Social Connections and Earnings Inequality

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Abstract

Inequality has been a topic of lively debate during the last decade. This paper will try to contribute to this literature by positing the channel of social connections and evaluating its quantitative importance. To do that, I have built a life cycle model with heterogeneous agents whose main features are a labor market with search and initial investments in education. Educational expenditures fulfill the double purpose of enhancing the human capital stock of the individual and his arrival rate of job offers when unemployed. The main result of the paper is that social connections have a very small worsening effect on earnings inequality. Educational expenditures are performed mostly to raise the human capital stock, as the marginal return in terms of job offers is too low. Educational expenditure subsidies that are focused on the lowest skill types of the population are a more effective policy to decrease earnings inequality than free public education for everyone, although shutting down the social connections channel is the most effective one.

1 Introduction

It is a feature of reality that to be informed of job offers can make a difference when we want to avoid long unemployment spells. The first that finds out about an open position at some place has a bigger chance of finally getting the job. This is because as time passes by, it is more costly for firms to keep a position vacant, so it is more likely that it will be filled out soon. Hence, people that do not have proper channels of information will tend to arrive late and lose opportunities of putting their human capital to use.

But what determines having good channels of information? As it has been pointed out by several authors (Calvo-Armengol (2004), Calvo-Armengol and Jackson (2004), Fontaine (2008), Ioannides and Soetevent (2006)), the social network to which one belongs plays a big role. If I am unemployed but more people in my network are employed than in other networks, it is more likely that someone in my network will receive news about an open position at some place. Those news might be passed along to me and I might be able to apply for the job before the rest and eventually get it. The same would happen if my network enjoys a higher arrival rate of job offers.

This differentiation in the quality of social networks may come from different sources, being one of the most important the physical spaces that are shared with people. It is in those places where social interaction arises and links and bonds are formed. The defining feature of physical spaces though, is that it is possible to exclude people from them, either physically or by charging some price. In human beings' lifetime school is the first environment of this kind. In this sense, parents that assess that surrounding their children with people that are part of a better social network than their own will improve their lifetime outcomes, either because of better matches or shorter unemployment spells, will be willing to pay some money for it. At the same time, parents that already belong to the best social networks, will try to deter the entry of new members to it by lifting the barrier of the price, as new members will not benefit the current members, but only harm them by reducing the probability of receiving job offers.

This situation might have consequences for earnings and wealth inequality. In the face of credit constraints, only those wealthy enough will be able to put their children in the best

social networks, allowing them to earn money faster, more frequently, and even better, perpetuating the privileged position that they themselves had. Additionally, one would expect that a more costly school would not only imply benefits in terms of networks, but also in terms of better educational inputs such as school infrastructure, lower pupil-teacher ratio and peers with a better parental background, making students better connected workers in the future and also more qualified workers than the rest. These two forces push toward a more unequal distribution of earnings and wealth.

Consequently, the main purpose of this paper is try to assess the relevance of the social connections channel on the total degree of earnings inequality. For that purpose a life cycle model with heterogeneous agents is built. Its main features are a labor market with search by households, and upfront investments in education that help to enhance households' human capital and their possibilities to receive job offers at the same time.

The main result of the paper is that higher investments in education make the earnings distribution just slightly more unequal through the channel of social connections. The effect is the most clear when looked through the lens of the top 10% share measure of inequality. If we shut down the social connections channel, this statistic is reduced in 0.21 percentage points. As it was said before, people that invest more in education possess a higher human capital but also spend less time on unemployment. The small effects are explained by very low marginal returns in terms of job offers when investing more in education.

Later, I proceed to conduct some policy experiments that might help shed some light about the effect of remedial measures. One of them is to establish a universal subsidy to educational investments, which can be understood as universal free public education. Here the effects are also very small, which is due to the fact that public education helps less skilled people that invested less but also puts more skilled people farther away in the distribution, being the inequality reducing effect not powerful enough to cause big decreases in this dimension. The second experiment is to subsidize investments in education but for the 5 lowest skill types, which can be understood as targeted public assistance. The idea behind this is that the government can observe what students come from disadvantaged families, which would be reflected in their skill type, so they are helped in their accumu-

lation of human capital. The purpose of the policy then would be enhance human capital accumulation, not improve their chances of being employed, which would be regarded as a side effect. Here the redistributive effect is stronger, but still small. Low type agents can increase their human capital more easily and also get an increased access to better social connections, effect not present for the more skilled types. The most important thing to note though, is that shutting down the social connections channel dominates, in terms of reducing earnings concentration, these policies.

