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Honest Grading, Grade Inflation and Reputation

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Abstract

When grades lose their informative value because the percentage of students receiving the best grade rises without any corresponding increase in ability, this is called grade inflation. Conventional wisdom says that such grade inflation is unavoidable since it is essentially costless to award good grades. In this paper, we point out an effect driving into the opposite direction: Grade inflation is not actually costless, since it has an impact on future cohorts of graduates, or, put differently, by grading honestly, a school can build up reputation. Introducing a concern for reputation into an established signaling model of grading, we show that this mechanism reduces or even avoids grade inflation.

Keywords: grading, signaling, reputation, education
JEL: I21, I23, D82

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1 Introduction

For many students the most important aspect in their graduation process is not learning, understanding and knowledge, but the received grade. They find themselves struggling for good grades since these are a prerequisite for later getting the best chances on the job market. Consequently, students often feel that grading is too tough. On the other side, employers often complain about an abundance of good grades, termed 'grade inflation', where grades increasingly lose their informative value. This seems to be true both for secondary and tertiary education; even in the most prestigious educational institutions, grade inflation is a big issue (Mansfield, 2001). The prevailing opinion is that grade inflation is inescapable because schools do not incur any direct costs when giving good grades, and therefore tend to increase the average grade. Thus, awarding good grades is essentially cheap talk. This idea is clearly formulated in the paper by Chan, Hao and Suen (2007), where there is always some grade inflation in equilibrium.

In this paper, we challenge this conclusion by considering a simple, but plausible form of costs associated with inflating grades: a loss of reputation. As soon as it is revealed that a school has inflated grades, the school's graduates of the next generation face less favorable conditions on the job market. This reduces the incentives to inflate grades, and may even eliminate grade inflation altogether.

To formalize this idea, we build upon the signaling model by Chan, Hao and Suen (2007), where employers must rely on the information provided by grades when recruiting workers and placing them on different jobs. The school may have a large or a small number of excellent students. Since employers do not observe which of these two states of nature occurred, the school may inflate grades by giving many good grades ('As') even in the state when only few students deserve it. Chan, Hao and Suen (2007) show that in equilibrium, there is either partial or full pooling of the grading strategies of the school across states of nature. That is, the school which has few excellent students will award some mediocre students an A with positive probability or even with certainty. Conversely, there is no separating equilibrium where in both states of nature the number of As equals the number of excellent students. Put differently, in this model, there is no equilibrium where grades are always given honestly. In contrast, in all equilibria, there is always some kind of grade inflation.

Into this model, we introduce a reputational element, which can be lost when the school is not grading honestly. We add a second cohort of graduates, which arrives on the labor market when the first cohort has already revealed their true ability and therefore the school's grading policy. In order to highlight the importance of reputation in the simplest possible way, we assume that the state of the world is identical for both cohorts, and that the school keeps its policy across cohorts. These assumptions capture, in a stylized way, the ideas that in reality the composition of the student body does not change widely across cohorts in the same institution, and that a university or school cannot easily change the grading standard between successive years. Grade inflation is a slowly sneaking process, which also can be reversed only slowly. When faced with two sequentially following generations coming as graduates from the same school, one would in general assume that they have been subject to a comparable grading policy.

Although, formally, this modification appears to be simple, our results show that this kind of reputation effect substantially changes the nature of the signaling game, and hence, grading policies. With increasing size of the second cohort, we find that the set of parameters supporting a full pooling equilibrium, where grade inflation occurs with certainty, is reduced in favor of the semi-pooling equilibrium, where grade inflation occurs only with some probability. Moreover, in a semi-pooling equilibrium the probability to inflate grades decreases in the size of the second cohort. Most importantly, there even exists a fully separating equilibrium if the size of the second cohort exceeds some threshold. Thus, the amount of grade inflation is reduced, and true and honest grading by the school is indeed possible, if reputation effects are taken into account.

The following Section 2 places our contribution in the wider context of the literature on grading policies and grade inflation. The paper proceeds in Section 3 by presenting the model. The equilibria involving grade inflation and honest grading are analyzed in Section 4. Section 5 provides some concluding remarks.

2 Relation to the literature

Research on grading policies aims at understanding how examination standards are set, at empirically identifying grade inflation, its causes and its consequences, and at evaluating possible instruments like reputation which may counteract lenient grading. In the following, we discuss work on these topics in turn.

