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Financial Liberalization and Income Inequality: Theory

“Without better knowledge of the trends in secular income structure and of the factors that determine them, our understanding of the whole process of economic growth is limited; and any insight we may derive from observing changes in countrywide aggregates over time will be defective if these changes are not translated into movements of shares of the various income groups.” (Kuznets, 1955)

3.1 Introduction

Financial liberalization is often regarded as a culprit for rising income inequality. This is curious given the lack of research on the impact of financial liberalization

24 This chapter is based on Bumann, S. and Lensink, R. (2015), Financial Liberalization and Income Inequality, mimeo, University of Groningen.
on income distribution. Especially the developments related to the global financial and economic crisis have raised renewed concerns about growing income inequality within countries and the differential effects of financial liberalization across income levels, leading to calls for more empirical and theoretical research on the relationship between financial liberalization and income inequality (Atkinson and Morelli, 2011).

Previous theoretical research has investigated various determinants of income inequality, such as labor markets (Gordon and Dew-Becker, 2008; Checchi and Garcia-Peñalosa, 2010), finance (Greenwood and Jovanovich, 1990; Galor and Zeira, 1993), technological change (Acemoglu, 2002; Card and DiNardo, 2002) and institutions (Acemoglu et al., 2013). Theoretical research on the impact of financial liberalization on income inequality is scarce though. This chapter seeks to contribute to this latter research strand.

A major concern with financial liberalization is that its benefits will not be shared equally, and that income inequality will increase. Needless to say, it is beyond the scope of this chapter to study all types of financial liberalization. Instead, we focus on reductions in reserve requirements and capital controls. We think of these policies as reforms that improve the efficiency of the domestic banking sector.

We develop a tractable model that features agents with varying investment abilities and a banking sector. The financial regulator affects banks by setting reserve requirements and by restricting the amount of foreign funds that can be used to finance domestic loans. These two policy interventions give rise to a wedge between the interest rate on deposits and the cost of borrowing. Financial liberalization means a reduction in this wedge. In other words, we consider the impact of financial liberalization on income inequality via banking sector efficiency, because a reduction in the wedge implies a lowering of the implicit taxation of the banking sector. The change in the wedge influences the choices of individuals. For example, more individuals find it optimal to invest due to lower borrowing cost. Moreover, the incomes of savers and borrowers are affected, translating into income inequality changes. The extent of inequality is summarized in terms of the Gini coefficient that ranges between zero and one. A value of zero
means that everyone has exactly the same amount of income. By contrast, a value of one indicates that one person earns all the income and everyone else nothing.

The early advocates of financial liberalization argued that a competitive financial system should support reductions in income inequality better than a repressed system. Under financial repression directed credit was often heavily subsidized and larger borrowers took advantage of privileges. Moreover, low interest rates spurred corruption and the turning of credit to influential parties (World Bank, 2005). Against this background, McKinnon (1973) and Shaw (1973) suggested that domestic financial liberalization is desirable.

There exists a large body of literature that provides insights into how eliminating different forms of financial restrictions would affect savings, investment, and growth. The inequality problem is generally overlooked though. Most models implicitly presume that the proceeds of financial liberalization are shared in a fair manner. This presumption is very superficial and seems inconsistent with the experiences of many countries over the past decades.

A notable exception is the model by Giné and Townsend (2004). The authors think of financial liberalization as policies that target interest rate controls such as the reduction of excess capitalization requirements, less restricted licensing requirements and enhanced ability to open new branches. Thus, financial liberalization means improved credit access, which tends to reduce inequality. It is assumed that the financial sector expands at a fixed rate, implying that the depth of the financial sector is entirely exogenous. However, this last point seems intriguing because financial liberalization may be a determinant of financial depth (Chinn and Ito, 2006). Compared with Giné and Townsend (2004), this chapter considers the impact of financial liberalization on income inequality and (partly) via financial depth.

Financial liberalization may refer to a variety of interventions such as the removal of entry barriers for new financial institutions, privatization of financial institutions, lifted restrictions on capital accounts and the reduction of reserve requirements (Abiad et al., 2010). As mentioned above, this chapter focuses on liberalizing reserve requirements and the capital account, which are arguably the most relevant areas of intervention. In 2010, according to IMF data, more than 90 percent of central banks required their commercial banks to maintain a certain
proportion of assets as reserve balances (Gray, 2011). Especially in economically weak countries, reserve requirement policies are often complemented by capital controls since foreign borrowing could undermine governments’ ability to control domestic funds and exchange rates (Agénéor and Montiel, 2008). Over time, governments have (gradually) reduced reserve requirements and capital controls. Although considerable differences across countries persist (Abiad et al., 2010).

The chapter proceeds as follows. Section 3.2 describes our theoretical framework and provides an overview of the previous literature. Section 3.3 presents our model. Section 3.4 analyzes the impact of financial liberalization on income inequality. Section 3.5 discusses our findings and concludes.

### 3.2 Analytical Framework and Literature Survey

As noted above, there does not exist much literature about the impact of financial liberalization on income inequality. By contrast, the effect of financial liberalization on economic growth has been extensively researched. We intend to use this latter strand of literature to guide our own analysis of the liberalization-inequality nexus. This approach is motivated by the fact that income inequality is one step forward from economic growth since it bears on the question of how the proceeds from economic growth are being distributed among individuals in an economy.

A good starting point is the seminal paper by Pagano (1993) on finance and growth. Using a simple endogenous growth model, the so called AK model, he derives that economic growth $g$ is determined by:

$$g = A\phi s - \delta,$$

with $A$, $s$, $\phi$ and $\delta$ denoting technological progress, the savings rate, the proportion of saving not lost in the process of financial intermediation and the depreciation rate, respectively.\(^{25}\) Increases in $\phi$ and $A$ reflect improvements in

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\(^{25}\) This approach is also broadly in line with Levine (2005) who refers to five different functions of financial systems. These functions are: 1) Producing information and allocating capital, 2) monitoring firms and exerting corporate governance, 3) risk amelioration, 4) pooling of savings, and, 5) easing the exchange of goods and services (Levine, 2005).
banking sector and allocative efficiency. A rise in $s$ implies greater financial depth in the sense of an expanded financial sector, as measured by the amount of credit.

Our theoretical model will focus on the effect of financial liberalization on banking sector efficiency and financial depth. The details of this link will be outlined in the next section when we describe our model. Here, we only would like to provide the reader with a general idea about our approach.

We assume that the primary effect of financial liberalization is on banking sector efficiency. The extent of banking sector efficiency is captured by the wedge between the cost of borrowing and the interest rate on deposits: the lower the wedge, the greater banking sector efficiency is. Concerning financial depth, we will distinguish two cases: first, we will study an economy where financial depth is exogenous and, second, we will assume that financial depth is driven by financial liberalization. Figure 3.1 summarizes the two different cases. Whereas the left panel represents the model with constant financial depth, the right panel depicts the model where financial depth is a function of financial liberalization.

Figure 3.1: Framework for analyzing the impact of financial liberalization
We proceed by discussing the relevant literature on financial liberalization, financial depth and income inequality.

**Banking sector efficiency ($\phi$)**

The wedge (or spread) between the cost of borrowing and the interest rate on deposits is a typical measure of banking sector efficiency. A narrow interest rate wedge is indicative of low transaction costs, reducing the cost of funds for investment. Low investment costs are crucial for economic growth.