The paper is laid out as follows. In the next section I will briefly go over the related literature on the matter. Then in section 3, I will describe the model with its main features. In section 4, calibration is discussed. In section 5, the main results of the model are explained. Section 6 finally concludes.

2 Related Literature

This paper is inserted in four strands of literature: the one about earnings inequality, the one about human capital production, the one about search and labor market outcomes, and the one about networks. In the case of the first two ones, previous quantitative literature has been mostly focused on the direct effect of human capital investments on the earnings distribution, as in Heckman et al. (1998), which is an analysis of the evolution of wage inequality made at the national level, and as in Erosa et al. (2010), which is a study of income differences at the cross-country level. My investigation also takes those elements into account in the proposed model, but it adds the effect that investments in human capital may have in the probability of putting that same human capital into use, affecting then the earnings inequality through a different channel.

With respect to the search and labor market outcomes literature, I try to use a very basic and simplified framework. The idea is to embed it into a life-cycle model and compute its main parameters. In this sense, the main marginal contribution of this document would be to combine both frameworks to analyze earnings inequality in a quantitative way. This makes a fundamental difference with the papers that talk about the relation between labor market outcomes and networks, which usually do not provide quantitative analysis

of their theoretical models. Among these articles we can count Calvo-Armengol (2004), Calvo-Armengol and Jackson (2004), Ioannides and Soetevent (2006), and Fontaine (2008). Calvo-Armengol (2004) and Calvo-Armengol and Jackson (2004) are the seminal papers in this field. In the first one, Calvo-Armengol builds a model that specifies at the individual level both the decision to form contacts with other agents and the process through which information about jobs is transmitted, finding that an equilibrium always exists and that only moderate levels of network asymmetry can be sustained. In the second, constructing on the previous paper, they explicitly model the network of social contacts, finding that unemployment exhibits duration dependence and that worse networks in terms of employment are persistent in their status. My paper takes these theoretical results and tries to reproduce them in a reduced form, by making the arrival rate of job offers dependent on the level of education expenditures chosen at the beginning of the individual's lifetime. This level of education would try to represent the choice of the network and its quality.

The paper closest to mine is the one of Fontaine (2008). This article provides a matching model where identical workers are members of ex-ante identical networks. The job arrival rate is also endogenous, like in this document, but wages are bargained, which is a feature not present here. His main result is that unemployment and wage dispersion arises endogenously as a consequence of the dynamics of networks, firms' strategies and wage bargaining. On the other hand, in this paper workers and networks are heterogeneous and dispersion arises as a consequence of optimal decisions of educational expenditures by agents.

On the empirical front, it stands out the work of Zimmermann (2016). He uses Chilean administrative data on income and the census of directors and top managers at publicly traded firms, finding that the positive effect of being admitted to elite programs on the probability for a graduate student of holding a top position or being in the top 0.1% of incomes is reinforced if that student went to a high-tuition private high school. Moreover, these effects are zero for people from other backgrounds. This paper tries to take these ideas, put them into a quantitative general equilibrium framework, and check whether this local effect can be generalized to the whole economy.

3 Model

This is an economy populated by overlapping generations of people. Individuals live for T years and work until they die. At the beginning of the life cycle, skill types are revelaed. Taking this into account, a prospective worker decides how much to invest in education. There are no credit constraints at this point, so he can commit his expected future lifetime income to repay the fictional loan. Once he has made his decision, he cannot make further investments. The individual will choose the option that gives him the highest expected lifetime utility.

3.1 Households

Let a_{st} be the stock of assets held at time t by a person of age s, and h^e_{st} the stock of human capital at time t of a person of age s that invested e at the beginning of his lifetime.

The optimal life cycle problem will be solved in two stages. In the first stage, conditional on the amount of education investment, I will solve for the optimal path of consumption $\{c_{st}\}$. This is done for each type of education. After that, I will select the investment amount, e, that maximizes individual's lifetime welfare.

