On the Welfare and Distributional Implications of Intermediation Costs

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Abstract

This paper studies the distributional implications of intermediation costs. We built a "Bewley" model economy where individuals experience uninsurable idiosyncratic shocks on labor productivity and financial intermediation is costly. Individuals smooth consumption by making deposits to a financial intermediary in good times and by running down credit balances or getting loans in bad times. Higher intermediation costs (IC) increase the costs for individuals to insure against idiosyncratic shocks and to smooth consumption over time. When IC increase by a factor of 10 from its baseline value of 4% (US case), aggregate welfare decreases by less than 1% of the average consumption. For those at the bottom 1% of the wealth distribution the welfare costs are roughly 41% of their consumption, while for those at the top 1% it is -0.17%.

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Área Escolhida: Microeconomia, Métodos Quantitativos e Finanas

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On the Welfare and Distributional Implications
of Intermediation Costs

Área Escolhida: Microeconomia, Métodos Quantitativos e Finanas

1 Introduction

This paper studies the following questions: What are the implication of intermediation costs on the economy? Are the welfare effects evenly distributed across individuals? We address these question by constructing an economy where individuals experience uninsurable idiosyncratic shocks on labor productivity and financial intermediation is costly. In order to highlight the distributional implication of intermediation costs we follow Erosa and Ventura (2002) and assume that there are two groups of *ex-ante* identical agents that differ in their average labor productivity: High (*type-H*) and low (*type-L*) productive agents. Within each group individuals face uninsurable idiosyncratic shocks to earnings. Agents smooth consumption by making deposits to a financial intermediary in good times and by running down credit balances or getting loans in bad times. Financial intermediation is, however, costly. Intermediation costs might reflect explicit and implicit financial sector taxes (e.g., tax on financial transactions, on intermediary profits, or inflation), bank regulation (e.g., non-interest-bearing reserve requirements) and institutional factors (e.g., bribes, corruption). Competition in the banking sector implies that the interest rate on loans is equal to the interest rate on deposits plus the intermediation costs. Therefore, the interest payment on loans are higher than the return on deposits. The spread between the two rates of return corresponds to the intermediation costs. Agents are also credit constrained. We consider the *natural* borrowing limit (see Aiyagari (1994)), which is the value such that in an agent's worst possible state, the interest payments are not higher than the agent's labor income.

A careful empirical investigation by Díaz-Giménez, Prescott, Fitzgerald and Alvarez (1992) shows that for collateralized loans the average interest rate is nearly 4 percent higher than the return on bank deposit in the United States. For uncollateralized loans the spread rate is in excess of 10 percent. Recent data from the World Bank[1] show that intermediation costs measured as overhead costs as a percent of total loans were in 2003 roughly 4 percent in the United States. In Brazil this figure is about 12 percent. Data from the International Financial Statistics show that the spread rate in Brazil is about 40 percent.

A Higher spread rate increases the costs for individuals to insure against idiosyncratic shocks and to smooth consumption over time. Specially those poor individuals that experience persistent bad shocks on labor productivity. Besides this partial equilibrium implication, there are two general equilibrium effects in opposite directions associated with intermediation costs. First, higher intermediation costs implies that more resources are deviated from productive use. In this case, the capital stock, the wage rate, and output decrease. As output decreases so does the average consumption and the average welfare. Notice, however, that a lower capital stock increases the interest rate and therefore the income from those that hold bonds, which are in general rich households. Therefore, the welfare of rich households might increase with a higher intermediation cost. Intermediation costs, on the other hand, decrease the demand for loans which increases savings, the capital stock, and output. A higher capital stock also implies a lower interest rate on bonds. The overall and distributional implications of intermediation costs depend on the magnitude of the two effects.

