QUOTAS IN EDUCATION AND EMPLOYMENT : AFFIRMATIVE ACTION OR NEGATIVE?

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Abstract

We model a hitherto unexplored facet of affirmative action – its effect on a country's competitiveness in international labor markets. We show how affirmative action, or merely the announcement of an affirmative action policy, can lead to large overall losses for a country, including losses for *both* the protected and non-protected groups, by affecting the country's ability to participate in the global workplace. It destroys rather than creates opportunities for the target group members and can lead to the folding up of the top-tier colleges in a country and to the migration of skilled industry elsewhere.

1.Introduction

"Affirmative action" – in the special sense of quotas in education and employment - has long been a hotbed of controversy, with opposing camps of scholars arguing for and against it. Advocates of quotas stress the benefits they confer on the protected group, often arguing that these benefits improve the group's position to a point where affirmative action will no longer be necessary. Opponents emphasize effects such as negative stereotyping – the perpetuation of negative self-fulfilling prophecies about the protected group – as well as the magnitude of losses for the non-protected group.

Weighing the protected minority's gains against the losses of the majority becomes a central feature of the debate. Perhaps surprisingly, the literature on quotas has tended to view members from protected and non-protected groups as engaging in a zero-sum game in the sense that a job or educational seat lost by a majority (non-protected) candidate is equivalent to one gained by a minority candidate.

In this paper, we focus on the effect of quotas on a country's *international competitiveness* in the global workplace[1]. We model candidates from both protected and non-protected groups as competing with a *global pool* of talent, for jobs in international firms which recruit world-wide. This is essentially a *globalized skill-intensive industrial*

[1] Our analysis is equally applicable to a country's participation in the international educational system.

sector which has access to labor and capital from across international borders and can also employ the best technology available worldwide. Due to the globalized nature of labor market competition in this sector, protected and non-protected candidates from the country imposing quotas are not playing a zero-sum game. To our knowledge, ours is the first paper to focus on this issue. We examine the implications for candidates of heterogeneous ability from both the protected and non-protected groups.

The type of quota we focus on is not based on physically observable characteristics, such as race or gender. We also assume that the international firms which make up the globalized skill-intensive industrial sector are not able to observe individual applicant quality, but *are* able to observe which institution the applicant had studied in. Moreover, they are informed about the policies different countries implement with regard to affirmative action.

Our basic tool is a two-stage game of imperfect information and signaling. In the first stage, colleges in different countries choose the stringency of their admission criteria, given a known distribution of abilities, and anticipating the effect of their criteria on the employability of their students and the fees they can command. In the second stage, firms in the globalized sector observe chosen standards (admission criteria) and policies in different countries to make their hiring decisions. They cannot observe the quality of individual applicants, but know the distribution of abilities and also know which college each applicant attended and can infer the average quality of applicants from each college based on the standard chosen by the college and what we call the college's instruction technology. Having been admitted to a particular college thus serves as a signal of average quality. However, we depart from the traditional educational signaling models of Spence (1973) in that we do not assume that education is unproductive per se : nor do we assume that candidates of different initial abilities face different marginal costs of getting this education. We do assume that some candidates may be excluded from getting an education in certain colleges based on the admission criteria chosen by the colleges in the first stage.

We assume a perfectly competitive market structure for the global firms. They are perfect competitors both in the labor and product markets. We endogenize the market structure for colleges.

By showing how a quota instituted by a particular country affects employability in globalized industry, we are essentially stressing the role of quotas (or their absence) as signals of average quality of candidates. These signals operate through the standards chosen by colleges in the country in question. The fact that we are focusing on a *global* sector is also important as the employers have access to a pool of global talent : protected and non-protected groups are no longer playing a zero-sum game. Essentially we highlight how quotas can affect a country's competitiveness in the international labor market.

The immediate motivation for our analysis comes from the caste quotas proposed by the Indian government. The Indian government proposes to reserve 50% of seats at the college and university levels, as well as 50% of faculty positions, for certain castes. As caste is not deducible from physical appearance, the proposed quotas fit the framework of our assumptions. However the analysis is of more general applicability to all cases where quotas are not based on observable characteristics.