Individuals can be employed or unemployed in every period. If they are employed, they earn a wage w_t per each unit of human capital they possess and face a probability λ of losing their jobs. If they are unemployed, they have to search for jobs. The arrival rate of job offers is a function $\rho(e)$ of the amount of education investment made by the individual. Once an offer arrives, the agent will draw a random offer-specific characteristic μ that will be i.i.d. from a known distribution $F(\mu)$. We may think of this characteristic as a measure of the luck of the agent. If μ is higher, we can interpret it as having received an offer that will enhance the efficiency with which his human capital will be used. If μ is low, the opposite. As a consequence of this, I will consider that if the agent accepts the offer, his human capital stock will be his initial human capital stock times μ for the time the link is active. If an offer is rejected, the agent remains unemployed that period. As it is typical in search models, agents may prefer to stay unemployed if the value of waiting is greater than the value of taking the job immediately. In this framework, this value of waiting can

be enhanced by a higher $\rho(e)$.

Given e, we can write the problem of an employed individual of age s at time t as:

$$V^E_{s,t}(h^e_{st}, a_{st}, e) = \max_{\{c_{st}\}} u(c_{st}) + \beta \left[(1-\lambda)V^E_{s+1,t+1}(h^e_{st}, a_{s+1,t+1}, e) + \lambda V^U_{s+1,t+1}(h^e_{st}, a_{s+1,t+1}, e)\right] \tag{1}$$

subject to:

$$c_{s,t} + a_{s+1,t+1} \leq a_{s,t}(1+r_t) + w_t \mu h^e_{s,t} - T_t$$
$$a_{s,t} \geq 0$$

where r_t is the net return on physical capital at time t, T_t are lump-sum taxes, and λ is the probability that the job link will be destroyed from one period to the other. I will abstract from labor supply in this paper.

Similarly, the problem of an unemployed individual of age s at time t is:

$$\begin{aligned} V^U_{s,t}(h^e_{st}, a_{st}, e) = &\max_{\{c_{st}\}} u(c_{st}) + \\ &\beta \left[\rho(e) \int \max\{V^E_{s+1,t+1}(\mu h^e_{s,t}, a_{s+1,t+1}, e), V^U_{s+1,t+1}(h^e_{s,t}, a_{s+1,t+1}, e)\} dF(\mu)\right] \\ &+ \beta \left[(1-\rho(e))V^U_{s+1,t+1}(h^e_{s,t}, a_{s+1,t+1}, e)\right] \end{aligned} \tag{2}$$

subject to:

$$c_{s,t} + a_{s+1,t+1} \leq a_{s,t}(1+r_t) + b - T_t$$
$$a_{s,t} \geq 0$$

where b is a subsistence wage and $\rho(e)$ is the aforementioned probability of receiving a job offer.

The period utility function will be a standard CRRA:

$$u(c_{st}) = \frac{c_{st}^{1-\sigma}}{1-\sigma}$$

The human capital production function will be given by:

$$h_{s,t}^{e} = A_h z(e+1)^{\xi} \tag{3}$$

where A_h is a common productivity parameter, while z is an idiosyncratic skill parameter that has a distribution $\Phi(z)$. There is a one in the educational investments part to generate a positive level of human capital when no investments are made. We can think of this as the human capital of a very low skilled worker.

An educational investment of size e will generate an arrival rate of job offers for the individual according to:

$$\rho(e) = 1 - \psi \exp\{-\kappa e^{\eta}\} \tag{4}$$

with $\psi, \eta \in [0, 1]$. The functional form has been chosen so as to ensure that $\rho(e)$ is between zero and one.

As it was previously said, at the beginning of life, agents choose the value of e that maximizes lifetime utility:

$$\hat{e} = \arg\max_{e} \left[\bar{c}^{e}(z) - x^{e}\right] \tag{5}$$

where $\bar{c}^{e}(z)$ is the consumption equivalent of the discounted expected lifetime utility of an individual of skill type z that invested the amount e, and x^{e} is the equivalent constant annual coupon that the individual would have to pay in order to repay a loan of e at the equilibrium interest rate. The only state variable in this stage is the skill type, which is revealed at the beginning of lifetime.