Such a wedge can stem from distortions in the interest rate on deposits and/or borrowing cost. According to McKinnon (1973) and Shaw (1973), financially repressive policies, which are characterized by government controlled interest rates and substantial amounts of reserves held by banks, lead to negative real interest rates on deposits. As a consequence, funds are being withdrawn from the banking sector, reducing the amount of credit available for investment. In line with the McKinnon-Shaw view, a liberalization of the financial system potentially raises interest rates, promoting savings. More savings eventually increase the quantity of domestic investments. Concerning the cost of borrowing, these may fall in the wake of capital account liberalization due to enhanced opportunities for risk diversification (Stulz, 1999; Henry, 2000; Bekaert and Harvey, 2000). Thus, the interest rate wedge tend to decline with financial liberalization.

**Financial depth ($s$)**

Different strands of literature study the impact of financial liberalization on financial depth. To begin with, the neoclassical literature has primarily been concerned with the effect of financial liberalization on the amount of saving and credit for investment. A theoretical argument for such a quantity effect of financial liberalization is that the removal of interest rate restrictions (implying improved banking sector efficiency) promotes saving and credit for investment (McKinnon, 1973; Shaw, 1973). Furthermore, financial liberalization improves credit availability due to foreign bank entry because foreign banks are less prone to government pressure to lend to preferred sectors (Agénor, 2003) and have access to international capital markets (Levine, 1996).
Whereas the neoclassical literature assumes that financial liberalization has a positive effect on financial depth, the second strand of literature shows that financial liberalization might undermine financial depth. This literature focuses on the role of information asymmetries in banks’ decisions. Information asymmetries can have different sources. For example, lenders may lack information about how much the borrowing firm has produced, giving rise to contracting problems (Townsend, 1974; Diamond, 1984; Greenwood et al., 2010). But information asymmetries can also occur prior to contracting and investing, resulting in adverse selection (Stiglitz and Weiss; Boyd and Prescott, 1986).

Models that incorporate asymmetric information generally find that the impact of financial liberalization on financial depth is ambiguous. On the one hand, financial liberalization intensifies competition among financial institutions, pushing improvements in the infrastructure of the financial sector. As a result, the degree of asymmetric information falls, raising the amount of credit (Stulz, 1999; Stiglitz, 2000; Claessens et al., 2001). On the other hand, more competition among banks could aggravate the problem of asymmetric information. For example, declining interest rate margins could encourage banks to economize on screening and monitoring efforts. In order to avoid greater risk exposure, banks might respond to competition by restricting firms’ credit access (Petersen and Rajan, 1995). The effect could vary across industries and firm sizes though. Whereas foreign bank entry may drive up credit availability for firms with a high ability to signal their quality, more competition may ration credit in more opaque industries (Dell’Ariccia, 2001). Financing to small firms might be hampered by liberalization, if domestic relationship lenders are replaced by foreign entrants (Detragiache et al., 2008; Beck et al., 2014).

There is a third strand of literature arguing that financial liberalization may impede financial deepening in developing countries. The so-called New Structuralist theory assumes that the informal financial sector is often very competitive and may play an important role in the process of financial

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26 Financial institutions such as banks play a pivotal role in mitigating these frictions as they can be mandated to monitor borrowers (Townsend, 1974; Diamond, 1984) or produce information themselves (Leland and Pyle, 1977; Boyd and Prescott, 1986).
intermediation (see, e.g., Van Wijnbergen 1983; Taylor 1983). Financial liberalization, in the form of interest rate deregulations or reductions in reserve requirements, will only lead to a reallocation of funds from the informal sector such that the total supply of funds available for investment does not increase, cancelling out the effects of financial liberalization. Bencivenga and Smith (1992) show that the claim made by the New Structuralist theory may indeed hold. However, they also show that financial liberalization may still be optimal owing to its positive effect on risk sharing.

**Allocative efficiency (A)**

Even though we do not consider allocative efficiency in our theoretical model, we provide a short account of this literature for reasons of completeness.

Research has shown that the impact of information asymmetry extends beyond financial depth to allocative efficiency. Therefore, if financial liberalization reduces information asymmetry, it can help financial institutions identify the most productive technologies (Greenwood and Jovanovic, 1990). In addition, it can promote the creation of new businesses (King and Levine, 1993; Blackburn and Hung, 1998; Acemoglu, et al., 2003).

A negative example of how financial liberalization might undermine allocative efficiency is given in Dell’Ariccia (2001). In his model, increased competition among foreign and domestic banks could undermine credit availability for companies that have high monitoring costs such that funds get distracted from those companies. As a consequence, worthwhile projects might not be undertaken.

**Income inequality**

Whereas this chapter studies the impact of banking sector efficiency and financial depth on income inequality, previous theoretical research has mainly looked at financial depth. One theme that seems to emerge from this literature is the conditional nature of the link between income inequality and financial depth. An

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27 The standard perspective on financial liberalization neglects the possibility of informal financial markets. Implicitly, it is assumed that informal markets are highly inefficient, characterized by monopolistic money lenders, and do not play a role for the financing of investments.
early contribution was made by Greenwood and Jovanovic (1990). In their model, financial depth is reflected in financial intermediaries’ ability to generate information about investment projects. Due to information frictions, joining those financial intermediaries is costly. In the process of economic development, more individuals can afford to join intermediaries though. On the one hand, this enhances the allocation of resources, but on the other hand, income inequality widens. However, as the economy develops further, the income distribution eventually stabilizes.

In related research, scholars have pointed out that greater financial depth may stimulate funding to poor individuals. In the presence of capital market imperfections, the initial wealth distribution determines access to financial resources for investment. Therefore, stimulating funding to talented individuals who were previously faced with binding credit constraints can induce economic development (see, e.g., Galor and Zeira 1993; Aghion and Bolton 1997; Aghion et al. 1999).

Demirgüç-Kunt and Levine (2009) survey the mechanisms by which financial depth potentially affects income inequality. They point out that the distributional effects of financial depth mainly depend on whether financial deepening operates on the extensive or the intensive margin. If financial deepening acts on the intensive margin, the direct use of financial services by individuals who used to be excluded from these services increases. In this case, financial deepening eventually reduces inequality. By contrast, financial deepening with respect to the intensive margin means that primarily households already using financial services take advantage. Consequently, financial deepening leads to a concentration of funds with rich individuals, entailing a rise in inequality.

This section has described links among financial liberalization, banking sector efficiency, financial depth and income inequality. The discussion suggests that the way in which efficiency improvements affect income inequality is not immediate since it might be influenced by other factors such as asymmetric information that give rise to credit constraints. Especially in view of this last point, the consideration of financial liberalization and financial depth within a joint
framework appears sensible, because the latter could influence the impact of financial liberalization.

### 3.3 Model

In this section, we develop a simple two-period model featuring a banking sector and heterogeneous agents. In period one, agents work and/or invest, while in period two, they consume their proceeds, consisting of their income plus either the return on investments net of borrowing costs or the return on savings. Households only access the capital market via banks. Furthermore, there is no uncertainty regarding wages or interest rates. Given this simple set-up, the time dimension does not matter which means we omit time subscripts from our notation.

#### 3.3.1 Banking Sector and Financial Liberalization Policies

We consider a consolidated commercial banking sector. Banks issue loanable funds in the form of domestic deposits $D$ and foreign deposits $F$. Assets include loans to investors $L$ and required reserves $R$. A typical bank balance sheet reads as:

\[
L + R = D + F
\]

We ignore equity as it would complicate the model enormously without providing additional insights concerning the policies we are considering here.

We incorporate two types of policies. First, we assume that the government sets required reserves. In developing countries, they are often imposed by weak governments that lack the power to raise sufficient tax revenues. Reserves imposed on banks therefore can secure demand for low-interest paying government funds (Agénor and Montiel, 2008). But because reserve balances are generally not being remunerated, they constitute an implicit tax on the domestic banking system. In practice, some countries set reserve requirements on both domestic and foreign deposits, some only on domestic deposits. In our model, for reasons for convenience, required reserves are a fixed fraction, $1 - h$, of total domestic deposits:
\[ R = (1 - h)D \text{ with } 0 < h < 1. \tag{3.2} \]

An increase in \( h \) implies a reduction in reserve requirements, that is, less financial repression and, hence, a larger degree of financial liberalization.