In sections 2 and 3 we use different model specifications for sectors other than globalized industry – sectors in which labor is not internationally mobile (we add a sector using capital and unskilled labor in one model, while in the second we instead add agriculture – which uses unskilled labor and a specific factor, land, as well as government) and solve the two-stage game first for the benchmark case without quotas, and then with quotas in place. Related literature is discussed in Section 4. Section 5 concludes with a discussion of the implications of our model.

2. Globalized Industry and Education

We model an open economy where product prices are set by the world market: the fixed relative commodity price is normalized to 1. The key sector in our model is globalized industry which produces manufactures using capital and skilled labor according to a CRS production function

$$Y_s = K_s\, g(W/K_s) \tag{1}$$

where W is the effective work done by the skilled industrial labour force L_s and K_s the capital invested in this sector. Writing ω for the work to capital ratio, this becomes

$$Y_s = K_s\, g(\omega) \tag{2}$$

The industry is globalized in the sense that not only its product but also its capital and the labor that it considers employable are perfectly mobile internationally and it has access to the best technology world-wide. Employers cannot assess the skill of individual employees *ex ante* but are interested in it because it affects unit labor costs and profits.

Skill-formation requires college education. Colleges use teachers according to a fixed teacher student ratio t. The colleges' costs C_n – colleges are indexed by n – comprise a fixed cost F (the interest on capital invested and any other opportunity cost) and a constant variable cost per student v (which includes the wage cost of the additional teaching requirement per student) up to a given capacity level M of student intake N_n.

$$C_n = F + vN_n \text{ for } N_n \leq M \tag{3}$$

$$C_n = \infty \text{ for } N_n > M. \tag{4}$$

Their income I_n comprises student fees (x per student).

$$I_n = xN_n. \tag{5}$$

We assume the existence of a perfect educational loan market so that all admitted students are able to defray their college expenses should they choose to do so.

Colleges have two functions: they sort students according to ability and add to their productivity. There is a known distribution of ability within the population $a_i \sim \Phi(0,1)$ where individuals are indexed by i and initial abilities lie between 0 and 1. The corresponding density function is $\varphi(a_i)$. Students are restricted to colleges in their own countries, though after graduation, they can work anywhere. Colleges run admission tests that unerringly detect individual abilities and admit all those above a specified cut-off $\underline{a}$. Those selected distribute themselves at random among existing colleges. The colleges then contribute to their productivity through a known teaching technology that ensures that the final productivity p_i of each student is an increasing, but concave, function of his initial ability:

$$p_i = p(a_i) \tag{6}$$

where $p' > 0$, $p'' < 0$. Concavity implies some, but not total, convergence in ability as a result of college education. Once he graduates, p_i represents the effective work done by individual i in skilled employment. We assume that the fraction of college graduates at any level of ability who prefer teaching to industrial employment is uncorrelated to

ability. In equilibrium, the fraction that teaches is t. Thus, total work done in skilled industry

$$W = (1 - t)\int_{\underline{a}}^{1} p(a_i)\varphi(a_i)da_i \tag{7}$$

while total employment in this sector

$$L_s = (1 - t) \int_{\underline{a}}^{1} \varphi(a_i)da_i. \tag{8}$$

We assume that there is free entry into the business of running colleges. We also assume that all colleges are identical in that they have access to the same teaching technology, though this is only an assumption of convenience and can be relaxed without changing any of our main results

While global industry is where all the action is, we need other sectors to complete a general equilibrium picture. In this section we present one possible specification for the other sectors, while in the next we model an alternative specification.

2.1 Model 1 : *Assumptions*

Model 1 includes, apart from skill-intensive global industry, a second sector that uses capital and unskilled labor. Unskilled labor is an undifferentiated mass where numbers alone count and ability counts for nothing. While the output of this sector and the capital used in it are perfectly mobile internationally, the labor employed is not. Output is a CRS function of capital K_u and the number of workers L_u:

$$Y_u = K_u f(L_u/K_u). \tag{9}$$

$$= K_u f(\lambda) \tag{10}$$

where $\lambda = L_u/K_u$.

