

Endogenous Economic Institutions, Wage Inequality, and Economic Growth^{*}

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Abstract

This paper suggests that the increase in the proportion of college graduates in the United States labor force in the 1970s may have been a causal factor in both the decline in the college premium during the 1970s and the large increase during the 1980s and the 1990s. I argue that the proportion of skilled workers in the labor force determines their relative importance in the political process. Thus, the increase in the proportion of skilled workers during the 1970s reduced skill premium in the short run, but induced a change in policies that increased the skill premium in the subsequent decades above its initial value.

Key Words: Endogenous Growth, Political Economy, Endogenous Institutions, Education, Innovation, Wage Inequality, Minimum Wage, Labor Unions, Special Interest Groups, Strategic Voting, Campaign Contributions, Skill Premium.

I. INTRODUCTION

In the period after 1970 economic fortunes diverged, especially in the United States. Middle and high income Americans have continued to benefit from the massive economic growth. But material well-being for the lower income classes has stagnated. Households with an annual

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income of over \$100,000 (year \$2000 dollars) increased from under 3% in 1967 to over 12% in 2000. In year 2000 dollars, median income increased from \$31,400 in 1967 to \$42,200 in 2000.

Although overall inequality increased steadily after 1970, this was not the case for skill premium. In 1970 college graduates earned 55% more than high school graduates. This premium fell to 41% in 1980, but then increased to 62% in 1995.¹

One explanation for the rapid increase in the college premium in the 1980s is skill biased technological change.² According to this explanation, an increase in the supply of skills has two effects on skill premium. First, it decreases skill premium through the conventional substitution effect which makes the economy move along a downward sloping relative demand curve. Second, it increases skill premium through the directed technology effect which shifts the relative demand for skills because the increase in the supply of skills induces faster upgrading of skill-complementary technologies. Galor and Moav (2000) argue that an increase in the rate of technological progress raises the returns to ability and simultaneously generates an increase in wage inequality between and within groups of skilled and unskilled workers and an increase in education. Finally, there is the international trade explanation. According to this theory, an increase in the volume of trade will increase the demand for skill intensive goods in countries that export these goods. This will increase both the supply of skills and the skill premium.

This paper provides another explanation that works through economic institutions and policies.³ Economic institutions determine the incentives of economic actors, and shape economic outcomes. As such they are social decisions chosen for their consequences. Different groups and individuals benefit from different economic institutions and policies. Thus, there is generally a conflict over these social choices, ultimately resolved in favor of groups with greater political power. An increase in the number of skilled individuals will increase their political power and their ability to affect economic policies.

¹ See Autor, Katz, and Krueger (1998).

² See Acemoglu (1998).

³ Hacker and Pierson (2011) argue that this is the only possible explanation because technical change and increased international trade should affect the same every advanced country. Evidence shows (see Freeman and Katz [2005], Katz et al. [1995], and Nickell and Bell [1996]) that skill premium increased sharply in the U.S., there was less of an increase in the U.K. and almost no change in most continental European economies.

Economists agree that economic institutions and policies are endogenously determined. McCarthy, Poole and Rosenthal (2006) argue about the changes in economic policy that took place during the 1980s: 'Reagan conservatism was a product sitting on a shelf in the political supermarket. In 1980, customers switched brands'. As the number of those who benefit from conservative economic policies increased dramatically during the 1970s, both parties, and not only Republicans, adopted relatively more conservative economic policies. McCarthy, Poole, and Rosenthal (2006) argue that both Democrats and Republicans became more conservative in economic issues after 1975. Gerring (1998) argues that after the 1970s Democrats have moved their platforms away from general welfare issues to issues based on ascriptive characteristics (race and gender) of individuals.

The basic argument is the following: low-educated voters are not able to fully understand the impact the various policies have on their income. As a result, they rely on advertisement in order to decide which policies will benefit them more. This gives an incentive to political parties to choose bad policies that benefit some groups, in exchange for campaign contributions that 'buy' unskilled workers' votes. Bad policies (low property right protection, high tax on profits, high cost to start a new firm and high minimum wage) imply smaller support from educated voters and bigger support from uneducated voters. An increase in the proportion of skilled workers in the labor force implies an increase in the relative importance of skilled workers in the political process. As a result, an increase in the proportion of skilled workers reduces skill premium in the short run, but then it induces a change in economic policies that increases the skill premium, possibly even above its initial value.

Empirical evidence supports the conjecture that economic institutions and policies can account for much of the rise in dispersion of the wage distribution. DiNardo, Fortin, and Lemieux (1996) find that from 1979 to 1988 the decrease in the minimum wage explains 24% (for men) and 32% (for women) of the change in the variance in log wages. Card and Krueger (1995) conclude that 20 to 30 percent of the rise in wage dispersion during the 1980s could be attributed to the decline in the real value of the minimum wage. Mishel, Bernstein, and Schmitt (1996) examine the 90/10 wage differential and report even larger effects. Lee (1999) finds that during the 1980s, the estimates for men, women as well as the combined sample, imply that almost all of the growth in the wage gap between the tenth and fiftieth percentiles is attributable to the erosion of the real

value of the minimum wage during the decade. He also argues that the minimum wage may account for as much as 80% of the growth in so called ‘within-group’ wage inequality and about 15% of the change in the return to schooling during the 1980s. This last piece of evidence shows also that skilled workers benefit from a low minimum wage.