Second, we assume that the government imposes impediments to international capital mobility such that domestic agents are constrained in borrowing from abroad. Especially in developing countries reserve requirement policies are often being complemented by capital controls in order to prohibit domestic investors from borrowing internationally, because the shift to foreign funds may undermine the government’s ability to hold sway over domestic funds (Agénor and Montiel, 2008). Also, capital controls are often installed to control swings in asset prices. Moreover, we assume that, owing to inferior knowledge about domestic projects, foreign lenders do not lend directly to domestic agents. Instead, foreigners make deposits at the domestic bank. Thus, all foreign capital flows take place through the domestic banking sector. In line with von Hagen and Zhang (2008), we allow the government to set the proportion of domestic loans that can be financed by foreign funds such that:

\[ F = aL \text{ with } 0 < a < 1, \tag{3.3} \]

with parameter \( a \) denoting the intensity of capital controls. An increase in parameter \( a \) corresponds to financial liberalization. A closed capital account, with \( a = 0 \), means that all loans need to be financed by means of domestic funds.

The interest rate on foreign deposits \( r_f \) is exogenously given and assumed to be always below the exogenous interest rate on domestic deposits \( r_d \). As a result domestic banks prefer to finance loans by means of foreign funds. However, because of capital controls, banks may only obtain a fraction of their domestic lending from abroad.

The banking sector is assumed to generate zero profits. Taking into account that required reserves are not being remunerated, the zero profit condition of banks reads as:

\[ r_iL = r_dD + r_fF, \tag{3.4} \]
with \( r_l \) being the interest rate at which banks lend money. Using equations 3.1 to 3.3, the previous equation can be rewritten as:

\[
    r_l = \frac{(1-a)}{h} r_d + ar_f. \tag{3.5}
\]

Equation 3.5 shows that, for a given interest rate on foreign deposits, financial liberalization alters the wedge between the interest rate on domestic deposits and the costs of borrowing. Both a lowering of reserve requirements (increase in \( h \)) and international capital controls (increase in \( a \)) decrease the wedge. Since we are not interested in the impact of changes in the foreign interest rate as such, and because the foreign rate is exogenous, we set it at zero for reasons of convenience.\(^{28}\) Hence, equation 3.5 simplifies to:\(^{29}\)

\[
    r_l = \frac{(1-a)}{h} r_d. \tag{3.6}
\]

The lending rate \( r_l \) and interest rate on deposits \( r_d \) are jointly determined by equation 3.6.

For reasons that will become clear later on, we formulate the following relationship between \( r_l \) and \( r_d \):

\[
    r_d = br_l, \text{ with } b \equiv \frac{h}{1-a}, \text{ } 0 < b < 1. \tag{3.7}
\]

Expression 3.7 implies that the relationship between \( r_d \), and \( r_l \), can be summarized in terms of the financial liberalization parameter \( b \). This parameter can be understood as a wedge between the two interest rates: a rise in \( b \), representing financial liberalization, means the wedge has declined.

\(^{28}\) The key insights of the model do not change under the assumption that \( r_f=0 \), it only facilitates the calculations.

\(^{29}\) It should be noted that the market clearing condition changes in the case of full liberalization of international capital controls, which is represented by \( a=1 \). If \( a \) is strictly below 1 (\( 0 < a < 1 \)), the interest rate on domestic deposits will exceed the one on foreign deposits (\( r_d > r_f \)). As a result, the entire demand for deposits by domestic agents will be held in the form of domestic deposits (\( D \)), and the domestic deposit rate will clear the capital market. The total demand for foreign currency denominated deposits is regulated by the government and set to \( aL \). When \( a=1 \), the interest rate on domestic deposits \( r_d \) will be determined by the exogenously given interest rate on foreign deposits \( r_f \). Total demand for domestic deposits will then become zero. The corresponding demand for deposits by domestic agents will be met by foreign-currency denominated deposits \( F \). In this case the capital market will be cleared by adjustments in demand for foreign denominated deposits by foreigners such that \( L=F \) (note that \( R=0 \) and \( D=0 \), if there are no controls on international capital).
3.3.2 Private Agents

The economy is inhabited by a continuum of private agents. At the beginning of the first period, all agents are endowed with the same labor income $w$ but differing abilities to produce investment projects $\phi$. In line with Kunieda et al. (2014), $\phi$ is uniformly distributed over $[0,1]$. Each agent knows her own ability. An agent who invests the amount $k$ will be able to sell $\phi k$ investments goods to the final production sector at price $q$. This means $q$ is the price of capital which equals the marginal product of capital, if the production sector features perfect competition. For reasons of convenience we normalize $q$ to one. The normalization does not affect our results, because $q$ is exogenous. In turn, parameter $\phi$ can be interpreted as the marginal product of investment of the private agent.

Each agent faces the following budget constraint:

$$w + l = d + k,$$

(3.8)

with $l$ and $d$ referring to individual borrowing and saving, respectively. Individual investments $k$ are always positive. Recall that $w$ is labor income.

We assume that information asymmetries between the bank and its clients give rise to borrowing constraints such that the maximum amount of individual borrowing $l$ is linearly related to initial wealth:

$$0 \leq l \leq \nu w, \text{ with } \nu \geq 0.$$

(3.9)

We interpret parameter $\nu$ as financial depth. A larger $\nu$ means that per unit of additional wealth, individual borrowing increases by $\nu$.

3.3.3 Maximization

Agents aim at maximizing consumption in the second period. Thereby, they face the following options. First, they can deposit their labor income $w$ at the domestic bank, earning interest $r_d$. Second, they may invest $w$, yielding a return equal to the individual marginal product of investment, $\phi$. Third, they may borrow from banks...
and then invest the sum of the loan and labor income, again earning a return $\phi$. The cost of borrowing equals the domestic lending rate $r_l$. We assume that the interest rate on deposits $r_d$ is always below the cost of borrowing. This means an agent will only borrow for productive reasons, or in other words, for financing capital investments. This also implies that individual demand for domestic deposits $d$ cannot exceed initial wealth.

Formally, each agent maximizes the following function:

$$\max_{d, l} (\phi k + r_d d - r_l l).$$  \hfill (3.10)

Expression 3.10 needs to be maximized subject to the two constraints in equations 3.8 and 3.9.

The solution to this problem yields two thresholds, namely, $T_1 \equiv r_l$ and $T_2 \equiv r_d$. The reader should note that the two thresholds are linked via the financial liberalization parameter, $b$, because above we showed that $r_d = br_l$, implying $T_2 = bT_1$. The thresholds characterize three types of agents, whose choices regarding saving, borrowing and investing are described below.

First, if an agent’s investment ability exceeds the cost of borrowing, $\phi > T_1$, the agent chooses to borrow as much as possible. The loan size is set at the maximum level, the demand for domestic deposits equals zero, and investment equals labor income plus total borrowing:

$$l = vw,$$
$$d = 0,$$
$$k = (1 + v)w.$$ \hfill (3.11)

Second, if an agent’s investment ability is below the domestic deposit rate, $\phi < T_2$, she will store her labor income in the form of domestic deposits:

$$l = 0,$$
$$d = w,$$
$$k = 0.$$ \hfill (3.12)

For this agent, the return on savings exceeds the marginal product of investment, inducing her to save.
Third, if an agent's investment ability lies between the two thresholds, $T_2 < \phi < T_1$, she will invest her labor income and not demand any deposits, because the return on investment is higher than the return on savings:

\begin{align*}
l &= 0, \\
d &= 0, \\
k &= w. \tag{3.13}
\end{align*}

For this group, the marginal product of investment, $\phi$, is below the cost of borrowing such that these agents choose not to borrow.