Before proceeding to the other parts of the model, let us discuss briefly the structure of the households module. The focus of this paper is in trying to quantify the role of social connections on earnings inequality. Here, they will be crucially represented by the arrival rate of job offers, which will be a reduced form of an existent social network that is operating in the background. As it is evident, the access to a better social network comes from a higher investment in education at the outset of the working life, which in turn depends heavily on the skill type of the individual. It is in this way that segregation is generated, and the main mechanism through which earnings inequality is amplified.

3.2 Aggregates

Prices of human and physical capital are determined as derivatives of an aggregate production function, which is meant to represent a continuum of identical atomistic firms. In order to compute these objects we need to construct aggregates of each kind of capital.

Let c index cohorts, and denote the date at which cohort c is born by t_c. First period of life will then be $t_c + 1$. The rental rate on physical capital at time t is r_t. The rental rate on human capital is w_t. Choices made by individuals depend on their type, z, their wealth, $a_{s,t}$, and their type of education e. Let $h^e_{s,t}(z, a_{s,t})$ be the human capital possessed, and $a^E_{s+1,t+1}(z, a_{s,t}, e)$ and $a^U_{s+1,t+1}(z, a_{s,t}, e)$ the policy functions for asset accumulation when employed and unemployed, respectively.

The age at time t of a person born at time t_c is $s = t - t_c$. Let $N^e(z, a, t_c, j)$ be the number of persons of type z, in cohort c, with wealth a and employment status $j = \{E, U\}$, that chose an education type e. Then, the aggregate stock of human capital at time t is:

$$H_t = \sum_{t_c=t-T}^{t-1} \sum_{e} \sum_{j=\{E,U\}} \int_z \int_a h^e_{t-t_c,t}(z, a) N^e(z, a, t_c, j) \mathbb{1}\{j = E\} d\Psi_t(z, a, t_c, e, j) \tag{6}$$

where $\Psi_t(z, a, t_c, e, j)$ is the joint distribution of z, a, t_c, e, and $j = E, U$ at time t. Similarly, the capital stock is:

$$K_t = \sum_{t_c=t-T}^{t-1} \sum_{e} \sum_{j=\{E,U\}} \int_z \int_a a^j_{t+1-t_c,t+1}(z, a) N^e(z, a, t_c, j) d\Psi_t(z)(z, a, t_c, e, j) \tag{7}$$

3.3 Equilibrium

The aggregate production function $F(H_t, K_t)$ will be a standard Cobb-Douglas:

$$F(H_t, K_t) = A K_t^{\alpha} H_t^{1-\alpha} \tag{8}$$

Given this, the rental rate of capital and the wage rate per unit of human capital are given by:

$$r_t = \alpha A \left(\frac{H_t}{K_t}\right)^{1-\alpha} - \delta \tag{9}$$

$$w_t = (1-\alpha) A \left(\frac{K_t}{H_t}\right)^{\alpha} \tag{10}$$

In this paper the only interesting role of the government will be to create a program of subsidies for the poor people to acquire a better education level. This will be analyzed later. Therefore, outside of this situation its functioning will be very simple: it will collect lump-sum taxes to fund subsistence wages, maintaining always a balanced budget. We can represent this by:

$$T_t = \sum_{t_c=t-T}^{t-1} \sum_{e} \sum_{j=\{E,U\}} \int_z \int_a b \mathbb{1}\{j = U\} d\Psi_t(z, a, t_c, e, j) \tag{11}$$

Finally, the earnings of a person of age s of cohort c type z with human capital $h^e_{s,t}(z, a_{s,t})$ and that had market luck μ when he was employed at time t are:

$$W(a_{s,t}, t, h^e_{s,t}(z, a_{s,t})) = w_t \mu h^e_{s,t}(z, a_{s,t}) \mathbb{1}\{j = E\} + (1 - \mathbb{1}\{j = E\}) b \tag{12}$$

Given all this, the definition of the equilibrium will be the following:

***Definition of equilibrium**: An equilibrium are sequences of $\{c_{st}(z, a_{s,t}, e, j)\}$, $\{a_{st}(z, a_{s-1,t-1}, e, j)\}$, education investment levels $e(z)$, value functions $V^E_{s,t}$, $V^U_{s,t}$, and V, stocks H_t and K_t, a joint distribution $\Psi_t(z, a, t_c, e, j)$, and prices r_t, w_t such that:*