This paper argues that political parties will choose such bad (for skilled workers) policies not in order to gain support from unskilled workers through redistribution, but in order to benefit some special interest groups in exchange for campaign contributions.⁴ Indeed, Neumark, Schweitzer, and Wascher (2004) argue that low-wage workers are adversely affected by minimum wage increases. Although wages of low-wage workers increase, their hours and employment decline, and the combined effect of these changes is a decline in earned income. They also find that relatively low-wage union members gain at the expense of the low-wage nonunion workers when minimum wages increase. This explains the vigorous support of labor unions for minimum wage increases and their significant contributions to the political campaigns.⁵ Labor market regulations, high taxes, corruption, and restrictions that increase the cost of starting a firm are some other policies that affect negatively skilled workers (entrepreneurs) more than unskilled. Labor unions, corrupt bureaucrats, and firms that target government subsidies and, thus, they prefer high tax rates and large government, are those that support these policies.

The assumption that unskilled individuals are impressionable voters is at the heart of the model. Impressionable are those voters who are not willing or are not able to make the calculations necessary for strategic voting. These voters pay attention to campaign advertisement. The more a party spends (holding constant the spending of its rival), the greater is its share of the impressionable votes. Strategic voters understand the political environment and the implications of their votes. By voting for the party whose platform he prefers, a strategic voter slightly increases his expected welfare. There is empirical evidence that education increases civic participation.⁶ Educated individuals participate more actively in politics, read more often newspapers, send letters to politicians and try to persuade others. Also, education allows those

⁴ Alesina, Glaeser, and Sacerdote (2001) show empirically that higher inequality is not associated with more redistribution. This implies that the traditional model of the median voter who chooses the level of redistribution is not a good representation of reality.

⁵ According to Hrebener, Burbank, and Benedict (1999), both in the 1995-1996 and in the 1997-1998 campaign cycles, five out of the top ten political action committee (PAC) contributors to federal candidates are labor unions.

⁶ See Dee (2003), Glaeser, Ponzetto, and Shleifer (2007), and, Milligan, Moretti, and Oreopoulos (2004).

who are interested in politics to understand and evaluate the different policies and the impact that these policies have on their welfare. In other words, education allows individuals to become strategic voters.⁷

The impact of an increase in the supply of skills on the skill premium is determined by two competing forces: the first is the conventional substitution effect which makes the economy move along a downward sloping relative demand curve. The second is the political economy effect, which shifts the relative demand curve for skills as shown in figure I, because the increase in the supply of skills induces policy changes that benefit skilled workers.

A large increase in the supply of college graduates as in the late 1960s and 1970s first moves the economy along a short-run (constant policy) relative demand curve, reducing the college premium. The relative supply change also increases the fraction of strategic voters and decreases the fraction of impressionable voters. Thus, policies change and skill premium increases. The relative demand curve in Figure I shifts to the right. If the political economy effect is not big enough then the skill premium first falls and then increases, but not above its initial level. In contrast, if the political economy effect is big enough, the model predicts that in the long run the college premium should increase. This case (shown in Figure I) explains the change in the U.S. college premium over the past 25 years.

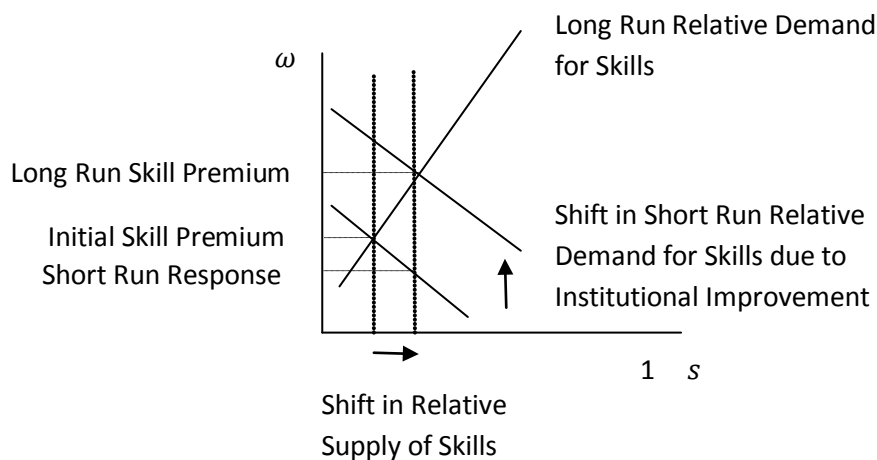


Figure I

⁷ A similar assumption has been made by Bourguignon and Verdier (2000). They argue that only those with high enough education vote. I argue that only those with high enough education are strategic voters.

II. THE MODEL

A. Production

There is a sequence of discrete time periods $t = 1, 2, \dots$. There is a mass L of workers in the economy. Workers can be skilled (entrepreneurs) or unskilled. I assume that the number of skilled and unskilled workers is exogenous. Later I will relax this assumption. There are s skilled and u unskilled individuals that supply labor inelastically. Individuals live forever and for simplicity I assume that they cannot save or borrow. In the end of each period they consume all their income, and thus they seek to maximize it.

People consume only one good, called the final good, which is produced by perfectly competitive firms using as inputs unskilled labor and a continuum of intermediate goods according to the technology:⁸

$$Y_t = u^{1-\alpha} \int_0^1 A_{it}^{1-\alpha} x_{it}^\alpha di, \quad (1)$$

where each x_{it} denotes the quantity of intermediate input i used in final good production at time t , and A_{it} is a productivity parameter that reflects the current quality of the intermediate good i . The coefficient α lies between zero and one. In any period the productivity parameters will vary across intermediate products because of the randomness of the innovation process.

Each intermediate good is produced by a monopolist each period, using the final good as all input, one for one. That is, for each unit of intermediate good, the monopolist must use one unit of final good as input. Final good that is not used for intermediate production is available for consumption.

