that bank deposits are divided into current account deposits (D_c), and time deposits (D_t), and that the rate of return on time deposits ($\bar{r}_{Dt}$) are higher and exogenously given. These points are summarised in the following assumption, which fits the stylised facts of relative return between current and time deposit accounts.

Assumption 2.8 (Structure of Deposit Rates)**.** *The structure of deposit interest rates are as follows:* $\bar{r}_{Dt} > r_{Dc}$.

Equation (7a) denotes the time evolution of demand deposits as a share of total bank deposits (α_{Dc}), where $1 < \mu < 0$ is an adjustment parameter and α^T_{Dc} is the target share of current deposits.

$$\dot{\alpha}_{Dc} = \mu(\alpha^T_{Dc} - \alpha_{Dc}) \tag{7a}$$

Households and firms' target share of current deposits is a positive function of the current deposit rate (r_{Dc}) and the long-run growth rate, but negatively related to the time deposit rate (r_{Dt}).

$$\alpha^T_{Dc} = f_0 + f_1 r_{Dc} - f_2 \bar{r}_{Dt} + f_3 y_n \tag{7b}$$

This is a straightforward specification that underlines the importance of own and cross interest rates, and income growth for the target share of current deposits. Substitution of Equations (6c) and (7b) into (7a) yields the steady-state share of current deposits in total bank deposits (α^*_{Dc}).

$$\alpha_{Dc}^{*} = f_0 + f_1\chi_3 + f_1 e_1 d_1(\bar{\Theta} - \Theta) - f_2\bar{r}_{Dt} + y(f_3 - f_1 e_1 d_2) \tag{7c}$$

The next proposition explains that a bigger than average fiscal deficit lowers the share of current deposits in total bank deposits.

Proposition 2.3 (Fiscal-Oil Dominance and the Share of Demand Deposits)**.** *An increase in the fiscal deficit relative to its mean lowers the steady-state share of current deposits in total bank deposits.*

The driving factor behind this result is the current account deposit rate (r_{Dc}), which falls relative to the time deposit rate (r_{Dt}) under a regime of fiscal or oil dominance (Proposition 2.2). In this case, the non-bank private sector places a greater share of its savings in time deposits to earn a higher return. One implication of this result is that total interest operating costs change because of the *volume* and *composition* of bank deposits, which is summarised in the following result.

Theorem 2.2 (Fiscal-Oil Dominance and Interest Costs in the Banking System)**.** *When the fiscal deficit rises relative to its mean, total interest operating cost ($\dot{r}^{cost}$) in the banking system evolves as follows:*

(a) Interest cost accelerates due to a growing share of higher interest-cost time deposits ($1 - \dot{\alpha}_{Dc}$),

(b) Interest cost accelerates due to rapid growth in bank deposits ($\dot{D}$), and

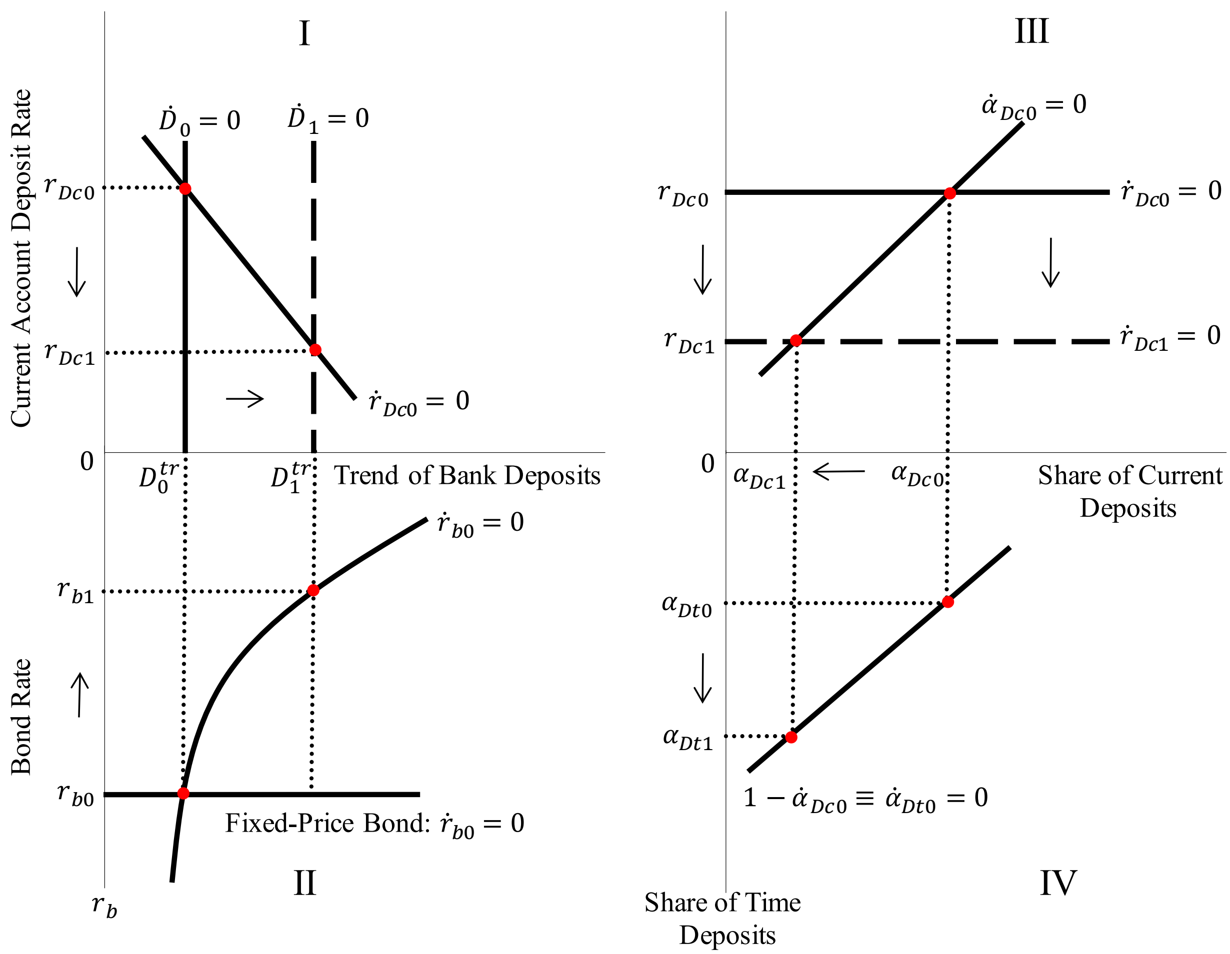
(c) Interest cost decelerates due to a rapid reduction in the current account deposit rate ($\dot{r}_{Dc}$).

$$\overbrace{\dot{r}^{cost}}^{\text{Dynamics of Interest Cost}} = \overbrace{\dot{r}_{Dc}\Big[(\alpha_{Dc})D\Big]}^{\text{Falling Interest Cost}} - \overbrace{\dot{\alpha}_{Dc}\Big[(\bar{r}_{Dt} - r_{Dc})D\Big]}^{\text{Rising Interest Cost}} + \overbrace{\dot{D}\Big[r_{Dc}(\alpha_{Dc}) + \bar{r}_{Dt}(1 - \alpha_{Dc})\Big]}^{\text{Rising Interest Cost}} \tag{8}$$

This is a straightforward and intuitive result that is consistent with the stylised facts though Equation (8) is theoretically ambiguous. The possibility of a decrease in total interest operating costs rests exclusively on $\dot{r}_{Dc}$, and political economy factors ensure that r_{Dc} has a lower threshold. It follows that the acceleration in the share of time deposits and total bank deposits overwhelm the contraction in the current deposit rate, such that, total interest operating cost accelerates when the fiscal deficit exceeds its historical mean.