Given that agents' ability is uniformly distributed over $[0,1]$, the proportion of borrowing investors equals $1 - T_1$, that of savers is $T_2$, and the proportion of agents who invest their labor income and do not borrow amounts to $T_1 - T_2$.

### 3.3.4 Capital Market Equilibrium

Given individual agents' choices of savings, borrowing and investment, we can now derive expressions for the aggregate demand and supply of funds. Then, we will determine the capital market equilibrium condition. In line with our discussion in section 3.2, we will consider two different closures of the model (see figure 3.1).

First, we will assume that financial depth $v$ is constant. Second, we will allow $v$ to adjust. The first case implies that there is only an efficiency effect of financial liberalization. Recall that efficiency is characterized by the wedge $b$ between the interest rates $r_l$ and $r_d$. In the second case, financial liberalization increases financial depth $v$, in addition to its efficiency effect. In particular, we will assume that the change in financial depth is such that borrowing cost remain constant. As we will see, the two different cases give rise to different effects of financial liberalization on equilibrium income inequality.

We are aware of the fact that the relationship between financial liberalization and financial depth is not necessarily positive. Nevertheless, we think that
analyzing the impact of financial liberalization on income inequality under the assumption of a positive link is an important first step.31

Using expression 3.11, the total aggregate demand for loans is given by:

\[ L = \int_{T_1}^{1} vw \phi = vw(1 - T_1) \]  

(3.14)

Using expression 3.12, the total aggregate supply of deposits equals:

\[ D = \int_{0}^{T_2} wd\phi = wT_2. \]  

(3.15)

Next, we can insert the expressions for \( L \) and \( D \) into the aggregate balance sheet condition, \( D + F = L + R \), or, \( D + aL = L + (1 - h)D \). Taking into account the relationship between the two thresholds, \( bT_1 = T_2 \), the equilibrium in the capital market reads as:

\[ vw(1 - T_1) + (1 - h)wbT_1 = wbT_1 + avw(1 - T_1). \]  

(3.16)

We can rewrite equation 3.16 as \((1 - a)vw = (1 - a)vT_1w - hbt_1w.\) After dividing through by \((1-a)\) and some rearranging, this equation becomes:

\[ vw(1 - T_1) = wbT_1. \]  

(3.17)

The left-hand side shows the demand and the right-hand side the supply of funds. The effect of financial liberalization, captured by a rise in parameter \( b \), is that more funds for borrowing become available. For example, an increase in parameter \( a \), meaning capital account liberalization, leads to additional funds from foreign depositors. In a similar vein, a rise in parameter \( h \), implying less strict reserve requirements, allows banks to extend a larger proportion of deposits as loans. Since both types of policies have the same qualitative impact, we restrict our analysis to the overall degree of financial liberalization \( b \). Investigating the two policies separately will not affect our conclusions.

As mentioned above, we consider two different closures of the model. Recall that in the first case \( v \) is assumed to be constant. In order to equate the demand and supply of funds following a financial liberalization, additional agents must become borrowing investors, which is brought about by a decrease in the

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31 As discussed in section 3.2, financial liberalization may impede financial depth in the presence of information asymmetries or informal financial sectors.
threshold $T_1$. A smaller threshold $T_1$ corresponds to a decline in the borrowing cost $r_l$ (recall that we have defined $T_1 \equiv r_l$ and $T_2 \equiv r_d$). As a consequence, more agents find it optimal to borrow and invest. In the second case, $v$ is endogenous to financial liberalization. This means, following a financial liberalization, the amount borrowed per individual increases, which we call financial depth. In this situation the borrowing cost stay constant.

**Case 1: adjustment in threshold parameter $T_1$**

We rearrange equation 3.17 for threshold $T_1$:

$$T_1 = \frac{v}{v+b^2}. \quad (3.18)$$

The derivative of $T_1$ with respect to $b$ is:

$$\frac{dT_1}{db} = \frac{-2bv}{(b^2+v)^2} < 0. \quad (3.19)$$

This derivative is negative which means that financial liberalization (an increase in parameter $b$) leads to a decrease in the threshold and, thus, a decline in the borrowing cost $r_l$.

The derivative of threshold $T_2$ with respect to $b$ is given by:

$$\frac{dT_2}{db} = \frac{v(v-b^2)}{(b^2+v)^2} \leq 0, \quad (3.20)$$

which can be positive or negative. But if financial depth is high with $v > b^2$, financial liberalization increases the interest rate on deposits. Thus, the impact of financial liberalization on $r_d$ depends on the level of $v$. We will pay special attention high and low levels of financial depth in the following analysis.

The reader should note the link between aggregate and individual effects of financial liberalization. At the aggregate level, financial liberalization leads to changes in thresholds $T_1$ and $T_2$ (or interest rates since $T_1 \equiv r_l$ and $T_2 \equiv r_d$) as shown in equations 3.19 and 3.20. Individuals take these changes as given. In order to restore the optimality of their consumption choices, agents may reallocate to the neighboring group. For example, savers become investors, and investors move to the top group. Movements in the opposite directions are also possible.
This means interest rate changes translate into changes in the proportions of savers, $T_2$, investors, $T_1 - T_2$, and borrowing investors, $T_1$.

Figure 3.2 illustrates the effect of financial liberalization on the equilibrium borrowing cost and deposit rate when financial depth is low. In the right panel, the downward sloping curve presents the demand for loans ($L = vw(1 - r_l)$), while the upward sloping curve displays the net supply of funds (demand for deposits minus reserves plus foreign funds: $NS = b^2 r_l w$). The equilibrium borrowing cost is given at the intersection of the two curves. An increase in the level of financial liberalization, $b$, raises the net supply of funds for private lending resulting in an upward rotation of the net-supply curve. Note that $v$ is constant, implying that the additional funds are used by agents who move from the second group (agents who only invest their initial wealth) to the group of borrowing investors. The left panel depicts the relationship between the two interest rates, $r_d = br_l$. An increase in $b$ leads to a clockwise rotation of the $r_l$ line. Low financial depth means that the interest rate elasticity of loan demand is low. Consequently, the decline in the cost of borrowing increases aggregate loan demand less than proportionately. The equilibrium deposit rate therefore declines.

In figure 3.3, the level of financial depth is assumed to be high. As a result, interest rate elasticity is high, implying that the loan-demand curve is flat. Thus, a small decrease in the lending rate will lead to a disproportionate increase in the demand for loans. An important implication is that the change in the interest rate on deposits could exceed the one in the borrowing cost, as shown in the left panel.
Notes: In the left panel, \( r_l = \frac{1}{b} r_d \), and in the right panel, the net supply of funds is given by \( NS = b^2 T_1 w = b^2 r_l w \), and the demand for loans is \( L = v(1 - T_1) w = v(1 - r_l) w \). An increase in \( b \), brought about by a lowering of reserve requirements and/or capital account restrictions, moves both the \( r_l \) curve and the \( NS \) curve, clockwise. The equilibrium in the capital market (right panel) determines the borrowing cost \( r_l \). Given \( r_l \), the interest rate on deposits \( r_d \) can be determined (left panel).

