In pursuit for impeccable veracity

Popov, Sergey V.

Higher School of Economics

18 August 2011

In Pursuit for Impeccable Veracity[1]

Sergey V. Popov

October 31, 2011

[1] Popov: Centre for Advanced Studies, Higher School of Economics, Moscow, svp@hse.ru. Thanks to Dan Bernhardt, David Wiczer and Angelo Mele for productive discussions. This paper was written with the support from the Basic Research Program at HSE. The usual disclaimer applies.

I study the institution of avoiding to hire one's school own PhD graduates for assistant professorships. I argue that this institution is necessary to create better incentives for researchers to incorporate new information in studies, facilitating the convergence to asymptotic learning of the studied fundamentals.

Keywords: academic inbreeding, moral hazard, knowledge, information dissemination.

JEL: A11, D43, D83, L13

The job market of economists features the dislike of *academic inbreeding*, the decision of a school to hire one of its own graduates for tenure-track positions. This is usually perceived as "rules of the game" and as a requirement for a "good" PhD program, without much contemplation about how academic inbreeding hurts the department[2]. This paper argues that such a commitment is a necessary response to the organization of educational process: it aligns the research incentives towards the fastest comprehension of researched phenomena.

[2] Hugo Horta, Francisco M. Veloso, and Rócio Grediaga. Navel gazing: Academic inbreeding and scientific productivity. *Management Science*, 56: 414–429, March 2010

Corporate world is not as averse to inbreeding as academia. One reason is the relatively higher significance of company-specific skills in corporate world[3]: there would be no reason for hiring students from other universities if their research were unapplicable to the faculty's. Another crucial difference is that in academia the final criterion of judgement of one's value—whether one is right or not—is in the process of perpetual discovery by judges as well as the judged. Because of this difference, when decision is made about the research's value, the researcher must not know the opinion of the decisionmaker[4].

[3] Boyan Jovanovic and Yaw Nyarko. Learning by doing and the choice of technology. *Econometrica*, 64(6):1299–1310, 1996

[4] This argument applies also to the blind review process: an author, knowing in advance who will referee the paper, has an incentive to bias the final version towards the opinion of the referee, which might not be socially optimal. Knowing the referee's identity after the submission will similarly affect the author's behavior after getting a revise-and-resubmit decision.

The Model

The model I use is a one-period game. There are three research departments, hereafter referred to as *Faculties*, who are interested in getting closer in a quadratic sense to the true value of a certain fundamental[5]. I denote this fundamental by $A \in R$. Faculty i has a signal about the value of fundamental $f_i = A + \epsilon_i$, where $\epsilon_i \sim N(0, 1/\eta)$.[6]

[5] Physicists of medieval times were estimating the size of the Earth, the distance to the Sun, and the speed of light. Modern economists are estimating, among others, the time discount factor, the risk aversity coefficient and the socially optimal unemployment rate.

[6] Normality here is used only to exploit the convenience of the implied formula for Bayesian update.

Each Faculty trains one *Student*[7], indexed by *almae matres*. Training exposes Student i to the value of her Faculty's signal f_i. Students simultaneously choose their *research positions*, a value $r_i \in R$. After

[7] Masculine pronouns shall denote Faculty agents, and feminine pronouns shall denote Student agents hereafter.

that, Faculties use research positions to decide who to hire. Faculty j prefers to hire a student whose research is closer to A:

$$\text{Faculty } j \text{ hires } \arg\min_i E\left[(r_i - A)^2 | f_j\right] = \arg\min_i (r_i - f_j)^2 + \frac{1}{\eta}.$$

Since Faculty does not know A, he uses the second best thing he has—his own signal; let a coin toss resolve ties.

Students have lexicographic preferences over placement in the following sense. They all prefer getting placed to 1 more than getting placed to 2, and getting placed to 2 is better for them than getting placed to 3. Moreover, they are eager to forego all chances of getting accepted to a lesser Faculty if that increases the chances to get placed to a better-ranked Faculty[8]. This makes the labor market function sequentially: first Faculty 1 chooses the ascendant, then Faculty 2 chooses between two of those who were not offered a position in 1, and finally the last Student joins the Faculty 3. The chance to get hired by the most preferred Faculty is then

$$P(i \text{ hired by } 1 | f_i, s_i) = P\left((r_i - f_1)^2 = \min_{k=1}^{3} (r_k - f_1)^2 | s_i, f_i\right),$$

and chances to get hired by other faculties have similar structure[9].

Students choose the research position r_i to get the best placement they can based on their Faculty's signal f_i and their private signal $s_i = A + \xi_i,\ \xi_i \sim N(0,1)$.[10]

[8] This is a strong assumption, and it is used for clarity.

[9] Here I intentionally do not write down the precise form of the maximized function, as we will use the lexicographic preference assumption to solve by dominance.

[10] ϵ_i and ξ_j are assumed to be mutually independent. The signals of faculties in real world are correlated through reading and writing in same journals and communicating on same conferences. This, however, will only complicate the policy choice formulas. The variance of 1 is a normalization.

THE SOCIAL PLANNER'S CHOICE is to minimize the variance of the most precise research. Since research r_i can only depend on signals f_i of the Faculty and s_i of the Student, the variance-minimizing research is the linear combination of f_i and s_i, with weights of $\frac{\eta}{1+\eta}$ and $\frac{1}{1+\eta}$. This produces a r_i with mean of A and variance of $\frac{1}{1+\eta} < \min(1, \frac{1}{\eta})$. Thus, at first-best, the squared deviation of research from A is on average better than it was at the beginning of the game.