2.2 *Equilibrium without Quotas*

Consider this model when there are no quotas. The mobility of all skilled employees ensures that skilled wages per head w_s are set exogenously by the world market. $w_s = \underline{w}_s$. However, since skill is potentially heterogeneous, industry in a particular country can earn the same rate of profit as elsewhere while paying the same wages only if the average skill of its employees matches that of industrial labor in the

outside world. With the rate of profit r fixed exogenously at the global level $\underline{r}$, the marginal productivity equation for capital

$$\underline{r} = g(\omega) - (\omega)g'(\omega) \tag{11}$$

sets the work/capital ratio $\underline{\omega}$ in skilled industry. This in turn determines the marginal productivity of effective work $g'(\underline{\omega})$. Now the expected marginal product per worker is $g'(\underline{\omega})p^*$ where p^* is the average productivity per worker and this is equated by the firm to the global skilled wage per head:

$$\underline{w_s}. = . \, g'(\underline{\omega})p^*. \tag{12}$$

Thus, the average productivity per skilled worker is set by global parameters at the level $\underline{p}^*$.

Colleges know this and set their admission cut-offs accordingly. Given their cost function, they enjoy economies of scale up to their capacity limit and so seek to maximize admissions, subject to the constraint that all their graduates should be employable in industry or as teachers in the college system. The mobility of all skilled employees ensures that skilled wages are set exogenously by the world market. However, skilled labor is potentially heterogeneous: so industry in a particular country can earn the same rate of profit as elsewhere while paying the same wages only if the average ability of its employees matches that of skilled labor in the outside world. Since employers cannot tell how productive an individual employee will be, they use the fact of his education at a particular college as a screening device. They know the college's teaching technology, the ability distribution of applicants for admission to it and the admission cut-off and can deduce from this the average ability level of its graduates. They absorb all graduates from this college if and only if this average equals or exceeds the global skill standard. Since colleges anticipate this, the admission cut-off $\underline{a}$ is determined by equation (13):

$$\underline{p}^* = W/L_s = [\int_{\underline{a}}^{1} p(a_i)\varphi(a_i)da_i]/[\int_{\underline{a}}^{1} \varphi(a_i)da_i]. \tag{13}$$

The cut-off $\underline{a}$ is uniquely related to labor productivity in the skilled sector. To enjoy economies of scale, colleges seek to admit the largest possible number of students (subject to capacity constraints) while ensuring that their graduates are employable in globalized industry. Thus they set the lowest cut-off at which the average ability of their graduates will just match global standards.

Teachers must also be drawn from the upper tail of the ability distribution above this cut-off since colleges cannot relax the cut-off without destroying the industrial job market for their graduates. The number of teachers is of course proportional to the number of students.

If the total number of students in the country who reach this cut-off is no greater than the capacity limit of a college ($\int_{\underline{a}}^{1}\varphi(a_i)da_i \leq M$), only a single college can survive. Its costs are determined by the number of students it admits:

$$C_n = F + v\int_{\underline{a}}^{1}\varphi(a_i)da_i \tag{14}$$

Its fees are set by the fact that this is a contestable market: if another college were to enter so that the number of admissible students in each college is halved, the cost per student would rise. The second college would enter only if the fee is high enough to enable it to break even at this higher level of unit cost. The first college could deter entry by charging a fee between this and the unit cost level it could enjoy as a monopolist:

$$2F/\int_{\underline{a}}^{1}\varphi(a_i)da_i + v \geq x_n \geq F/\int_{\underline{a}}^{1}\varphi(a_i)da_i + v. \tag{15}$$

If, however, the number of students of the required level of ability exceeds the capacity of a college, there will be several colleges catering to industry in equilibrium with the eligible students distributed at random among them. If we ignore integer constraints, they will all be operating at capacity; and competition among them will drive fees down to their unit costs at this level of intake:

$$x_n = F/M + v. \tag{16}$$

In either event, students would accept admission offers – and an equilibrium with colleges and industry would therefore exist – if the fee thus charged is equal to or less than the present value of the excess of the skilled wage over the unskilled.