Our quantitative exercises suggest that the aggregate effects of intermediation costs on output and welfare are not quantitatively very significant. When intermedi-

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[1]Database on Financial Structure and Economic Development. See also Beck, Demirgüç-Kunt and Levine (1999)

ation costs increase by a factor of 10 from the baseline value of 4 percent (US case), output decreases by 0.6 percent and welfare (measured by the average consumption level) decreases by less than 1 percent. The aggregate results, however, hide important distributional effects. The welfare of *type-H* individuals decreases by about 0.17 percent, while for *type-L* individuals welfare reduces by about 1.38 percent when intermediation costs increase by a factor of 10.

We further investigate the distributional impacts of intermediation costs by analyzing the welfare costs of intermediation costs by different wealth groups: When the spread rate increases from its benchmark value of 4 percent by a factor of 10, the welfare costs for individuals at the bottom 1 percent of the wealth distribution are roughly 41.63 percent of their average consumption, while those at the top 1 percent of the wealth distribution have a welfare gain of roughly 0.17 percent of their average consumption.

Our results suggest that although intermediation costs do not have a strong effect on the aggregate, they have important distributional implications. Intermediation costs are strongly regressive and they might generate welfare gains for those at the top of the wealth distribution by increasing the returns on asset holdings.

Notice that since we are not considering occupational choices we might see the aggregate results as conservative figures. Intermediation costs might prevent individuals who are credit constrained to run an entrepreneurial activity or might reduce the size of a business project. This might have important implications on the level of capital employed by entrepreneurs an therefore on the economic activity. Using this idea Antunes, Cavalcanti and Villamil (2005) show that when the intermediation costs increase by a factor of 10 from the baseline value of 4 percent, output per capita decreases by less than 5 percent.[2] This is a stronger effect than the observed in our

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[2]They show that investor protection on the other hand have a stronger effect on output per capita

model economy, but it still is not a very important effect.[3]

2 The Model

The economy is inhabited by a continuum of infinite-lived households. As described in short, there are two sets of *ex-ante* identical households: high and low productive households. Agents face an idiosyncratic shock on labor productivity. Therefore, agents from the same group are heterogenous *ex-post*.

2.1 The banking sector

There are banks in this economy whose major role is to intermediate between households by making loans to households who want to borrow and by accepting deposits from those who want to lend. Intermediation is, however, costly. There is a cost τ per unit of value intermediated. Let D be household deposit accepted, and L denotes bank loans to the household sector. Let r and r_L be the net interest rates on deposits and loans, respectively. In each period banks solve the following static problem:

$$\max_{L,D} D - (1+r)D - L + (1+r_L)L - \tau L, \tag{1}$$

subject to

$$L \le D, \ D, L > 0. \tag{2}$$

Free entry in the banking sector implies that

$$r_L = r + \tau. \tag{3}$$

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than intermediation costs.

[3]In particular, if we want to account for the high disparity in income levels across countries. See also Erosa (2001).

The intermediation costs τ might reflect explicit and implicit financial sector taxes (e.g., tax on financial transactions, on intermediary profits, or inflation), bank regulation (e.g., non-interest-bearing reserve requirements) and institutional factors (e.g., bribes, corruption).

2.2 The production sector

At any time period t there is a production technology that converts capital, K_t, and labor, N_t, into output Y_t, such that

$$Y_t = K_t^{\alpha} N_t^{1-\alpha}. \tag{4}$$

α corresponds to the capital income share and it is a number between zero and one. Input prices are given by their marginal productivity

$$w_t = (1 - \alpha)K_t^{\alpha}N_t^{-\alpha}, \tag{5}$$

$$r_t = \alpha K_t^{\alpha-1}N_t^{1-\alpha}. \tag{6}$$

2.3 The household sector

Households face idiosyncratic shocks on labor productivity. A household with shock z receives labor income wz. We assume that z follows a finite state Markov process with support $\mathcal{Z}$. In order to highlight the distributional implications of intermediation costs we follow Erosa and Ventura (2002), and assume that the population is partitioned in two subsets. *Type-H* households have the support of their productivity shocks on the set $\mathcal{Z_H}$, while the shocks of *type-L* households have the support of their shock on $\mathcal{Z_L}$, where $\mathcal{Z_L}$ and $\mathcal{Z_H}$ form a partition of $\mathcal{Z}$. The average productivity of *type-H* households are higher than the average productivity of *type-L* households. Specifically, we assume that households within each group can experience two possible productivity