Summary. Figure 1 summarises the basic mechanics of the bond and deposit markets in a regime of fiscal or oil dominance. Quadrant I shows the determination of the current account deposit rate (r_{Dc}), where the deposit rate curve ($\dot{r}_{Dc} = 0$) is downward sloping and inversely related to the trend of bank deposits. As the latter rises, it lowers the normal bank liquidity ratio and compromises the bank's ability to service interest costs without reducing profitability. Thus, the bank lowers the current account deposit rate. The perfectly inelastic deposit curve ($\dot{D} = 0$) illustrates that the trend of bank deposits is unrelated to the current account deposit rate since this is determined by the degree of fiscal-oil dominance and long-run growth. Given initial conditions of r_{Dc0} and D^{tr}_0, an increase in the primary fiscal deficit above its historical mean accelerates the volume of bank deposits, and shifts the deposit curve to the right ($\dot{D}_1 = 0$). Overall, quadrant I shows that a bigger than average fiscal deficit lowers the current account deposit rate to r_{Dc1}, and raises the trend of bank deposits towards D^{tr}_1.

Figure 1: Fiscal-Oil Dominance, Bond and Deposit Markets



Quadrant II demonstrates why the non-bank private sector chooses to hold the accelerating volume of bank deposits. As the trend of bank deposits rises to D^{tr}_1, the bank increases its demand for central bank bonds to maintain its normal liquidity ratio. This generates an excess demand for bonds and lowers the bond rate from r_{b0} to r_{B1} (in the case of a flexible-price bond), which incentivises the non-bank private sector to hold the volume of bank deposits associated with the higher trend. In the case of a fixed-price bond—the perfectly elastic curve in quadrant II—the bank is able to purchase all the bonds the central bank issues at the fixed price of r_{b0}. However, the latter does not prevent a decrease in the current account deposit rate as the central bank does not issue sufficient bonds to exhaust the non-borrowed excess reserves in the banking system (a necessary requirement of fiscal or oil dominance, see Lemma 2.1). Since the bank is unable to investment all its non-interest-bearing assets (non-borrowed excess reserves), it resorts to lowering the current account deposit rate to maintain its normal liquidity ratio. In this scenario, the non-bank private sector's relatively high liquidity preference ensures it holds the volume of bank deposits associated with the higher trend (see Assumption 2.7).

Quadrants III and IV demonstrate how total bank deposits are distributed between current and time deposits. In quadrant III, the upward sloping curve ($\dot{\alpha}_{Dc} = 0$) shows that the share of current deposits in total bank deposits rises when the current account deposit rate increases. In turn, the perfectly elastic curve illustrates that the current account deposit rate is unrelated to the share of current deposits as this is determined by the trend of bank deposits. In quadrant IV, the downward sloping curve ($\dot{\alpha}_{Dt0} = 0$) demonstrates that the share of time and current deposits are necessarily inversely related. Given initial conditions of r_{Dc0}, α_{Dc0}, and α_{Dt0}, an increase in the fiscal deficit above its mean shifts the deposit rate curve downwards until the current account deposit rate falls to r_{Dc1}, and the share of current and time deposits falls (α_{Dc1}) and rises (α_{Dt1}), respectively.

Overall, these results overturn the standard analyses that regard excess bank liquidity as an indicator of risk aversion, and comparatively low deposit rates as an exercise in bank oligopoly power; and instead demonstrate that these banking pathologies are driven by the extent of fiscal or oil dominance.

2.4 Loan Market

This sub-section demonstrates how fiscal or oil dominance affects the loan market.

Recall Assumption 2.2 (c) that the representative bank has a required capital adequacy ratio of $v < 1$.

$$v = \frac{\text{Capital}}{\text{Loans}}$$

The banking sector must satisfy this minimum regulatory requirement to absorb any losses or non-performing loans. Since bank capital is sourced from the accumulation of retained profits, it follows that the bank must earn some minimum profit to comply with the required capital adequacy ratio.

Bank profits are divided into two components as stated below.

Definition 2.3 (Components of Bank Profits)**.** *Bank profits are divided into retained earnings to satisfy capital adequacy requirements, and dividend payments to satisfy shareholders' requirements.*

In turn, bank profits are the difference between interest receipts on foreign assets, loans and bonds, and interest payments on bank deposits, less provisions for non-performing loans. Given this specification, a bank profit margin (BPM) is defined as follows.

Definition 2.4 (Bank Profit Margin)**.** *The bank's profit margin (BPM) is the ratio of profits to deposits, where profits satisfy Definition 2.3.*

$$BPM = \frac{Profits}{Deposits}$$

From Axiom 2.1, it is transparent that a regime of fiscal or oil dominance increases deposits and lowers the bank's profit margin. But the bank does not change its behaviour if the volume of deposits increases with its trend. In this case, the prevailing loan rate accounts for the predictable increase in the bank's interest operating costs and maintains the bank's profit margin within a normal range. However, when the trend of bank deposits rises, the bank's profit margin falls at an increasing rate. This is particularly problematic because the bank must earn sufficient profits to cover both dividend payments and its required capital adequacy ratio. Proposition 2.2 is a reminder that the bank leans against a falling profit margin when it lowers the current account deposit rate. But this is unlikely to be sufficient due to political economy factors that formally or informally establish a lower threshold on the deposit rate. It follows that the bank also increases its target profit (π^T) to maintain its profit margin within a normal range.

