Finance, distribution and the economic objective of cooperative financial institutions[†]

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Abstract

This paper proposes a model where the structure rather than the size of the financial sector explains its influence on income distribution. Because of information asymmetries, a financial sector dominated solely by profit-maximizing financial intermediaries will increase income and wealth inequality as it gives preferential access to credit for high-income agents, whereas a diversified inclusive financial sector with alternative models of finance, like cooperatives, will reduce the inequality gap. No full convergence in income distribution can be realized through finance only and there is still a need for redistribution policies. Accordingly, an objective function for cooperative financial institutions should define a desired pricing behaviour that can increase the income of members at a rate higher than the average growth rate of the economy.

1. Introduction

Continued expansion of the financial sector lies at the heart of the current debate over income inequality. The 2007-08 financial crisis increased criticism over the role of the financial sector in the economy. Banks and capital markets became widely viewed as disconnected from their societies, with privatised profits for bank managers and shareholders while losses are socialised

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and harm the whole economy. I present a model that argues that the structure rather than the size of the financial sector explains its influence on income distribution. Because of information asymmetries, a financial sector dominated solely by profit-maximizing financial intermediaries will widen income and wealth inequality, as it gives preferential access to credit for high-income agents, while a diversified financial sector that includes alternative models of banking, such as cooperative financial institutions, will be more inclusive and will reduce the income inequality gap. I further propose an objective function for cooperative financial institutions to define a desired deposit and lending interest rates, as well as optimal total credit supplied for the members and the possibility to seek external borrowing, all of which aim at increasing the income of the cooperative members at a rate higher than the average growth rate of the economy.

The model proposed here attempts to explain how financial cooperatives may adjust the distributional output of the financial sector. In imperfect credit markets with asymmetric information and a costly screening process, the credit decision depends mainly on the value of the borrower's collaterals relative to the loan size (leverage ratio) and the lender-borrower relationship, acquired from persisting social interaction or previous credit transaction. The lender-borrower relationship can be thought of as the borrower's credit social capital. In a credit market dominated solely by an investor-owned bank, where low- and middle-income agents have no credit social capital, only high-income agents will be able to borrow and hire additional workers with a wage rate lower than the marginal product of labour. Meanwhile, those who have low wealth and low credit social capital will be credit rationed, and will be unable to adopt new production techniques or invest in their human capital to improve their productivity, as they cannot borrow at an interest rate below the marginal return on their capital. The income of low- and middle-income agents from self-employment or from wages will be constrained to their initial productivity, and wealth inequality will continue to increase depending on the initial wealth distribution, convexity of savings rate and heterogeneity of production techniques. High-income agents will finance their new investments from the deposits of low- and middle-income agents after utilising all of their deposits. However, if middle-income agents can pool their deposits together in a new financial institution that they own themselves based on some homogeneity among them, then they can increase their individual credit social capital. Assuming that the cooperative is less exposed to asymmetric information and moral hazards, it will lend middle-income agents the required capital to upgrade their production function at an interest rate

lower than the marginal product of capital. But only middle-income agents are able to mobilise enough deposits to form a financial cooperative, while low-income agents will remain credit rationed. As a result, in a credit market where both type of institutions operate, the income and wealth gap between middle- and high-income agents will narrow, but the same level of inequality may continue to persist between middle- and low-income agents. Finally, the model develops a simple economic objective function for financial cooperatives, where the aim of a cooperative is to increase the income of its members at a rate higher than the average growth rate of the economy, so that the member of the cooperative can improve (or maintain) her wealth ranking in the class structure.

The key assumptions in the model below are based on the assumption of credit market failure and traditional assumptions for financial cooperatives, which are particularly relevant to underdeveloped and emerging financial cooperative sectors. These include, first, being small and bound to geographical or sectorial concentration (closed defined membership) to allow members' direct participation in decision-making, peer monitoring and social sanctions. Second, local management that is independent from the government or the centralised network (federation). Third, the ability to mobilise sufficient deposits from the members as the main source of funds available for credit, with no access to capital markets. Finally, the ability to have institutional integration between primary financial cooperatives. However, while most cooperative financial institutions share the same basic principles, different models of cooperative banking exist, as a result of historical and cultural factors, how cooperatives were introduced and the way they evolved, as well as the structure of the financial sector and of the economy, political institutions, the level of development and the regulatory framework (Khafagy, 2017: 468). For instance, most of the European cooperatives were founded as grassroots, independent, self-help associations that emerged spontaneously, while the development of cooperatives in developing countries is strongly dependent on the colonial governments that implanted cooperatives as instruments to implement their own economic policies. Cooperatives remain government instruments in some less developed economies, where the objective of cooperatives is not to create alternative contractual arrangements that govern the relationship between the members and the market, and among the members themselves, but to follow the policies of the state (Khafagy, 2017: 471). Moreover, although financial exclusion is a significant obstacle for growth and distribution in less developed and emerging economies, it is no longer a major

problem in most industrialised economies. Investor-owned banks in mature financial systems are able to finance small and medium businesses as asymmetric information and moral hazard problems are better mitigated by strong contract enforcement and verifiable information about prospective borrowers, all of which limits the comparative advantage of financial cooperatives. Furthermore, matured financial cooperative sectors have access to the capital market, while surpluses in less developed financial cooperative sectors are the only source to obtain additional capital, since their shares are usually untradeable. Deposit insurance schemes may also have weakened members' incentives to monitor cooperatives' operations, but deposit insurance schemes are not widely available or effective yet in less developed financial cooperative sectors (Khafagy, 2018). Likewise, some large cooperative movements in Europe have evolved into national networks with centralised business functions to gain from economies of scale, which weakened members' participation in decision-making. While networks and federation in less developed financial cooperative sectors are formed to secure liquidity positions, if possible, through short- or long-term borrowing, acting like lenders of last resort, and in some countries closely supervise and monitor the performance of their primary cooperatives, there is rarely centralised management over the whole sector.

There are four main implications for modelling the desired and actual lending and deposit cooperative fees based on the model's proposed economic objective of financial cooperatives, which give indications of the optimal decisions that a cooperative can make to increase the welfare of its members. First, it provides a plausible explanation on why cooperatives may not be able to improve the relative welfare of their members and reduce income inequality. Second, and more importantly, it recommends optimal lending and deposit fees that can help the cooperative decision-making, and is more applicable in small cooperatives and cooperatives with homogeneous borrowers. Third, it highlights the desired total credit supply for the members. Finally, it assesses the need and potential of the cooperative to seek external borrowing.

Economic theory and empirical literature provide contradictory predictions on the impact of the financial sector on income inequality. A number of theories suggest that a developed financial sector should boost economic growth and reduce inequality. That is because, theoretically, financial intermediary institutions channel money from those who have surplus savings to those who have high-yield investment opportunities. In that sense, according to the theory of

diminishing marginal returns on capital, low-capital investments should be more preferable to lend as they yield higher marginal returns than high-capital investments, thus low-income people will have the opportunity to benefit from the money channelled through financial intermediaries from wealthy people (Beck et al., 2007; Ben Naceur and Zhang, 2016).[‡] The allocation of capital through the financial sector can also affect the rate of economic growth and the demand for labour, both of which have direct implications on poverty and income distribution (Demirgüç-Kunt and Levine, 2009). However, credit market imperfections distort this process, making financial development only beneficial for those who have sufficient collateral and/or political connections to access bank credit. Constraints on access to capital is a main reason for persistent and increasing income inequality. Low-income populations are usually excluded from the development of the financial sector because information asymmetries discourage banks from lending to them. Overcoming credit constraints will benefit the poor, reduce wealth inequality, enhance growth and improve the efficiency of capital allocation, through allowing low-income populations to exploit productive investment opportunities (Banerjee and Newman, 1993; Galor and Zeira, 1993; Aghion and Bolton 1997; Piketty, 1997).