shocks: $z_1^i = \bar{z}^i + \Delta^i$ and $z_2^i = \bar{z}^i - \Delta^i$, for $i = H, L$ and with $\bar{z}^H/\bar{z}^L > 1$. We also

assume that the transition probability matrix $\mathcal{P}(z^i, z'^i) = Prob(z_{t+1}^i = z'^i/z_t^i = z^i)$ is

the same for both type of households. Each household has preferences defined over

stochastic processes for consumption, c_t, given by the following utility function

$$E_0[\sum_{t=0}^{\infty} \beta^t u(c_t)], \quad \beta \in (0, 1). \tag{7}$$

The period utility function is represented by

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}.$$

Agents can make deposits and get loans from financial intermediaries. Let $a_t = d_t - l_t$

be the wealth of a household at period t, and $I(a_t < 0)$ be a function which takes

value 1 when $a_t < 0$ and zero otherwise. The one period budget constraint of each

household is

$$c_t + a_{t+1} \leq (1 + r_t + \tau I(a_t < 0))a_t + w_t z_t, \quad a_{t+1} \geq \underline{a}, \tag{8}$$

where $\underline{a}$ is a borrowing limit. In the quantitative exercises we will consider the *natural*

borrowing limit (see Aiyagari (1994)). This is the value such that in an agent's worst

possible state, the interest payments are not higher than the agent's labor income. In

this case, the borrowing limit is different for agents type H and type L. A household

position at period t is described by her asset holding and labor shock, $x = (a, z)$. The

Bellman equation associated to each household's problem is:

$$v(a, z) = \max_{a' \geq \underline{a}, d', l'} \{u((1 + r + \tau I(a < 0)a + wz - a') + \beta E[v(a', z')]\}, \tag{9}$$

such that

$$a' = d' - l'.$$

The associated policy functions are $d' = g_d(a, z)$, $l' = g_l(a, z)$, $a' = g_a(a, z)$, and

$g_c(a, z)$. The decision rules and the transition probability matrix for the productiv-

ity shocks define an unconditional distribution over asset holdings and productivity

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shocks, which we denote by λ. Formally, define $X = [\underline{a}, \bar{a}] \times \mathcal{Z}$ and let χ be the associated Borel σ-algebra. For each $B \in \chi$, $\lambda(B)$ corresponds to the mass of households whose individual states vectors lie in B. Let $Q(x, B)$ be the endogenous transition probability of the households state vector. It describes the probability that a household with state $x = (a, z)$ will have a state vector lying in B next period. The probability measure λ is stationary provided that

$$\lambda(B) = \int_X Q(x, B) d\lambda \ \text{ for all } B \in X. \tag{10}$$

In a stationary equilibrium banks, firms, and households solve their respective problems, and all markets clear. The market clearing conditions for goods, assets, capital and labor in the stationary equilibrium are:

$$\int_X g_c(a, z) d\lambda + \delta K + \tau \int_X I(a < 0) d\lambda \ = \ AK^\alpha N^{1-\alpha}, \tag{11}$$

$$\int_X g_d(a, z) d\lambda \ = \ D, \tag{12}$$

$$\int_X g_l(a, z) d\lambda \ = \ L, \tag{13}$$

$$\int_X g_a(a, z) d\lambda = \int_X g_d(a, z) d\lambda - \int_X g_l(a, z) d\lambda \ = \ K, \tag{14}$$

$$\int_X z d\lambda = L. \tag{15}$$

3 Quantitative experiments

The purpose of the quantitative analysis is to provide a numerical assessment of the welfare and distributional effects of intermediation costs. The quantitative exercises require us to calibrate the theoretical model. We must determine values for a set of parameter, which are related to (i) preferences, (ii) technology, (iii) stochastic process on labor productivity, and (iv) intermediation costs and borrowing limits. Our strategy is to choose parameter values consistent to the empirical observations

in the United States. We then perform counter-factual analysis by investigating the effects of high intermediation costs on the economy and welfare.

