Household Income Dynamics in Emerging Market Finance: *Limited Participation Banking vs. Crowdfunding*

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Abstract

This paper examines asset price and household income/consumption dynamics in a small open economy subject to terms of trade shocks, under two financial regimes. The first is a limited-participation banking (LPB) regime, in which firms borrow from banks for financing costs of labor, investment and intermediate goods for both the relatively riskless natural-resource traded sector and the non-traded sector. The second regime is more financially-inclusive banking/crowdfunding (BCF) regime, in which the households directly receive returns to capital from pooled lending to home-goods firms. Simulation results show that the banking regime better insulates the economy from negative shocks but limits the upside gain from positive shocks which would take place in the banking-crowdfunding regime.

Key words: crowd funding, DSGE models, boom-bust episode
JEL Classification: E44, F33, F32,

1 Introduction

With the exception of the United States, most of the external financing for firms comes from the domestic banking system. Japanese and German firms, for example, rely on barrnks for more than 75% of their funding needs. The same patterns of high banking finance for firms are true throughout the lower income and emerging market countries.[1]

Given the wave of banking crises in the past decade, there are expectations of increased regulation as well as more scrutiny of bank lending practices world wide. Under pressure from the Basel Accords, it should not be surprising that banks are now holding more and more reserves relative to their total lending.

All of this means that bank lending to firms will become more and more risk averse. Put another way, banks will demand higher and higher risk premia for lending to firms which do not have easily accessible and marketable collateral, such as start-up firms

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[1]By contrast, US firms rely on banks for less than 20% of their funding.

in the non-traded sector, and will prefer to lend to larger firms which export natural resources or traded goods readily exported at world prices, with easily valued collateral.

In small open economies, this means that the brunt of bank lending will go to the traded sector. The non-traded or home-goods sector, often the more labor intensive sector, will then be at a disadvantage for funding relative to natural-resource exporting sectors of the economy. Yoshino (2013) notes, it is clear that the flow of funds to venture business, small enterprises and local firms will tend to dry up, as the Basel accords gain more stringency. Yoshino and Taghizadeh-Hesary (2014) point out another reason for fostering more inclusive alternatives to a pure bank financing.. Small and medium enterprises in need of financing employ more that 60% of the labor force and constitute almost 40% of GDP in the years between 2007-2012 in emerging economies in Asia.

This paper examines overall macroeconomic adjustment and household income dynamics in a small open economy, subject to recurring shocks to terms of trade, under a pure banking system, which is the only source of lending to both traded and non-traded firms, and under a more financially inclusive banking/crowdfunding system, in which households not only make deposits, but also purchase investment goods and lend capital to non-traded local firms, through mutual funds. We call the pure banking system a limited-participation banking (LPB) regime, and a system with household access to domestic capital markets in a banking/crowdfunding (BCF) regime.

Crowdfunding is defined popularly in the following way: [2]

> Crowdfunding is a method of raising capital through the collective effort of friends, family, customers, and individual investors. This approach taps into the collective efforts of a large pool of individuals—primarily online via social media and crowdfunding platforms—and leverages their networks for greater reach and exposure.

Crowdfunding presumes a relatively deregulated financial enviornment as well as a financially educated work force. There are many types of crowdfunding schemes, such as equity-based or reward-based system. We are interested in two key questions. In a financially more inclusive BCF environment, with firms less dependent on banking finance, do households face greater downside risks when there are negative shocks? Conversely, if there are positive shocks, what are the costs of delaying a change to a more inclusive financial environment, in which workers in the non-traded sector can participate in crowdfunding sysems for raising capital?

The model of this paper is a simple two-sector model, with a traded natural resource sector, using labor and imported intermediate goods, and a non-traded home sector using labor and capital, which relies on imported investment goods. We embed adjustment costs in this sector along with depreciation of the capital stock. The reason is that we wish to work with Tobin's Q. This variable plays a crucial role in determining the bank lending rates to the home-goods firms. Since these firms do not have the same collateral as the natural resource exporting sector does, the bank lending rate varies with the value

[2]https://www.fundable.com/learn/resources/guides/crowdfunding-guide/what-is-crowdfunding

of existing capital relative to the market value of the capital stock of these firms, which comes from Tobin's Q.

In the LPB regime, there are two households, a banking household and a worker household. The banking household borrows or lends in international markets, and purchases intermediate and investment goods, and rents these items to the firms. This household also receives deposits from households and pays a return to the depositors based on the risk free rate, adjusted for reserve requirements. To finance the purchase of the intermediate and investment goods, the banking household borrows internationally. It faces a higher risk premium for purchases of investment goods to the non-traded sector than for intermediate goods to the natural resource export sector.

The worker household in the LPB regime receives income from labor provided to the two types of firms as well as returns from deposits. It is a limited participation regime in this restricted sense: the household can only save through tmaking deposits in the banking system.

In the more inclusive BCF regime, households who work can also invest in capital in non-traded firms. In this case, these non-traded firms do not have the same high borrowing costs as they would from a risk-averse banking system demanding collateral based on the market value of the firm's capital.

However, since the households involved in the BCF regime also supply labor to the non-traded sector, they know the firm-level technology better than the risk-averse banks, who have to borrow internationally, and who only monitor Tobin's Q for adjusting their lending rates. In this regime, the households invest in a different type of capital stock, which augments labor productivity, but comes at a higher rate of depreciation. We assume that one of the goals of the households making investments in the MF regime is to improve their own labor productivity.

In the BCF regime, the banking household continues to borrow internationally and supply intermediate goods to the relatively risk-free natural resource firms, while receiving deposits from the worker households. However, in this regime, the non-traded sector rents capital from the worker-managed mutual funds.

We thus identify a trade-off between the cost and the efficient acquisition of capital in each regime for the home-goods producing firms. In the LPB regime, the cost of investment is higher, but capital depreciates less quickly. By contrast, in the more inclusive BCF framework, acquisition of capital goods is less costly but these goods depreciate more quickly, while augmenting labor productivity.

We assume that the banks face the zero lower bound on international borrowing/lending when there are negative shocks. Similarly, the firms and mutual funds are constrained by irreversible investment. The capital stock can only be reduced by depreciation since investment cannot be negative.

For simplicity we abstract from government spending and taxes, and assume a fixed exchange rate. We also assume full price flexibility in both sectors. The price of the natural resource good is set by world prices while the price of the home good is set by marginal cost pricing. While Calvo (1983) pricing for home goods would add greater realism, we wish to draw attention to the role of the specific financial frictions in both regimes.