Greenwood and Jovanovic (1990) propose a non-linear relationship (inverted U-shaped curve) between financial development and income inequality. In the early stage of economic development, trade is unorganised and financial services are nearly non-existent. In the intermediate stage of development, income levels and saving rates increase, and a functioning financial sector begins to be formed, but income inequality widens as the rich start to have preferential access to financial services. Finally, in the maturity stage of economic development, the financial sector overcomes its imperfections and becomes more inclusive, allowing a stable distribution of income and higher growth rates. Galor and Zair (1993: 36) argue that in the presence of credit constraints and indivisibility of human capital investments, initial wealth inequality will have short- and long-run consequences on wealth distribution because only rich agents will be able to afford investing in human capital. Banerjee and Newman (1993: 276) argue that credit-constrained agents will choose their occupations between working for wage or being self-employed, since poor agents are not able to borrow because the credit market is imperfect and consequently they cannot invest in high-yield projects. Wage contracts will

[‡] Banerjee and Duflo (2005: 479-484) provide a general overview of theoretical and empirical evidence for high marginal returns on low-capital investments.

replace credit contracts where wealthier agents hire and monitor poorer agents. Wage rate and occupational opportunities will depend on the initial wealth distribution, and long-run wealth distribution will be determined by occupational choice and wage rate, as well as the savings behaviour of poorer agents. Similarly, Piketty (1997: 173) shows that, in a perfect credit market, the marginal product of capital would only influence the equilibrium interest rate that will be identical across all borrowers irrespective of their initial level of wealth. On the other hand, in an imperfect credit market, unequal initial wealth distribution may result in self-sustaining high interest rates that slow down the rate of capital accumulation for credit-constrained individuals. Aghion and Bolton (1997: 152) argue that even with credit market imperfections, wealth may trickle down if there is high rate of capital accumulation, but that will not be sufficient enough to achieve efficient distribution. They argue that permanent redistribution policies would be needed because one-shot redistribution will not have long-run effects on distribution. In return, redistribution enhances the efficiency of the economy as there will be equal investment opportunities and it will speed up the trickle-down process.

Section 2 present the model setup, the assumed production function and determinants of income. Section 3 describes the dynamics of income distribution in a closed economy with a financial sector that consists of only profit-maximizing investor-owned banks, and the resultant transfer of capital from low-middle income agents to high-income agents. Section 4 examines the dynamics of income distribution when the financial sector consists of a profit-maximizing investor-owned bank and a member-owned cooperative financial institution. Section 5 proposes an economic objective function for financial cooperative institutions and the concluding remarks are in Section 6.

2. Model setup

The model presented here follows Banerjee and Newman (1993), Piketty (1997) and Aghion and Bolton (1997) to a large extent. Assuming a closed economy that has infinite discrete time horizon $t = 0,1,2, \ldots$ and a constant continuum of risk-neutral infinitely-lived population $N = (1,2, \ldots n)$, and at each period t, every individual $n \epsilon N$ has an initial wealth w_t and one indivisible labour unit, and gains income y_t by supplying labour and/or capital. The economy consists of two sectors: a one-good manufacturing sector and the financial sector. The financial

sector consists of two institutions: one is an investor-owned bank, which will be referred to as the *Bank*, and the other type is a financial cooperative, hereafter referred to as the *Cooperative*. The current distribution of wealth is represented by a distribution function $G_t(w)$, and aggregate wealth of the whole economy is W. The economy is divided into three economic classes, and the aggregate wealth of each class can be represented by W_l, W_m and W_h. Where $W_l = \int_0^{w_l} w\, dG_t(w)$, $W_m = \int_{w_l}^{w_m} w\, dG_t(w)$ and $W_h = \int_{w_m}^{w} w\, dG_t(w)$. $G(w_l)$ represents the fraction of low-income population with current wealth equal or below w_l, $G(w_m)$ represents the fraction of middle-income population with current wealth above w_l and equal or below w_m, and $G(w_h)$ represents the fraction of high-income population with current wealth above w_m. Similar to Banerjee and Newman (1993), agents are divided into five groups based on their occupations: inactive, skilled, unskilled, self-employed and capitalist, so that agents of low-income population $G(w_l)$ can be inactive, unskilled or self-employed, and $G(w_m)$ can be inactive, skilled, or self-employed, while $G(w_h)$ can only be inactive or capitalist. To avoid unnecessary complexity, assume a constant proportion for each of the three classes in total population, so that we have only occupational mobility within the same wealth class but no mobility across the classes.

Accumulated wealth of each agent w at any time t is equivalent to her total deposits at the banking sector d and her tradeable assets p^T, so $w = d + p^T$. The quantity of tradeable assets for each agent varies among agents based on their initial wealth, and their values change with time based on changes in their market price. At the end of each period, income y_t is divided between consumption c_t and savings s_t, in the form of additional deposits or additional tradeable assets, which are added to the current wealth to constitute the individual's initial wealth next period, so that $w_{t+1} = w_t + s_t \; and \; s_t = d_t + p_t^T$. I assume a convex savings function following Kaldor (1955: 95), Stiglitz (1969: 389) and Bourguignon (1981: 1469-1470), implying that high-income agents have higher marginal propensity to save than low- and middle-income agents do, and that the propensity to save increases with income, so $s_t = \sigma_i y_t$, with σ_i as the propensity to save, which differs among economic classes.

2.1. Production function

The production function follows the approach of Acemoglu (2003) and Jones (2005) to incorporate both capital and labour-augmenting technological progresses. The aggregate production function is a concave, constant-returns-to-scale function.

$$F(A, K, L) = A_K K^{\alpha} A_L L^{1-\alpha}.$$

K and L are aggregate capital and aggregate labour, and A_K and A_L are the economy's general capital-augmenting and labour-augmenting technological progresses. The parameter A can be thought of as a collection of production techniques available in the economy, and individual agents can choose from a set of $A(a_k^i, a_l^i)$, where $i = \{1,2, \dots, n\}$, $a_k^1 < a_k^2 < a_k^n$ and $a_l^1 < a_l^2 < a_l^n$. In the short-run, high-income agents are already using the optimum production techniques available in the economy (a_k^n, a_l^n), while low and middle-income entrepreneurs are using less advanced technologies than the economy's optimum level of technology. Finally, α is a parameter that lies between 0 and 1 representing the share of capital in the output, and capital does not depreciate. The output generated from each agent's investment has the form of $f(a_k k, a_l l) = a_k k^{\alpha} a_l l^{1-\alpha}$, where l is the number of workers, equals 1 if the agent is self-employed with no workers, and $k = \frac{K}{l}$ is the amount of capital per worker. The production function at both macro and individual level has the characteristics $f(k)$: $f(0) = 0, f'(k) > 0, f''(k) < 0, f'(0) = \infty \; and \; f'(\infty) = 0$, and $f(k)$ can shift because of changes in the adopted production techniques.