Each monopolist at t maximizes his profit measured in units of the final good:

$$\Pi_{it} = p_{it}x_{it} - x_{it} \quad (2)$$

where p_{it} is the price of the intermediate good i relative to the final good.

⁸ This model is based on Aghion and Howitt (2009).

The inverse demand curve facing each monopolist charging the price p_{it} is the marginal product:

$$p_{it} = \alpha(A_{it}u)^{1-\alpha}x_{it}^{\alpha-1} \quad (3)$$

Therefore, the monopolist in sector i chooses the quantity x_{it} to maximize profits,

$$\Pi_{it} = (\alpha(A_{it}u)^{1-\alpha}x_{it}^{\alpha-1} - 1)x_{it} \quad (4)$$

which implies an equilibrium quantity:

$$x_{it} = \alpha^{\frac{2}{1-\alpha}}A_{it}u \quad (5)$$

The equilibrium profit of the monopolist is:

$$\Pi_{it} = (1 - \alpha)\alpha^{\frac{1+\alpha}{1-\alpha}}A_{it}u \quad (6)$$

In each period, entrepreneurs (skilled individuals) will attempt an innovation, each one in a different sector. If an entrepreneur succeeds, the innovation will create a new version of the intermediate good, which is more productive than previous versions. Specifically, the productivity of the intermediate good will go from last period's value $A_{i,t-1}$ up to $A_{it} = \gamma A_{i,t-1}$, where $\gamma > 1$. If he fails, then there will be no innovation and the intermediate good will be the same one that was used in $t - 1$, so $A_{it} = A_{i,t-1}$.

In order to innovate, the entrepreneur must conduct research, a costly activity that uses entrepreneur's labor as its only input. The probability that an innovation occurs in any period t is:

$$\mu_t = \lambda \frac{\varphi A_t}{A_{it}^*} \quad (7)$$

where $A_{it}^* = \gamma A_{i,t-1}$ is the productivity parameter if he succeeds. The reason why the probability of innovation depends on A_{it}^* is that as technology advances it becomes more complex and thus harder to improve upon. λ is a parameter that reflects the productivity of the research sector. Entrepreneurial skills are produced by two inputs: time and local knowledge. I take as given the

amount of time spend in education by each entrepreneur.⁹ Local knowledge is a public input which we assume to be proportional to aggregate productivity $A_t = \int_0^1 A_{it} di$. φA_t is the skill level of each entrepreneur.¹⁰

Each entrepreneur's wage is his expected reward from innovation:¹¹

$$w_s = \lambda \frac{\varphi A_t}{A_{it}^*} \Pi_{it} = \lambda \frac{\varphi A_t}{A_{it}^*} (1 - \alpha) \alpha^{\frac{1+\alpha}{1-\alpha}} A_{it} u = \lambda \varphi A_t (1 - \alpha) \alpha^{\frac{1+\alpha}{1-\alpha}} u \quad (8)$$

because $A_{it}^* = A_{it}$ when innovation takes place. Equation (8) implies that the expected reward is the same in all sectors.

Each unskilled worker will receive his marginal product. Simple algebra gives:

$$w_u = (1 - \alpha) \alpha^{\frac{2\alpha}{1-\alpha}} A_t \quad (9)$$

Skill premium, ω , is defined as follows:

$$\omega = \frac{w_s}{w_u} = \lambda \varphi \alpha u = \lambda \varphi \alpha (L - s) \quad (10)$$

I assume for simplicity that $L = 1$ and thus, s is the share and the number of skilled workers. Skill premium becomes:

$$\omega = \lambda \varphi \alpha (1 - s) \quad (11)$$

B. Political economy model

There are two political parties, A and B . Each party announces before the election the set of policies that will implement if elected. To simplify the analysis I restrict the available policies to

⁹ It is straightforward to endogenize the time spend on education. Suppose that $\varphi = (1 - n)n^m$ represents the effective supply of skills, where n is the time spent in education and m lies between zero and one. Each entrepreneur chooses the same n in order to maximize φ .

¹⁰ The same assumption is made by Howitt and Mayer-Foulkes (2005). They assume that the skill level depends on the average level of technology.

¹¹ This is not the actual wage. It is the expected wage. The actual wage is either zero or Π_{it} . To simplify the analysis I assume that entrepreneurs can buy insurance. Thus, they receive with certainty their expected reward from innovation.

those that affect directly only the profit of a successful innovator.¹² Such policies are for example the tax rate on profits, efforts to reduce corruption and protect property rights, the cost to start a new firm, labor market regulations like the minimum wage, etc.¹³ The outcome of each set of policies is a tax rate, t , such that t is the total fraction of the profits that the owner of each firm loses because of taxation, corruption, labor market regulations, etc.¹⁴

This tax rate affects directly the wage of skilled workers (and their relative wage, or skill premium). The wage becomes:

$$w_s = \lambda \frac{\varphi A_t}{A_{it}^*} (1 - t) \Pi_{it} = (1 - t) \lambda \varphi A_t (1 - \alpha) \alpha^{\frac{1+\alpha}{1-\alpha}} u \quad (12)$$

And the skill premium:

$$\omega = (1 - t) \lambda \varphi \alpha (1 - s) \quad (13)$$

There are, also, two special interest groups, SIG_A and SIG_B . Members of each group are all the economic agents that benefit from the policies of party A and B respectively. When an economic agent benefits from the policies of both parties then this agent is member of both interest groups. Members can be the firms that receive part of the total tax revenue as a subsidy, the bureaucrats who benefit from corruption, and the labor unions that receive contributions from their members who benefit from the higher minimum wage and other labor market regulations. I assume that both special interest groups are small enough such that there is no coordination cost and no free riding.