**Figure 3.2: Impact of financial liberalization when \( v \) is low**

Notes: In the left panel, \( r_l = \frac{1}{b} r_d \), and in the right panel, the net supply of funds is given by \( NS = b^2 T_1 w = b^2 r_l w \) and the demand for loans is \( L = v w (1 - T_1) = v w (1 - r_l) \). An increase in \( b \), brought about by a lowering of reserve requirements and/or capital account restrictions, moves both the \( r_l \) curve and the \( NS \) curve, clockwise. The equilibrium in the capital market (right panel) determines the borrowing cost \( r_l \). Given \( r_l \), the interest rate on deposits \( r_d \) can be determined (left panel).

**Figure 3.3: Impact of financial liberalization when \( v \) is high**
Case 2: adjustment in financial depth parameter \( v \)

We now move on with the second case in which financial depth \( v \) increases endogenously with financial liberalization. Therefore, we go back to capital market equilibrium equation 3.17 \((vw(1-T_1) = wbT_1)\) and rearrange it for \( v \):

\[
v = \frac{b^2 T_1}{(1-T_1)}.
\]

(3.21)

The derivative is given by:

\[
\frac{dv}{db} = \frac{2bT_1}{(1-T_1)} > 0.
\]

(3.22)

Equation 3.22 shows that financial liberalization (an increase in parameter \( b \)) induces a rise in \( v \). This means the amount each individual can borrow has increased. Note that we assume constant borrowing cost \( r_l (\equiv T_1) \). This is a very strong assumption. But it will help us to pin down the impact of financial liberalization on equilibrium income inequality. Obviously, in reality we may observe adjustments in the amount individuals can borrow, and the cost of borrowing.

Figure 3.4 depicts the effect of financial liberalization, a rise in \( b \), when \( v \) is endogenous. The right panel presents the adjustments in the net supply and demand for funds. The net-supply curve \((NS = b^2 r_l w)\) moves clockwise since more funds become available for a given cost of borrowing \( r_l \). The loan-demand curve \((L = v(1-r_l)w)\) rotates anti-clockwise such that \( r_l \) remains unchanged.

The left panel shows an increase in the interest rate on deposits due to the declining wedge (since \( r_d = b r_l \)).
To summarize the discussion of the capital market equilibrium, financial liberalization can have different effects. First, financial liberalization leads to changes in both the borrowing cost and interest rate on deposits. Second, we assumed that financial liberalization positively affects financial depth \( v \). Note that in both cases financial liberalization improves the efficiency of the banking sector because the wedge between \( r_l \) and \( r_d \) decreases. But importantly, the additional impact of financial liberalization via financial depth is only present in the second case. It should be noticed once again that we consider a very special case because financial liberalization improves financial depth such that the borrowing cost remain constant. As we will see, this has important implications for equilibrium income inequality.

**Figure 3.4: Impact of financial liberalization when \( v \) is endogenous**

Notes: In the left panel, \( r_l = \frac{1}{b} r_d \), and in the right panel, the net supply of funds is given by: \( NS = b^2 T_1 w = b^2 r_l w \) and the demand for loans is: \( L = v(1 - T_1) w = v(1 - r_l) w \). An increase in \( b \), brought about by a lowering of reserve requirements and/or capital account restrictions, moves the \( r_l \) curve in the left panel clockwise. Keeping \( r_l \) fixed, the \( NS \) curve in the right panel rotates south, whereas the \( L \) curve rotates north.
3.4 Income Inequality and Financial Liberalization

We derive the Lorenz curve and Gini coefficient as measures of income inequality and examine how these are affected by financial liberalization. To this end, we first calculate the amounts consumed by each type of agent. Note that income equals consumption in our simple model. Afterwards, we compute the Lorenz curve and Gini coefficient. The Gini coefficient is a commonly used summary measure of inequality.

3.4.1 Consumption

We use the consumption function \( c = \phi k + r_i d - r_i l \) and plug in the choices of the three types of agents regarding borrowing, investing and saving.

High ability agents with \( \phi > T_1 \) invest their entire wealth. Moreover, they borrow money. Using expression 3.11, their consumption reads as:

\[
c = \phi(1 + \nu)w - r_i \nu w = (\phi(1 + \nu) - \nu T_1)w.
\]

(3.23)

Low ability agents with \( \phi < T_2 \) store their entire wealth at the bank in the first period. Therefore, using expression 3.12 their consumption amounts to:

\[
c = br_i d = bT_1 w.
\]

(3.24)

Finally, agents with intermediate investment ability, \( T_2 < \phi < T_1 \), invest their income, but do not save, nor do they borrow money. Hence, given expression 3.13 we can write that:

\[
c = \phi w.
\]

(3.25)

Average consumption equals:

\[
\bar{c} = \int_0^{bT_1} bT_1 w d\phi + \int_{bT_1}^{T_1} \phi w d\phi + \int_{T_1}^{1} (\phi(1 + \nu) - \nu T_1) w d\phi,
\]

\[
= T_1^2 b^2 w + \frac{T_1^2 (1 - b^2) w}{2} + \frac{(\nu - 1) T_1^2 - 2 \nu T_1 + 1 + \nu) w}{2},
\]
The derivative of average consumption with respect to financial liberalization parameter $b$ is given by:

$$\frac{dc}{db} = \frac{by^2}{b^2 + v}w > 0. \quad (3.27)$$

Financial liberalization, a rise in parameter $b$, unambiguously raises average consumption. The intuition is that a rise in $b$ leads to a lowering of the implicit taxation of the private sector.

### 3.4.2 Lorenz Curve

Before computing the Gini coefficient, we need to derive the Lorenz curve ($LC$). The Lorenz curve plots the cumulative proportion of total income against the cumulative proportion of individuals ordered by income, showing the $100y$ percent of total income accruing to the bottom $100x$ percent of households.

Assume random variable $Z$ is characterized by the distribution function $F(z)$ with finite mean $\mu = \int zdF(z)$ and inverse distribution function $F^{-1}(t)$. Then, the Lorenz curve is generally defined to be (Gastwirth, 1971):

$$LC(x) = \frac{1}{\mu} \int_0^x F^{-1}(t) dt, \text{ with } 0 \leq x \leq 1, \quad (3.28)$$

In equation 3.28, $LC(x)$ represents the proportion of total income owned by the bottom $x$ proportion of the population. The smaller this proportion, the more unequal the income distribution will be.

In our model, investment ability $\phi$ is uniformly distributed over $[0,1]$. The inverse distribution function simply is $F^{-1}(\phi) = \phi$. The Lorenz curve for consumption or income can therefore be written as:

$$LC(x) = \frac{1}{c} \int_0^x c(\phi) d\phi. \quad (3.29)$$

For agents with low ability, $0 \leq x \leq bT_1$, expression 3.29 becomes:
\[ LC(x) = \int_0^x \frac{bT_1}{c} w \, d\phi, \]
\[ = \frac{bT_1 x}{c} w. \]  
(3.30)

For agents with intermediate ability, \( bT_1 \leq x \leq T_1 \), the Lorenz curve is:
\[ LC(x) = \int_0^{bT_1} \frac{bT_1}{c} w \, d\phi + \int_{bT_1}^x \frac{\phi}{c} w \, d\phi, \]
\[ = \frac{b^2 T_1^2}{c} w + \frac{x^2 - b^2 T_1^2}{2c} w, \]
\[ = \left( \frac{b^2 T_1^2 + x^2}{2c} \right) w. \]  
(3.31)

In the case of high-ability agents with \( T_1 \leq x \leq 1 \), the Lorenz curve can be computed as follows:
\[ LC(x) = \int_0^{bT_1} \frac{bT_1}{c} w \, d\phi + \int_{bT_1}^{T_1} \frac{\phi}{c} w \, d\phi + \int_{T_1}^x \frac{(\phi(1+v) - vT_1)}{c} w \, d\phi, \]
\[ = \frac{b^2 T_1^2}{c} w + \frac{(1-b^2) T_1^2}{2c} w + \frac{(1+v)x^2 - 2v T_1 x - (1-v)T_1^2}{2c} w, \]
\[ = \left( \frac{(b^2+v)T_1^2 - 2v T_1 x + (1+v)x^2}{2c} \right) w. \]  
(3.32)

The share in total income of the bottom \( x \) proportion of the population is given by \( LC(x) \). Thus, expressions 3.30 to 3.32 can be used to determine the income shares of savers, investors and borrowing investors.