In addition, agents are assumed to have heterogeneous skills, so the production function at the individual level is allowed to be stochastic, with $f(k)$ taking different values depending on the probability of success of the investment $p(e)$, which is a function of the level of effort exerted by each individual. The level of effort is defined in more detail below, but generally if the borrower exerted the required effort then $e = 1$ and $e = 0$ otherwise. However, within each income class the weight of idiosyncratic effects will be offset at the aggregate level, and will not critically disturb the mean income of each income class and of the total economy. We can expect $u = y - u'(e)$ to be the individual's indirect utility from investment, where $u'(e)$ is the disutility from exerting the effort e.

2.2. Income determinants

Agents can either borrow b from banks at a lending rate equal to r_b in order to invest and gain (at least) the return on the capital invested $pf(k)$, where k in this case is total capital invested equal to $b + d$; or not borrow and invest only their deposits, in which case $k = d$. In addition, the agent can either be self-employed or hire other workers to carry on the labour effort and pay v wages for l workers. The investments of the self-employed are similar to the investments of high-income capitalists and differ only in their size.

Generally, the individual income if she borrowed the amount b, with interest rate r_b and hired a number of l workers will be $y = pf((d + b)) - (1 + r_b)b - lv$, while if she failed to borrow the required capital she will only gain $y = pf(d)$. If the agent chose to invest, she will not gain returns on her deposits in the form of interest rates r_d but rather as part of the overall investment return $pf(k)$. If the agent chose not to invest and to be inactive, she will only gain returns on her deposits that will be equal to the current deposit rate r_d, and her total return will be equivalent to deposit rate $y = r_d d$. Finally, the agent can work for another agent and gain returns on her deposits in addition to wage v, such that $\underline{v_t}$ is the wage paid for unskilled agents, and $\overline{v}_t$ is the wage paid for skilled agents, while lv is the total wage paid for l workers.

Finally, the minimum accepted wage ($\underline{v}$ for unskilled and $\overline{v}$ for skilled worker) must be higher than the expected return from low-middle income self-employment $pf(\underline{k})$ less safe return from deposits $r_d d$. Therefore, capitalists can choose a wage rate between the return of self-employed low- and middle-investment and the marginal product of labour, and wages will be bounded by

$$pf(\underline{k}) - r_d d < v < a_k a_l (1 - \alpha) k^{\alpha} l^{-\alpha}. \quad (1)$$

Additional capital does not have to yield diminishing marginal returns and agents can have *increasing* or *constant* total growth in output by hiring additional labour or adopting advanced production technology. Accordingly, since high-income agents are using the optimal production technique in the short run, then additional capital can yield increasing or constant growth rates as long as additional labour units balance the marginal returns on capital. Taking the defined wage rate in equation (2.1), then high-income investors can always hire additional workers if the

expected return of a self-employed investment (low or middle) less deposit rates is below the marginal product of labour.

Similarly, new capital for low- or middle-income agents can help the agent to hire one or more workers and again additional units of labour will balance the additional capital. Moreover, the ability to borrow increases low- and middle-income agents' opportunities to enhance their production techniques, by advancing the productivity of their physical or human capital (e.g. modern machinery or individual skills), so they will not be limited to the marginal rate of return of their existing production capacity (as if a_k or a_l were constant). Therefore, I assume that $\forall\, p > 0 :\ f(d+b) > f(d)$ and $f'(d+b) > f'(d)$. Meaning that for low- and middle-income agents, if the probability of success of the investment is above zero, the output of an investment funded by both the agent's deposit and external borrowing will yield higher marginal return than if the investment is funded solely by the agent's deposits, because the loan will shift the production function curve.

The income of each occupation is

$$y_t \begin{cases} y^u = r_d d_t \\ y^e = pf(k,l) - (1+r_b)b - lv \\ y^\omega = v_t + r_d d_t. \end{cases} \tag{2}$$

Where y^u, y^e and y^ω represent the income for inactive agents, entrepreneurs (self-employed) and skilled/unskilled workers, regardless of their income level, the growth in the income of each group will be

$$y' \begin{cases} y'^u = \dfrac{dr_d}{dt} \\ y'^e = pf'(k,l) - r_b - \dfrac{dv}{dt} \\ y'^\omega = \dfrac{dv}{dt} + \dfrac{dr_d}{dt}. \end{cases} \tag{3}$$

Lastly, y_l, y_m and y_h are the incomes of low-, middle- and high-income agents and the distribution of income is represented by a Gini formula that follows Sen (1973: 31), Deaton (1997: 139) and Jenkins (1991: 16).

$$G = 1 + \frac{1}{N} - \frac{2}{N^2 \bar{y}} \sum_{i=1}^{N} h_j y_i.$$

Where N represents the total number of agents, $\bar{y}$ is the mean income of the economy and h_j is the income rank of the income-group j, such that $j = \{1,2,3\}$ and $h_1 = y_h$, $h_2 = y_m$ and $h_3 = y_l$. Therefore, disproportionate growth of income among the classes due to credit market dynamics can be reflected in the Gini formula.

3. Income and wealth distribution with credit rationing

In a first-best credit condition, the ability to obtain capital from a perfect credit market—where there is no moral hazard and asymmetric information—will be entirely based on the feasibility of the investment and not on the value of collaterals, so that no agent will be credit rationed based on her initial wealth (Piketty, 1997: 176). If banks have full information about their clients and there is perfect contract enforcement, then the allocation of productive capital between agents will be independent from the current distribution of wealth, as banks will be willing to lend all agents, regardless of their initial wealth, and without collaterals. Moreover, in a perfect credit market, where there is full competition between lenders, no transaction costs and no borrowing constraints, the lending rate will be equivalent to the marginal rate of return on capital, and agents can borrow any desired amount that enable them to choose the optimum investment using the best production techniques available in the economy. All agents will thus be subject to the same production function of the economy, and because of the diminishing marginal returns assumption, poor agents will experience higher growth rates than richer agents. Therefore, we can expect that "rich agents will lend capital to poor agents so as to equalise the marginal product of capital throughout the economy, overall production units" (Piketty, 1997: 176).

However, in imperfect credit markets, banks cannot directly observe the borrower's behaviour, and they are unable to determine whether the borrower will supply the required high effort $e = 1$ to guarantee the success of the investment or not $e = 0$. The amount of capital that an agent can

borrow has to be relative to the value of collaterals she can provide, and the lender will try to predict the borrower's repayment ability subject to the success and failure of the investment $f(k)$ after borrowing $k - b$ by predicting the level of effort that the borrower will supply. Similar to Stiglitz and Weiss (1981:395-396), after adding the effort exerted by the borrower, the lender expects a return of

$$y_b = \min\{pf(k) + p_{t+1}^T; b(1 + r_b)\}.$$

While the borrower expects a return subject to

$$y_i = \max\{pf(k) - b(1 + r_b) - lv - u'(e); -p_{t+1}^T\}.$$

Therefore, the lender predicts that a borrower will decide to supply the high effort e only if the return of the investment less the effort exerted, wages and the loan repayment exceeds the loss of collaterals. Therefore, I define e to be

$$e = \begin{cases} 1 & \text{if} \quad f(k) + p_{t+1}^T - lv - u'(e) > b(1 + r_b) \\ 0 & \text{if} \quad f(k) + p_{t+1}^T - lv - u'(e) \leq b(1 + r_b). \end{cases} \tag{4}$$

We can predict the expected level of effort exercised by the borrower as a function of the expected return from the investment in case of full success $p = 1$, the value of collaterals, the value of repayments to the lender and disutility of exercising the high effort. The conditions of equation (2.4) shows that the borrower is more likely to exercise high effort if the expected return is sufficiently high to compensate the disutility of work, or if she has high-value assets held as collaterals that she may lose if she failed to repay the loan. Equation (2.4) also shows how the borrower will exercise less effort if the value of the loan repayment is high, as she will gain less from the returns of her effort, and since the repayment increases as the interest rate increases, the lender will expect high interest rates to have negative effects on repayment.