Meanwhile, the unskilled sector absorbs all those who fail to get into college and therefore into skilled employment.

$$L_u = L - \int_{\underline{a}}^{1}\varphi(a_i)da_i \tag{17}$$

where L is the total labor force. Since capital is perfectly mobile, the global rate of profit prevails in both the skilled and unskilled sectors and determines the capital/effective work ratio in the former and the capital/worker ratio in the latter:

$$\underline{r} = f(\lambda) - \lambda f'(\lambda) \tag{18}$$

This model is a crude approximation to some stylized facts regarding Western economies which are supposedly polarized between a high-wage well-educated and skilled sector and a low-wage little-educated and unskilled one.

2.3 *A Quota Regime*

Suppose now that government legislates a quota (say 50% for convenience) for a specific group in college admissions. The rationale for the quota is that the representation of this group in the upper tail of the general ability distribution above the cut-off (and therefore in college admissions and skilled employment) is considered inadequate by the government. We assume that the target group is not observationally distinct, that its members can establish their group-identity on the basis of documents that they may choose to produce only when it is to their advantage to do so.

Colleges must now examine separate ability distributions – for the target group and for the others – and ensure that their separate cut-offs to the two groups result in offers to equal numbers from the top of each distribution. But this would reduce the average ability of those admitted to college and the average skill of the graduates (since the rationale for quotas is that the lower ability distribution of the target group leads to a particularly low share for it in college admissions and better jobs). Quotas therefore would raise unit labor costs and depress the profitability of the skilled sector below the global level. Skilled industry would prefer labor from colleges in countries where admissions are not similarly constrained. Since their graduates are no longer employable in industry, the market for college education would collapse and all colleges would fold up.

The mathematical representation of the phenomenon we have just described is straightforward. Our earlier analysis of the model without quotas proved that in the absence of quotas, colleges in the country were setting the admission cutoff at $\underline{a}$ such that $\underline{a}$ satisfies (13) and ensures an average college graduate productivity level of p*. While the overall distribution of abilities in the population is $a_i \sim \Phi(0,1)$, we now introduce some additional structure by assuming two distinct ability distributions for the protected and non-protected groups. Their distribution functions are respectively denoted by Φ^P and Φ^{NP}. Now the quota requirement implies that the colleges need to set two *different*

group-specific standards, say $\underline{a}^P$ and $\underline{a}^{NP}$. From the fact that quotas are needed to "protect" one group in the first place, we may infer that

$$1- \Phi^P(\underline{a})<1- \Phi^{NP}(\underline{a}) \tag{19}$$

The 50% quota constraint implies a choice of $\underline{a}^P$ and $\underline{a}^{NP}$ such that

$$1- \Phi^P(\underline{a}^P) = 1- \Phi^{NP}(\underline{a}^{NP}) \tag{20}$$

(19) and (20) together imply that

$$\underline{a}^P<\underline{a}< \underline{a}^{NP} \tag{21}$$

If implemented, the quota policy would squeeze out some middle-ability students from the non-protected group at the expense of some lower-ability students from the protected group. If the policy could indeed be implemented, the expected productivity level of this college's graduates would fall to a level below the global skill standard p* : it would fall to

$$\underline{P} = [.5\int_{\underline{a^P}}^{1} p(a_i)\varphi^P(a_i)da_i + .5\int_{\underline{a^{NP}}}^{1} p(a_i)\varphi^{NP}(a_i)da_i]/[.5\int_{\underline{a^P}}^{1} \varphi^P(a_i)da_i + .5\int_{\underline{a^{NP}}}^{1} \varphi^{NP}(a_i)da_i] \tag{22}$$

As a result the college graduates in a country implementing quotas would become unemployable in the global skilled sector and the market for college education would fold up.

More importantly, if skilled industry is not permitted to hire labor from abroad but is forced into a quota regime whether directly or indirectly by compelling it to randomly hire the graduates of the quota-bound colleges, its rate of profit will fall below world levels. This will induce a flight of capital abroad. The skilled sector will disappear from the industrial as well as the educational system.

Labor released from the skilled sector will be absorbed in unskilled activity at lower wages per head than it previously enjoyed, while enough capital will also flow into the unskilled sector to maintain its capital/labor ratio at the level mandated by the exogenous rate of profit. The impact on the incomes of both the target group and the others is entirely negative since high-wage opportunities in skilled industry are replaced by low-wage unskilled employment. Members of the target group who were capable enough to qualify for college and skilled industry without quotas lose, while other members of the target group gain nothing. Likewise for those outside the target group. Owners of capital continue to earn the same rate of profit as before, though they may

have to seek investment outlets abroad (if capital displaced from the skilled sector is not fully absorbed into the unskilled sector). National income contracts.