The timing of events is the following: first, the two parties announce their set of policies. Then, each SIG announces its contribution to its party, and finally election takes place.¹⁵ Also, I

¹² These policies affect directly the wage of strategic voters. All other policies that this paper does not consider affect only unskilled workers. The assumption that policies that affect unskilled workers are exogenous is based on the basic assumption of the model that impressionable voters do not take into account the proposed policies when they vote.

¹³ Benabou (2005) uses a similar way, through a unique tax rate, to represent the set of public policies like taxes and transfers, minimum wage laws, firing costs, etc.

¹⁴ Note that this set of policies determines the wage *before* taxes which is also the marginal product of labor.

¹⁵ This timing implies that SIG will not contribute money in order to influence policies. In order for this to happen, SIG should contribute before the party announces its policy. In this paper, SIG give their contributions after the parties announce their policies. Thus, SIG have only electoral motive. See Grossman and Helpman (2001) for a detailed discussion about influence and electoral motive.

assume that after a party announces its policy, it cannot change it and it is committed to implement it, if elected.

Voters maximize the following utility:

$$U_j = c^b f_j^\alpha \quad (14)$$

Where c is consumption (each individual consumes all her income), and f_j depends on the political ideology of the specific individual, j , and on the political ideology of each party.

There are two types of voters: strategic and impressionable.¹⁶ According to Grossman and Helpman (2001), ‘strategic voters understand the political environment and the implications of their votes’. On the other hand, ‘impressionable voters rely on campaign ads’. Grossman and Helpman (2001) assume that the share of strategic and impressionable voters is exogenous. I assume that the level of education affects the ability of people to make the calculations necessary for strategic voting.¹⁷ The assumption here is that policies are complicated and their effect on people’s income is difficult to calculate. Individuals with high enough education are able to make these calculations and, thus, they know exactly how a specific policy will affect them. Political advertisement has no effect on them. In other words, the assumption is that political advertisement will not make them change their mind once they know the policy that each party is willing to adopt. Individuals with relatively low education cannot make the necessary calculations and, thus, they don’t know how a specific policy will affect them. Political advertisement affects their decision. If the amount of advertisement is bigger for one of the parties, this party will attract more impressionable voters. For simplicity, I assume that skilled individuals have high enough education and they are strategic voters, while unskilled individuals are impressionable voters.

Strategic voter’s j utility is:

$$U_{ij}^S = (f_{ij})^\alpha (w_s(t_i))^b, \quad (15)$$

where $i = A, B$ denotes party A and B .

¹⁶ The analysis and the model presented here are based on Grossman and Helpman (1996, 2001)

¹⁷ Also, education affects civic participation. See Dee (2003), Glaeser, Ponzetto, and Shleifer (2007), and, Milligan, Moretti, and Oreopoulos (2004).

Strategic voter j chooses party A if: $f_{Aj}^a c_A^b \geq f_{Bj}^a c_B^b \rightarrow \frac{f_{Bj}}{f_{Aj}} \leq \left(\frac{w_s(t_A)}{w_s(t_B)}\right)^{\frac{b}{a}}$. Where $f_j = \frac{f_{Bj}}{f_{Aj}}$ is the relative popularity of party B for voter j . I assume that f_j is uniformly distributed with mean z .¹⁸ Also: $c_i = w_s(t_i)$, shows that consumption is equal to the wage, and that the wage depends on the set of policies, t_i .

The share of votes for party A among strategic voters is:

$$V_A^s = \frac{1}{2} - z + \left(\frac{w_s(t_A)}{w_s(t_B)}\right)^{\frac{b}{a}}, \quad (16)$$

where z shows the relative popularity of party B 's fixed position. If $z = 1$, then the two parties are equally popular and, thus, if they choose the same policies, each will get 50% of the votes.

Impressionable voters' utility is:

$$U_i^u = (f_i)^a (Ew_u(t_i))^b, \quad (17)$$

where $i = A, B$ denotes party A and B .

Impressionable voters cannot estimate the effect of the policy on their income. They form expectations with respect to this effect:

$$Ew_u(t_i) = (D_i)^\beta, \quad (18)$$

$i = A, B$. D_i is the contribution of SIG_i to party i . This is also the amount that this party will spend on advertising. β is a parameter measuring the effectiveness of the campaign spending.

Impressionable voter j chooses party A if: $f_{Aj}^a (D_A^\beta)^b \geq f_{Bj}^a (D_B^\beta)^b \rightarrow \frac{f_{Bj}}{f_{Aj}} \leq \left(\frac{D_A}{D_B}\right)^{\frac{\beta b}{a}}$, where $f_j = \frac{f_{Bj}}{f_{Aj}}$ is the relative popularity of party B for voter j . Again, f_j is uniformly distributed with mean z . This means that the popularity of the two parties is the same among strategic and impressionable voters.