The main instrument to constraint agents from borrowing will be the interest rate, and so we need to calculate what determines the interest rate when the lender cannot predict the borrower's behaviour ex-ante. Interest rates will vary fundamentally between different loan contracts because of the default probability of the borrower, and the monitoring costs to mitigate such risk, assuming each loan bears a proportionate share of the cost of fund r_d and the required profit $\hat{\pi}$

equivalent to the loan size. In addition, $\lambda\frac{\bar{z}}{b}$ reflects the inverse relation between the size of the loan b relative to the average loan size of the bank's portfolio $\bar{z}$ and administration costs λ, because, as Banerjee and Duflo (2010: 63-64) point out, there are fixed costs associated with every contract irrespective of its size. So small loans bear higher proportionate costs than bigger ones. However, each loan has unique monitoring costs m. So the interest rate of each loan contract is determined to cover the cost of fund, monitoring costs, administration or operational costs and the desired net profit of the lender, as follows:

$$r = r_d + \lambda\frac{\bar{z}}{b} + m + +\hat{\pi}. \tag{5}$$

Besides loan size relative to the average loan size of the bank's portfolio $\frac{\bar{z}}{b}$, the main variable that will vary among the agents is the monitoring costs. Monitoring costs will be determined ex-ante based on the expected end-value of the borrower's tradeable assets p_{t+1}^{T} that can be held as collaterals, and lender-borrower relationship, that can be thought of as the *credit social capital* of the borrower acquired either from previous lending contracts with the lender or other social ties between the lender and the borrower. The monitoring costs will be

$$m = \gamma\frac{b}{p_{t+1}^{T}(1-\psi)} - \eta. \tag{6}$$

Recalling that b is the loan amount, p_{t+1}^{T} is the value of the borrower's tradeable assets at the maturity of the lending contract, and the new notation here γ is a coefficient attributed to monitor the uncollateralised part of the loan $\frac{b}{p_{t+1}^{T}}$ (standard leverage ratio). Moreover, ψ represent liquidation costs for selling the tradeable assets p_{t+1}^{T}, and η denotes the lending relationship between the lender and the borrower or the borrower's credit social capital. From equation (2.6), we can formulate a simple relationship between monitoring costs and the size of the loan, wealth and social capital of the agent. Such that, in line with Baxter (1967) and Copeland and Weston (1988: 498-499), we have a positive relationship between monitoring costs and the leverage ratio, implying a positive relationship between the monitoring effort exerted and the size of the loan. At the same time, there is a negative relationship between monitoring costs and the value of

the borrower's wealth (tradeable assets after accounting for liquidation costs)[§], as well as a negative relationship with her social capital.

Equations (2.5) and (2.6) indicate that the lender charges high-leveraged agents who have no or low credit social capital with higher interest rate. In neo-classical settings, high interest rate will reduce the demand for credit. Assuming a risk-averse agent who can truly predict the value of her expected returns, then she will not seek additional credit, in the first place, if the cost of additional capital r_b is higher than her marginal return on capital. Additionally, since high interest rate increases the value of repayments, and given the positive relation between the value of collaterals and the expected effort exerted by the borrower established in equation (2.4), then the lender anticipates that low- and middle-income agents will not have enough incentives to supply the sufficient effort. The probability of the success of their investment will be low (or almost zero). Thus, the ability of an agent to borrow (her credit worthiness) will *completely* depend on her wealth and her social capital, and agents with low wealth and low credit social capital are credit rationed.

This is assuming that there is a minimum capital k^* required for using an advanced production technique (a_k^*, a_l^*), in which low- and middle-income agents need to improve their productivity, whereas without this minimum production technique, production of low- and middle-income agents will be limited to their initial production technology and we can expect diminishing marginal returns to strictly hold. Assume also that the average deposit of low- and middle-income agents is lower than the minimum required capital, such that $d_l < d_m < k^*$. In addition, high-income agents are already using the optimum production techniques available in the economy (a_k^n, a_l^n). Figure (1) suggests future dynamics for wealth distribution if the financial

[§] If $\gamma(b, p_{t+1}^T)$, then the relation with the loan size will be easily predicted as a positive slope curve or straight line $\gamma'(b) > 0$ and $\gamma''(b) > 0$ that is not expected to converge. However, the function $\gamma(p_{t+1}^T)$ is a little challenging to define. Stiglitz and Weiss (1981: 402-405) theorems number 10 and 12 indicate that wealthier borrowers might be more willing to undertake riskier investments. So $\gamma(p_{t+1}^T)$ should take a U-shaped curve, in which low-wealth agents are assigned with high monitoring efforts, and the required monitoring efforts should decreases as the borrower's wealth increases until the borrower's wealth reaches a threshold in which the monitoring efforts assigned to oversee her investment start to increase as her wealth increases. However, I do not find it reasonable here for a U-shape assumption in equation (2.6). Because equation (2.6) considers the cost of liquidating the borrower's collaterals, then there is no reason for monitoring to increase for rich agents, even if the risk of their investments is recognisably high. For instance, consider $p_{t+1}^T(1 - \psi) \geq b$, (e.g. all tradeable assets held as collaterals are cash deposits with zero liquidation costs). Obviously, such a loan is almost risk-free for the lender, and there is no need to increase the monitoring effort for that contract. For that, I expect a downward slope representing a negative relation between coefficient of monitoring efforts and the borrower's wealth $\gamma'(p_{t+1}^T) < 0$ and $\gamma''(p_{t+1}^T) < 0$.

sector consists only of investor-owned banks, where only high-income agents have enough collateral and lending relationships with the bank, and low- and middle-income agents are credit rationed because they do not meet the lending criteria. It predicts that there will be no convergence in the wealth distribution, and aggregate wealth of high-income agents will grow faster than the aggregate wealth of the two other classes and faster than the average wealth of the economy $\overline{w}$. Accordingly, the distance on the vertical axis between the future wealth of high-income agents w_{ht+1} and the future wealth of low- and middle-income agents w_{lt+1} and w_{mt+1} would widen compared to the original distance represented on the horizontal axis for w_{ht}, w_{lt} and w_{mt}.