The income share of savers, \( LC(T_2) \), equals:
\[ LC(T_2) = \int_0^{bT_1} \frac{bT_1}{c} w \, d\phi = \frac{bT_1^2}{c} w, \]  
(3.33)

This means the proportion of savers, \( T_2 \), owns \( \frac{bT_1^2}{c} w \) of total income. The income share of borrowing investors is given by:
1 − LC(T₁) = 1 − (\int_{0}^{bT₁} bT₁ \frac{b}{c} w d\phi + \int_{bT₁}^{T₁} \frac{T₁}{c} w d\phi) = 1 − \left(\frac{2b^2T₁^2 + T₁^2}{2c}\right)w. \quad (3.34)

Finally, the income share of investors who do not borrow, amounts to:

\[ LC(T₁) − LC(T₂) = \left(\frac{(1−b^2)T₂^2}{2c}\right)w. \quad (3.35) \]

Figure 3.5 depicts a stylized Lorenz curve for our model. The x-axis displays population shares. The proportion of savers is T₂, the proportion of agents who invest their initial wealth but do not borrow equals T₁ − T₂, and the one of borrowing investors amounts to 1 − T₁. The corresponding income shares can be read off from the y-axis. These are LC(T₂), LC(T₁) − LC(T₂) and 1 − LC(T₁) for savers, investors and borrowing investors, respectively. We will use the information about income and population shares below when we examine the impact of financial liberalization on the distribution of income.

![Figure 3.5: Stylized Lorenz curve of the model](image)

**Notes:** The x-axis represents population shares: T₂ is the proportion of savers, T₁ − T₂ is the proportion of agents who invest their initial wealth but do not borrow, and 1 − T₁ is the proportion of borrowing investors. The corresponding income shares can be read off from the y-axis. These are LC(T₂), LC(T₁) − LC(T₂) and 1 − LC(T₁) for savers, investors and borrowing investors, respectively.
3.4.3 Gini Coefficient

If each agent has the same consumption or income level, the cumulative proportion of total consumption owned by the cumulative proportion $x$ of the population will also be $x$. In other words, population shares $x$, and income shares $LC(x)$, coincide implying that the difference $(x - L(x)) = 0$. With inequality, a proportion $x - L(x)$ of total consumption is being removed from the bottom 100x percent of the population. Using this insight, it is possible to calculate the average difference between the line of equality, $x$, and the Lorenz curve, which is the same as the surface between $x$ and $L(x)$. The lower triangle of the Lorenz diagram has a surface of 1/2. Thus, to get a coefficient that lies between 0 and 1, the integral of the difference $x - L(x)$ must be multiplied by two to get the following expression for the Gini coefficient:

$$Gini = 2 \int_0^1 (x - LC(x)) \, dx = 1 - 2 \int_0^1 LC(x) \, dx.$$  

Next, expressions 3.30 to 3.32 can be used to calculate the Lorenz integral:

$$\int_0^1 LC(x) \, dx = \int_0^{bT_1} \frac{bT_1 x}{c} \, w \, dx + \int_{bT_1}^{T_1} \frac{b^2 T_1^2 + x^2}{2c} \, w \, dx + \int_{T_1}^{1} \frac{(b^2 + v)T_1^2 - 2vT_1 x + (1 + v)x^2}{2c} \, w \, dx,$$  

$$= \frac{T_1^3 b^3}{2c} W + \frac{(1 + b^2 - 4b^2)T_1^3}{6c} W + \frac{3(b^2 + v)T_1^2 - (3b^2 + v + 1)T_1^3 - 3vT_1 + 1 + v}{6c} W,$$

$$= \frac{1 + v - 3vT_1 + 3(b^2 + v)T_1^2 - (b^3 + v)T_1^3}{6c} W.$$  

(3.36)

It follows that the Gini coefficient is equal to:

$$Gini \equiv 1 - 2 \int_0^1 LC(x) \, dx = \frac{2T_1^3(v + b^3) - 3T_1^2(v + b^2) + 1 + v}{3(T_1^2(v + b^2) - 2vT_1 + 1 + v)}.$$  

(3.37)

Note that the Gini coefficient is entirely determined by the threshold value that divides the agents into investors and workers $T_1$, the financial depth parameter $v$, as well as the financial liberalization parameter $b$. 
3.4.4 Impact of Financial Liberalization on Income Inequality

We proceed by examining the impact of financial liberalization, a change in \( b \), on income inequality. Thereby, we will distinguish between the two cases outlined above: first, financial liberalization leads to changes in the interest rate on deposits as well as the cost of borrowing, and second, financial liberalization causes a rise in financial depth.

We would like to stress at the outset that for the first case, an evaluation of the impact of financial liberalization on the Gini coefficient is not straightforward. Note that changes in interest rates, \( r_l \) and \( r_d \), correspond to changes in population shares. This implies that financial liberalization does not only affect income shares, but also population shares. It proves difficult to determine a condition under which changes in income and population shares are such that the Gini coefficient unambiguously goes up or down.

The relatively easier case arises when financial depth, \( v \), adjusts endogenously though. In this situation the borrowing cost do not decline but the interest rate on deposits still does improve. As a result, the income share of savers rises, whereas that of borrowing investors does not.

**Impact of financial liberalization on the Gini coefficient when \( T_1 \) is endogenous**

If we write Gini = \( f(b, v, T_1(v, b)) \) the derivative of the Gini coefficient with respect to parameter financial liberalization parameter \( b \) is given by:

\[
\frac{d\text{Gini}}{db} = \frac{df}{db} \left( - \right) + \frac{df}{dT_1} \left( \frac{db}{dT_1} \right) \left( - \right) \leq 0. \tag{3.38}
\]

\[= \frac{2bv^2(2vb^6+2b^6+6b^4v^2+6b^4v+b^3v^3+3bv^3-(3b^5v^2+3b^5v+4v^3))}{3(b^2+v)^2(v+b^2)^2} \leq 0. \tag{3.38}
\]

\[^{32}\text{Details about the different parts of the derivative can be found in the appendix.}\]
The derivative can be positive or negative. Part 1 in the first line of expression 3.38 shows that, keeping everything else constant, an increase in $b$ reduces the Gini coefficient. The intuition is that a fall in $b$ lowers the wedge between the deposit rate and the cost of borrowing. In other words, the income gap between the bottom and upper parts of the income distribution gets smaller.\(^{33}\) The rise in income of agents in the bottom of the distribution implies a larger income share for savers. Presumably, if the income share of the bottom income group increases with financial liberalization, income inequality should be lower.

But financial liberalization also generates higher incomes for individuals at the top of the income distribution owing to a reduction in borrowing cost $\eta$, which is highlighted by the second part of the derivative in 3.38. Thus, if the lower income bracket receives a larger proportion of total income, and at the same time the very top income bracket also receives a larger proportion, the net effect may be wider inequality.

In order to see the impact of financial liberalization directly in terms of income shares, we study the derivatives of $LC(T_1)$, and $LC(T_2)$ with respect to parameter $b$. Recall that the income shares owned by savers, investors and borrowing investors are equal to $LC(T_2)$, $LC(T_1) - LC(T_2)$ and $1 - LC(T_1)$, respectively.