Since we are focusing on the experience of small Asian Pacific-Rim economies, we examine the effects of changes in the export price,as the driving force of the economy. Only in the BCF regime, when workers manage the type of capital rented to the non-traded firms, do productivity effects come into play.

The results show that a switch to the BCF regime has significant upside benefits for overall consumption, as well as household income and asset prices, during boom times. However, the LPB regime reduces the downside effects of a series of negative shocks during bust cycles.

Clearly these regimes are extreme, with an all or none banking sector provision of capital to the non-traded sector. Our results suggest that since small open economies, particularly those in emerging Asia, are subject to boom and bust cycles in terms, a trade, the best financial structure would be a more inclusive mix of both traditional bank lending and crowdfunding provision of capital to the non-traded sector.

Financial frictions have been at the center of recent theoretical research [see, for example, Brunnermeier and Sannikov (2014) and Brunnermeier et al. (2012)]. In empirical work, Balduzzi et al. (2013) examined banks' cost of funding and firm-level decision making Using Italian data during two periods of adverse shocks, they found that the cost of funding, measured in the costs of spreads and equity valuation, resulted in lower bank debt levels, . investment and employment in younger firms. Earlier Galindo et al. (2007) found with data for 12 lower-income countries that financial liberalization policies increased the efficiency with which firms allocated investment funds. This work is consistent with similar research reported by Chari and Blair Henry (2008)

The next section lays out our model, first in the LPB financial framework, then in the BCF framework. Then we discuss the calibration of the model and examine the properties of both models for shocks to terms of trade. Finally, we turn to stochastic simulations to evaluate the dynamics of household income and asset prices under the two regimes for both boom and bust episodes.

2 The Model

We first describe the household and its budget in the pure banking economy. We then take up production and pricing decisions, and the role of the banking sector in this regime. Then we describe the modifications due to a mixed banking/crowdfunding regime.

2.1 Households

There are two households: workers and bankers. Each agent consumes a composite good of domestically produced non-traded goods and traded goods which are also exports. Aggregate consumption will be the sum of all the individual consumptions.[3]

[3]We ignore imported foreign consumption goods since the vast bulk of imported goods are intermediate goods or investment goods for augmenting the capital stock.

The worker household maximizes an intertemporal utility function based positively on consumption and negatively on labor effort:

$$V_t^w = \max_{\{C_t^w, L_t, M_t\}} U(C_t^w, L_t) + \beta^w \mathbf{E_t} V_{t+1}^w \tag{1}$$

$$U(C_t^w, L_t) = \frac{1}{1-\eta} \left(C_t^w\right)^{1-\eta} - \frac{1}{1+\omega} \left(L_t\right)^{1+\omega} \tag{2}$$

where β^w is the discount factor, C_t is an index of effective consumption, L_t work hours, while $1/(1-\eta)$ is the intertemporal elasticity of substitution, and the parameterω represents the Frisch elasticity of labor supply, The symbol $\mathbf{E}_0$ is the expectations operator at time $t = 0$.

The composite good is formed by the commonly used CES aggregator:[4]

$$C_t^w = \left[(1-\gamma)^{\frac{1}{\theta}} \left(C_t^{w,h}\right)^{\frac{\theta-1}{\theta}} + (\gamma)^{\frac{1}{\theta}} \left(C_t^{w.x}\right)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \tag{3}$$

The parameter θ is the intratemporal elasticity of substitution between the domestically produced non-traded home ($C_{h,t}^w$) and export ($C_{x.t}^w$) good. The parameter γ represents the share of export good in the consumption of domestically produced goods.

Minimizing expenditure gives the following expressions for home and traded good consumption as:

$$C_t^{w,h} = (1-\gamma) \left(\frac{P_t^h}{P_{,t}^c} \right)^{-\theta} C_t^w \tag{4}$$

$$C_t^{w,x} = \gamma \left(\frac{P_{,t}^x}{P_t^c} \right)^{-\theta} C_t^w \tag{5}$$

The domestic goods price index $P_{c,t}$ is given by the following formula:[5]

$$P_t^c = \left[(1-\gamma) \left(P_t^h\right)^{1-\theta} + \gamma \left(P_t^x\right)^{1-\theta} \right]^{\frac{1}{1-\theta}} \tag{6}$$

The economic agent receives net transfers from the government, Υ_t,dividends Π_t, from the export firms and the home-goods firms and wage payments $W_t L_t$, where W_t is the economy-wide wage rate. We assume that savings are held only in the bank, as deposits (M_t) which earns interest at the rate R^m. The aggregate budget constraint has the following expression:

$$W_t L_t + (1 + R_{t-1}^m) M_{t-1} = P_t^c C_t^w + M_t \tag{7}$$

[4] The microfoundations with differentiated goods using the Dixit-Stiglitz aggregator have not been spelled out since they are now well known.

[5] This is derived using the definition, $P_t C_t = P_t^h C_t^h + P_t^x C_t^x$, and the two demand equations.

The macro-aggregate agent chooses consumption, labour, and deposits to maximize intertemporal utility, given by equation (1), subject to the budget constraint, The agent chooses non-trivial solutions in that $C_t > 0$, $L_t > 0$, $M_t > 0$ taking as given the vector of prices for labour and consumption goods, $\{W_t,\ P_t^c\}$, the returns for money $\{R_t^m\}$, total dividends Π_t, and the initial stock of money holdings, $\{M_{t-1}\}$.

Maximizing (1) subject to (7) yields the following Euler conditions:

$$\lambda_t^w = \frac{(C_t^w)^{-\eta}}{P_{c,t}} \tag{8}$$

$$L^\omega = (C_t^w)^{-\eta}\,\frac{W_t}{P_t^c} \tag{9}$$

$$\lambda_t^w = \beta^w \mathbf{E}_t\left[(1+R_t^m)\lambda_{t+1}^w\right] \tag{10}$$

The first equation, given by (8), tells us that the marginal utility of income is equal to the marginal utility of consumption divided by the price level. The second equation tells us that the demand for leisure is inversely related to the real wage and positively related to consumption. The last equation tells us that the marginal utility of money balances and income today are equal to the expected discounted value of the return on deposits multiplied by the utility in the next period.

We note that the worker household is not a rule of thumb consumer, who has no access to financial markets and consumes the entire wage income. Such a device, as noted Canova and Paustian (2011), is a friction used in many models to help the artifical data match key properties of actual data, but often at a cost of assuming an absurdly high proportion of such consumers.