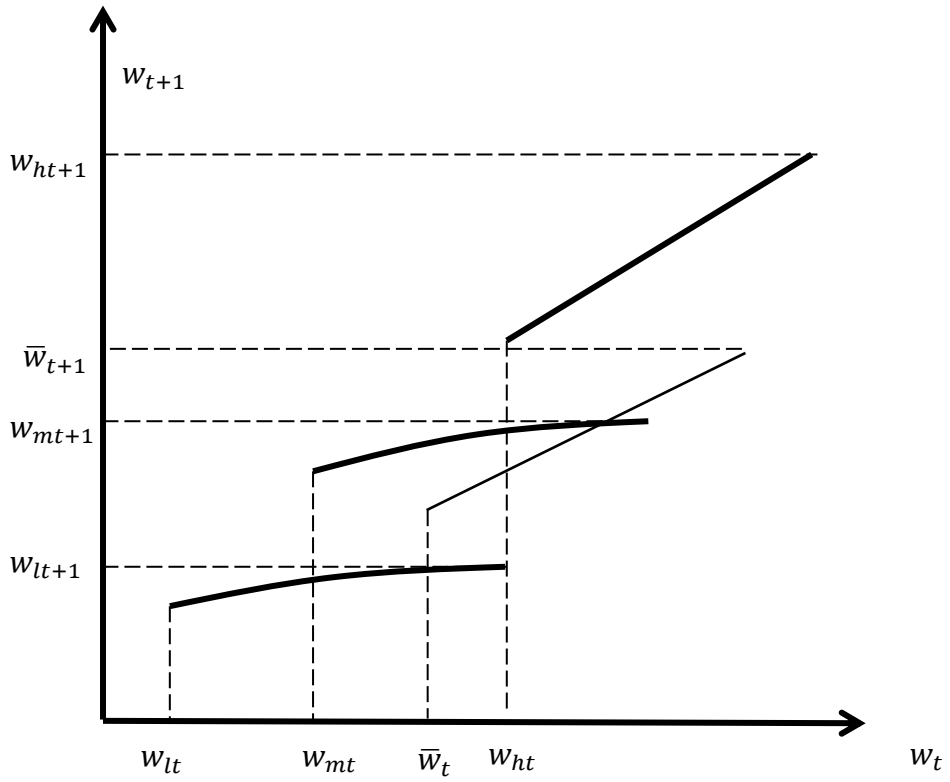

Figure 1. Wealth per income class with financial sector dominated by investor-owned bank

The inability of low- and middle-income agents to raise capital for potential investments restricted their expected income from self-employment and, as a result, from wages as well. Self-employed low- and middle-income agents will be more likely to have diminishing marginal

returns, because investing only their deposits—with their low propensity to save affecting their future investments as well—do not allow them to improve their productivity by using advanced production techniques. If the potential return of low- and middle-income self-employment remained below the marginal return on labour of high-income production (from equation (2.1)), then high-income agents can hire additional workers with wage rates favouring capital owners and thus maintain increasing net-returns—given that they are able to increase both factors of production simultaneously, and profiting from the marginal return on capital as well as the difference between the potential return of low- and middle-income self-employment and the marginal return on labour $y' = f'(\overline{k}) - r_b + f'(l) - [f'(\underline{k}) - r_d]$. Moreover, the convexity of the savings function enables high-income agents to invest a larger portion of their savings in future investments, which increases their capital stock at a rate faster than other classes. Finally, although believing that long-term dynamics are beyond such a simple economic model, even if we assume that the growth of income will reach zero, wealth of high-income agents in a steady state will continue to grow at a higher rate than other classes because wealth w^* when $g_y^* = 0$ is $w^* = [1 + \sigma_i y^*]^n w_{t-n}$. Thus, inequality in wealth distribution will continue to increase because of initial wealth distribution, propensity to save, production techniques and the corresponding initial level of income. In addition, the high rate of capital accumulation can help high-income agents to enhance the optimum production technologies already available. While if low- and middle-income agents remain credit rationed and with low propensity to save, then there will be no reason to assume that they will endogenously be able to accumulate enough capital to enhance their production techniques as well. Such growth in wealth inequality is adjusted, usually in reality, by government interventions or socio-political shocks that redistribute wealth exogenously. In many cases, social and political movements are driven by high inequality levels in the first place, and claim that they intentionally seek to redistribute wealth on a more equitable basis.

Capital transfer

Contrary to the desired and assumed results of a perfect credit market, in an imperfect credit market high-income agents, after utilising all their deposits, will finance their new investments from the deposits of low- and middle-income agents. To simply see that, denote B as the aggregate outstanding loans provided in the economy; $\underline{B}$ represents aggregate loans to low- and

middle-income agents at interest rates $\underline{r}$; and $\overline{B}$ is the aggregate loans provided to high-income agents at interest rates $\overline{r}$, such that usually $\underline{r} > \overline{r}$. Similarly, the aggregate deposits are denoted by D, $\underline{D}$ is low- and middle-income deposits and $\overline{D}$ is high-income deposits, with the same interest rate on deposits r_d. Government expenditures are G, and total taxes are T. Putting R_s to denote the regulatory reserves, then the credit market's balance sheet constraints can be written as $B + G \leq T + D - R_s$, and can further be expanded to

$$\underline{B} + \overline{B} + G \leq \underline{D} + \overline{D} + T - R_s. \tag{7a}$$

When low- and middle-income agents are credit rationed or their share in the credit market is minimal so that $\underline{B} \approx 0$, and when government expenditures exceed tax returns $G > T$, then part of these expenditures will be financed through debt from the credit market at the lowest lending interest rate r^*, and it will have the priority to be financed because it is fully secured. We will denote aggregate government loans as $\hat{B}_g$. Similarly, when high-income agents utilise all or more of their deposits $\overline{B} \geq \overline{D}$, then we will denote additional credit for high-income agents as $\hat{B}_h$. We can then rewrite the balance sheet of the credit market as

$$R_s + \hat{B}_g + \hat{B}_h - \underline{B} \leq \underline{D}. \tag{7b}$$

From this simple representation, it is easy to see that when low- and middle-income cannot borrow from the credit market, and when government expenditures exceed tax revenues and/or when high-income agents utilise all their deposits, then any additional credit for government expenditures or for high-income individuals will be financed by the deposits of the low- and middle-income agents: namely, the deposits of inactive and salaried agents, to stay in line with our initial assumption that self-employed agents invest their deposits while save their tradeable assets. That will be the case even if the marginal return on capital and the interest rate on low and middle-sized investments are higher than the marginal return on capital and interest rates of government expenditures and high-income agents' investments. Because of the high leverage

and low credit social capital of low- and middle-income loan contracts with the bank, the risk associated to these contracts is high and puts pressure on the lending interest rate, keeping $f'(\underline{b}) < \underline{r}$. So, even if $f'(b_g) < f'(\overline{b}) < f'(\underline{b})$, and the return of the banks is $\underline{r} > \overline{r} > r^*$, the bank will still prefer the less risky loan contracts given to the government, followed by high-income borrowers. Another way to express this idea is to think about the net return of the lender (from equation 2.5) when choosing between three loan contracts: for the government, a high-income agent and for a low- or middle-income agent.

$$\pi_b(B) = \max\left\{\underline{p}\underline{b}\underline{r} - \underline{m} - \lambda\frac{\overline{z}}{\underline{b}}\ ;\ r^*\ ;\ \bar{p}\overline{b}\overline{r} - \overline{m} - \lambda\frac{\overline{z}}{\overline{b}}\right\}. \qquad (7c)$$

Although the interest rate on a low- or middle-income loan contract is higher than the interest rates charged for the government or a high-income agent $\underline{r} > \overline{r} > r^*$, the lender will prefer the latter two contracts. This is unsurprising as the probability of success (and repayment) of the government and a high-income agent is higher $p_g > \bar{p} > \underline{p}$ ($\bar{p}_g \cong 1$), and because the monitoring costs of a high-income agent's contract are lower than the costs of a low- or middle-income agent's contract $\overline{m} < \underline{m}$.