The bank's target profit is a positive function of its expected share of non-performing loans (β^e), and the trend of bank deposits (D^{tr}). This is an intuitive formulation since an increase in β^e and D^{tr} require more profits to cover the losses associated with non-performing loans, and the higher interest operating costs.

$$\pi^T = g_0 + g_1\beta^e + g_2D^{tr} \tag{9a}$$

There are many determinants of non-performing loans but I emphasise three key factors relevant to low- and middle-income countries: long-run growth, quality of risk assessment institutions (Ω), and the volatility of commodity prices (vol).

$$\beta^e = h_0 - h_1y_n - h_2\Omega + h_3vol \tag{9b}$$

This formulation indicates that the bank expects a lower share of non-performing loans when the long-run rate of economic growth increases, and monitoring, screening and risk assessment institutions improve. However, a higher volatility of commodity prices increases the expected share of non-performing loans.

Consider the differential Equation below, which illustrates the evolution of the prime loan rate (r_L^P).

$$\dot{r}_L^P = \rho(r_L^T - r_L) \tag{9c}$$

Equation (9d) explains that the target prime loan rate (r_L^T) is a linear function of the bank's target profit, which implies that the maintenance of a stable bank profit margin regulates the prime loan rate.[15]

$$r_L^T = j_0 + j_1\pi^T \tag{9d}$$

Substitution of Equations (5d), (9a), (9b) and (9d) into (9c), yields the steady-state prime loan rate (r_L^{P*}), where $\chi_4 = g_0 + g_1h_0 + g_2d_0$.

$$r_L^{P*} = j_0 + j_1\left[\chi_4 + y_n(g_2d_2 - g_1h_1) - g_1h_2\Omega + g_1h_3vol + g_2d_1(\Theta - \bar{\Theta})\right] \tag{9e}$$

Proposition 2.4 summarises this result.

Proposition 2.4 (Fiscal-Oil Dominance and the Prime Loan Rate)**.** *An increase in the fiscal deficit above its mean raises the steady-state prime loan rate.*

[15]This pricing behaviour is consistent with the empirical evidence that banks with lower realised capital adequacy ratios set higher loan rates (Hubbard et al. 2002). In the case of this model, fiscal or oil dominance lowers the bank's profit margin and correspondingly, retained earnings. It follows that the bank's capital adequacy ratio falls below the minimum threshold, which requires a higher loan rate to satisfy capital requirements.

The driving factor behind this result is that a bigger than average fiscal deficit accelerates deposits in the banking system and increases its interest operating cost (Theorem 2.2). In turn, this lowers the bank's profit margin and compromises its ability to satisfy the required capital adequacy ratio with given dividend payments. Thus, the bank raises the loan rate to comply with the banking regulation. In the absence of a higher loan rate, the bank can lower its dividend payments to ensure it has sufficient retained earnings but such a scenario may well undermine the incentive to provide banking services.

A key implication of this result is that it contracts the demand for loans and therefore, undermines overall credit creation. Corollary 2.1 summarises this point.

Corollary 2.1 (Fiscal-Oil Dominance and Credit Creation)**.** *Given Proposition 2.4, fiscal-oil dominance undermines private sector credit creation, where L_D and l_0 are the demand for credit and business confidence, respectively.*

$$L_D = l_0 + l_1 y_n - l_2 r_L^P \tag{10}$$

Remark 2.2 (Private Sector Credit and the Bank's Liquidity Ratio)**.** In sub-section 2.3, the model shows that the bank lowers the current account deposit rate (Proposition 2.2) to maintain its normal liquidity ratio, and Corollary 2.1 helps in this regard since a reduction in private sector credit lowers bank deposits.

A common indicator of bank efficiency is the interest rate spread, and the following result states that fiscal or oil dominance engenders inefficiency in the banking system.

Theorem 2.3 (Fiscal-Oil Dominance and the Interest Rate Spread)**.** *As the fiscal deficit rises above its mean, the interest rate spread increases—defined as the difference between the steady-state loan and deposit rates: $r_L^* - r_{Dc}^*$.*

This result underscores the point that the purpose of the interest rate spread is to permit the bank to obtain its target profit and satisfy capital adequacy requirements.

Recall Assumption 2.2 (b) that the bank liquidity ratio is defined as the ratio of bonds to deposits. Another common indicator of bank liquidity is the loan-deposit ratio (*LDR*) defined as follows.

Definition 2.5 (Loan-Deposit Ratio)**.** *The loan deposit ratio is given below:*

$$LDR = \frac{Loans}{Deposits},$$

where a value significantly less than one is considered chronic excess liquidity.

Substitution of Equations (5d), (9e), and (10) into this definition derives the steady-state loan-deposit ratio (LDR^*):

$$LDR^* = \frac{\Phi_0 + \Phi_1 y_n + \Phi_2 \Omega - \Phi_3 vol + \Phi_4(\bar{\Theta} - \Theta)}{d_0 + d_1(\Theta - \bar{\Theta}) + d_2 y_n}, \qquad (11)$$

where $\Phi_0 = l_0 - l_2 j_0 - l_2 j_1 \chi_4$, $\Phi_1 = l_1 + l_2 j_1 g_1 h_1 - l_2 j_1 g_2 d_2$, $\Phi_2 = l_2 j_1 g_1 h_2$, $\Phi_3 = l_2 j_1 g_1 h_3$, and $\Phi_4 = l_2 j_1 g_2 d_1$. The following Proposition states that a bigger than average fiscal deficit provides for a lower loan-deposit ratio. The intuition is that fiscal deficits create bank deposits faster than the bank can find creditworthy borrowers or screen/evaluate loan applications. It is worth reminding the reader that a bank deposit is created as soon as the government's check is cleared, but creditworthiness and the bank's ability to assess risk improve at a significantly slower rate.

Proposition 2.5 (Fiscal-Oil Dominance and the Loan-Deposit Ratio)**.** *Suppose the loan-deposit ratio is an indicator of bank liquidity. When the fiscal deficit is above its mean, it lowers the loan-deposit ratio and generates excess bank liquidity.*

Following Definition 2.5, the loan-deposit ratio remains *constant* whenever the bank creates or recalls a loan as a deposit is simultaneously created with each new loan. It follows that a *low* loan-deposit ratio is not related to the bank's credit policy, rather, the degree of fiscal or oil dominance. As noted earlier, there is no central bank reserve constraint on loan creation and there is no bank deposit constraint on credit creation either. In other words, the bank does not require deposits to create loans as both are created *ex nihilo*.

The next presentation disaggregates the bank's loan portfolio, and analyses how its composition evolves and influences total interest income.

Composition of Loan Portfolio. Suppose that bank loans are divided into two broad categories: 1. Non-tradables such as consumer durables (say, real estate) (L^C), and 2. Tradable or production loans (L^P). The latter can be further disaggregated into resource and non-resource sectors but such detail adds little to the overall analysis. The following assumption outlines the structure of loan rates.

Assumption 2.9 (Structure of Loan Rates)**.** *(a) In the case of a consumption-biased economy, the structure of interest rates is as follows:* $r_L^C < r_L^P$*, where* r_L^C *indicates the loan rate on consumer durables.*

(b) In the case of a production-biased economy, the structure of interest rates is as follows: $r_L^C > r_L^P$.