1. *$\{c_{st}(z, a_{s,t}, e, j)\}$ and $\{a^j_{st}(z, a_{s-1,t-1}, e)\}$ are the maximizers of $V^E_{s,t}$ and $V^U_{s,t}$ for given prices w_t and r_t and every possible level of education investment e*
2. *e is the maximizer of V*
3. *H_t and K_t are the firms' profit maximizers given prices w_t and r_t*

4. *Government budget is balanced*

$$T_t = \sum_{t_c=t-T}^{t-1} \sum_{e} \sum_{j=\{E,U\}} \int_z \int_a b \mathbb{1}\{j = U\} d\Psi_t(z, a, t_c, e, j)$$

5. *Markets clear:*

   (a) *Physical capital market:*

$$K_t = \sum_{t_c=t-T}^{t-1} \sum_{e} \sum_{j=\{E,U\}} \int_z \int_a a^j_{t+1-t_c,t+1}(z, a) N^e(z, a, t_c, j) d\Psi_t(z)(z, a, t_c, e, j)$$

   (b) *Human capital market:*

$$H_t = \sum_{t_c=t-T}^{t-1} \sum_{e} \sum_{j=\{E,U\}} \int_z \int_a h^e_{t-t_c,t}(z, a) N^e(z, a, t_c, j) \mathbb{1}\{j = E\} d\Psi_t(z, a, t_c, e, j)$$

   (c) *Goods market (balanced by Walras' Law)*

4 Calibration

I calibrate the model for the U.S. economy in a steady state situation, assuming that the net rental rate of capital, r_t, is equal to 0.05, which is the measured value of the return on non-financial corporate capital net of taxes as reported in Poterba (1997) for the period 1990-1996 in the United States. In this sense, the calibration is performed not solving the general equilibrium of the model, but the partial one. The main reason for doing this is for the sake of speed in the computation of results, as solving the entire multi-dimensional mapping in general equilibrium is a heavy task that I commit to undertake in the next versions of this article.

Externally calibrated parameters: The model period is 1 year. Given this, I set the discount factor β to 0.994, which is a usual value in the life cycle literature with certain ends of lifetimes (Huggett, 1996). The relative-risk aversion parameter σ is set to 1.5, which fol-

lows the microeconomic studies reviewed by Auerbach and Kotlikoff (1987) and Prescott (1986). The physical capital depreciation rate is set to 0.06, as it was estimated in Stokey and Rebelo (1995). The share of capital income to GDP is set to 0.4, as taken directly from US national accounts for the period 2005-2015. The productivity parameters A and A_h are going to be set to 1, as their values do not modify the main results of the model, which have to do with distributions within a country. Skill types will have a log-normal distribution with mean zero and variance σ_z^2. This parameter is set to 0.38, which is the value set by Huggett (1996) for the variance of initial types. Finally, the parameter λ, which represents the annual probability that a job link is broken will be estimated from data provided by the Bureau of Labor and Statistics and set to 0.1664.

Internally calibrated parameters: There are 5 parameters that are left to calibrate. Let us define the parameter set as:

$$\Omega \equiv \{\psi, \sigma_\mu, \xi, \eta, \kappa\}$$

Let M^E denote the vector of empirical moments and $M(\Omega)$ denote the vector of model-simulated moments for a given Ω. The method for estimating the parameters is by minimizing the following loss function by searching over the possible values of Ω:

$$\min_{\Omega} \sum_{m=1}^{5} \frac{|M_m^E - M_m(\Omega)|}{|M_m^E|}$$

The parameters are estimated jointly but one can provide a discussion about how each empirical moment could be associated with the identification of some particular parameter.

Consider first the identification of ψ. This parameter rules the lower bound of the rate at which job offers arrive, so it has a direct effect on the overall unemployment rate of the economy. Therefore, an obvious empirical moment that one would like to have is the long-run or structural unemployment rate of the U.S. economy, which is not determined by cyclical fluctuations but by the real frictions in the labor markets. I calculate then the average annual unemployment rate for the period 2006-2016 from the Federal Reserve

databases.

In addition to this, σ_μ also affects the unemployment rate of the economy, but it should also affect differentially the unemployment rates of subsets of the population. People that have invested more in education have a higher probability of receiving a job offer when unemployed, so they will get more draws of μ over time. If μ has a very high variance, it is more likely that people will get low enough values so that they will not be willing to accept the job offer. Hence, the unemployment rate of well educated people should go up. For this reason, assuming that μ distributes normal with mean 1 and variance σ_μ^2, I target the average unemployment rate of people with Bachelor's degree or more over the period April 2005 to April 2015.