4. Income and wealth distribution with financial cooperatives

The type of lender assumed in the previous scenario is similar to traditional investor-owned banks and, as the screening process depends on the borrower's expected return, collaterals and reputation (or relationship with lender), low- and middle-income agents are credit rationed. However, if the lender is less exposed to asymmetric information and moral hazards, then the lending rate can be reduced and more people can have access to additional capital. A financial cooperative can have a comparative advantage over the *Bank* because it is formed locally, targeting a small geographic area, and there is usually a degree of homogeneity and previous social relations between the members themselves (Guinnane, 2001: 370), making the *Cooperative* able to serve some of the agents who were previously credit rationed by the *Bank*.

Since the lending rate is a function of targeted net profit of the lender and monitoring costs, it is reasonable to assume that the interest rate of the *Cooperative* will be lower than that of the

Bank ($r_c < r_b$) for any $b = k - d$. Because, theoretically, the desired net profit of a *Cooperative* is lower than a *Bank* ($\pi_c < \pi_b$), and high social relation with the borrower $\eta_c > \eta_b$. That comes from the fact that financial cooperatives are not-for-profit organisations, and so the desired rate of profit of a financial cooperative per loan π_c is most likely to be lower than the profit of a traditional bank π_{kb}.

In addition, monitoring costs are low for financial cooperatives compared to traditional banks ($m_c < m_b$) because social capital η is high in the *Cooperative* monitoring formula while it is almost zero for low- or middle-income agents dealing with the *Bank*[**]. Angelini et al. (1998) defined two hypotheses under which the *Cooperative* can screen potential borrowers better than the *Bank*. The first one is the *long-term interaction hypothesis*, suggesting that financial cooperatives are more engaged in their communities' social life, and so they have cost-free information that investor-owned banks can obtain by costly monitoring. In addition, cooperatives can rely on "social sanctions" to penalise defaulters (Banerjee et al., 1994; Besley and Coate, 1995; and Angelini et al. 1998). Second is *peer-monitoring hypothesis*, suggesting that members of financial cooperatives have additional incentives to monitor the actions of their peers. That is because members are liable, completely or in part, for the default of any loan taken by other members. If a borrower defaults, then other members lose some of their savings because part of each loan is financed by other members' money. Moreover, the interest paid on the part of the loan that is financed by other members is the income of these members, as returns on deposits, so they have incentive in ensuring that the loan and its interest are paid (Banerjee et al., 1994: 492). Peer monitoring is a mechanism that exists not only in cooperatives but also in similar group lending programs. Stiglitz (1990) demonstrated that by making the individual borrower co-sign his neighbour's loan, peer-monitoring transfers risk from the lender (bank) to the co-signer, and imposes additional risks on the co-signer. A co-signer of a loan agreement is, thus, a borrower him/herself who agrees to guarantee the repayment of a part of his neighbour's loan in case his

[**] In Mersland (2009: 471), out of 586 microfinance institution globally, cooperatives had the lowest operating expense to loan portfolio ratio (OER) and portfolio yield (interest income to portfolio), of 14% and 23% respectively, compared to 20.8% and 34.2% for shareholders banks, and 27.7% and 38.6% for non-profit organisations. Identical results were reported in Tchakoute-Tchuigoua (2010: 440). In Périlleux et al. (2012: 396), cooperatives had the lowest average interest rate per loan and at the same time the highest average deposit rate in the sample. However, in all of these studies, the average loan size of cooperatives was higher than shareholder or not-for-profit organisations, so that low lending rates and operating costs can be associated with the loan size rather than only social capital.

neighbour has defaulted. This joint agreement allows both borrowers to obtain additional funds at lower interest rate, which cannot happen without this agreement. The utility of both borrowers is high only if both of them are successful; but if one borrower fails and the other succeeds, the second borrower's utility will be low, even if his project succeeds. Stiglitz (1990) argues that peer monitoring improves borrowers' welfare, because the lender will compensate the co-signer for undertaking this additional risk by providing a larger loan that will have a higher return when invested in the safe project, and which in return eliminates the borrowers' incentives to invest in the risky project (Stiglitz, 1990: 361).

Hence, if $r_c < r_b$ for any $b = k - d$, and recalling that the level of effort exerted by the agent is the main determinant for the probability of success and is inversely related to the interest rate, then $p_c(e) > p_b(e)$ and $p_c f'(k) - r_c > p_b f'(k) - r_b$, and accordingly:[††]

$$p_c f'(k) - b(1 + r_c) - lv - u'(e) > p_b f'(k) - b(1 + r_b) - lv - u'(e). \qquad (8)$$

Now, if there is $b^* = k^* - d$ with lending rate $r_c(b^*)$ lower than $f'(k^*)$, and $f(k^*) + p_{t+1}^T - lv - u'(e) > b^*(1 + r_c)$, then low- and middle-income agents who can borrow at lending rate $r_c(b^*)$ will escape the concavity of their initial production function and the wage rate of skilled and unskilled workers will increase correspondingly.

However, the division of the economy into three classes imposes two setups with different resulting paths for income distribution with the existence of cooperative financial institutions. The first and idealistic setup is if there is no high disparity in the initial wealth distribution between low- and middle-income agents. Under this assumption, both classes will have nearly the same deposits and tradeable assets to form their cooperatives and benefit from its financial services, as well as attracting external borrowings collectively from the high-income class. Then we could treat both classes as one class from the beginning, which would be less realistic to assume especially in early stages of development, where class differences are substantial compared to later, more developed stages where heterogeneity in wealth and skills may be less

[††] The analysis here focus on the loan size with specific collateral and the corresponding interest rate that the cooperative can provide middle-income agent compared to the bank. However, the cooperative's information and enforcement advantage allows it to provide credit to the members in favourable terms in general, not only interest rates. Guinnane (2001: 379-380) explained how early cooperatives in Germany provided long-term loans with low collaterals relying on co-signers and the locality of cooperatives.

severe between the classes. It is reasonable to assume that only middle-income agents are capable of forming cooperative financial institutions, because establishing a cooperative requires the pooling of a minimum capital and deposits that enable the cooperative to successfully provide financial services and even attract external funding from outside its own members. This is also in line with Bowles and Gintis (1997: 243) and their modelling of workers' cooperatives, which suggests that the number of workers who probably join cooperative firms increases with the wealth of the workers.[‡‡]

[‡‡] Although Jones and Kalmi (2009) have not found a strong statistical correlation between inequality and the formation of cooperative organisations, however, this assumption is still reasonable as the average loan size of cooperatives is reported to be higher than microcredit providers as mentioned earlier in Mersland (2009), Tchakoute-Tchuigoua (2010) and Périlleux et al. (2012).