This assumption captures the different emphases of government policy. In low- and some middle-income countries, there may be a government-led housing drive and other initiatives to improve household consumption, and the overall quality of life. In this case, I consider the economy to have a consumer bias, where government's support provide for a structure of interest rates that is consistent with Assumption 2.9 (a). This is necessary to incentivise the consumption of housing services and other consumer durables. Alternatively, government's policy and public investment agenda may promote a production bias, where the structure of interest rates is consistent with Assumption 2.9 (b), which is necessary to incentivise investment in the production sector. The bank finds it worthwhile to structure its interest rates to suit government policy because the latter creates contingent guarantees, and its public consumption and investment in priority areas reduce consumer risks in a consumption-biased economy; and investment risks in a production-biased economy.

Suppose the share of consumer loans in total loans (ω_C) evolves as follows, where $1 < \lambda < 0$ is an adjustment parameter and ω_C^T is the bank's target share of consumer loans.

$$\dot{\omega}_C = \lambda(\omega_C^T - \omega_C) \tag{12a}$$

The target share of consumer loans rises when long-run growth increases as this indicates stronger wage growth and higher probability of repayment. Similarly, when the prime loan rate rises and the demand for tradable loans fall, the bank rearranges its portfolio in favour of consumer loans. Also, an increase in real estate prices (REP) improves collateral valuation and raises the bank's target share of consumer loans.

$$\omega_C^T = m_0 + m_1 y_n + m_2 r_L^P + m_3 REP \tag{12b}$$

Real estate prices are driven by expectations in the non-bank private sector as shown below, where $0 < \sigma < 1$ is an adjustment parameter.

$$R\dot{E}P = \sigma(REP^e - REP) \tag{12c}$$

Expectations are anchored by the real exchange rate ($RER \equiv \bar{S}/\hat{P}$), where $\hat{P}$ is the domestic rate of inflation, and the share of consumer loans in total loans. The intuition for the latter is straightforward: the non-bank private sector expects real estate prices to rise as the bank increases its share of mortgage loans and other real estate-related consumer durables.

$$REP^e = n_0 - n_1 RER + n_2 \omega_C \tag{12d}$$

To abstract away from unnecessary complications, the rate of inflation is modeled as a simple linear function of the fiscal deficit relative to its mean, and the rate of inflation in the foreign country or major trading partner ($\hat{P}_F$). The latter captures the import component of domestic inflation and the former shows that fiscal policy is an important source of demand-pull inflation. Thus, the real exchange rate appreciates when the fiscal deficit is above its mean and the rate of foreign inflation increases.

$$RER = q_0 + q_1(\bar{\Theta} - \Theta) - q_2 \hat{P}_F \tag{12e}$$

A real exchange rate appreciation raises expectations about house prices because real estate-related imports are cheaper in real terms, and as the fiscal deficit rises above its mean, it increases demand for both commercial and residential properties through higher wages and employment.

Substitution of Equations (12e) and (12d) into (12c) yields the steady-state real estate price level (REP^*), which rises when the fiscal deficit is above its mean, and increases with the rate of imported inflation and the share of consumer loans.

$$REP^* = n_0 - n_1 q_0 + n_1 q_1(\Theta - \bar{\Theta}) + n_1 q_2 \hat{P}_F + n_2 \omega_C \tag{12f}$$

In turn, the steady-state share of consumer loans is given below (ω_C^*), after the substitution of Equations (9e), (12f) and (12b) into (12a):

$$\omega_C^* = \frac{\rho_0 + \rho_1(\Theta - \bar{\Theta}) + \rho_2 \hat{P}_F + \rho_3 y_n + \rho_4 vol - \rho_5 \Omega}{1 - m_3 n_2}, \tag{12g}$$

where $\rho_0 = m_0 + m_3 n_0 - m_3 n_1 q_0 + j_0 + j_1 \chi_4$, $\rho_1 = m_2 j_1 g_2 d_1 + m_3 n_1 q_1$, $\rho_2 = m_3 n_1 q_2$, $\rho_3 = m_1 + j_1 g_2 d_2 - j_1 g_1 h_1$, $\rho_4 = m_2 j_1 g_1 h_3$, and $\rho_5 = m_2 j_1 g_1 h_2$.

This result underlines that an increase in the volatility of commodity prices forces the bank to diversify into a higher share of consumer loans, but better screening of tradable or production loans (Ω) lowers the steady-state share of consumer loans. A faster long-run growth rate reduces borrowers' risk, and a similar result is observed with higher imported inflation as this increases real estate prices and collateral valuation. Ergo, the steady-state share of consumer loans rises. Finally, a higher than average fiscal deficit encourages the bank to raise its share of consumer loans. The latter result is summarised below.

Proposition 2.6 (Fiscal-Oil Dominance and the Share of Consumer Loans). *An increase in the fiscal deficit relative to its mean raises the steady-state share of consumer loans in total bank loans.*

Several channels produce this result. First, an increase in the fiscal deficit above its mean appreciates the real exchange rate through wage inflation and employment growth, which enhances the probability of loan repayment. Second, the real exchange rate appreciation leads to higher real estate prices and collateral valuation. Third, it also raises the prime loan rate and crowds out credit creation in the production sector. Overall, the sum effect raises the share of consumer loans in the banking sector, and illustrates the mechanics of the *financial resource curse* or Dutch Disease. One implication of this result is that total interest income changes because of the *volume* and *composition* of bank loans, which is summarised in the following result.

Theorem 2.4 (Fiscal-Oil Dominance and Interest Income in the Banking System). *When the fiscal deficit rises relative to its mean, total interest income ($\dot{r}^{income}$) in the banking system evolves as follows:*

(a) Interest income accelerates due to a rapid growth in the prime loan ($\dot{r}_L^P$),

(b) Ambiguous: though the share of consumer loans accelerates ($\dot{\omega}_C$), the net effect depends on the extent of the consumption or production bias (Assumption 2.9), and

(c) Interest income decelerates due to a reduction in credit creation ($\dot{L}$), (Corollary 2.1).

$$\overbrace{\dot{r}^{income}}^{\text{Dynamics of Interest Income}} = \overbrace{\dot{r}_L^P\Big[(1-\omega_C)L\Big]}^{\text{Rising Interest Income}} + \overbrace{\dot{\omega}_C\Big[(r_L^C - r_L^P)L\Big]}^{\text{Ambiguous}} + \overbrace{\dot{L}\Big[r_L^C(\omega_C) + r_L^P(1-\omega_C)\Big]}^{\text{Falling Interest Income}} \quad (13)$$

Theorem 2.4 (a) and (c) are straightforward and intuitive results, but a rising share of consumer loans has ambiguous effects on interest income. In a consumption-biased economy—where $r_L^C < r_L^P$ following Assumption 2.9 (a)—a higher share of consumer loans *reduces* interest income, and the reverse is true in a production biased-economy. This is an interesting result and may be one factor that determines the *magnitude* of interest rate changes as is outlined in the following Conjecture.