Using that, in equilibrium, $T_1 = \frac{v}{(v+b^2)}$ and $T_2 = bT_1$, the derivatives are given by:

\[
\frac{dLC(T_1)}{db} = \frac{-2bv^2(2v+2b^2v+b^4v+2b^2+b^4)}{(b^4v+b^4+b^2v^2+2b^2v+b^4v)^2} < 0, \quad (3.39)
\]

\[
\frac{dLC(T_2)}{db} = \frac{-4bv^2(b^4v+b^4-v^2)}{(b^2v^2+2b^2v+b^4+v^2+b^4v)^2} \leq 0. \quad (3.40)
\]

The second derivative can be both positive and negative, while the first derivative is unambiguously negative. This means the income share of borrowing investors $1 - L(T_1)$ increases with financial liberalization. The effect on the income shares of savers and investors cannot be signed.

\(^{33}\) Only the income, or consumption, of the bottom group of the distribution is directly affected by a change in financial liberalization parameter $b$. 
In addition to shifts in income shares, financial liberalization entails changes in population shares. As mentioned above, individuals take interest rates as given. Given lower borrowing cost, some additional individuals will choose to borrow. Consequently, the population share of borrowing investors $1 - T_1$ increases. The change in the population share of savers $T_2$ is ambiguous though (see the derivative $dT_2/db$ in equation 3.20).

When income and population shares adjust simultaneously, the overall change in inequality is hard to sign. For a clearer understanding of this point, we present the described effects in the Lorenz diagram in figure 3.6.

**Figure 3.6: Adjustments in population and income shares after financial liberalization**

*Notes: This figure depicts one possible example for the impact of financial liberalization on the Lorenz curve. The x-axis represents population shares: $T_2$ is the proportion of savers, $T_1 - T_2$ is the proportion of agents who invest their initial wealth but do not borrow, and $1 - T_1$ is the proportion of borrowing investors. The corresponding income shares can be read off from the y-axis. These are $LC(T_2)$, $LC(T_1) - LC(T_2)$ and $1 - LC(T_1)$ for savers, investors and borrowing investors, respectively. It is assumed that the population shares of both borrowing investors and savers rise, so do their income shares.*
The reader should realize that the adjustments shown in the figure provide just one example of how financial liberalization affects population and income shares. In figure 3.6 it is assumed that the population shares of both borrowing investors and savers rise, so do their income shares.

Note that the income increase at the top of the distribution is greater than at the bottom. Many other possible adjustments in income and population shares are conceivable. Therefore, the overall effect of financial liberalization is difficult to predict. However, considering the level of financial depth may be helpful.

As we have shown in figures 3.1 and 3.2, the impact of financial liberalization on the lending and deposit rates depends on the level of financial depth $v$. If financial depth is sufficiently high, the rise in the deposit rate exceeds the decline in the lending rate. In other words, the effect of financial liberalization on the lending rate decreases with financial depth since $d^2T_1/dbdv > 0$. At the same time, the impact of financial liberalization on the deposit rate increases since $d^2T_2/dbdv < 0$. As a consequence, the income per saver may increase disproportionately, so may their income share. Moreover, in appendix 3.A.1 we show that the impact of financial liberalization on the wedge (part 1 in expression 3.38) is increasing in $v$. By contrast, the impact on the borrowing cost is decreasing in $v$, reducing the positive effect of financial liberalization on income inequality (part 2 in expression 3.38). Thus, income inequality is more likely to decrease at high levels of financial depth. We cannot push a particular value of financial depth, because the relationship between financial liberalization and income inequality is highly non-linear in financial depth. But we can say that if financial depth is high, income changes occurring in the bottom part of the income distribution are greater than those occurring at the top. Since those changes are beneficial for savers, the Gini coefficient tends to fall. Intuitively, if financial depth is high, the economy has the capacity to absorb the additional funds that become available in the wake of financial liberalization. As a consequence, the efficiency effect dominates. By contrast, if financial depth is low, there tends to be an oversupply of funds following financial liberalization, attenuating the rise in the deposit rate.
**Impact of financial liberalization on the Gini coefficient when \( v \) is endogenous**

When the level of financial depth \( v \) is endogenous, we can write \( \text{Gini} = f(b, v(T_1, b), T_1) \). The derivative with respect to \( b \) is given by:\(^{34}\)

\[
\frac{d\text{Gini}}{db} = \frac{df}{db} + \frac{df}{dv} \frac{dv}{db},
\]

\[\text{part 1} \quad \text{part 2}\]

\[
= -\frac{2bT_1^2(-b^3T_1^2 - 3bT_1 + 2T_1 + 2)}{3(T_1 b^2 + 1)^2} < 0. \tag{3.40}
\]

It is easy to show that, given our parameter restrictions \( T_1 < 1 \) and \( b < 1 \), financial liberalization unambiguously lowers the Gini coefficient implying less income inequality. The main intuition for this result is that the interest rate on deposits increases, while the borrowing cost stay constant.

A rise in parameter \( b \) lowers the wedge between the two interest rates \( r_l \) and \( r_d \), reducing the Gini coefficient. The second effect is a rise in financial depth \( v \). Recall our assumption that \( v \) adjusts such that threshold \( T_1 \) does not change. The rise in \( v \) tends to increase income inequality because each borrowing investor can borrow a larger amount, invest more and generate a higher income. However, borrowing investors must also repay a larger loan. The second effect never outweighs the fall in the wedge, which means the overall effect on the Gini coefficient is negative.

Again examining the adjustments in income shares proves useful in order to understand the decline in income inequality. Using that financial depth equals \( v = b^2T_1/(1 - T_1) \), the derivatives of the income shares \( LC(T_2) \) and \( LC(T_1) \) are given by:

\[
\frac{dLC(T_1)}{db} = \frac{2bT_1^2(1-T_1)}{(T_1 b^2 + 1)^2} > 0, \tag{3.41}
\]

---

\(^{34}\) We prove the signs of the derivatives in the appendix.
\[
\frac{dLC(T_2)}{db} = \frac{4T_2^2 b}{(T_2 b^2 + 1)^2} > 0.
\] (3.42)

The derivatives imply that the income share of savers $LC(T_2)$ increases with financial liberalization, while that of borrowing investors $1 - LC(T_1)$ falls. If the bottom group receives a larger share in total income, and the top group a smaller, overall inequality declines. Intuitively, when measured in relative terms, inequality only improves if households in the bottom benefit disproportionately than better-off households. This is the case when $v$ is endogenous as borrowing cost do not fall. By the same token, if financial depth adjusts, it is less likely that distortions undermine the efficiency effect. And it is the efficiency effect which mainly helps agents at the bottom of the income distribution.

### 3.5 Discussion and Conclusion

With this research, we have sought to investigate the relationship between financial liberalization and income inequality. To this end, we have built a simple model in which agents save, invest and/or borrow. In addition, the model features a banking sector that is subject to financial liberalization polices. All saving and borrowing takes place via the banking sector. Thus, the banking sector creates a transmission channel between financial liberalization and income inequality.

In our model, financial liberalization had two different effects on the banking sector. First, it led to changes in both the borrowing cost and the interest rate on deposits. Second, we assumed that financial liberalization affects financial depth, in addition to its impact on the wedge between the cost of borrowing and interest rate on deposits. Note that in both cases financial liberalization implied an improvement in the efficiency of the banking sector due to the declining wedge. But importantly, the impact of financial liberalization via financial depth was only present in the second case. As we have shown, the two cases had crucial implications for the relationship between financial liberalization and equilibrium income inequality.
When there is only an efficiency effect, financial liberalization reduces income inequality only if financial depth is high. Intuitively, if financial depth is high, the economy has the capacity to absorb the additional funds that become available due to financial liberalization. As a consequence, the efficiency effect dominates. Conversely, if financial depth is low, there tends to be an oversupply of funds following financial liberalization, attenuating the rise in the deposit rate. This last effect undermines the positive income effect for savers, while borrowers gain disproportionately from financial liberalization. When both financial depth and efficiency improve, income inequality decreases unambiguously. The main intuition for this outcome is that savers gain twice: there is a fall in the wedge, and, in addition, the deposit rate tends to increase because of increasing credit demand.