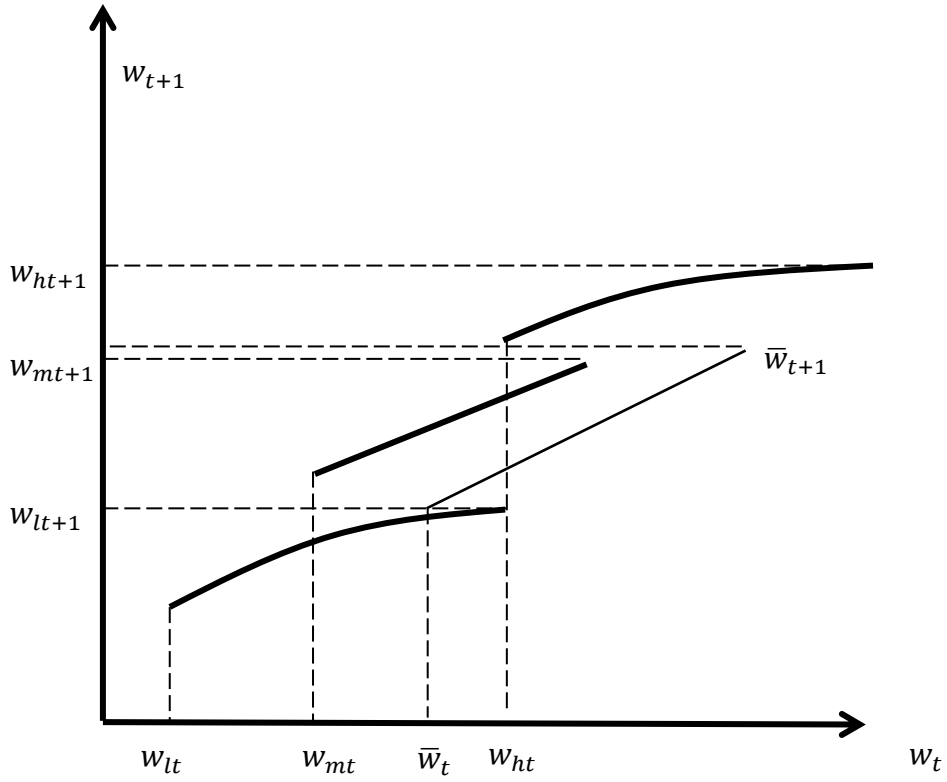

Figure 2. Wealth per income class with diversified financial sector (investor-owned bank and financial cooperative)

If only middle-income agents are able to borrow b^* at lending rate $r_c(b^*)$, figure (2) shows that only middle-income agents will experience a high growing rate of returns, above the average growth of the economy. Moreover, the income and wealth gap will narrow between high- and middle-income agents, because middle-income agents are able to enhance their productivity by better technology or invest in their own human capital. They can correspondingly hire additional workers that compensate for the additional growth of capital. However, the same level of inequality may continue to persist between middle- and low-income agents as long as low-income agents are credit rationed. Their income will increase only for the short or medium run because of increasing demand on labour from middle-income entrepreneurs as well as high-income ones. The low supply of skilled labour—because more middle-income agents prefer to be self-employed—may also motivate high-income agents to invest in the skills of low-income agents and thus improve their productivity and wage rate simultaneously. Nevertheless, in the

absence of targeted policies to channel credit for lower-income agents, by government or civil society, their income in the long run will continue to be limited to their outdated initial production techniques without sufficient capital accumulation to adopt new technologies. For that, it is hard to predict that the introduction of financial cooperatives *alone* will lead the aggregate wealth distribution to totally converge to a steady state where all agents have a nearly similar level of wealth, irrespective of the initial wealth distribution and individual skills. This last argument may apply for middle-income agents as well. If the initial wealth disparity between high- and middle-income agents is too wide and middle-income agents do not have sufficient initial capital to mobilise to form a cooperative, then they will not be able to provide the required capital for their borrowers or entrepreneurs, and will not be able to collectively obtain additional funds from high-class agents. As a result, their wealth will also be limited to the concavity of their initial productivity.

As for capital transfer, a cooperative does not only rely on members' deposits to finance its credit services; it can also mobilise external funds from inside the cooperative system, usually from the regional or national cooperative federation; more rare, but not unheard-of, is for funds to come from similar primary cooperatives. External funds can also come from outside the cooperative system, usually through the federation that can borrow from a financial institution in the credit market. In both cases, because the members of the cooperative are acting as collective debtors and relying on their joint liability, they are able to raise funds at interest rates and credit conditions that would not be available if they approached the credit market individually. External borrowing is crucial also for liquidity mismatch risk (Guinnane, 1997: 252; 2001: 370). Given the ability to approach the bank collectively, and going back to equations (2.7a, b and c), the collective loan contract will be favoured now to the bank compared to the individual's contract. The loan acquired by the cooperative as a whole from the bank is denoted by as $\underline{\hat{b}}$ (e.g. $\underline{\hat{b}} = \sum \underline{b}$, with monitoring effort $\underline{\hat{m}}$ and interest rate $\underline{\hat{r}}$. The size of the collective loan will reduce the monitoring effort compared to an individual loan, thus the interest rate will be lower because of less monitoring effort as well as less administration costs $\left(\lambda \frac{\bar{z}}{\underline{\hat{b}}} < \lambda \frac{\bar{z}}{b}\right)$ and $\underline{\hat{p}} > \underline{p}$ (equations 2.5 and 2.6). It is convenient that the net return of the bank extracted from equation (2.7c) can be:

$$\underline{p}\underline{b}\underline{r} - \underline{m} - \lambda\frac{\bar{z}}{\underline{b}} < \underline{\hat{p}}\underline{\hat{b}}\underline{\hat{r}} - \underline{\hat{m}} - \lambda\frac{\bar{z}}{\underline{\hat{b}}},$$

$$\underline{\hat{p}}\underline{\hat{b}}\underline{\hat{r}} - \underline{\hat{m}} - \lambda\frac{\bar{z}}{\underline{\hat{b}}} \;\geq\; \bar{p}\bar{b}\bar{r} - \overline{m} - \lambda\frac{\bar{z}}{\bar{b}}, \qquad \text{only if } \underline{\hat{r}} \geq \bar{r}.$$

So the net return from a collective loan is certainly higher than a loan to an individual middle-income agent. The second condition states that the return from the cooperative collective loan *can* be more preferred if it carries a higher interest rate than the high-income agent's loan. The ability for the cooperative collective loan to bear a higher interest rate comes from the fact that the individual production function of the agents themselves will still witness high returns, as the condition of $f'(\bar{b}) < f'(\underline{b})$ still holds in the presence of additional capital. Thus, financial intermediation may be able, in this scenario, to channel surplus funds from high-income agents to middle-income ones who can invest it in projects yielding higher marginal returns.