The share of votes of party A among impressionable voters is:

¹⁸ Grossman and Helpman (1996, 2001) assume uniform distribution, too.

$$V_A^u = \frac{1}{2} - z + \left(\frac{D_A}{D_B}\right)^{\frac{\beta b}{a}} \quad (19)$$

And the total share of votes for party A is:

$$V_A = V_A^s s + V_A^u (1 - s) = \frac{1}{2} - z + \left(\frac{w_s(t_A)}{w_s(t_B)}\right)^{\frac{b}{a}} s + \left(\frac{D_A}{D_B}\right)^{\frac{\beta b}{a}} (1 - s) \quad (20)$$

And so:

$$V_A = \frac{1}{2} - z + \left(\frac{(1-t_A)\lambda\varphi A_t(1-\alpha)\alpha^{\frac{1+\alpha}{1-\alpha}u}}{(1-t_B)\lambda\varphi A_t(1-\alpha)\alpha^{\frac{1+\alpha}{1-\alpha}u}}\right)^{\frac{b}{a}} s + \left(\frac{D_A}{D_B}\right)^{\frac{\beta b}{a}} (1 - s), \text{ and} \quad (21)$$

$$V_A = \frac{1}{2} - z + \left(\frac{1-t_A}{1-t_B}\right)^{\frac{b}{a}} s + \left(\frac{D_A}{D_B}\right)^{\frac{\beta b}{a}} (1 - s), \quad (22)$$

where s is the fraction of skilled individuals and, thus, the fraction of strategic voters, and $(1 - s)$ is the fraction of unskilled individuals and, thus, the fraction of impressionable voters. Also, again, individuals consume all their income,

$$c = w_s = (1 - t)\lambda\varphi A_t(1 - \alpha)\alpha^{\frac{1+\alpha}{1-\alpha}u}.$$

The probability that $V_A \geq \frac{1}{2}$, that is, the probability that party A wins the election is equal to the probability that $z \leq \left(\frac{1-t_A}{1-t_B}\right)^{\frac{b}{a}} s + \left(\frac{D_A}{D_B}\right)^{\frac{\beta b}{a}} (1 - s)$. z is a random variable and $F()$ is its distribution function. The probability that party A wins the election, P_A , is equal to:

$$P_A = F\left(\left(\frac{1-t_A}{1-t_B}\right)^{\frac{b}{a}} s + \left(\frac{D_A}{D_B}\right)^{\frac{\beta b}{a}} (1 - s)\right) \quad (23)$$

Given D_B , t_A and t_B (remember that first parties announce their policies and then SIG choose their contributions), SIG_A will choose D_A in order to maximize its expected net benefit:

$$B_A = P_A(D_A)\zeta t_A \pi - D_A \quad (24)$$

Where $P_A(D_A)$ is the probability that party A wins the election when contribution is D_A , and $\zeta t_A \pi$ is the total net benefit from the set of policies, t_A , for SIG_A . π is the total profit of all the monopolists, and ζ lies between zero and one and captures the deadweight loss.¹⁹

The FOC is the best response function for SIG_A :

$$F' \left(\left(\frac{1-t_A}{1-t_B} \right)^{\frac{b}{a}} s + \left(\frac{D_A}{D_B} \right)^{\frac{\beta b}{a}} (1-s) \right) \frac{\beta b D_A^{\frac{\beta b}{a}-1}}{D_B^{\frac{\beta b}{a}}} (1-s) \zeta t_A \pi = 1 \quad (25)$$

Similarly for SIG_B :

$$B_B = P_B(D_B) \zeta t_B \pi - D_B, \quad (26)$$

where $P_B = 1 - P_A$.

The FOC is:

$$F' \left(\left(\frac{1-t_A}{1-t_B} \right)^{\frac{b}{a}} s + \left(\frac{D_A}{D_B} \right)^{\frac{\beta b}{a}} (1-s) \right) \frac{\beta b D_A^{\frac{\beta b}{a}}}{D_B^{\frac{\beta b}{a}+1}} (1-s) \zeta t_B \pi = 1 \quad (27)$$

The two FOCs imply:

$$\frac{D_A^*}{D_B^*} = \frac{t_A}{t_B} \quad (28)$$

Party A will choose t_A to maximize its share of votes:

$$V_A = \frac{1}{2} - z + \left(\frac{1-t_A}{1-t_B} \right)^{\frac{b}{a}} s + \left(\frac{t_A}{t_B} \right)^{\frac{\beta b}{a}} (1-s) \quad (29)$$

The FOC which is also the best response function for party A is:

$$\frac{b(1-t_A)^{\frac{b}{a}-1}}{a(1-t_B)^{\frac{b}{a}}} s = \frac{\beta b (t_A)^{\frac{\beta b}{a}-1}}{a(t_B)^{\frac{\beta b}{a}}} (1-s) \quad (30)$$

¹⁹ I assume here that the members of each special interest group receive an amount that is proportional to the entire amount the firms lose because of the policy. The more realistic model with deadweight loss that is proportional to the square of the 'tax' is presented in the appendix. The two approaches give different tax rates in equilibrium, but they predict a very similar effect of the supply of skills on skill premium.

Party B maximizes:

$$V_B = 1 - V_A = \frac{1}{2} + z - \left(\frac{1-t_A}{1-t_B}\right)^{\frac{b}{a}} s - \left(\frac{t_A}{t_B}\right)^{\frac{\beta b}{a}} (1-s) \quad (31)$$

The FOC is:

$$\frac{b(1-t_A)^{\frac{b}{a}}}{a(1-t_B)^{\frac{b}{a}+1}} s = \frac{\beta b(t_A)^{\frac{\beta b}{a}}}{a(t_B)^{\frac{\beta b}{a}+1}} (1-s) \quad (32)$$

The two first order conditions imply:

$$t_A^*(s) = t_B^*(s) = t^*(s) = \frac{\beta(1-s)}{s+(1-s)\beta} \quad (33)$$

PROPOSITION 1. In equilibrium:

- Both political parties choose the same policy (tax rate), $t^*(s) = \frac{\beta(1-s)}{s+(1-s)\beta}$, which is a decreasing function of the supply of skills and an increasing function of the effectiveness of the political campaign, β .