We also point out that in the steady state, the gross rate of return on deposits is equal to the inverse of the discount factor of the worker household:

$$(1+\overline{R}^m) = \frac{1}{\beta^w}$$

The banking household has the following utility function, based on consumption alone, since the banking family manages assets, but does not supply labor to firms For the sake of simplicity, we assume that the relative risk aversion coefficient η is identical to the household coefficients. The discount rate is given by β^b.

$$V_t^b = \max_{\{C_t^b\}} U(C_t^b) + \beta^b \mathbf{E_t} V_{t+1}^b \tag{11}$$

$$U(C_t^b) = \frac{1}{1-\eta}\left(C_t^b\right)^{1-\eta} \tag{12}$$

As in the case of the workers, the composite good is formed by the commonly used CES aggregator:[6]

$$C_t^b = \left[(1-\gamma)^{\frac{1}{\theta}}\left(C_t^{b,h}\right)^{\frac{\theta-1}{\theta}} + (\gamma)^{\frac{1}{\theta}}\left(C_t^{b,x.}\right)^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \tag{13}$$

[6]For simplicity we assume that the CES parameters are identical for the households.

Minimizing expenditure gives the following expressions for home and traded good consumption as for this household:

$$C_t^{b,h} = (1-\gamma)\left(\frac{P_t^h}{P_t^c}\right)^{-\theta} C_t^b \tag{14}$$

$$C_t^{b.x} = \gamma\left(\frac{P_t^x}{P_t^c}\right)^{-\theta} C_t^b \tag{15}$$

The banking household has access to international markets for borrowing and lending at the international interest rate R_t. This banking household, receives deposits from households, but must set aside a fraction of these deposits for reserves at the ratio γ_m. The household purchases intermediate goods for production in traded goods firms and investment goods, to augment the capital stock to be leased to non-traded goods firms. We assume that the banking household has to borrow internationally for payment for the investment goods and for the intermediate goods at the rates R_t^{nh} for the non-traded sector and R_t^{nx} for the export sector.

We assume that the lending for the traded sector intermediate goods is relatively riskless so that R_t^{nx} is equal to the international risk-free rate plus a small constant risk premium. For the non-traded sector, we assume that the lending rate has a fixed and variable component, which changes with the market value of the outstanding capital stock in this sector relative to its steady state value:

$$1 + R_t^{nx} = (1 + R_t)(1 + \Phi^x) \tag{16}$$

$$1 + R_t^{nh} = (1 + R_t)(1 + \Phi_t^h) \tag{17}$$

$$\Phi_t^h = \Phi_0 + \Phi_1(I_t^h/Q_t K_{t-1}^h - \delta/\overline{Q}) \tag{18}$$

The variable Q_t is Tobin's Q, the replacement value of the stock of capital. The idea is that the international lenders to the banking household will demand a risk premium for investment in the non-traded sector, based on the ratio of planned investment to the market value of capital, $I_t^h/Q_t K_{t-1}^h$,relative to the steady state values of this ratio, $\delta\bar{K}^h/\bar{Q}\bar{K}^h = \delta/\bar{Q}$.This risk premius is given by the variable Φ_t^h

The banking household has the following budget constraint:

$$\begin{aligned} B_t + R_t^h K_{h,t-1} + R_t^x K_{x,t-1} + (1-\gamma_m)M_t = P_t^c C_t^b + (1 + R_t^{nh})(P_t^* I^h + P_t^* \Psi_t) \\ +(1 + R_t^{nx})P_t^* K_{x,t} + (1 + R_t)B_{t-1} + (1 + R_t^m)M_{t-1} \end{aligned} \tag{19}$$

The constraint tells us that the cash inflows of the banking household come from international borrowing, B_b, returns to capital rented to non-traded firms, $R_t^h K_{h,t-1}$, returns on intermediate goods rented to export firms, $R_t^x K_{x,t-1}$, and on deposits, net of reserve requirements, $(1-\gamma_m)M_t$. The nominal cash outflows are for consumption goods, $P_t^c C_t^b$, and for the purchase of investment goods, I^h,inclusive of adjustment costs Ψ_t and financing costs, R_t^{nh}, given by the world price P_t^*. Further cash outflows are for the purchase of intermediate goods, $K_{x,t}$,inclusive of borrowing costs, as well as the servicing of external debt B_{t-1}, at the world interest rate R_t, and the cost of the deposit liabilities, M_{t-1}, with the deposit rate given by R_t^m.

The variable Ψ_t representing adjustment costs on capital, with ψ the adjustment cost parameter, has the following quadratic functional form:

$$\Psi_t = \frac{\psi}{2}\left(\frac{I_t^h - \delta\bar{K}^h}{K_{t-1}^h}\right)^2 K_{t-1}^h \tag{20}$$

The parameter δ is the depreciation rate. The capital stock has the following law of motion:

$$K_t^h = (1-\delta)K_{t-1}^h + I_t^h \tag{21}$$

We also assume that investment decisions are irreversible:

$$I_t^h \geq 0 \tag{22}$$

The banking household optimizes its intertemporal utility function with respect to the choice of its consumption path C_t^b as well as its accumulation of foreign bonds, investment in the capital stock of non-traded goods I^h , provision of intermediate goods to the traded sector $K_{x,t}$, and deposits accepted from the household sector M_t.

Optimizing the intertemporal utility function gives the following first order conditions:

$$\lambda_t^b = \frac{(C_t^b)^{-\eta}}{P_{c,t}} \tag{23}$$

$$\lambda_t^b = \beta^b \mathbf{E}_t\left[(1+R_t)\lambda_{t+1}^b\right] \tag{24}$$

$$\lambda_t^b(1+R_t^{nx})P_t^* = \beta^b \mathbf{E}_t\left[R_{xt}\lambda_{t+1}^b\right] \tag{25}$$

$$\lambda_t^b(1-\gamma_m) = \beta^b \mathbf{E}_t(1+R_t^m)\lambda_{t+1}^b \tag{26}$$

$$I_t^h = \delta\overline{K}_h + \frac{K_{t-1}^h}{\psi}\left[\frac{Q_t - (1+R_t^{nh})P_t^*}{(1+R_t^{nh})P_t^*}\right] \tag{27}$$

$$Q_t = \beta^b \mathbf{E}_t\left[\lambda_{t+1}^b R_t^h + \lambda_{t+1}^b \psi(1+R_{t+1}^{nh})P_{t+1}^*\left(\frac{I_{t+1}^h - \delta\bar{K}^h}{K_t^h}\right)^2 + Q_{t+1}(1-\delta)\right] \tag{28}$$

For these first order conditions, the following arbitrage conditions emerge:

$$(1+R_t^m) = (1-\gamma)(1+R_t) \tag{29}$$

$$\frac{R_{x,t}}{(1+R_t^{nx})_t P^*} = (1+R_t) \tag{30}$$

These conditions tell us that the gross interest rate on deposits is lower than the gross return on the risk-free bond by the factor $(1-\gamma)$. The second condition tells us that the return on intermediate goods, net of financing costs, should be equal to the return on the risk-free bond. We also note that the gross lending rate to non-traded firms, $(1 + R_{t+1}^{nh})$, by equations (17) and (18), is a function of the expected investment and Q, and the current-period capital stock at time t.