5. Financial cooperative economic objective function

The economic objective of a financial cooperative is to maximise the welfare of its members who are also the owners, by providing financial intermediary services, and not only to maximise its profit, as dividends are only part and not all of the owners' gains. Taylor (1971) argues that financial cooperatives should minimise interest spread, that is, minimise the difference between interest rates charged on loans to members and interest rates paid on members' deposits. Smith et al. (1981) and Smith (1984) suggest that the objective of financial cooperatives is to increase the monetary gains of their members: that is, providing lower interest rates to their borrowers and higher interest rates to their depositors compared to the market rate. In line with all that, since members' wealth is the accumulation of savings from previous yearly incomes, I write the objective function of financial cooperatives as a function of maximizing yearly income of the members by providing higher deposits rates and lower lending rates that compensate the income growth of the rest of the economy. More generally, if we stayed in line with our theory that financial cooperatives have potentials to reduce income inequality, then the economic objective function of a financial cooperative must aim at increasing the income of its members at a rate

higher than the average growth rate of the economy. For example, returns from interests on deposits will be the only source of income for an inactive net-depositor. Thus she will prefer that the rate of change of the interest rate on deposit is not less than the average nominal growth rate of the economy, so that she can improve (or maintain) her wealth ranking in the class structure. Similarly, the increase in income of a net borrower who is a self-employed agent after acquiring additional capital should exceed the average economy's nominal growth rate after paying the interest rates on the loan. Accordingly, the financial cooperative economic objective function will be:

$$V(c) = \sum_{i=1}^{m} [f'(k_i) - r_c - g] + \left[\frac{dr_d}{dt} - g\right]. \qquad (9)$$

Where members are $i = \{1,2, \dots, m\}$ and g denotes the nominal growth of income per capita, $f'(k_i)$ is the marginal return on capital equivalent to the additional return from the loan, r_c is interests paid on the loan (for net-borrowers) and $\frac{dr_d}{dt}$ rate of change of interests gained on deposits (net depositors). It is clear from the equation above that the only two factors that the financial cooperative can alter are the deposit and lending rates. The desired deposit and lending fees are then constrained with following inequalities in order to satisfy the objective function defined above:

$$\frac{d\hat{r}_d}{dt} \geq g,$$

$$f'(k) - \hat{r}_c \geq g.$$

To analyse how a financial cooperative can determine their deposit and lending rates in favour of the members' welfare we will have to link the cooperative's interest rate with a market interest rate that we will consider as the safe investment that the cooperative can make using the money mobilised from its members. We will denote such a market rate as r^*, similar to the above lending rate to the government. Accordingly, the desired deposit rate of a financial cooperative will be $\hat{r}_d = r^* - \hat{\theta}$, and $\hat{\theta}$ is a deposit fee to cover the operational costs of providing depository

services. Similarly, the desired lending rate will be $\hat{r}_c = r^* + \hat{\phi}$, with $\hat{\phi}$ as a lending fee. Therefore $\hat{\theta}$ and $\hat{\phi}$ can be written as:

$$\hat{\theta} \leq r^* - r_{dt-1}(g+1), \tag{10a}$$

$$\hat{\phi} \leq f'(k) - g - r^*. \tag{10b}$$

Such that $r_d = r_{dt-1}(g+1)$. The cooperative has cash flow constrains that dictate its pricing behaviour. We will first define the total deposits as D, total interest bearing assets as I, where $I = (1 - R_s)D$, and R_s is the legal required reserves. Moreover, x is the fraction of I raised by external borrowing, $1 - x$ is the fraction raised by deposits, z is the fraction of I invested in loans, and $1 - z$ is the fraction of I invested in the safe investment (e.g. government securities). And, as earlier, θ and ϕ will denote deposit and lending fees, in addition to a similar representation for fees on external borrowing that will be denoted by δ. Finally, we will put the desired net return of the cooperative with all the operational expenses, which includes salaries, administration costs, loan-loss provisions and interest paid on the legal reserves under one variable. We will call them ε, and calculate it by taking the total amount of expenses and net return as percentage of interest bearing assets. Now we can easily define the cash flow of a financial cooperative similar to DeAngelo and Stulz (2015: 226).

$$z(r^* + \phi) + (1 - z)r^* = (1 - x)(r^* - \theta) + x(r^* + \delta) + \varepsilon.$$

From that we can derive the actual deposit and lending fees.

$$\theta = \frac{z\phi - x\delta - \varepsilon}{x - 1}, \tag{11a}$$

$$\phi = \frac{\theta(x-1) - x\delta + \varepsilon}{z}. \tag{11b}$$

There are four main implications for this simple modelling for the desired and actual lending and deposit cooperative fees. First, it gives a possible explanation for why cooperatives may fall short in improving the relative welfare of their members and reducing income inequality. Second, and more importantly, it recommends an optimal lending and deposit fees that can help

the cooperative decision-making. For instance, if $\hat{\theta} > \theta$ and $\hat{\phi} < \phi$, may be because of industry slow-down or any similar reasons that reduce the potential returns of borrowers, accordingly, equation (2.11b) suggests that equalizing the actual deposit fees with the desired on $\hat{\theta} \approx \theta$ will simultaneously reduce the actual lending rate, thus compensating for the expected reduction in the borrower's returns. A further example may be that it shows how deposit and lending rates, and consequently the welfare of members, would change if the operational efficiency ε of the cooperative changed as well. The third implication is to determine the desired total credit to be supplied for the members. The final implication is assessing the need and potential of the cooperative to seek external borrowing.

$$z = \frac{\theta(x-1) - x\delta + \varepsilon}{\phi}, \tag{12a}$$

$$x = \frac{z\phi + \theta - \varepsilon}{\theta + \delta}. \tag{12b}$$

Equations (2.12a and b) suggest optimal loans (z) and/or external borrowings (x) as a percentage of total interest bearing assets (I). Again, combined with equations (2.10 and 2.11) it gives more insights into the optimal decision that a cooperative can make to increase the members' welfare if $\hat{\theta} > \theta$ and/or $\hat{\phi} < \phi$, through increasing/reducing the loan supply and/or external borrowings. In addition, it clarifies the optimal response for the change in the external borrowing rate $r^* + \delta$ due to a change in δ.

6. Concluding remarks

The ability to obtain capital from a perfect credit market—where there is no moral hazard or asymmetric information—would be entirely based on the projected cash flow of the desirable investment, whereas in imperfect credit markets, providing credit depends on the borrower's collaterals and the lender-borrower relationship. If the financial sector consists solely of investor-owned banks, then only high-income agents will obtain additional capital because they have enough collateral and lending relationships with the bank, whereas low- and middle-income agents will be credit rationed. The inability of low- and middle-income agents to raise capital for potential investments restricts their expected income from self-employment as well as from

wages, because they cannot adopt more advanced production techniques or invest in their human capital, so their income will be limited to their initial production technology and we can expect diminishing marginal returns to strictly hold. Moreover, high-income agents can hire additional workers at wage rates that favour capital owners, thus maintain increasing net returns if the potential return of low- and middle-income self-employment remained below the marginal return on labour of high-income production. High-income agents will be able to increase both factors of production simultaneously, and because of the convexity of the savings function, they will increase their capital stock at a rate faster than other classes. Thus, the aggregate wealth of high-income agents will grow faster than the aggregate wealth of the two other classes and faster than the average wealth of the economy.

When government expenditures exceed tax revenues and/or when high-income agents utilise all their deposits, then any additional credit for government expenditures or for high-income individuals will be financed by the deposits of the low- and middle-income agents. Cooperative financial institutions are expected to be less exposed to asymmetric information and moral hazards, and are thus more able to lend middle-income agents the required capital to upgrade their production function at an interest rate lower than the marginal product of capital. The potential of financial cooperatives to reduce income inequality depends on their ability to increase the income of their members at a rate higher than the average nominal growth rate of the economy. Since only middle-income agents are able to mobilise enough deposits to form a cooperative, low-income agents will remain credit rationed and the financial sector alone cannot achieve full convergence in income distribution. In conclusion, it is therefore important—especially for less developed economies—to advocate and promote the creation and growth of well-functioning member-owned financial institutions, rather than just pushing towards more financialisation as an end by itself and not as a means for inclusive prosperity.

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