Proof. Follows from the differentiation of $t^*(s)$ with respect to s and β .

Thus, the level of economic institutions can be expressed as a function of the percentage of skilled workers.

C. The effect of the supply of skills on skill premium

Remember that skill premium, ω , and also the relative demand for skilled labor is:

$$\omega = (1-t)\lambda\varphi\alpha(1-s) \quad (34)$$

It can be derived easily that, if the level of economic institutions, t , is exogenous (in which case we have the short run demand for skilled labor, i.e. the demand for skilled labor before institutions adjust, after an exogenous change in the relative supply of skills) then an increase in the share of skilled workers will decrease skill premium: $\frac{\partial \omega}{\partial s} = -(1 - t)\lambda\varphi\alpha < 0$

This implies that the short run demand is always downward sloping. Given the demand for skilled labor, an increase in the supply of skilled labor will result to a lower skill premium.

Things are very different when the amount of skilled labor affects the level of economic institutions (long run). In this case, skill premium becomes:

$$\omega = (1 - t^*(s))\lambda\varphi\alpha(1 - s) \quad (35)$$

where: $t^*(s) = \frac{\beta(1-s)}{s+(1-s)\beta}$

The total effect of an exogenous change of the proportion of skilled workers is the following:

$$\frac{\partial \omega}{\partial s} = -\frac{\partial t^*(s)}{\partial s}(\lambda\varphi\alpha(1 - s)) + (1 - t^*(s))\frac{\partial(\lambda\varphi\alpha(1-s))}{\partial s} \quad (36)$$

where $\frac{\partial t^*(s)}{\partial s} = -\frac{\beta}{(\beta(1-s)+s)^2} < 0$

Thus, the total effect is decomposed into two effects: the first is the one described above and is negative. The second effect is positive, and it is coming from the fact that the amount of skilled labor affects the level of economic institutions and policies, and through them, the returns to skilled labor. In other words, the supply of skilled labor affects the demand for skilled labor.

More specifically, the second term of the right hand side of equation (36), is always negative and shows the decrease in skill premium right after an increase in the relative supply of skills. This captures the short run response (see Figure II) and it is simply the movement along the short run demand curve (in the short run, $\frac{\partial t^*(s)}{\partial s} = 0$). On the other hand, the first term is always positive and shows the increase in skill premium in the long run caused by the institutional improvement

that the increase in the relative supply of skills induces. In Figure II this is shown by the shift to the right of the short run demand curve.

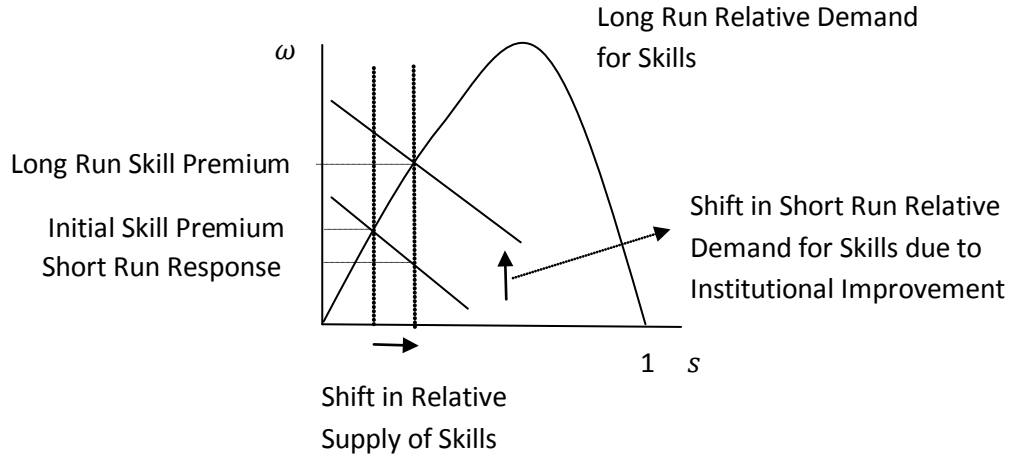


Figure II

If the second term is higher than the first, then the total effect is negative:

$$\frac{\partial \omega}{\partial s} = -\frac{\partial t^*(s)}{\partial s}(\lambda \varphi \alpha (1-s)) + (1-t^*(s)) \frac{\partial(\lambda \varphi \alpha (1-s))}{\partial s} < 0 \quad (38)$$

In this case, the positive effect from institutional improvement is lower than the negative market effect.

If the first term is higher than the second, then the total effect is positive.

$$\frac{\partial \omega}{\partial s} = -\frac{\partial t^*(s)}{\partial s}(\lambda \varphi \alpha (1-s)) + (1-t^*(s)) \frac{\partial(\lambda \varphi \alpha (1-s))}{\partial s} > 0 \quad (39)$$

This case, shown in Figure II, is consistent with what was observed in the U.S. during the 70s and the 80s.

The above analysis is summarized in the following proposition:

PROPOSITION 2. Short run and long run relative demand for skills:

- a. The short run relative demand for skills,

$$\omega_{SR}(s) = \frac{w_s}{w_u} = (1 - t)\lambda\phi\alpha(1 - s)$$

is always downward sloping. The skill premium always decreases right after an exogenous increase in the relative supply of skills.