In the steady state, Tobin's Q has the following value, when we examine the expressions for both investment I_t^h and Q_t :

$$\begin{aligned} \overline{Q} &= (1 + \overline{R}^{nh})\overline{P}^* \\ &= \frac{\beta \overline{\lambda}^b \overline{R}_h}{1 - \beta(1 - \delta)} \end{aligned} \tag{31}$$

The bottom line is that the presence of borrowing costs, $\overline{R}^{nh}$ leads to a higher steady state value of Q. This in turns requires a higher rate of return in capital in this sector, which implies a lower steady-state level of the capital stock.

Finally we see that the steady state gross risk-free interest rate is equal to the inverse of the discount rate β^b :

$$(1 + \overline{R}) = \frac{1}{\beta}$$

2.2 Production and Pricing

There are two types of production and pricing activity, one for tradeable and one for non-tradeable goods. We assume that the same nominal wage rate W_t holds across sectors, so that labor is fully mobile between these sectors. This assumption is a familiar one. We also assume that labor is completely mobile between the two sectors, so that the real wage is equal across the sectors.

2.2.1 Export Goods

The export good is a natural resource and inexhaustible. The output $Y_{x,t}$ is demanded by households $C_{x,t}$ and foreigners X_t (exports):

$$Y_t^x = C_t^x + X_t \tag{32}$$

$$C_t^x = C_t^{w.x} + C_t^{b.x} \tag{33}$$

Following a small open economy assumption, we assume that the economy can export any of the natural resource product at current world prices P_t^{x*}.This price follows a logrithmic autoregressive stochastic process, with autoregressive coefficient ρ^p and a normally distributed stochastic shock ϵ^p with variance σ^p :

$$\ln(P_t^x) = \rho^p \ln(P_{t-1}^x) + (1 - \rho^p) \ln(\bar{P}^x) + \epsilon_t^p, \tag{34}$$

$$\epsilon^p \tilde{} N(0, \sigma^p) \tag{35}$$

We assume a Cobb-Douglas production function:

$$Y_t^x = A^x \left(z_t L_t^x\right)^{1-\alpha^x} \left(K_t^x\right)^{\alpha^x} \tag{36}$$

The symbol A^x is a fixed technological factor. The firm pays wages to the worker household and rental rates on the intermediate goods to the banking household. The variable z_t is a skill-augmenting process. We discuss this below.

The total profits of the firms , driven to zero in competition, Π_t^x to households each period, has the following form:

$$\Pi_t^x = P_t^x Y_t^x - [W_t L_t^x + R_t^x K_t^x] \tag{37}$$

Minimizing total costs subject to the production function constraint yields the following first-order conditions for the exporting firms, for the employment of labor and use of intermediate goods:

$$\frac{\alpha^x W_t}{(1-\alpha^x) R_t^x} = \frac{K_t^x}{L_t^x} \tag{38}$$

2.2.2 Non-traded Goods

The firm producing non-traded home goods Y_t^h combines labour L_t^h and a capital good K_{t-1}^h in a Cobb-Douglas production function:

$$Y_t^h = A^h \left(K_t^h\right)^{\alpha^h} \left(z_t L_t^h\right)^{1-\alpha^h} \tag{39}$$

The symbol L^h denotes the labour services hired by the firms. The coefficient α^h is the factor share of capital goods and A^h a coefficient and as in the case of exporting firms. The variable z_t is a skill-augmenting process, common to both the traded and non-traded sectors.

The market clearing equation are given by the following equations

$$Y_t^h = C_t^{w.h} C_t^{b.h} \tag{40}$$

Total profits are given by the following equation. As in the case of the exporting firm, the wage bill is remitted to the worker household and the rental bill for capital is remitted to the banking household:

$$\Pi_t^h = P_t^h Y_t^h - (W_t L_t^h + R_t^h K_{t-1}^h) \tag{41}$$

Minimizing total costs subject to the production function constraint yields the following first-order conditions for the exporting firms, for the employment of labor and use of intermediate goods:

$$\frac{\alpha^h W_t}{(1-\alpha^h) R_t^h} = \frac{K_t^h}{L_t^h} \tag{42}$$

We assume flexible prices for monopolistically competitive firms. In this case, the price of domestic goods is set equal to the marginal cost:

$$P_t^h = \frac{(1+R_t^{nh}) W_t^{1-\alpha^h}][Q_t)^{\alpha^h}]}{A^h} \cdot \left(\frac{1}{(\alpha^h)^{\alpha^h} (1-\alpha^h)^{1-\alpha^h}} \right) \tag{43}$$

The domestic price level P_t^h is thus a function both of the wage cost W_t , the shadow cost of capital and the borrowing costs.

2.2.3 Labor Mobility

We assume that the same real wage prevails in both sectors. This implies the following relations governing capital/labor ratios:

$$\begin{aligned} W_t &= \frac{(1-\alpha^h)R_t^h K_t^h}{\alpha^h L_t^h} \\ &= \frac{(1-\alpha^x)R_t^x K_t^x}{\alpha^x L_t^x} \end{aligned} \tag{44}$$

2.3 The Banking-Crowdfunding Regime

Under the BCF regime, the worker household makes deposits in the banking system,but also can channel savings to a non-bank financial institutions by buying directly investment goods and lending capital to the non-traded firms.