3.1 Calibration and computation

Calibration: Below we describe how we set parameter values.

Preferences: The model period is taken to be one year,[4] and the utility discount factor β is chosen to be 0.96. This value implies a rate of time preference of about 4.1%, which is standard in the literature (see, for instance, Huggett (1993) and Aiyagari (1994)) The risk aversion coefficient σ is assumed to be 2.0, which is consistent to the micro evidences reported by Mehra and Prescott (1985).

Production technology: The capital income share α is set to be 0.36, which is consistent to the estimates of Gollin (2002). The depreciation rate δ is set to 6%, a value also used in the business cycle literature (see Stokey and Rebelo (1995)). Results are not very sensitive to the depreciation rate.

Stochastic process on labor productivity: The stochastic process on labor productivity is similar to the one determined by Erosa and Ventura (2002). They use data from the US Bureau of Census and the average labor income of college graduates relative to non-college graduates to pin down the relative value of the average labor employment $\bar{z}^H/\bar{z}^L$. The estimated value for $\bar{z}^H/\bar{z}^L$ is 1.837, while the fraction of low productive agents in the sample is about 69%. Recall that the two productivity shocks are $z_1^i = \bar{z}^i + \Delta^i$ and $z_1^i = \bar{z}^i - \Delta^i$ for $i = H, L$. Erosa and Ventura restricted the transition probabilities to satisfy $p(z_1^i, z_1^i) = p(z_2^i, z_2^i) = 0.9$ and they set $\Delta^i = \bar{z}^i \times 0.15$.

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[4]We will also run experiments by considering a time period to be a quarter of a year.

Table 1: Parameter values, baseline economy.

Parameters	Values	Comment/Observations
β	0.96	Subjective discount factor (standard value)
σ	2	Risk aversion coefficient based on micro evidences reported by Mehra and Prescott (1985)
α	0.40	Capital income share based on estimations by Gollin (2002)
δ	0.06	Depreciation rate (see Stokey and Rebelo (1995))
$\bar{z}^H / \bar{z}^L$	1.837	Relative labor income of college and non-college graduates
Δ^i	$\bar{z}^i \times 0.15$	Labor productivity shock based on Erosa and Ventura (2002)
$p(z_1^i, z_1^i) = p(z_2^i, z_2^i)$	0.9	Transition probability matrix based on Erosa and Ventura (2002)
τ	4%	Intermediation costs based on Demirgç-Kunt et al. (2004)
$\underline{a}$	$-w(\bar{z}^i - \Delta^i)/(1+r)$	Natural borrowing limit

Intermediation costs and borrowing limit: Data from the International Financial Statistics show that from 1995 to 2003 the average spread rate in the United States was about 3%. Díaz-Giménez et al. (1992) report that the interest rate on loans is 4% to 10% higher than the return on deposits, depending whether or not the borrowing is in the form of collateralized loans. Using micro level data, Demirgç-Kunt, Leaven and Levine (2004) show that net interest margin is about 4% in the United States. We therefore assume that the spread rate τ is 4%. We set $\underline{a}$ to the *natural* borrowing limit $-w(\bar{z}^i - \Delta^i)/(1+r)$ for $i = H, L$.

Computation: With all parameter values determined we compute the stationary equilibrium as follows. First, we generate a grid for the asset values a from $\underline{a}$ to $\bar{a}$.[5] The size of grid increments was set to 0.1. We then guessed a value for the interest rate r, which should be lower that the rate of time preference (see Aiyagari (1994)). With a value for the interest rate we calculate w and solved the dynamic programming problem of each agent (see equation (9)). When asset holdings are positive ($a >= 0$) the gross interest rate is $(1+r)$, otherwise ($a < 0$) the gross interest rate is $(1+r+\tau)$. Given the policy function $g_a(a,z)$ we calculate the endogenous invariant distribution $\lambda(a,z)$ for the state space $x = (a,z)$. Next, we used the market clearing condition on assets to calculate r'. If the expected average asset holdings is close to $K(r)$ we stop. Otherwise, we decrease (increase) r, as long as the average asset holdings is higher (lower) than $K(r)$.[6]