In the third place, ξ affects the return on human capital investments in terms of income. In this sense, it should have influence on the amount of educational expenditures undertaken by people, which are expressed in the annual coupon that they have to pay. Thus, I also target the ratio of private educational expenditures over GDP, which is taken from OECD (2013) data for the U.S.

Closely related to the previous one, η and κ will affect the amount of educational expenditures as well, by changing the average time a person will be unemployed during its lifetime. To identify them I propose two moments, one of them is the state level standard deviation to mean ratio of tuition costs at private schools, and the other is the unemployment rate of people with less than high school as highest educational attainment. In the case of the former, it would be ideal to have individual level educational expenditures or school level tuition costs, but there does not seem to exist publicly available databases of this kind. Nonetheless, if we assume that state-specific effects are washed out when the average across all states is performed, we can have a potentially good target. The idea behind this is that a higher κ will induce people to exert more effort by investing in education at the beginning of their lifetimes, and that a lower η, which is assumed to be between 0 and 1, will make additional efforts more and more costly, creating dispersion. Similarly, as these two things happen, low educated people should see less job offers per unit of time, so it will be harder for them to leave the unemployment state. The private school tuition

costs data is taken from the Private School Review website[1] and the unemployment data from the Bureau of Labor Statistics.

For the moment I will abstract from the non-pecuniary costs shown in Section 3. There will be 10 possible skill types. Calibration results are displayed in Table 1.

Table 1: Parameters and Data Targets

Parameter	Value	Target/Source	US	Model
β	0.994	Huggett (1996)		
σ	1.5	Auerbach and Kotlikoff (1987)		
δ	0.06	Stokey and Rebelo (1995)		
α	0.40	U.S. National Accounts		
σ_z	0.6164	Huggett (1996)		
λ	0.1664	Bureau of Labor Statistics		
ψ	0.7184	Unemployment rate	6.2%	14.3%
σ_μ	0.2182	Un. rate of bachelor's degree or higher	3.35%	13.48%
ξ	0.0218	Private educ. expendit. over GDP	3.5%	3.5%
η	0.564	Std. dev./mean tuition cost priv. schools	0.4879	0.3647
κ	5.8823	Un. rate HS drop outs	10.65%	14.19%

We can observe that the model struggles to match the unemployment rates. It fares better when matching the standard deviation to mean ratio of tuition costs of private schools, and it performs really well when reproducing the private educational expenditure over GDP. One potential explanation for this behavior is the imperfect match between the educational expenditure levels in the model and the associated highest educational attainments of people in reality. Many people might have a bachelor's degree without ever spending money, because of the use of public education and scholarships. On the other hand, there might be people that invested a lot of money in private schools but did not go to college or did not complete a certain degree, but were successful anyway. In addition to this, it was already noted that the statistics related to tuition costs of private schools were imperfect. This might be playing a role as well. To improve the performance of the model in matching these targets is one of the main tasks for the future.

[1] www.privateschoolreview.com/tuition-stats/private-school-cost-by-state

5 Results

In this section I will report the results of the overall level of inequality existent in the model, and how it changes when shutting down the channel of social connections. In addition to this, I will perform two policy experiments. The first of them will be to establish a flat subsidy to all educational investments, in an attempt to represent free public education. The second one will be to focus the help in the five lowest skill types of the population.

5.1 Effect of the Social Connections Channel

To assess the role of the social connections channel first I am going to show the overall level of inequality existent in the baseline model. After that, I will shut down the social connections channel and force everyone to have the arrival rate of the median agent in terms of educational expenditures.

The overall level of inequality in the baseline model (BE) and in the modified one (ME) is:

Table 2: Inequality: Baseline and Modified Models

Statistic	Earnings BE	Earnings ME	Wealth BE	Wealth ME
Variance of logs	12.83	12.84	8.00	8.50
Gini coefficient	0.41	0.41	0.98	0.98
Mean/Median	1.14	1.13	NA	NA
Top 10% share	34.15%	33.94%	100%	100%

We can observe that there is very little to a nil effect of shutting down the social connections channel, which points to the strong predominance of the direct effect of human capital investments. In this sense, investments that were made in the baseline model were made mostly to improve the stock of human capital and not for social connections motives, as the marginal return in this dimension is very low. The low marginal return is driven by parameters η and κ, which reinforces the idea of improving the calibration stage. The top 10% share of earnings is the one displaying the most evident reduction in inequality, but it is still small.