The household budget constraint includes the purchase of imported investment goods (with the associated adjustment costs $\widetilde{\Psi}_t$) and the return from renting capital to firms at the rate R_t^h The capital stock is also subject to the law of motion given by equation 21

$$W_t L_t + (1+R_{t-1}^m)M_{t-1} + R_t^h K_{t-1}^h = P_t^c C_t + M_t + P_t^* I_t^h + P_t^* \widetilde{\Psi}_t \tag{45}$$

$$K_t^h = (1-\widetilde{\delta})K_{t-1}^h + I_t^h \tag{46}$$

$$\widetilde{\Psi}_t = \frac{\widetilde{\psi}}{2}\left(\frac{I_t^h - \tilde{\delta}\overline{K}^h}{K_{t-1}^h}\right)^2 K_{t-1}^h \tag{47}$$

$$I_t^h \geq 0 \tag{48}$$

The worker household cannot access international markets. In this regime, the households deposit less money into the banking system in order to finance the purchase of investment goods, inclusive of the adjustment costs.

The key difference from firm bank-financed investment and crowdfunding financed investment is in the adjustment costs and depreciation rate for capital. The adjustment cost function has the same functional form as the case of the LPB regime. In this case, we assume that investors in the MF regime are closer to the firm, since they also supply labor and thus work at these firms. Thus we assume that the adjustment costs are lower. However we also assume that the MF owners and providers of labor input wish to purchase a different type of capital, which has a higher depreciation rate, with $\widetilde{\delta} > \delta$. This capital, which is imported, has the property of enhancing the labor-augmenting technology.

The variable z_t has the following law of motion:

$$\ln(z_t) = \rho^z \ln(z_{t-1}) + (1-\rho^z)\ln(\overline{z}) + (1-\rho^z)\rho^{zk}\ln(K_{t-1}^h/\overline{K}^h) \tag{49}$$

We call this form of investment in technology skill-enhancing, since a wage premium emerges. [see Acemoglu (2003)]. Of course the labor-augmenting technology index can also respond to various forms of taxes on labor or capital, as noted by Aghion et al. (2013).

There is thus a trade-off in the dynamics of investment between the LPB and the BCF regimes. Firms face lower adjustment costs when making investment decisions but higher depreciation rates under the MF regime, whereas in the LPB, there are higher financing costs for capital which depreciates at a lower rate, and thus is more durable.

For the household the following first order conditions now apply, with the inclusion of both investment goods and the return on capital in the budget constraint:[7]:

$$I_t^h = \tilde{\delta}\overline{K}^h + \frac{K_{t-1}^h}{\tilde{\psi}}\left[\frac{Q_t/\lambda_t^w - P_t^*}{P_t^*}\right] \tag{50}$$

$$Q = \beta^w \mathbf{E}_t\left[R_{t+1}^h\lambda_{t+1}^w + \lambda_{t+1}^w\widetilde{\psi}P_{t+1}^*\left(\frac{I_{t+1}^h - \widetilde{\delta}\overline{K}^h}{K_{t-1}^h}\right)^2 + Q_{t+1}(1-\widetilde{\delta})\right] \tag{51}$$

In this regime, we assume that the banks continue to lend to the relatively riskless traded-good producing firms for labor and costs of intermediate goods and to the home goods firms for the wage bill. The banking household has the following modified budget constraint:

$$\begin{aligned} B_t + R_t^x K_{t-1}^x + (1-\gamma_m)M_t = P_t^c C_t^b + (1+R_t^{nx})P_t^* K_t^x \\ + (1+R_t)B_{t-1} + (1+R_t^m)M_{t-1} \end{aligned} \tag{52}$$

The following first-order conditions apply, for the optimal choice of consumption, borrowing, accepting deposits, and providing intermediate goods to exporting firms:

$$\lambda_t^b = \frac{(C_t^b)^{-\eta}}{P_t^c} \tag{53}$$

$$\lambda_t^b = \beta^b\mathbf{E}_t\left[(1+R_t)\lambda_{t+1}^b\right] \tag{54}$$

$$\lambda_t^b(1+R_t^{nx})P_t^* = \beta^b\mathbf{E}_t\left[R_t^x\lambda_{t+1}^b\right] \tag{55}$$

$$\lambda_t^b(1-\gamma_m) = \beta^b\mathbf{E}_t(1+R_{t+1}^m)\lambda_{t+1}^b \tag{56}$$

To better match key stylized facts of small open economies in Asia, we assume that the households are high savers, so that the initial conditions starts with a large stock of deposits/ International indebtedness is not a source of risk.

3 Calibration

Table 1 shows the calibrated values of the parameters of the model. These parameters are not meant to capture any one particular economy. Many of the calibrated parameters

[7]The first-order conditions in equations 8-10 remain in this regime and are omitted.

are standard and widely used, such as relative risk aversion coefficient, η, set at 2.5, and the Frisch labor supply elasticity, ω, set at .5. We set the discount rate for workers, β^w, to mimic the steady state of a low-interest rate environment for households. The discount rate for the banking sector, β^b is slightly lower, indicating the higher returns available to this sector in the international bond market. The differences in the discount rates guarantees that the workers' risk-free deposit rate is lower than the bankers' international risk-free bond rate.

The intratemproal elasticity of substitution between traded and non-traded goods, θ, is also standard for low-income open economies [see, for example, Ogaki et al. (1996)]. For the production parameters, we assume that the export sector is more intensive in the use of the intermediate goods relative to labour, than the home sector, which uses capital relative to labor. Thus $\alpha^x = .4$, while $\alpha^h = .3$.

For the investment adjustment costs, we assume that the costs are lower in the BCF regime than the banking regime, in which the firms themselves purchase investment goods with bank lending. Hence $\psi > \widetilde{\psi}$. Depreciation is set at a quarterly rate of .025 in the LPB regime but at a value of .05 in the BCF regime, indicating that the capital is more up to date in the BCF regime.

For the autoregressive parameters for the terms of trade, we assume at a quarterly frequency, a high degree of persistence, with $\rho^P = .9$. Similarly for the labor-augmenting technology parameter, in the BCF regime, we assume that this variable adjusts slowly to changes in the stock of capital, so that the persistence is high, with $\rho^z = .9$. We assume a neutral response to the capital stock changes, neither too large nor too small, relative to the steady state, with $\rho^{zk} = .5$.

For the financial friction parameters, we assume that the deposit rate is slightly below the already low risk-free rate, based on the reserve parameter The spread for the risk premium for loans to the export sector, Φ^x, is set at .05, while the fixed and variable components for the spread to the non-traded sector, Φ_0, Φ_1, are set at .15 and .01. A rise in Tobin's Q will thus lower the spread to the home goods sector, but it will not go lower than the spread applied to the traded-sector.

For the stochastic processes, we set the autoregressive parameters ρ^p, at a value of .9, for quarterly frequency for simulation. For the standard deviations of the shock, σ^p,we set the base values of .01.