- b. The long run relative demand for skills:

$$\omega_{LR}(s) = \frac{w_s}{w_u} = (1 - t^*(s))\lambda\phi\alpha(1 - s) = \frac{s\lambda\phi\alpha(1 - s)}{s + (1 - s)\beta}$$

is upward sloping when:

$$0 \leq s < \frac{\sqrt{\beta}}{1 + \sqrt{\beta}} < 1$$

and it is downward sloping when:

$$0 < \frac{\sqrt{\beta}}{1 + \sqrt{\beta}} < s \leq 1$$

For sufficiently low values of s , skill premium increases in the long run after an exogenous increase in the relative supply of skills.

Proof. See appendix

Figure II presents the case where an increase in the relative supply of skills decreases skill premium in the short run, but increases it in the long run above its initial value.

In order to examine whether the magnitudes of the changes in the relative wage of skilled labor that this model predicts are similar to the ones that were observed in the United States after 1970, it would be useful to assign numbers to the parameters and see what is this model's predicted short run and long run effect of the observed change in the supply of skills. According to Barro and Lee (2001), the fraction of college graduates in the United States in 1970 was 21%. I assume that $s = 0.21$, $\alpha\lambda\phi = 3.5$ and that $\beta = 0.2$, and I take $t_1 = 0.43$, and $\omega = 1.56$, which means that college graduates earn 56% more than those without a college degree. This is exactly the number in the beginning of 1970s. Again according to Barro and Lee (2001), the fraction of

college graduates in the United States in 1980 was 30%. In this case, and under the assumption that policies are constant, $t_1 = 0.43$, I find $\omega_{SR} = 1.4$ which is the short run response that the model predicts and it is very close to the actual value which is 1.41. Finally, in order to find the long run skill premium I find first the new equilibrium level of t when $s = 0.3$. This is: $t_2 = 0.32$. This value of t implies that the long run value of skill premium is $\omega_{LR} = 1.67$, which is very close to the actual value that is 1.62 in 1995.

III. ENDOGENOUS SUPPLY OF SKILLS

In the previous section the supply of skilled and unskilled labor was exogenous. In this section, I assume that education choices are forward looking and respond to returns. Of course, there can still be exogenous changes in the supply of skills caused for example by a change in the quality of education.

I assume that in the beginning of every period workers must become reeducated in order to qualify as skilled workers with the new generation of technology.²⁰ If an individual decides to become educated, he or she will receive the wage of the skilled worker, w_s . The cost of education is proportional to the skilled wage, $\sigma v_i w_s$, where σ is a subsidy on education or simply the quality of education. When the quality of education is higher, σ is low, then the cost of education is lower. We could think of this cost as a time cost. If the quality of education is higher, then a worker will spend less time in order to become skilled. $v_i \geq 0$ is a random variable that captures the heterogeneity among individuals caused by different ability or credit constraints. Lower values of v_i imply higher ability. If an individual chooses to remain uneducated, he or she will receive w_u .

An individual i will become skilled if: $w_s - \sigma v_i w_s \geq w_u$, which implies that all individuals with $v_i \leq \frac{\omega-1}{\sigma\omega}$ will choose to become skilled. The fraction of skilled workers is $s = G\left(\frac{\omega-1}{\sigma\omega}\right)$, where G is the distribution function of v_i , and ω is the skill premium. This function represents the supply

²⁰ An alternative assumption could be that the economy is populated by dynastic families and that each family has one member that lives only one period, so that every period a new member replaces the old.

of skills. Under the assumption that v_i is uniformly distributed in $[0,1]$, the supply function becomes: $s = \frac{\omega-1}{\sigma\omega}$.

The relative supply curve is shown in Figure III. As expected, it is upward sloping. A decrease in the cost of education, or an increase in the quality of education shifts the relative supply curve to the right. All the results presented above, in the model with exogenous supply of skills, hold here as well.

Figure III shows that when the quality of education is high enough there are three equilibria: the first at $s = 0$ is stable, the second, s_1 , is unstable and the third, s_2 , is stable. The economy will end up in the third equilibrium only if initially the relative supply of skills is sufficiently high, $s > s_1$. If initially the relative supply of skills is lower than this critical point, then the economy will remain in a poverty trap. Low education levels will make beneficial for the political parties to allow high levels of corruption and impose high taxes on profits, and these policies will offer poor incentives for investment and innovation. This explains why poor democracies with low levels of education cannot escape stagnation. Special interests capture the government and extract rents through policies that keep the country poor because there is no sufficient number of voters that is willing to support growth promoting policies.

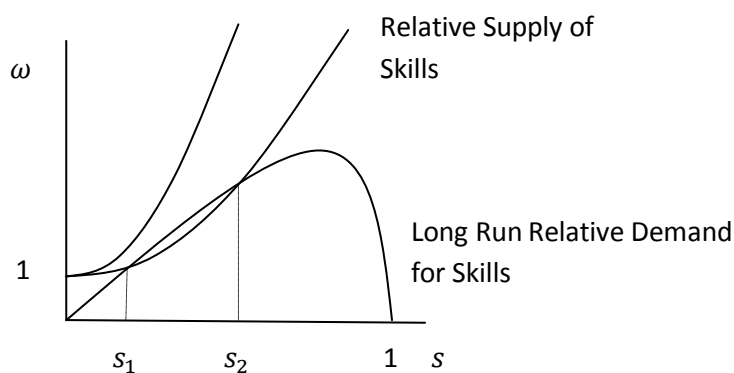


Figure III

IV. CONCLUDING REMARKS

This paper argues that there are three distinct groups in every democracy: the uneducated, the educated, and the (political) elite. I argue that voters have the power to choose their leaders, but not all voters are able to act as strategic voters. Strategic voting implies that voters are able to make the calculations that are necessary in order to evaluate the effect that policies have on their welfare. To a large extent, economic institutions and policies, for example the level of corruption, can be determined endogenously through the political process. If all voters were strategic then we wouldn't observe democracies with bad policies and economic institutions (there are several examples in Latin America and Africa). I argue that only educated individuals act as strategic voters, and that the political conflict is mainly between the educated individuals and the political elite (and those who have access to it). This doesn't mean that uneducated voters do not participate in politics. The relative political power of the elite depends on the proportion of uneducated voters. The elite can use its influence and money in order to 'buy' the support of these voters. The level of education determines the allocation of the political power, and the allocation of the political power determines the quality of economic institutions.