THE PURE STRATEGY EQUILIBRIUM is the collection of research policy decisions $\langle r_i^* \rangle_{i=1}^3$ (Student j chooses r_j^* in equilibrium) and estimates of chance of hiring $\left\langle p_{ij}^* \right\rangle_{i,j=1}^3$ (Student i has p_{ij}^* probability of getting hired by Faculty j in equilibrium) for every $\langle f_i, s_i \rangle_{i=1}^3$ tuple of signals such that:

- r_i^* delivers the maximal element of the placement preferences of Student i conditional on observing f_i and s_i, and rationally believing in actions of other Students r_{-i}^*;
- p_{ij}^* are consistent with the optimal decision of Faculties.

WHEN ACADEMIC INBREEDING IS ALLOWED, Student 1 can guarantee herself a placement to 1 by choosing $r_1 = f_1$. By lack of atoms in the assumed signal structure, the chance of another school's student to choose exactly $r_i = f_1$ is zero, and therefore Students 2 and 3 have zero chance of getting hired to 1, no matter how they choose r_i. Thus, 2 can only get to Faculties 2 and 3, and since 2 observes f_2, he can too choose $r_2 = f_2$, guaranteeing herself a placement to 2. Now, no matter how 3 chooses r_3, his placement will be in 3.[11] Therefore, with academic inbreeding there is an equilibrium where $r_i^* = f_i$, $p_{ii}^* = 1$ and no scientific progress is happening.

[11] That is, Student 3, in principle, can choose the optimal mixture of s_3 and f_3 as her research, but she might as well choose $r_3 = 0$, or stay with $r_3 = f_3$. She will choose $r_3 = f_3$ if there's more than one student from at least one faculty, no matter which. This refinement of "threat of unemployment" will make the equilibrium unique.

WHEN ACADEMIC INBREEDING IS NOT ALLOWED in Faculty 1, $p_{11}^* = 0$, and Student 1 can only be employed by 2 or 3. Student 1 would rather be employed by 2, and therefore chooses r_1 to minimize

$$E[(r_1 - f_2)^2 | s_1, f_1] = E[(r_1 - A)^2 | s_1, f_1] + \frac{1}{\eta},$$

which results in $r_1 = \frac{\eta f_1 + s_1}{\eta + 1}$, the first-best value of her research. Student 2 can be employed by 1, 2 or 3, and she would rather be employed by 1. She chooses her research to minimize

$$E[(r_2 - f_1)^2 | s_2, f_2] = E[(r_2 - A)^2 | s_2, f_2] + \frac{1}{\eta},$$

which results in $r_2 = \frac{\eta f_2 + s_2}{\eta + 1}$, again the first-best value of her research, and same holds for Student 3. Thus, just the commitment by Faculty 1 to not to employ his own students is sufficient to move[12] the equilibrium outcome from no development of precision of knowledge about A to first-best precision of knowledge about A.

[12] The choice to abstain from academic inbreeding by Faculty 1 improves the precision of it's own newly hired Student *ex ante*. Therefore, the commitment of Faculty 1 is individually rational. The decision to introduce the academic inbreeding aversion is endogenous.

This result would not be possible with just two schools, as the choice of research policy would not affect the allocation of students. Similar results obtain if students would prefer to stay in *alma mater*; but in order to abandon the trap of repeating the research of the faculty it would be necessary is that *all* schools, not only the best ones, do not hire their own students.

Discussion and Conclusion

THE ASSUMPTION ABOUT STUDENTS' PREFERENCES is unusual and very strong. We do need it for the argument of dominance solvability to work, but it is not necessary for equilibrium existence. Moreover, it is obvious that the more a student would prefer to stay in her own school, the stronger are the incentives to bias the research decision towards the faculty's opinion, since it's used to determine the worthiness of the candidate. Were there some weights with which students were weighing chances of acceptance to different schools, these weights would affect the student's decision, pulling it away from the first-best choice of research position. This assumption, therefore, is not crucial[13] to the finding that inbreeding undermines the research process. However, without this assumption the commitment of Faculty 1 to abstain from academic inbreeding might stop being credible: Student 1 would exhibit better research on average than Student 2 even in the symmetric framework, since Student 2 will somewhat bias her research towards the research of her Faculty, a thing she would not do in lexicographic preference setting.

[13] In current form, it has some risk-loving flavor to it: any Student would prefer to get into Faculty 1 with a small probability and work for Faculty 3 with the rest of probability rather than guarantee herself a placement to Faculty 2. However, it is not just the variance that student like, it's the exposure to better future, so "risk-loving" is not an appropriate term for this behavior.

THE ASSUMPTION OF IDENTICAL DISTRIBUTION OF SIGNALS is also strong. One would argue that since all students would like to join faculty 1, eventually faculty 1 will feature a better precision of faculty signal than, say, faculty 2.[14] Of course, had faculties cared about the precision of the signal at each period of an analogous dynamic infinite-time game, and were they endowed with different own signal precision or differently able students, then attractive faculties might be interested in hiring their own graduates from time to time. Particularly, assume faculty 1's students had the variance of their signals of $\frac{1}{2}$; then the variance of socially optimal choice of their research would be $\frac{1}{2+\eta}$, which is less than what can deliver any other student[15]—and this exacerbates in dynamic setting. The problem of how to make students of 1 to take into account their own signal persists.

[14] Observe that this is not true in the baseline model: all research choices have identical precision.

[15] One could treat the variance of the signal as the level of effort, introduce increasing costs of effort, and observe how academic inbreeding diminishes incentives for exercising effort.

BANNING ACADEMIC INBREEDING improves student incentives towards choosing their research positions at first-best levels. Were faculties evaluating their own students, they would be creating incentives that biase the research policy towards the faculty's own opinion more than necessary. The described mechanism has nothing to do with moral hazard on the side of employers, which is usually used when arguing against academic inbreeding from ethical points and long-run signaling reasons.

References

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