Table 1: Parameter Specification		
Parameters	Definitions	Calibrated Values
β^b, β^p	discount factor	.990, .995
η	relative risk aversion	2.5
ω	labour supply elasticity	0.5
γ	share of tradeables in consumption bundle	0.4
θ	intratemporal substitution elasticity	1.25
$\delta,\widetilde{\delta}$	depreciation rate on capital	0.025, .05
α^h, α^x	parameters in production function for capital	0.3, 0.4
$\psi, \widetilde{\psi}$	adjustment costs for investment	0.15, .05
γ_m	parameters for deposits	0.05,
Φ^x, Φ_0, Φ_1	risk premium for export and home goods lending	0.05,.15, .01
$\rho^p,\ \rho^z, \rho^{zk}$	autoregressive parameters for export-price shock	.9,.9,.5
σ^p	standard deviation for export-price shocks	.01

The implied steady state values appear in Table 2. As you can infer from the model, the higher the depreciation rate and the capital intensity in production, the more open the economy becomes. We assume, for simplicity, that the imported goods are used for investment in capital goods in the non–traded sector or as intermediate goods for production in the traded sector.

Table 2: Steady State Values		
Variable	Definition	Calibrated Value
c/y	Consumption/GDP	.364
x/y	Export/GDP	.64
$(M/P)/y$	Real Money/GDP	5.39
$(I^h + K^x)/y$	Total investment/GDP	.55
R, R^*	Risk free rate	.0101
R^m, R^{nx}, R^{nh}	Interest on deposits and loans to firms	0.005, 0.0606,0.1111
P^*, P^x, P^h, P^c	Price indices	1,3.18,2.63,2.83
$N^x/y, N^h/y$	Loans to export and home-goods firms/GDP	.7,.07

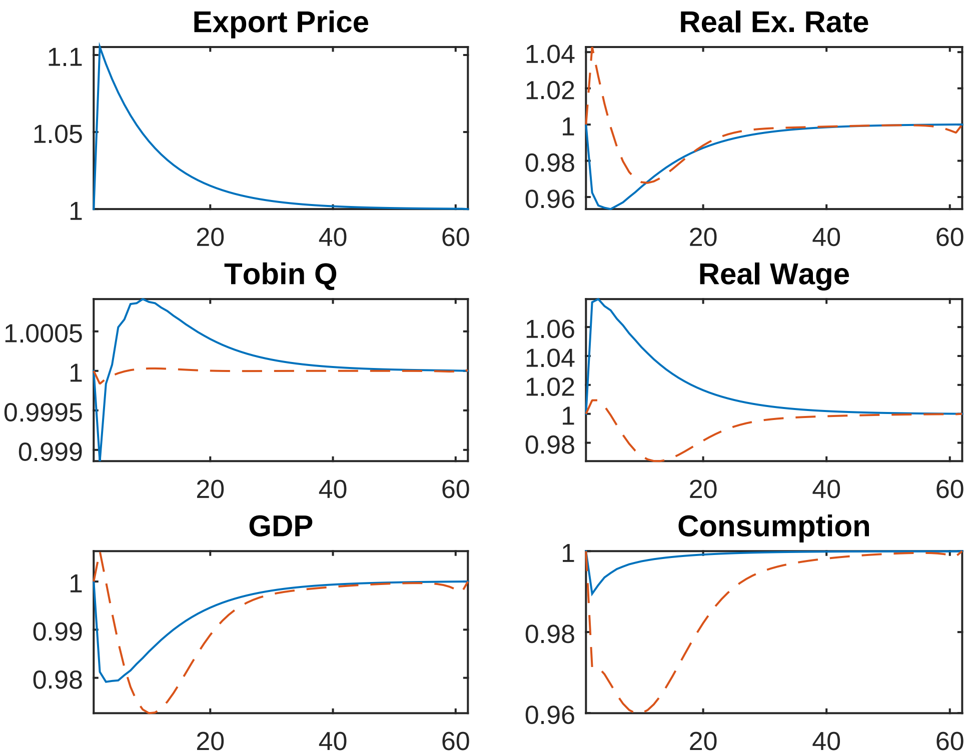
4 Simulation Results

We first examine the response of the model, under the two regimes, to once-over shocks, positive and negative, to the export price. Then we examine the behavior of key various for recurring shocks to export prices. We solve the model with the extended path method of Fair and Taylor (1983), implemented by Adjemian et al. (2014).

4.1 Impulse Response Paths

Figure 1 pictures the response of the real exchange rate (the relative price of traded to non-traded goods), Tobin's Q, the real wage, GDP, and consumption, to a once-over

Figure 1: Adjustment to a Positive Export Price Shock



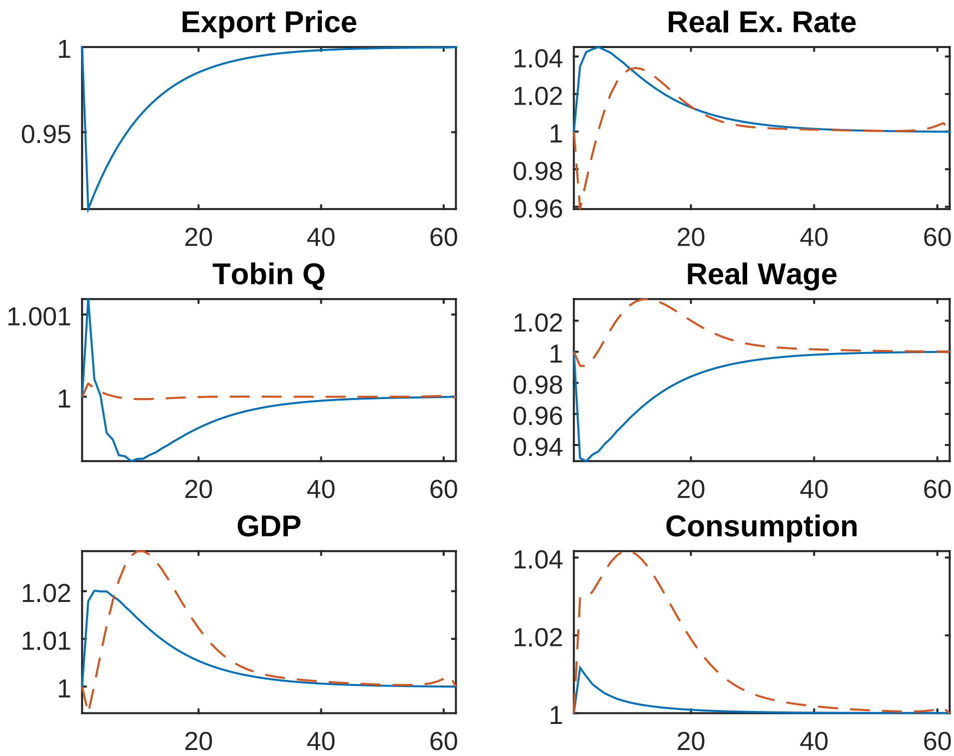
increase and a once-over decrease to the shock to the export price. The shock represents an initial change of 10 percent. The solid curves represent adjustment under the LPB regime, while the broken curves represent the corresponding adjustment in the BCF regime.