It is necessary to notice that the NAs in the wealth columns are due to the fact that the median level of asset holdings is zero in the simulations. As you can see, there is a very high concentration of wealth in this economy, which also makes the top 10% share of assets to be 100% of the total of the economy.

5.2 Effect of Free Public Education

Here the procedure will be that a common subsidy is given to all individuals at the beginning of their lifetimes to finance educational investments. The subsidy will be equal to the median of the equivalent annual coupon x^e paid by the individuals in the model without public education. The subsidy will improve the human capital stock of those who receive it in the same way that private investments do, i.e. the new total educational expenditure will be equal to the private effort e plus the present value of the subsidy.

Table 3: Inequality: Universal Public Education Environment

Statistic	Earnings	Wealth
Variance of logs	12.83	7.97
Gini coefficient	0.41	0.98
Mean/Median	1.14	NA
Top 10% share	34.13%	100%

As we can see, there are no meaningful effects of free public education on any of the inequality statistics. The reason is that the subsidy only reduces the burden over the individual's lifetime associated with repaying the educational expenditures loan, but it does not affect in a significant way the marginal decisions with respect to how much to invest. In this sense, there is an effect on the overall level of earnings but not on its dispersion. Effects might be different if the government charged some kind of distortionary tax to fund the subsidy and/or we computed the general equilibrium.

If we look again to the top 10% share statistic, we will find that universal free public education is less effective in reducing earnings concentration than shutting down the social connections channel, which helps to validate somehow the mechanism considered.

5.3 Effect of Focused Public Subsidies

In this section I will set the public subsidy to the same level of section 5.2. but it will only be given to the five lowest skill types. The idea is that the government has the ability to observe the background of people and infer their skill types from there. The subsidy, just like in the previous section, will enhance the human capital of the agents by the equivalent amount in present value.

Table 4: Inequality: Focused Public Education Environment

Statistic	Earnings	Wealth
Variance of logs	12.83	8.00
Gini coefficient	0.41	0.98
Mean/Median	1.13	NA
Top 10% share	34.09%	100%

Once again, the effects are very small. The only statistic that changes something is one more time the top 10% share of total earnings. If we take this as our preferred measure of inequality, we can see that this policy is marginally more effective in reducing earnings inequality than the one of free public education to everyone. This is due to the simple fact that universal public education helps the less skilled, but also puts the more skilled farther away. The effect should be stronger for the less skilled because of the concavity of the human capital production function, but the function is not concave enough to generate strong effects. The same applies for the jobs arrival rate function. When subsidies are focused only on the less skilled instead, there is only improvement for them so the inequality reducing effect is more powerful. However, it is still less potent than shutting down the social connections channel, which is a remarkable outcome.

6 Conclusion

Inequality has been a topic of lively debate during the last decade. Its determinants are varied and to assess the relevance of each one of them has been a hard enterprise. This paper has tried to contribute to this literature by postulating the channel of social connections and evaluating its quantitative importance. To do that, I have built a life cycle

model with heterogeneous agents whose main features are a labor market with search and initial investments in education. The education expenditures fulfill the double purpose of enhancing the human capital stock of the individual and his arrival rate of job offers when unemployed and looking for a job in his working life. The main result of the article is that social connections matter only slightly for earnings inequality, being the effect most clear in the case of the top 10% share. In addition to this, education expenditure subsidies that are focused on the lowest skill types of the population are a more effective policy to decrease earnings inequality than free public education to everyone. Nonetheless, the strongest inequality reducing effect is associated with shutting down the social connections channel, which lends hope to the validity of the mechanism.

The main tasks that are left to do are: first, to get a more robust identification of the parameters that pertain to the human capital production function and the arrival rate of job offers function, and second, to frame the model in a way such that people are effectively credit constrained to invest in education at the beginning of their lifetimes and provide a more explicit network behind the arrival rate of job offers.

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