Conjecture 2.1 (Consumption-Biased Economy and the Interest Rate Spread). *A consumption-biased economy has a larger interest rate spread when compared to a production-biased economy.*

In the case of a consumption-biased economy, a rising share of consumer loans reduces interest income and may induce a wider interest rate spread to stabilise profits when compared to a production-biased economy. On consideration of this Conjecture, the financial Dutch Disease binds in two dimensions: 1. It accelerates the share of consumer loans at the expense of production loans, and 2. It increases the interest rate spread, which reinforces the first dimension.

Property Price (In)stability. Next, I illustrate the dynamic properties of real estate prices and highlight the factor that underlines property price instability with a positive bias, which endures until there is a bust in the property market. The dynamic system is reproduced below.

$$\dot{REP} = \sigma\Big(n_0 - n_1 q_0 - n_1 q_1(\bar{\Theta} - \Theta) - n_1 q_2 \hat{P}_F + n_2 \omega_C - REP\Big) \tag{14}$$

$$\dot{\omega}_C = \lambda\Big\{m_0 + m_1 y_n + m_2\Big(j_0 + j_1\Big[\chi_4 + y_n(g_2 d_2 - g_1 h_1) - g_1 h_2 \Omega + g_1 h_3 vol + g_2 d_1(\Theta - \bar{\Theta})\Big]\Big) + m_3 REP - \omega_C\Big\} \tag{15}$$

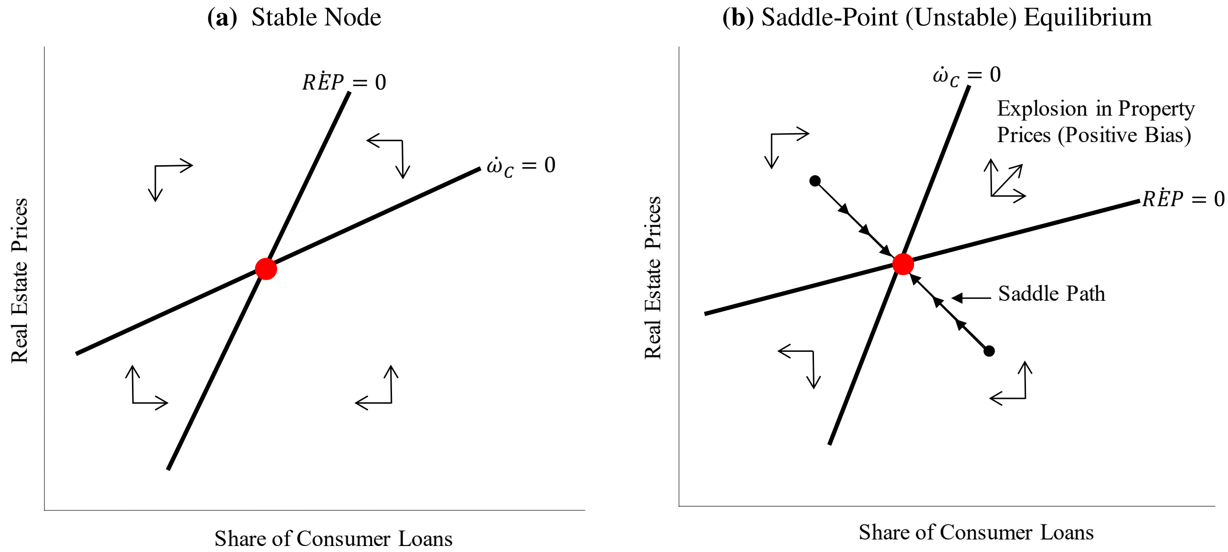
Proposition 2.7 (Property Price Instability)**.** *The dynamic system (14) and (15) has a stable equilibrium when* $n_2 m_3 < 1$ *and a saddle-point unstable equilibrium when* $n_2 m_3 > 1$.

Figure 2 shows that the stability properties hinge on the slope of the property price curve ($\dot{REP} = 0$) relative to the consumer loans curve ($\dot{\omega} = 0$). If the former is steeper, a property boom and the corresponding collateral valuation effect only weakly increases the share of consumer loans, then, real estate prices are dynamically stable. This is depicted in panel (a), where the bank is not fooled by the valuation effect—or its current share of consumer loans is close to its upper limit—and the bank can adequately evaluate ability to repay independent of the property market effect. Unfortunately, this has not been the experience of real estate markets in both developed and developing countries.[16]

Panel (b) demonstrates the case of property price instability, where only by accidental placement on the saddle path, or by policy, does the property market exhibit price stability. The driving factor behind this saddle-point instability is the pronounced positive effect of real estate prices on the share of consumer loans through the collateral valuation effect—the property price curve is flatter. In this case—indeed the typical case—the bank is keen to capitalise on the property boom by

[16] Cerutti et al. (2017) uses a new dataset on housing finance and house prices for a sample of more than 50 countries, and find strong evidence of real estate boom-bust cycles. Also, see Doojav and Damdinjav (2021) for recent evidence of similar cycles in Mongolia.

Figure 2: Stability Analyses



disproportionately increasing its share of consumer loans, which further increases property prices. Thus, an explosion in property prices is realised with no stable adjustment process, only a property market bust will stabilise prices.

By definition, the share of consumer loans in total bank loans has an upper limit of 100 percent. But portfolio diversification ensures that the effective upper limit is significantly less than one. It follows that as the bank approaches this upper limit it will ration consumer credit (or do so more extensively), and this establishes the *peak* in property prices. What follows the latter is well-known but beyond the medium-run time frame and the focus of this article. By now, it is elementary that fiscal or oil dominance is the source of the positive bias, that is, when the fiscal deficit is above its mean, the real exchange rate appreciates and this sets in motion a race to the top between real estate prices and the share of consumer loans.

Why does a rational bank participate in the race to the top? From Theorem 2.2, the bank is concerned about the acceleration in its interest operating cost, and Theorem 2.4 (b) states that a higher share of consumer loans increases interest income if the economy has a production bias, that is, $r_L^C > r_L^P$, Assumption 2.9 (b).[17] In a consumption-biased economy ($r_L^C < r_L^P$), the bank still participates in the race to the top because the property boom increases collateral valuation for

[17]See Bourne (1985) and Bourne (1982) for evidence in Trinidad and Tobago that banks aggressively increased their share of consumer loans during the oil boom in the 1970s. Since these loans had higher rates of interest than production loans, banks' profits increased dramatically.