The earliest contributions explaining how schools set grading standards were provided by Costrell (1994), Costrell (1997) and Betts (1998). In these models, students weigh their individual effort, depending on personal ability, to pass school against the benefit of obtaining the degree, and schools maximize the wages earned by their students. Like in Chan, Hao and Suen (2007) and in the present paper, in this line of research, a school trades off a higher wage for graduates or A-students, which calls for tougher standards, against a higher number of graduates or A-students, which requires a more lenient standard.

Sharing this focus, Popov and Bernhardt (2010) have developed a model in which schools with a better distribution of abilities will inflate grades by more than schools with a less able student body. This arises since the marginal A-student of an elite institution can free ride on the signal value created by the many really good A's at this school. Although it also deals with leniency of standards, this work addresses a different issue than the present paper. In the model by Popov and Bernhardt (2010), the grading standard and the distribution of abilities in a school is known to firms, and the mismatch between jobs and workers arises from the fact that in the labor market, the average rather than the marginal productivity of A-students will be equalized across schools. In contrast, our approach analyzes the inference of firms about individual productivity when the distribution of abilities is private information of the school.

Rather than awarding overstated grades, some universities make transcripts less informative than feasible. As shown by Ostrovsky and Schwarz (2010), such a policy can be optimal for the students on aggregate: By compressing the grade distribution, the school foregoes the most attractive job placements but may improve the average placement of its students. Similar to the work cited so far and to our contribution, this approach features a trade-off between highest achievers and mediocre students. The informational assumption about the grading policy, however, differs. In the model by Ostrovsky and Schwarz (2010) grades are correct on average and the ability distribution is known to employers. Our paper instead focuses on whether, in the absence of such information, a school can credibly signal a good quality of its student body by using an honest, unbiased grading strategy.

Empirically, grade inflation has been measured by describing the time trend of grades. For example, in studies of individual universities, Grove and Wasserman (2004) and Baird (2009) estimate statistically significant and quantitatively important increases in average grades over time. Similarly, Bauer and Grave (2011) find a marked increase in grades awarded by German universities since the 1980s. In cross section, different grading policies can be identified by measuring the grades awarded by individual schools against standardized test results or labor market outcomes. Moreover, by relating such measures to characteristics of schools, one can shed light on possible causes of grade inflation such as competition (Wikström and Wikström, 2005), the social composition of the school's student body (Himmler and Schwager, forthcoming, 2012), teacher incentives (Martins, 2010; Bauer and Grave, 2011; Franz, 2010), or regional differences (Bagues, Sylos Labini and Zinovyeva, 2008).

Research has also aimed at evaluating the consequences of lenient grading policies. In line with the predictions by Costrell (1994) and (Betts, 1998), Babcock (2010) confirms in an empirical analysis of course evaluations at UC San Diego that study time is lower in courses which are better graded. As Mechtenberg (2009) shows, biased grading may also have more subtle effects on student careers. In her model, mathematics teachers selectively award overstated grades to female students. This erodes the credibility of those grades for talented female students and induces them to provide less effort in mathematics and sciences. On the part of employers and further education institutions, the likely consequence of grade inflation is to use other signals for screening applicants. Thus, Wongsurawat (2009) shows that U.S. law schools in their admission procedures increasingly rely on standardized test scores rather than on college grades. If average ability differs among social classes, employers react to grade inflation by downgrading the degree of graduates from disadvantaged backgrounds (Schwager, 2012) or by hiring only those with personal links to the employer (Tampieri, 2011). Finally, Caplan and Gilbert (2010) point out that grade inflation also has financial consequences for the school itself since students who have to repeat courses pay more tuition.

There are different approaches which aim at reducing the amount of grade inflation. Many universities restrict professors to some kind of grade distribution, or put ‘grades in context’, which basically means to reveal the grade distribution. Bar, Kadiyali and Zussman (2009a) however show that this policy can even increase the average grade. This arises since students of intermediate ability tend to enrol more often in leniently graded courses once information on course specific grade distributions is publicly available. In an empirical analysis of student records at Cornell University, Bar, Kadiyali and Zussman (2009b) find evidence for such behavior.

Damiano, Hao and Suen (2008) consider a rating agency which issues quality signals about multiple clients such as PhD graduates, stocks, or consumer products. They show that the agency can improve its payoff per client compared to an agency with a single client by strategically exploiting the possibility to send multiple signals. On the other hand, when the agency is composed of individual raters which issue their signals independently, then correlation among the quality of clients restricts the ability of raters to inflate grades. Thus, while Damiano, Hao and Suen (2008) are focussed upon the interaction of multiple raters using multiple signals, we consider a single school with a common grading policy. Moreover, the key difference between this contribution and the present paper is that in Damiano, Hao and Suen (2008), a reputational concern of the rating agency is assumed in a reduced form utility function. Contrary to this, we derive such a concern from an explicit modeling of two cohorts, where employers update beliefs about the underlying grading policy between periods. In this simple framework, we show that grade inflation is reduced or even eliminated altogether.