3.2   Benchmark economy

In this section we analyze some properties of the benchmark economy. Table 2 reports some key statistics for the US economy and for the model generated data. First, we observe that the model matches well the capital to output ratio. However, the model has a lot less wealth and earnings inequality than the data do. The top 1 percent of all households have nearly 27 percent of all the wealth in the data, while in the model they held roughly 2.5%. As a result the wealth and income Gini indexes are much smaller in the model than in the data. As reported in Quadrini and Ríos-Rull (1997), this is a common feature of heterogeneous agent version of neoclassical growth models with uninsurable idiosyncratic shocks to earnings. By using personal savings agents

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[5]We set the upper bound $\bar{a}$ such that an agent who has assets above this level chooses a smaller value in the next period.

[6]Notice that the updated value of r cannot exceed the rate of time preference.

Table 2: Selected statistics: US data and benchmark. Data for the US economy are from Quadrini (2000)

	Capital-output ratio	Wealth Gini (%)	Income Gini (%)	Percentage wealth in the top				
				1%	5%	10%	20%	30%
US data	3.0	75	45	26.6%	46.5%	60%	75.9%	85.8%
US data (only workers)	3.0	55	42	4.2%	15.3%	26.2%	44.5%	58.3%
Model	3.30	37	20	2.3%	10.4%	20.1%	38.0%	53.5%

can insure against temporary shocks to their earnings. Nevertheless, when we consider only workers in the sample the model has a better fit to the data. For instance, the percentage of wealth held by the top 1 percent is roughly 4.2 and 2.3 percent in the data and in the model, respectively. Entrepreneurs' wealth is about 5 times that of workers (see Quadrini (2000)). Entrepreneurs in general face a higher rate of return on savings than workers, and the risks associated with business activities provide additional motives to increase their savings.[7] Since we do not model entrepreneurs' behavior explicitly, we should compare the model generated data with the sample with only workers. In any case, we should see the distributional implications of intermediation costs in our model as conservative numbers.

[7]See Quadrini (2000) and Cagetti and De Nardi (2002) for a model with entrepreneurship and wealth inequality. See also Antunes et al. (2005) for the implications of intermediation costs and investor protection on productivity in a model with occupational choice.

3.3 Results

In this section we study the distributional and welfare implications of intermediation costs. We, however, first analyze the effects of intermediation costs on some aggregate variables.

3.3.1 Aggregate effects

Table 3 shows the effects of intermediation costs on the interest rate, capital to output ratio, output, consumption and welfare. We measure the welfare costs of the spread rate as the average permanent consumption supplement that make households in an economy with a given spread rate as well off as in the economy with intermediation costs similar to those observed in the benchmark economy. This is a standard measure of welfare in economics (see, for instance, Lucas (1990)).

Recall that intermediation costs deviate resources from productive use. When intermediation costs increases we should expect a decrease in capital, output, and in the wage rate, and an increase in the interest rate. However, as the spread rate increases lending become more expensive. This increases deposits and therefore capital, which increases output and decreases the interest rate. Our results suggest that the two effects roughly cancel each other and the negative effect of the spread rate (wasted resource) dominates for high levels of intermediation costs. For low levels of intermediation costs the capital to output ratio increases, but it decreases for high levels. However, the effects are not quantitatively significant. In fact the capital to output ratio and the aggregate output remain almost the same when the spread rate raises by a factor of 25 from the benchmark value of 4 to 100 percent. The interest rate increases by roughly 3 percent or 0.12 percentage point.