3. Another Model

3.1 *Assumptions*

Model 2 adds two other sectors to skilled industry. The first of these is agriculture: this is unskilled, but uses land (a fixed endowment normalized to 1) rather than capital along with unskilled labor according to the production function

$$Y_a = h(L_a). \tag{23}$$

The second new sector is government. Government does not contribute to output, but is essentially a device for creating employment. It hires L_g individuals at a wage $\underline{w}_g$ that is fixed by fiat. This wage is fixed at a level higher than the marginal product of labor in agriculture. For the present, we assume that the government is funded by a poll tax. We make this assumption so as to make the most favorable possible case for affirmative action; as will be seen later, the assumption that government revenue R is an increasing function of national income (rather than a constant $\underline{R}$, as with a poll tax) would further reinforce our conclusions. As it is, government hiring is fixed at $\underline{L}_g$, the solution of the equation

$$L_g\underline{w}_g = \underline{R} \tag{24}$$

Though government has no interest in the productivity of its employees, we assume that it must distribute jobs on the basis of ability as a precaution against nepotism. However, government is no more capable of identifying ability *ex ante* than industry and must use a college education as an index of it.

3.2 *Without Quotas*

With government wages being fixed by fiat, the volume of government employment is determined by the budget. Now, government always fixes its wage below the industrial wage: if it did not, it would draw labor away from industry so that government employment competes with industrial employment instead of supplementing it. Therefore, everyone who receives an offer from industry prefers it to government service. Government distributes its jobs to individuals in the second layer of ability who

could not qualify for the colleges that cater to industry. Since however ability is signaled only by college education, a market emerges for a second tier of colleges with lower cut-offs than those required by the institutions from which industry recruits. Colleges in this second tier set their cut-offs so that the number of applicants who qualify for them but not for the top tier precisely equals

$$\underline{L}_g(1 + t),$$

the number of jobs distributed by government plus the number of teaching jobs available in second-tier colleges. The latter of course is proportional to second-tier college admissions. The number of second-tier colleges and the fee they charge is determined as with the first tier and the condition for the existence of the second-tier college system is that this fee should be less than the present value of the excess of the administrative wage over the marginal product of agricultural labor.

Our assumptions imply a bifurcation of teachers (as well as students) between the two college systems, with those in the top tier earning the industrial wage and those in the second receiving the administrative wage. This is not however essential to our analysis. Nothing really would change if all teachers were educated in second tier colleges and earned second tier wages.

This model is an approximation to some South Asian economies (notably India). In these, government perceives employment creation to be a major objective and intervenes extensively in wage fixation for government and universities through Pay Commissions and the like. In the era of globalization, these economies have tended to acquire a tripolar structure with agriculture, government and industry characterized by vastly different wage-levels and educational requirements. In turn, this has been reflected in a bipolar higher education system where a handful of centres of excellence coexists with a mass of purveyors of low-quality degrees.

3.3 *Quotas in Government and Related Colleges Only*

Imagine that in this model, government imposes a quota in favor of a specific group in government hiring and in second-tier college admissions, but not in top-tier

colleges. The second-tier colleges must now examine separate ability distributions – for the target group and for the others – and ensure that their separate cut-offs to the two groups result in offers to equal numbers from the top of each distribution (after allowing for the exodus to the top-tier colleges of those who qualify for them). The result is a substantial redistribution of college admissions and government jobs from the less capable in the general category to the target group. The average ability level of college students and government employees declines, but since these are not productive sectors, there is no impact on output or national income. Nor does the decline in the standards of second-tier colleges affect their viability: their graduates are hired by the government which is not perturbed by the erosion of their ability.