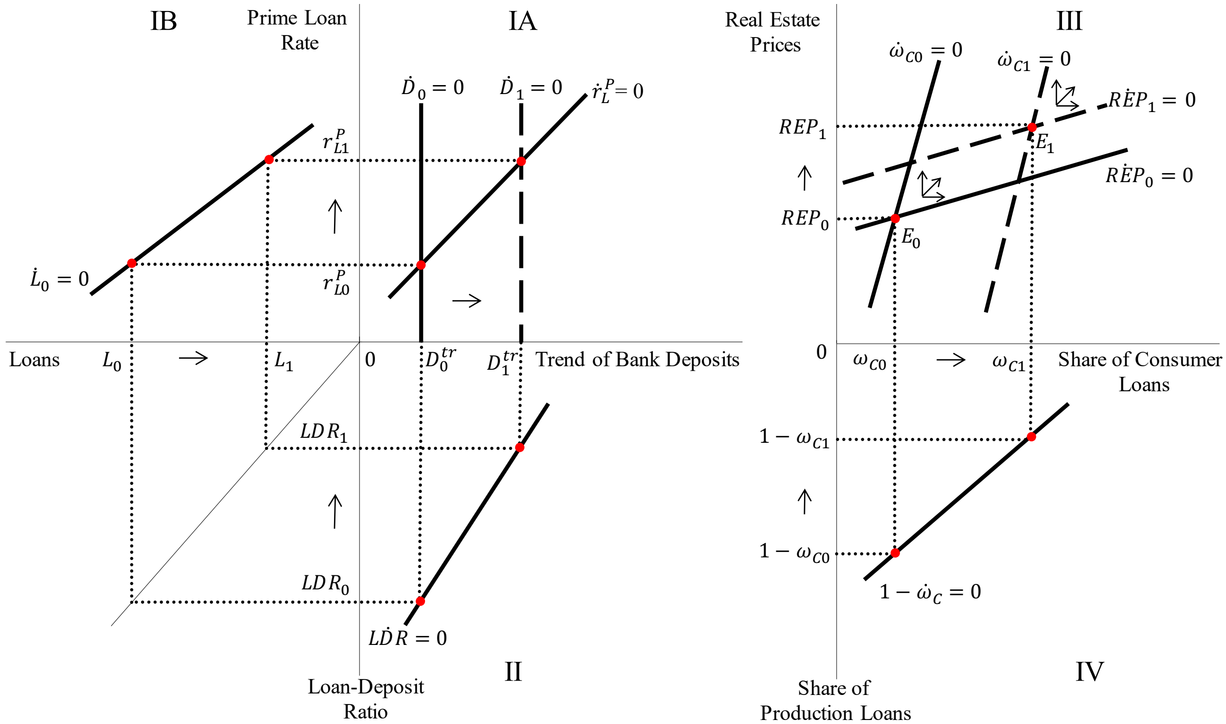
higher interest production loans. Moreover, competition from non-bank financial institutions (for instance, mortgage providers) leaves the bank with little choice, otherwise, it loses market share.

Remark 2.3 (Non-Bank Financial Institutions and Competition)**.** This model does not formalise the role of the non-bank financial system because it is not a major deposit-taking sector. Therefore, it is *not* confronted with an acceleration in its interest operating cost, and if so, certainly not on a comparable degree to the banking system. This implies that competition for market share is particularly intense, and indicates that the bank participates in the race to the top even if the economy has a consumption bias.

Summary. Figure 3 summarises the basic mechanics of the loan market in a regime of fiscal or oil dominance. Quadrant IA shows the determination of the prime loan rate, where the upward sloping curve ($\dot{r}_L^P = 0$) demonstrates that an increase in the trend of deposits lowers the bank's profit margin, and in turn, raises the prime loan rate. The perfectly inelastic deposit curve ($\dot{D} = 0$) illustrates that the trend of bank deposits is unrelated to the prime loan rate. Given initial conditions of r_{L0}^P and ${D^{tr}}_0$, an increase in the primary fiscal deficit above its mean accelerates the volume of bank deposits and shifts the deposit curve to the right ($\dot{D}_1 = 0$). Overall, quadrant IA shows that an increase in the fiscal deficit raises the trend of bank deposits to ${D^{tr}}_1$ and the prime loan rate to r_{L1}^P. Consequently, loan creation contracts from L_0 to L_1 as is depicted in quadrant IB. In turn, quadrant II highlights that the loan-deposit ratio falls from LDR_0 to LDR_1, which is validated through the higher trend of bank deposits and the reduction in loan creation.

Quadrants III presents the case where prices in the real estate market are unstable. Both the consumer loan and property price curves are upward sloping because real estate prices and the share of consumer loans have positive feedback effects. Given the initial equilibrium of E_0, any placement to the northeast positions the property market for an explosion in real estate prices. When the primary fiscal deficit rises above its mean, it increases the demand for real estate (commercial and residential), which raises the price level as the property price curve shifts upward and to the left ($R\dot{E}P_1 = 0$). The higher primary deficit also raises the demand for consumer loans and shifts the consumer loan curve to the right from $\dot{\omega}_{C0} = 0$ to $\dot{\omega}_{C1} = 0$. The medium-rum equilibrium *appears* to be E_1 but this is never realised as the economy is pushed off its stable branch—the saddle path. In this case, the higher primary deficit engenders a property boom and accelerates the share of consumer loans as is indicated by the directional arrows. Finally, quadrant IV demonstrates that the share of production loans falls by definition, or more accurately, decelerates as fast as the share of consumer loans rises.

Figure 3: Fiscal-Oil Dominance and the Loan Market



In summary, these results capture the price and quantity effects—interest rates and property prices, and loans and their distribution—of bigger than average fiscal deficits funded by the central bank (fiscal dominance) or oil/resource receipts (oil dominance).

2.5 Steady-State Equilibrium

This sub-section defines the steady-state equilibrium.

Definition 2.6 (Medium-Run Equilibrium)**.** *The steady-state equilibrium is realised when the banking system obtains a new trend of deposits, where bank prices* $(\dot{r}_B = \dot{r}_{Dc} = \dot{r}_L^P = 0)$ *and quantities* $(\dot{D} = \dot{L} = \dot{F}_{cb} = 0)$ *have fully adjusted. This is a medium-run equilibrium because of rising prices in the property market* $(R\dot{E}P \neq 0)$*, and a growing share of consumer loans* $(\dot{\omega}_C \neq 0)$.

This definition implies that the medium-run equilibrium is characterised by a financial resource curse: a real estate boom that crowds out the share of production loans, an increase in the prime loan rate that reinforces the latter, and lower credit creation. It is worth noting that this equilibrium transitions to the long-run by way of a financial crisis: a collapse in real estate prices, a corresponding rise in non-performing loans, and changes in bank prices and quantities that reinforce the financial resource curse.