What are the effects on welfare? When intermediation costs increase lending

Table 3: Aggregate effects

	Interest rate	Capital-output ratio	Wage rate	Output	Average consumption	Welfare costs
Benchmark, $\tau = 4\%$	3.26%	3.32	100	100	100	0%
Spread rate = 0%	3.32%	3.30	99.4	99.4	100	-0.02%
Spread rate = 8%	3.32%	3.32	99.8	99.8	99.8	0.15%
Spread rate = 16%	3.32%	3.32	99.8	99.8	99.6	0.36%
Spread rate = 32%	3.33%	3.30	99.4	99.4	99.5	0.49%
Spread rate = 40%	3.34%	3.30	99.4	99.4	99.1	0.92%
Spread rate = 100%	3.38%	3.27	98.9	98.9	98.7	1.24%

becomes more expensive. This increases the costs for households to insure against idiosyncratic shocks and to smooth consumption over time. We should therefore expect a decrease on welfare as intermediation costs increase. The effects on the aggregate welfare, however, are also not quantitatively very important. When the spread rate increases by a factor of 2 from the benchmark value, welfare reduces by less than 1/6 of 1 percent of the average consumption level. The aggregate consumption level would have to increase by about 0.15% to compensate individuals to live in an economy with a spread rate of 2 times the benchmark value of 4%. Further increases in the spread rate by a factor of 10 and 25 decrease welfare by 0.92 and 1.24 percent of the average consumption level, respectively.[8]

We next investigate the distributional effects of intermediation costs. Are the welfare costs of spread rates distributed uniformly over the population? Do the

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[8]Just for comparison, Erosa and Ventura (2002) show that inflation rates of 5 and 10 percent generate welfare loss of about 0.70 and 1.57 percent, respectively, of the average consumption level.

aggregate results hide important distributional consequences of intermediation costs?

3.3.2 Distributional effects

Table 4 reports the welfare costs of spread rates for the two type of agents: *type-H* and *type L*. Notice that the impacts of intermediation costs are stronger for low than high productive agents. When the spread rate, for instance, increases by a factor of 10 from the benchmark value, welfare reduces by roughly 0.17% and 1.38% for high and low productive agents, respectively.[9] This is an important difference, which suggests that intermediation costs have a regressive impact on welfare. Indeed consumption inequality increases as intermediation costs increases.

It is important to highlight that we are considering the natural borrowing limit, which is higher for type-H than for type-L individuals. The welfare difference of intermediation costs for type-H and type-L individuals would be higher if we had considered an *ad-hoc* credit limit.

In order to further investigate the distributional impacts of intermediation costs we analyze the welfare costs of spread rates by different wealth groups. We consider households in the following percentiles of wealth: Those on the bottom 1%, 5%, 10% and 50% of the wealth distribution; and those on the top 10%, 5% and 1% of the wealth distribution. We then calculate the average welfare costs in terms of average consumption in each wealth group. This allows us to study the welfare costs on the tails of the wealth distribution. Table 5 contains the results.

It is straightforward to observe that the effects of intermediation costs on welfare are far from be uniformly distributed. As expected the costs from the spread rates are concentrated on households on the low tail of the wealth distribution. When the

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[9]When the spread rate decreases from the benchmark value to zero, welfare increases by about 1.58% for type-L agents and decreases by 2.66% for type-H individuals.

Table 4: Distributional effects 1

	Average welfare costs		
			Consumption
	Type-H	Type-L	Gini
Benchmark, $\tau = 4\%$	0%	0%	16.57%
Spread rate = 0%	2.66%	-1.58%	16.28%
Spread rate = 8%	0.00%	0.24%	16.73%
Spread rate = 16%	0.00%	0.58%	16.86%
Spread rate = 32%	0.10%	0.74%	17.05%
Spread rate = 40%	0.17%	1.38%	17.18%
Spread rate = 100%	1.00%	1.40%	17.66%

spread rate increases from its benchmark value of 4 percent by a factor of 2 and 10, the welfare costs for households at the bottom 1 percent of wealth are roughly 14.04 and 41.63 percent of the consumption in the respective wealth group. Therefore, when intermediation costs increases by a factor of 2 households at the bottom 1 percent of wealth would require an increase in consumption of 14.04 percent to be as well off as in an economy with a spread rate of about 4 percent. We can also observe that intermediation costs have also important welfare costs on individuals at the bottom 5 and 10 percent of the wealth distribution.