We see that the response of the real exchange rate, real wage, and Tobin's Q is stronger under the LPB regime, while the response of GDP and consumption is stronger, and negative, under the BCF regime.

The negative response to the positive shock in the export price should not be surprising. After the initial shock, there are expectations of falling export prices, which means falling returns to investment in the traded-goods sector. The ensuring fall in the real wage (after an initial increase), GDP, and consumption are consequences of the expected fall in the export earnings. We also see that the real exchange rate initially moves in opposite directions in the two regimes. Given that the output drop and fall in overall demand are stronger in the BCF regime, the price of home goods falls more quickly. This leads to the stronger initial increase in the real exchange rate in this regime, relative to the LPB regime.

Figure 2 pictures the corresponding impulse response paths for a once-over negative

Figure 2: Adjustment to a Negative Export Price Shock



shock to the export price. We see that the positive response of both GDP and consumption is stronger under the BCF regime than the LPB regime. As in the case of the positive shock, the response of Tobin's Q and the real wage is much stronger under the LPB regime than the BCF regime. We also see that the real exchange rate initially moves in opposite directions. Given that the demand to the expected rise in the export price is stronger in the BCF regime, the homes good price rises faster in this regime, leading the exchange rate to fall initially.

It would be tempting to say that the BCF regime induces more volatility in real variables relative to the LPB regime, for positive and negative shocks, based on this impulse response analysis. For a more complete assessment, we will examine the response of key macroeconomic variables in a full stochastic setting, which recurring shocks to export prices.

4.2 Stochastic Simulations

The results suggest that the BCF regime effectively insulates the economy from the negative effects of export-price shocks, while moderating the upside effects of favorable productivity and export-price shocks.

We do not compare the regimes by standard welfare comparison. The reason is that over long periods of simulation length, the variables will remain close to their steady-state values. Not suprisingly, little or no differenes will emerge in any comparion of regimes. Instead, we compare the performance of key variables in boom-bust and bust-boom episodes, when the economy is away from the steady state, in good times or in bad times. These are the times when differences in the performance of alternative policy regimes emerges. In such times, the payoffs of one regime or the other become more apparent.

We illustrate our model's implications regarding the effects of a BCF regime relative to a LPB regime by isolating both boom and bust events, first a boom-bust episode, then a bust-boom episode. We take 10,000 quarterly observations generated by our stochastic simulations and, emulating the empirical literature on sudden stops, identify particular boom and bust episodes. Following the definition provided by Mendoza (2010), we specify the boom and bust episodes by periods in which GDP expanded or contracts by more than 1.67 standard deviations relative to its stochastic mean.

The results of this exercise are presented in Figures 3 and 4. We capture the event dynamics by taking the median values for these episodes, with a normalization factor for each variable at unity four periods prior to the sudden stop at time $t = 0$. The frequency of such boom and bust episodes is 5%.

Figure 3 pictures the dynamics of an export price boom-bust episode. During the boom period, Q rises only so slightly in the LPB regime and practically not at all in the BCF regime. The real wage rises, but the capital stock falls. With the anticipated falling capital stock, there is an increase in the spread (the return on capital less the risk-free rate), as the marginal productivity of capital increases.

As is the case of the impulse response analysis we see that the real wage and real exchange rate are more responsive under the LPB regime, while real GDP and consumption are more response, and fall more quickly, under the BCF regime. We see that this is due to the fall in the labor-augmenting productivity factor due to the fall in the capital stock.

The dynamics of a bust-boom cycle appear in Figure 4. We see that the initial fall generates expectations of a succeeding increase. This leads to an expansion in output and investment, as capital stock increases, inducing a fall in the spread in the LPB regime and a rise in labor-augmenting technology in the BCF regime.

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5 Conclusion

This paper examined macroeconomic adjustment in a small open economy to a change in the export price, under two regimes, a limited-participation banking (LPB), in which workers can only deposit in banks, and bankers and borrow/lend internationally and invest in firms. We compared this adjustment with the dynamics of banking/crowdfunding