3 Conclusion

This article models the banking system under the condition of fiscal or oil dominance. When the latter holds—as it does in many resource-based economies (Hooley et al. 2021; Da Costa and Olivo 2008)—a financial resource curse is observed where the banking system is less developed: banks are more liquid, better capitalised, and more profitable, but give fewer loans to firms, which lowers long-run growth (Beck 2011). The key channel is that fiscal or oil dominance floods the banking system with deposits faster than banks can find creditworthy borrowers. In other words, the banking system—like the real economy—has an absorption constraint. Since fiscal-oil dominance increases banks' assets and liabilities, namely, non-borrowed and non-remunerated central bank reserves and bank deposits—it increases banks' interest operating costs. Consistent with the evidence, I show that this leads to a higher interest rate spread, which explains why banks appear more profitable in resource-based economies. This result captures the basic idea in this article with the additional insight that commodity price shocks or fiscal-oil dominance accelerate the banks' share of consumer loans and underwrite an unstable boom in property prices. Thus, the financial resource curse.

Two additional insights are worth noting. First, the persistence of excess bank liquidity (bonds to deposits), non-remunerated excess reserves, and a loan-deposit ratio significantly less than one; do not indicate the banks' preference for risk or liquidity. The model demonstrates that the degree of fiscal-oil dominance explains these stylised facts. Second, the evidence of a large stock of bank deposits, excess liquidity, and reserves but few loan provisions; best dispels the myth that the banking system intermediates national savings. Banks do not need deposits or even central bank reserves to extend credit, as they can borrow reserves from the central bank at a penalty rate and create deposits *ex nihilo* (McLeay et al. 2014; Godley and Lavoie 2012: ch.7). However, banks require a creditworthy borrower and an investment project with calculable risk. Almost by definition, resource-based economies are at higher risk: credit-rating institutions are lax or absent, commodity prices are volatile and raise the risk premium, low human capital compromises the quality of loan applications, and weak inter-sectoral linkages reduce the size of the market and probability of repayment. It is transparent that more central bank reserves and deposits do not relax these constraints.

What is to be done? In the case of fiscal dominance—central bank-financed fiscal deficits—a bond-financed programme ensures that banks' can accumulate an interest-bearing asset to accommodate the rising interest costs. In plain terms, a bond-financed programme reduces the financial resource curse. However, like fiscal dominance, bond-financed deficits also depreciate the exchange rate (Branson 1977) or compromise the central bank's ability to maintain its pegged rate (Annicchiarico et al. 2011). Alternatively, the central bank can remunerate the excess reserves in the banking system as is presently practiced with quantitative easing, but this increases bank wealth and undermines exchange rate stability (Frankel 1983). There are no shortcuts.

In the case of oil dominance—oil-financed fiscal deficits—concerns about exchange rate stability are temporarily relaxed. But a bond-financed programme or the sterilisation of oil-financed fiscal deficits is still necessary to ensure that banks can accommodate the accelerating interest costs without raising the interest rate spread. This insight is also recognised by Ossowski and Halland (2016: 18-19), but it is worth noting one caveat: oil dominance tightens the foreign exchange constraint in the future as it temporarily relaxes the constraint today. In other words, the *size* of the oil-financed fiscal deficit is of first-order importance. There are also no shortcuts with resource wealth.

Typically, bond-financed programmes raise concerns about domestic debt sustainability, but any sovereign can service debt denominated in its currency (Buiter 2021: 27, 54). To stabilise the interest cost, the central bank should sell *all* the bonds demanded at an *institutionally determined* rate, which accounts for the prevailing global interest rate and country-risk premium. Consult Constantine (2022) for details on the optimal fiscal deficit that is consistent with stable debt and full employment in open economies.

Evidence of a financial resource curse is not a failure of economic science but the dereliction of economic management. A key pillar of central banking is that fiscal policy should not affect the banking system's *net income*, lest the banks undermine monetary objectives. For this reason, competent central bankers sterilise foreign exchange interventions, insist on bond-financed expenditures by ruling out monetised deficits, and remunerate excess bank reserves as is presently undertaken with quantitative easing. Thus, evidence of fiscal or oil dominance underlines the policy *choices* of the financial resource curse and repeated balance of payments crises in exchange for more fiscal space.

Appendix: Omitted Proofs

Proof of Lemma 2.1. Recall that excess reserves evolve as follows: $\dot{ER} = \dot{R} - k\dot{D}$. Now, consider the commercial and central banks' stylised balance sheets, where F^b, L, and D are net foreign assets held by the bank, loans, and deposits, respectively.

$$\overbrace{F_b + \bar{B} + L + R}^{\text{Commercial Bank's Assets}} \quad = \quad \overbrace{D}^{\text{Liabilities}}$$

After taking time derivatives, deposits in the commercial banking system evolve as follows:

$$\dot{D} = \dot{F}_b + \dot{\bar{B}} + \dot{L} + \dot{R}. \tag{A.1}$$

From the central bank's balance sheet, the dynamics of bank reserves are given below:

$$\overbrace{F_{cb} + CG}^{\text{Central Bank's Assets}} \quad = \overbrace{D_g + \bar{B} + R}^{\text{Liabilities}}$$

$$\dot{R} = \dot{CG} + \dot{F}_{cb} - \dot{\bar{B}} - \dot{D}_g, \tag{A.2}$$

and after substitution into Definition (A.1) bank deposits evolve as follows.

$$\dot{D} = \dot{F}_b + \dot{F}_{cb} + \dot{L} + \dot{CG} - \dot{D}_g$$

From Definition 2.1, $G - T \equiv \dot{CG} - \dot{D}_g$, and after substitution, the evolution of bank deposits is given by:

$$\dot{D} = \dot{F}_b + \dot{F}_{cb} + \dot{L} + (G - T).$$

Recall Asummption A 2.3, which states that the central bank maintains a fixed peg. It follows that changes in the bank's net foreign asset position ($\dot{F}_b$) are driven or negated by the central bank per the fixed peg. Thus, $\dot{F}_b = 1 - \dot{F}_{cb}$, and the evolution of bank deposits in the fixed-exchange rate economy is governed by the following dynamic process:

$$\dot{D} = 1 + \dot{L} + (G - T). \tag{A.3}$$

The substitution of (A.2) and (A.3) into the dynamic Definition of excess reserves ($\dot{ER} = \dot{R} -$

$k\dot{D}$), and recalling that $G - T \equiv \dot{CG} - \dot{D}_g$, yields:

$$\dot{ER} = (1-k)(G-T) + \dot{F}_{cb} - \dot{\bar{B}} - k(1+\dot{L}). \tag{A.4}$$

Given the fixed exchange rate mandate, an increase in the fiscal deficit has ambiguous effects on the dynamics of excess reserves because the central bank maintains the peg by selling foreign currencies to the bank in exchange for bank reserves. To see this clearly, recall that $\dot{F}_{cb}$ is governed by the following process:

$$\dot{F}_{cb} = \gamma\Big(a_0 - a_1 b_0 + a_1 b_1 (T-G) - F_{cb}\Big), \tag{A.5}$$

which indicates that an increase in the fiscal deficit induces the central bank to dishoard foreign exchange. Central to this proof is the idea that the parameters $a_1 b_1$ reflect the non-bank private sector's marginal propensity to import or save in foreign assets. If $a_1 b_1 = 1$, then, a fiscal deficit leads to a one-to-one loss in the foreign assets held by the central bank. However, if $a_1 b_1 < 1$, which is the case in reality, the loss in foreign assets is less than proportionate.