Notice that the welfare implications of intermediation costs go in an opposite direction for households at the upper tail of the wealth distribution. Households at the top 1 percent of the wealth distribution have a welfare gain for high levels of intermediation costs above the benchmark value. For instance, for those households at the top 1 percent of the wealth distribution an increase in the spread rate from 4 to 40 percent increases their average consumption level by about 0.17 percent.

Table 5: Distributional effects 2

	Welfare costs by wealth groups						
	$p_{0.01}$	$p_{0.05}$	$p_{0.10}$	$p_{0.5}$	$p_{0.9}$	$p_{0.95}$	$p_{0.99}$
Benchmark, $\tau = 4\%$	0%	0%	0%	0%	0%	0%	0%
Spread rate = 0%	-5.17%	-3.07%	0.12%	0.13%	0.14%	0.18%	0.20%
Spread rate = 8%	14.04%	3.15%	0.34%	0.30%	0.20%	0.11%	0.04%
Spread rate = 16%	21.27%	4.44%	0.37%	0.29%	0.18%	0.09%	0.03%
Spread rate = 32%	31.77%	7.40%	1.51%	1.49%	0.17%	0.05%	-0.17%
Spread rate = 40%	41.63%	10.63%	2.34%	1.50%	0.17%	-0.03%	-0.17%
Spread rate = 100%	189.59%	33.13%	5.80%	1.61%	-0.29%	-0.34%	-0.44%

What is the rationale behind the above distributional impacts? When intermediation costs increase there are two effects in opposite directions. First a higher spread rate decreases the demand for loans which increases savings, the capital stock, and output. A higher capital stock also implies a lower interest rate on bonds, but a higher wage rate. Intermediation costs, however, deviate resource from productive use and therefore might decrease the capital stock and output and therefore might have an overall negative impact on consumption. A lower capital stock increases the interest rate and therefore the income from those that hold bonds, which are in general rich households. A lower capital stock decreases the wage rate and therefore the wage income. The results on tables 3 and 5 suggest that the second effect dominates. The positive effects of higher spread rate on the welfare of households at the top of the wealth distribution come therefore from a general equilibrium effect through an increase in the interest rate, which compensates the decrease in wage rate for those who hold high level of bonds.

4   Concluding Remarks

In this paper we developed a neoclassical growth model in which agents face uninsured idiosyncratic shocks on labor productivity and financial intermediation is costly. Intermediation costs generate a wedge between the loan and the deposit rate, such that the loan interest rate is equal to the deposit rate plus the intermediation costs. These cost might reflect reflect explicit and implicit financial sector taxes (e.g., taxes on financial transactions, on intermediary profits, or inflation), bank regulation (e.g., barriers to entry and non-interest-bearing reserve requirements) and institutions.

We show that the aggregate effects of intermediation costs on output and welfare are not quantitatively very significant. When intermediation costs increase by a factor of 10 from the baseline value of 4 percent (US case), output decreases by 0.6 percent and welfare (measured by the average consumption level) decreases by less than 1 percent. The aggregate results, however, hide important distributional effects. The welfare of high productive individuals decreases by about 0.17 percent when the intermediation costs increase by a factor of 10, while for low productive individuals welfare reduces by about 1.38 percent. In addition, when the spread rate increases from its benchmark value of 4 percent by a factor of 10, the welfare costs for individuals at the bottom 1 percent of the wealth distribution are roughly 41.63 percent of their average consumption, while the welfare costs for those at the top 1 percent of the wealth distribution are about -0.17 percent of their average consumption.

For countries with high intermediation costs such as Brazil where the spread rate averaged roughly 40 percent from 1995 to 2003, government can improve substantially the welfare of low income individuals by reducing costs on intermediary financing.

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