Given these two main findings, the outcome of financial liberalization remains an empirical question. Therefore, the next chapter will be devoted to an empirical investigation into the impact of financial liberalization on income inequality. More precisely, we want to test the following two predictions:

1. The effect of financial liberalization on income inequality depends on the level of financial depth.
2. Financial liberalization reduces income inequality via financial depth.

We would like to mention three major limitations of our analysis. First, we assumed that there is a positive link between financial liberalization and financial depth. However, as pointed out in the literature survey in section 3.2, this is need not be the case. In particular, competitive pressures in the wake of financial liberalization might deteriorate financial depth. How such a negative relationship plays out on income inequality merits further research. Second, the Gini coefficient as a summary measure of income inequality has its shortcomings. In particular, it is silent on which parts of the income distribution are affected by financial liberalization. Our analysis of income and population shares provided additional insights though. Third, when we analyzed the case with endogenous financial depth, we assumed that the change in financial depth is such that borrowing cost remain constant. This is a very strong assumption since in reality we may expect adjustments in both the amount individuals can borrow and borrowing cost. However, this assumption allowed us to pin down the impact of financial liberalization on equilibrium income inequality.
Despite these limitations, we see our analysis as an important step in the attempt to understand the impact of financial liberalization on income inequality. Yet, more research is needed into how other financial liberalization policies relate to income inequality. Such research may also enhance our understanding of how policies influence economic growth, because changes in income distribution inform us about the channels through which policies affect the economy. This is a point to which Kuznets (1955) alluded several decades ago.

There are various possibilities for future research. The first refinement concerns the impact of financial liberalization on financial stability and the probability of crisis. Some scholars view increasing capital account liberalization and unfettered capital flows as serious threats to financial stability (see, e.g., Demirgüç–Kunt and Detragiache, 1998; Stiglitz, 2000; Rancière et al., 2006). One relevant channel through which crises affect the distribution of income is crisis vulnerability because poor individuals are highly susceptible to negative shocks as they lack the means to insure themselves against risk. In addition, they are often adversely affected by economic measures to combat crises (Ocampo et al., 2008). Second, we did not explicitly model the labor market. In the model, labor is uniform with respect to productivity implying that every worker earns the same wage. This neglects the findings of research that explains wage differentials by skill differentials and acquired human capital (for a review see Acemoglu, 2002). In this regard, financial liberalization might alter the relative price of skilled labor. Another labor market channel concerns the bargaining power of workers, which could be undermined by financial liberalization (Jayadev, 2007). Third, there obviously are other financial liberalization policies that could have important implications for income inequality. For example, liberalization of restrictions on bank entry could divert domestic deposits to entering foreign banks. As a result, domestic banks need to rely on non-deposit-based funding by borrowing from other banks. Consequently, the cost of borrowing may rise (Rashid, 2011).
3.A Appendix

3.A.1 Derivative of the Gini with respect to \(b\) if \(T_1\) is endogenous

The derivative of the Gini coefficient, \(\text{Gini} = f(b, v, T_1(v, b))\), with respect to \(b\) is given by:

\[
\frac{d\text{Gini}}{db} = \frac{df}{db} + \frac{df}{dT_1} \frac{dT_1}{db} \quad \text{(3.A.1)}
\]

The first part of the derivative equals:

\[
\frac{df}{db} = \frac{-2bv^2((-b^3-3b+4)v^3+(-b^3+2b^2-2b+4)3b^2v^2+(4b^2-3b+12)b^4v+4b^6)}{3(b^2+v)^3(v+b^2v+b^2)} < 0. \quad \text{(3.A.2)}
\]

The nominator of equation 3.A.2 is negative, while the denominator is positive. The second part consists of two derivatives which are given by:

\[
\frac{df}{dT_1} = \frac{-2b^2v(b^2-vb+2v)}{(b^2+v)(v+b^2v+b^2)} < 0, \quad \text{and} \quad \text{(3.A.3)}
\]

\[
\frac{dT_1}{db} = \frac{-2b^2v}{(b^2+v)^2} < 0. \quad \text{(3.A.4)}
\]

Both derivatives are negative. Combining the last two derivatives yields the following expression for part 2:

\[
\frac{df}{dT_1} \frac{dT_1}{db} = \frac{12b^3v^2(b^2-vb+2v)}{3(b^2+v)^3(v+b^2v+b^2)} > 0. \quad \text{(3.A.5)}
\]

The derivative in 3.A.2 (part 1 in 3.A.1) tends to be larger than expression 3.A.5 (part 2 in 3.A.1), if financial depth \(v\) is high. To see this, we take the cross partial derivative of \(df/db\) with respect to \(v\) and, for the sake of convenience, evaluate it at \(b = 1\):
\[
\frac{d\left(\frac{df}{db}\right)}{dv} \bigg|_{b=1} = \frac{-(-36v^5-14v^4+76v^3+70v^2+16v)}{3(2v+1)^3(v+1)^4} \leq 0. \quad (3.6)
\]

As can be seen, expression 3.6 is positive if \( v \) is large. Next, we take the cross partial derivatives of expressions 3.5 again evaluating them at \( b = 1 \) which yields the following expression for part 2:

\[
\frac{d\left(\frac{df}{dT_1 db}\right)}{dv} \bigg|_{b=1} = \frac{-8v^4+16v^2+8v}{(2v+1)^2(v+1)^4} \leq 0. \quad (3.7)
\]

Expression 3.7 shows that the cross partial derivative is negative for large values of \( v \). Thus, the effect of financial liberalization \( b \) on part 1 is increasing in financial depth \( v \), whereas the effect of \( b \) on part 2 is decreasing in financial depth. Consequently, it is more likely that the Gini coefficient is reduced by financial liberalization if \( v \) is high.

### 3.A.2 Derivative of the Gini with respect to \( b \) if \( v \) is endogenous

The derivative of the Gini coefficient, \( Gini = f(b, v(T_1, b), T_1) \) with respect to \( b \) is given by:

\[
\frac{dGini}{db} = \frac{df}{dy} \bigg|_{y=\text{part 1}} + \frac{df}{dy} \frac{dy}{db} \bigg|_{y=\text{part 2}} \quad (3.8)
\]

\[
= -\frac{2bT_1^2(-b^3T_1^2-3bT_1+2T_1^2+2)}{3(T_1b^2+1)^2} < 0. \quad (3.9)
\]

The term in parentheses is unambiguously positive. Thus, the overall term is negative. For the sake of completeness, we report the derivatives of the parts 1 and 2. The derivative of part 1 is given by:
\[
\frac{df}{db} = \frac{(2T_1^2b (2T_1^2b^2 + 3T_1^2b^3 + 2T_1^2b^2 + 3T_1b - 2T_1^2b^3 - 4T_1b^2 - 4))}{(3(T_1b^2 + 1)^2)} > 0
\]  
(3.A.10)

The derivatives of the second part are:

\[
\frac{df}{dv} = \frac{(2T_1(T_1 - 1)^2(-T_1^2b^3 + T_1^2b^2 + 2T_1b^2 + 1))}{(3(T_1b^2 + 1)^2)} > 0, \text{ and}
\]  
(3.A.11)

\[
\frac{dv}{db} = \frac{2T_1b}{1 - T_1} > 0.
\]  
(3.A.12)