Substitution of Equation (A.5) into (A.4) presents the dynamic evolution of excess serves in a fixed-exchange rate economy.

$$\dot{ER} = (1-k)(G-T) + \gamma\Big(a_0 - a_1 b_0 + a_1 b_1 (T-G) - F_{cb}\Big) - \dot{\bar{B}} - k\dot{L}. \tag{A.6}$$

Ceteris paribus, an increase in the fiscal deficit accelerates excess reserves in a fixed-exchange rate economy when the sum of $k + (\gamma)(a_1 b_1) < 1$:

$$\frac{\partial \dot{ER}}{\partial (G-T)} = 1 - k - (\gamma)(a_1 b_1).$$

Note that the marginal propensity to import or save in foreign assets is weighed by the central bank's speed of adjustment (γ), which is plausibly less than one. This result is more pronounced when an increase in the fiscal deficit raises the prime loan rate and decelerates credit creation as is outlined in Corollary 2.1. □

Proof of Theorem 2.1. Recall from the proof of Lemma 2.1 that the dynamics of excess reserves are given by:

$$\dot{ER} = (1-k)(G-T) + (1-k)\Big[\gamma\Big(a_0 - a_1 b_0 + a_1 b_1 (T-G) - F_{cb}\Big)\Big] - \dot{\bar{B}} - k\dot{L}.$$

It is transparent that persistent non-borrowed excess reserves are only realised when the fiscal deficit—financed by the central bank or foreign exchange earnings—exceeds the sale of bonds and credit creation. It follows that persistent excess reserves are driven by policy choice rather than indicative of the bank's preference for risk or liquidity. □

Proof of Lemma 2.2. From Equation 5d:

$$\frac{\partial D^{tr}}{\partial \Theta} = d_1. \tag{A.7}$$

□

Proof of Proposition 2.1. From Equation 5f:

$$\frac{\partial r_B^*}{\partial \Theta} = \frac{-c_2 d_1}{c_1}. \tag{A.8}$$

□

Proof of Proposition 2.2. Following Equation 6c:

$$\frac{\partial r_{Dc}^*}{\partial \Theta} = -e_1 d_1. \tag{A.9}$$

□

Proof of Proposition 2.3. As Equation 7c demonstrates:

$$\frac{\partial \alpha_{Dc}^*}{\partial \Theta} = -f_1 e_1 d_1. \tag{A.10}$$

□

Proof of Theorem 2.2. This follows directly from Equation 8. □

Proof of Proposition 2.4. Equation 9e outlines:

$$\frac{\partial r_L^{P*}}{\partial \Theta} = j_1 g_2 d_1. \tag{A.11}$$

□

Proof of Corollary 2.1. Substitution of Equation (9e) into (10) yields the steady-state stock of loans (L^*):

$$L^* = l_o + l_1 y_n - l_2\Big(j_0 + j_1\Big[\chi_4 + y_n(g_2 d_2 - g_1 h_1) - g_1 h_2 \Omega + g_1 h_3 vol + g_2 d_1(\Theta - \bar{\Theta})\Big]\Big). \tag{A.12}$$

It is transparent that a bigger than average fiscal deficit lowers the steady-state stock of credit:

$$\frac{\partial L^*}{\partial \Theta} = -l_2 j_1 g_2 d_1. \tag{A.13}$$

□

Proof of Theorem 2.3. This follows directly from Propositions 2.4 and 2.2. □

Proof of Proposition 2.5. Given Equation 11, the steady-state loan-deposit ratio falls when the fiscal deficit is above its mean:

$$\frac{\partial LDR^*}{\partial \Theta} = \frac{-\Phi_4(d_0 + d_1(\Theta - \bar{\Theta}) + d_2 y_n) - \Big(\Phi_0 + \Phi_1 y_n + \Phi_2 \Omega - \Phi_3 vol + \Phi_4(\bar{\Theta} - \Theta)\Big) d_1}{(d_0 + d_1(\Theta - \bar{\Theta}) + d_2 y_n)^2}, \tag{A.14}$$

where $\partial LDR^*/\partial \Theta < 0$. □

Proof of Proposition 2.6. A bigger than average fiscal deficit raises the steady-state share of consumer loans:

$$\frac{\partial \omega_C^*}{\partial \Theta} = \frac{\rho_1}{1 - m_3 n_2}. \tag{A.15}$$

□

Proof of Theorem 2.4. This follows directly from Equation 13. □

Proof of Proposition 2.7. The system of differential equations is reproduced below.

$$R\dot{E}P = \sigma\Big(n_0 - n_1 q_0 - n_1 q_1(\bar{\Theta} - \Theta) - n_1 q_2 \hat{P}_F + n_2 \omega_C - REP\Big)$$

$$\dot{\omega}_C = \lambda\Big\{m_0 + m_1 y_n + m_2\Big(j_0 + j_1\Big[\chi_4 + y_n(g_2 d_2 - g_1 h_1) - g_1 h_2 \Omega + g_1 h_3 vol + g_2 d_1(\Theta - \bar{\Theta})\Big]\Big) + m_3 REP - \omega_C\Big\}$$

The system is formed by the terms of the Jacobian matrix:

$$J = \begin{bmatrix} \frac{dR\dot{E}P}{dREP} & \frac{dR\dot{E}P}{d\omega_C} \\ \frac{d\dot{\omega}_C}{dREP} & \frac{d\dot{\omega}_C}{d\omega_C} \end{bmatrix} = \begin{bmatrix} -1 & n_2 \\ m_3 & -1 \end{bmatrix}$$

The trace of the Jacobian matrix is $-1-1<0$, and hence always negative. However, the determinant of the system is ambiguous as $1-m_3n_2 \lesseqgtr 0$. Since the product of the off-diagonal elements of the matrix is unambiguously positive, the system does not satisfy the necessary condition for oscillations or cyclical dynamics. Thus, one of two equilibria is possible: 1. A stable node if the determinant is positive, or 2. A saddle-point (unstable) equilibrium if the determinant is negative. Figure 3 illustrates both possibilities, where a stable equilibrium is only possible if the $\dot{\omega}_C = 0$ locus is flatter, otherwise, a saddle-point equilibrium is realised. □

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