This model provides an explanation for the observed pattern of the supply of skills and skill premium in the United States after 1970. It argues that an increase in the supply of skills decreases skill premium in the short run, but then it induces institutional improvement through the political process. As a result, skill premium increases, possibly above its initial value.

V. APPENDIX

A. *Deadweight loss from taxation that is proportional to the square of the tax rate.*

This appendix examines the case in which the deadweight loss from the policies is proportional to the square of the 'tax' rate. In this case special interest groups receive $\left(t - \frac{1}{2}t^2\right)\pi$ instead of $\zeta t\pi$.

SIG_A maximizes:

$$B_A = P_A(D_A)(t_A - \frac{1}{2}t_A^2)\pi - D_A,$$

and SIG_B maximizes:

$$B_B = (1 - P_A(D_B))(t_B - \frac{1}{2}t_B^2)\pi - D_B.$$

The two first order conditions imply:

$$\frac{D_A^*}{D_B^*} = \frac{t_A - \frac{1}{2}t_A^2}{t_B - \frac{1}{2}t_B^2}$$

Party A will choose t_A to maximize its share of votes:

$$V_A = \frac{1}{2} - z + \left(\frac{1-t_A}{1-t_B}\right)^{\frac{b}{a}} s + \left(\frac{t_A - \frac{1}{2}t_A^2}{t_B - \frac{1}{2}t_B^2}\right)^{\frac{\beta b}{a}} (1-s)$$

The FOC which is also the best response function for party A is:

$$\frac{b(1-t_A)^{\frac{b}{a}-1}}{a(1-t_B)^{\frac{b}{a}}} s = \frac{\beta b(1-t_A)(t_A - \frac{1}{2}t_A^2)^{\frac{\beta b}{a}-1}}{a(t_B - \frac{1}{2}t_B^2)^{\frac{\beta b}{a}}} (1-s)$$

Party B maximizes:

$$V_B = 1 - V_A = \frac{1}{2} + z - \left(\frac{1-t_A}{1-t_B}\right)^{\frac{b}{a}} s - \left(\frac{t_A - \frac{1}{2}t_A^2}{t_B - \frac{1}{2}t_B^2}\right)^{\frac{\beta b}{a}} (1-s)$$

The FOC is:

$$\frac{b(1-t_A)^{\frac{b}{a}}}{a(1-t_B)^{\frac{b}{a}+1}} s = \frac{\beta b(1-t_B)(t_A - \frac{1}{2}t_A^2)^{\frac{\beta b}{a}}}{a(t_B - \frac{1}{2}t_B^2)^{\frac{\beta b}{a}+1}} (1-s)$$

The two first order conditions give only one solution for t that lies between zero and one. This is the same for both political parties:

$$t^*(s) = \frac{2\beta(1-s) + s - \sqrt{s(2\beta + s - 2\beta s)}}{2\beta(1-s) + s}$$

The long run relative demand for skill becomes:

$$\omega_{LR}^*(s) = \left(1 - \frac{2\beta(1-s) + s - \sqrt{s(2\beta + s - 2\beta s)}}{2\beta(1-s) + s}\right) \alpha \lambda \varphi(1-s)$$

The equation $\frac{\partial \omega_{LR}^*(s)}{\partial s} = 0$ has only one solution that lies between zero and one, $\forall \beta \in \left(0, \frac{1}{2}\right) \cup \left(\frac{1}{2}, \infty\right)$:

$$s^* = \frac{3\beta - \sqrt{\beta(4 + \beta)}}{4\beta - 2}$$

Also, L'Hospital's rule implies:

$$\lim_{\beta \rightarrow \frac{1}{2}^-} \frac{3\beta - \sqrt{\beta(4 + \beta)}}{4\beta - 2} = \lim_{\beta \rightarrow \frac{1}{2}^+} \frac{3\beta - \sqrt{\beta(4 + \beta)}}{4\beta - 2} = \frac{1}{3}$$

Again, when $s < s^*$, the long run relative demand for skills is upward sloping, while when $s > s^*$, the long run relative demand for skills is downward sloping.

B. Proof of Proposition 2.

- a. Follows from the differentiation of $\omega_{SR}(s)$ with respect to s .
- b. The derivative of $\omega_{LR}(s)$ with respect to s is: $\frac{\partial \omega_{LR}(s)}{\partial s} = \frac{\alpha \varphi \lambda (\beta(s-1)^2 - s^2)}{(\beta + s - \beta s)^2}$. Set it equal to zero and solve for s : $s_1^* = -\frac{\sqrt{\beta}}{1-\sqrt{\beta}}$ and $s_2^* = \frac{\sqrt{\beta}}{1+\sqrt{\beta}}$. For $\beta > 0$, $s_1^* \in (-\infty, 0) \cup (1, +\infty)$, and $s_2^* \in (0, 1)$. The derivative of $\omega_{LR}(s)$ with respect to s is positive when $s = 0 < s_2^*$. Thus, the relative demand for skills is upward sloping when $0 \leq s < s_2^* < 1$ and downward sloping when $0 < s_2^* < s \leq 1$.

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