3.4 *Quotas in Industry and Top Colleges as well*

Entirely different are the consequences of an extension of quotas to skilled industry and top-tier colleges. As we have shown, this leads to the collapse of the top-tier college system and the escape of skilled industry to jurisdictions beyond the reach of the quota regime. All the most capable students, including the best members of the target group are forced into second-tier colleges and government jobs at lower wages. Since the availability of government jobs and, accordingly, of slots in these colleges is fixed, this crowds out some of the less capable, who are driven into agriculture. National income contracts. So does the income of all groups of workers, including the target group.

The imposition of quotas on industry and on colleges that cater to it is thus totally counter-productive even from the viewpoint of the group that the quotas are designed to protect. Not only does it fail to generate any jobs in industry or admissions to top-tier colleges for the latter; it also destroys any possibility of industrial employment or top college admissions for the most capable members of the target group. As these individuals must now find government employment, they will crowd out an equal number of the less capable.

Moreover, national output and income contract as industry escapes abroad. So does the income of the target group itself as any high-wage opportunities in industry for its most capable members melt away.

We have made two assumptions so far that are favorable to the case for quotas: (1) that quotas in the recruitment of teachers do not impair the quality of teaching, and (2) that tax revenues (and therefore the employment potential of government) are independent of the level of national income. If we relax these assumptions and allow quotas in the hiring of teachers to erode teaching standards and the contraction of national income to reduce the capacity of government as an employer, our conclusions will be further reinforced. In particular, the reduction in government jobs will ensure that the 'favored' group is definitely injured (even if it didn't lose any industrial jobs, since it didn't have any in the first place).

4. Some Related Literature

Although the literature on affirmative action is extremely prolific, none of it to our knowledge deals with the consequences for participation in international markets. The classic literature on affirmative action includes Phelps (1972), Arrow's (1973) model of statistical discrimination, on which Akerlof (1976) builds, and Coate and Loury's (1993) paper on negative stereotypes. Other papers have dealt with different aspects of affirmative action. There have been theoretical models of discrimination (eg Fryer, forthcoming), of choices between different types of affirmative action policies (eg Fryer and Loury (2005), Wydick (2002)), of "role model" and "mentoring" effects of affirmative action (eg Chung (2000), Athey, Avery and Zemsky (2000)), and there have been many empirical or applied papers exploring the consequences of different types of admissions policies, their relationship with the black-white achievement gap, and projecting the impact on labor market outcomes and earnings of the removal of affirmative action. Papers in this latter category include Arcidiacono (2005), Espenshade and Chung (2005), and Card and Krueger (2005).

In our paper, we emphasize the signaling role conveyed to international employers by affirmative action policies, working through their effects on colleges' choice of admission standards, when the employers in a globalized skill-intensive sector have access to a pool of global talent. The estimate of average quality of graduates from any particular college becomes important to the employers in the absence of knowledge about individual-specific traits. As such, our paper is related to the idea of signaling, though as already mentioned, our assumptions do not mirror those made by Spence in his

classic paper (1973). Our approach differs because we model educational institutions as decision-making entities with an objective function, therefore instead of being free to choose any level of education, an individual may be constrained by the admission criteria chosen by a particular institution. The standards themselves convey signals to potential employers – signals which can be affected through policy. "Screening" in our model also does not correspond to the traditional setup envisaged in classic papers on screening theory – Rothschild and Stiglitz (1976) or Riley (1976) – of employers offering a menu of contracts which lead groups to self-select. The screening role in our model is performed by colleges when they set their admission standards – screening candidates above a certain ability. It is because of this screening role that status as a college graduate can act as a signal of quality to potential employers.

5. Conclusion

We have shown how a country's international competitiveness in the global workplace is affected by "affirmative action" policies in the sense of quotas. We examine a setup where firms in a globalized skill-intensive sector are free to recruit from many countries. They lack knowledge of specific individual traits, but know which college a job applicant attended, the admission standards chosen by that college, the college's level of instruction and the overall distribution of abilities. Affirmative action policies, or even their announcement, triggers changes in the standards a college chooses – affecting the ability of candidates from the country in question to participate in the international labor market. We focus on affirmative action which is not based on observable distinctions.

The mere announcement of an affirmative action policy can lead to the breakdown of the college system in the country in question, resulting from anticipated exclusion from the international labor market : no groups gain while the more able from both the target and the general groups lose. Even more drastically, skilled industry can emigrate out of the country in question and national income contracts.

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