Figure 3: Adjustment During Export Price Boom/Bust Episode

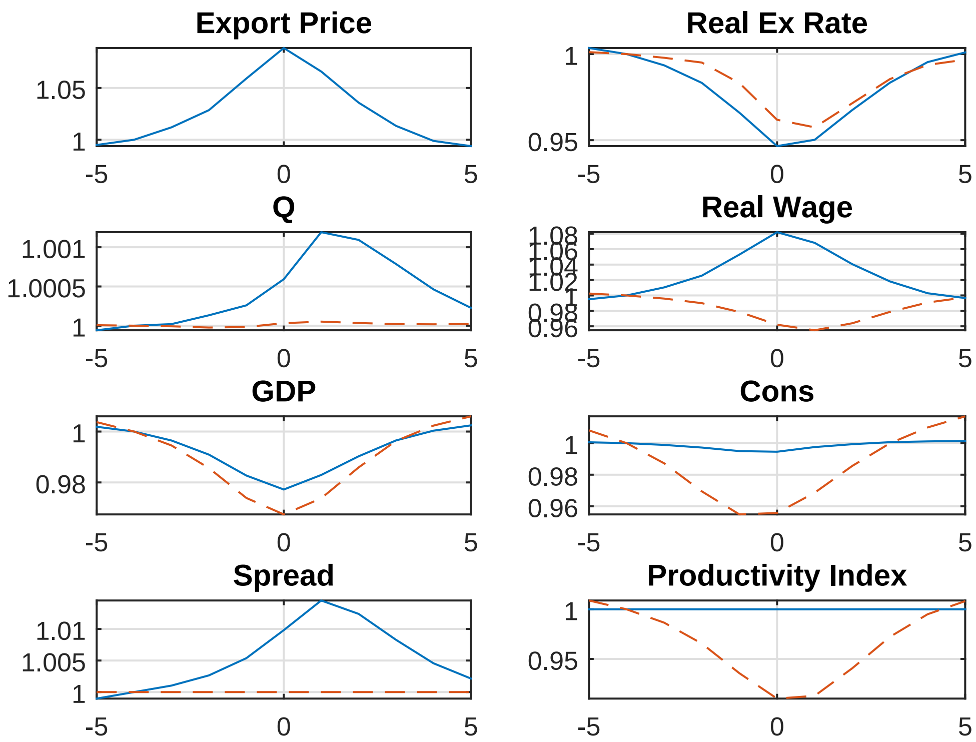
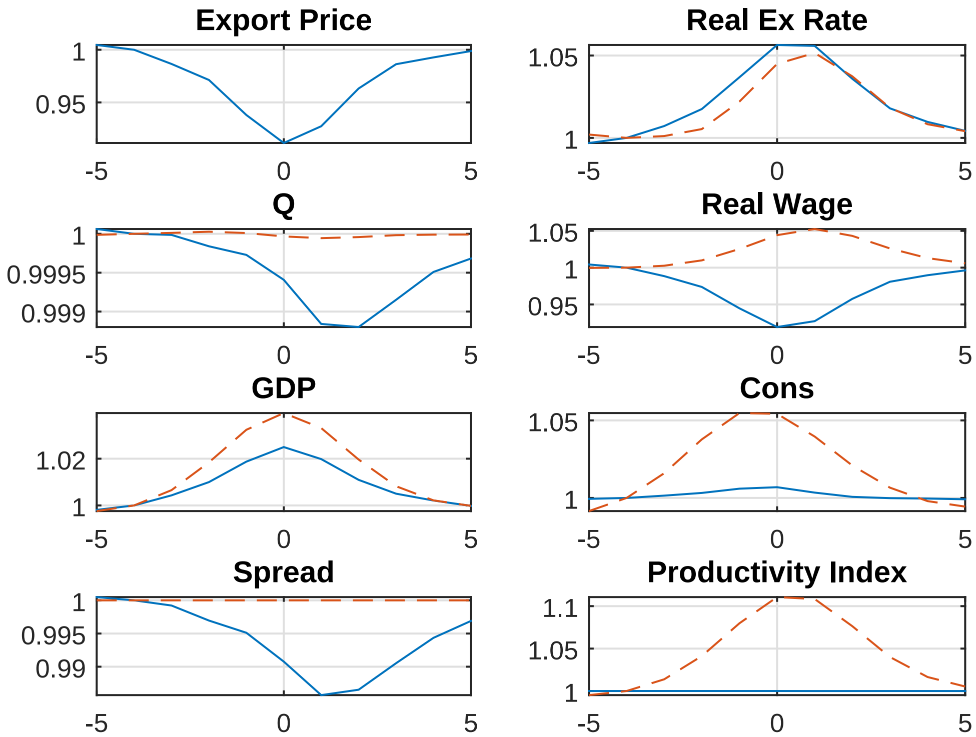


Figure 4: Adjustment During Export Price Bust/Boom Episode



(BCF) regime, in which workers can pool their savings and invest in the non-traded sector of economy.

We assume that investment in irreversible: it cannot be negative so that the capital stock can only decrease through depreciation. In the LPB banking regime, investors demand a risk premium for investment in the non-traded sector, which depends on the market value of the assets of the firms. We also assume that in the BCF regime, in which workers invest in the firms where they supply labor, they will invest in a capital stock which augments labor productivity. The capital in this regime depreciates more quickly than the capital generated by the investment by the bankers.

The results show that the BCF regimes generate more upside gains than the LPB regime when there are positive shocks or expectations of an increase in the export prices. The BCF regime also has greater downside risks than the LPB regime. However, given the investment is irreversible, the downside adjustment following negative shocks is slower and more limited than the upside adjustment following positive shocks.

We have abstracted from issues of financial liberalization and inequality. In low income countries, financial liberalization also entails openness to foreign aid as well as foreign investment. There is an ongoing debate about the effectiveness of foreign aid on growth as well as equality in these countries [see, for example, Easterly (2007)], how banking reforms affect equality [see Delis et al. (2014)] and the role of government spending on equality [see Lim and McNelis (2013)]. We also ignored the possibility of redistributive taxes from the banking to the worker households and the ensuing equity and efficiency issues [see Correia (2010) and Correia (1999)]. Finally we also note that moving from a LPB to the BCF regime is only one limited form of financial liberalization in a developing economy.

Overall the results of this paper make a case for a transition to a less restrictive BCF regime. The upside gains and downside losses are greater than those of a LPB banking regime, to be sure, so that an optimal mix of financing from both types of regimes would be the preferable outcome.

The model in this paper leaves out the question of indirect deindustraialization due to export booms in natural-resource producing economies, due to Corden and Neary (1982), and the related question of Harrod-Balassa-Samuelson effects [Harrod (1933), Balassa (1964), and Samuelson (1964)]. Exploration of these issues in the presence of banking and crowdfunding regimes requires a more extensive model.

We add a not of caution that the comparion of the regimes comes from behavior of the economy in boom or bust events. The behavior of the key variables before or after the peak or trough values do not represent the behavior of these variables in normal times. Thus one should not conclude that consumption is more smooth (as in the permanent income hypothesis), overall, in one regime than another, or more pro-cyclical, as we see in the BCF regime.

The key assumption which gives the added plus to the BCF regime in boom episode is that the workers will acquire special capital which is skill augmenting. There is, of course, the likelihood that once this process reaches a given threshold, investment will ramp off, as workers become more risk adverse in the face of a commodity bust.

In many ways our analysis harks back to the debate about free vs. regulated banking. As Christ (1993) notes, there is evidence that free banking is more stable than regulated banking. Free banking in earlier eras meant that banks could function as start-ups without state or federal charters, reserve requirements or deposit insurance. Our BCF regime is in some sense a free banking regime, in which the free bank stockholders assume full liability for their losses. As Christ points out, the likelihood of a free banking regime, with unlimited bank stockholder liability, is remote. Our results simply illustrate the advantages of the BCF regime for the non-traded sector, while allowing regulated banks to be the principle sources of finance for the traded-good sector.

We also want to add a clarification in the light of the earlier debates about free banking. In our model, the LPB regime is not necessarilty a more regulated regime relative to a more de-regulated BCF regime. Put another way, the LPB regime may be a very deregulated system in itself. The fact that the BCF regime does not emerge simply reflects a lack of financial education or human capital available to workers in the non-traded sector.

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