A model which features a dynamic updating of employers’ beliefs is provided by Zubrickas (2012). In the static version of that model, teachers compress grades at the top of the ability distribution. Although this strategy distorts incentives for the (small number of) highest achievers, it pays off since incentives for (the large number of) students with lower abilities are raised. Thus, lenient grading occurs because it allows for a costless way of rewarding large numbers of students and so increasing the average effort exerted. In the dynamic extension, employers learn that the average performance of students with top grades is rather moderate and update their expectations accordingly. This in turn makes it worthwhile for teachers to extend the range of top grades even further downward in the ability distribution, eroding the signal value further. Although this approach shares the element of information updating with our idea of reputation building, the nature of learning is fundamentally different. In Zubrickas (2012) the signal value of grades is a public good among teachers since employers are unable to discern the grading strategies of individual teachers or schools. In our approach, the individual school builds up reputation. Consequently, we reach the opposite conclusion: Introducing a dynamic element unequivocally improves the quality of the signal provided by grades.

Finally, we discuss a recent contribution which, like our work, explicitly analyzes school reputation. In MacLeod and Urquiola (2012), alumni send two signals to the labor market: individual grades and the reputation of the school. The authors show that if the school can selectively admit students on the basis of entry test scores or family background, the equilibrium effort of students is reduced. This arises since with selective admission, the signal value of the individual grade is reduced in favor of the school's reputation. The main difference between this approach and our paper is in the meaning of reputation. In MacLeod and Urquiola (2012) reputation is defined to be the average skill of a school's graduates, whereas in our model, reputation refers to the reliability of grades. Consequently, in MacLeod and Urquiola (2012) grades, while noisy, are unbiased, and firms observe the distribution of abilities in any given school. In contrast, in our model, the school has private information about the composition of its student body, and grade inflation may be used as a strategic instrument by the school.

As these theoretical and empirical results show, the common belief in literature is that grade inflation occurs pervasively, and that it also is to a large extent unavoidable. Contrary to that, our model shows that schools who do not inflate grades instead have another advantage: They build up a reputation, so that employers treat later cohorts from the same school better when previous exam grades have not been revealed to be exaggerated.

3 The model

In the model, there is a school with two types of students, good students (type G) and mediocre students (type M). The world has two states: a favorable state (state F), which occurs with probability π, $0 \leq \pi \leq 1$, and an unfavorable state (state U), which occurs with the remaining probability $1-\pi$. In the favorable state the school has a greater fraction of good students (ϕ_F) than in the unfavorable state (ϕ_U), where $0 < \phi_U < \phi_F < 1$.

The state of the world and the type of the individual student are known to the school. In contrast, employers do not observe the state of the world, nor the type of a specific student, but the received grade. There are two possible grades: A and B, and the school follows one of two strategies in each state of the world. The strategies are called tough grading, or t, giving As to the fraction ϕ_U of the students and Bs to the rest, and easy grading, or e, giving As to the fraction ϕ_F and Bs to all others. The honest grading policy would consist in allocating A to type G students and B to type M students, that is, choosing strategy e in state F and strategy t in state U. In state U, grades can be inflated by strategy e, and in state F, grades could be deflated by strategy t. The probability that the school inflates the grades, given that the state is U, is denoted by p with $0 \leq p \leq 1$. This probability is endogenously determined in equilibrium and summarizes the amount of grade inflation, where $p = 0$ corresponds to honest grading, and $p = 1$ stands for maximal grade inflation. Contrary to grade inflation, we do not consider equilibria with grade deflation, where some good students are refused the deserved A.

From the employer's point of view, there are two types of jobs: Job L, a low demanding job anybody can manage with productivity ω_0 per period, and Job H, a high demanding job that only a type G employee can manage with output ω_G per period. A type M worker will become desperate at this job and therefore produce only output ω_M per period, where $\omega_G > \omega_0 > \omega_M > 0$. Employees work for $T > 0$ periods and employers can observe their true type after τ_H periods on job H and τ_L periods on job L, where $\tau_H < \tau_L \leq T$ is assumed.

Our key modification relative to Chan, Hao and Suen (2007) consists of having two cohorts of graduates. The second cohort begins to work at some point in time after τ_L periods, when the true ability of workers from the first cohort has already been observed. The share of the first cohort in the total population of students is λ, where $0 \leq \lambda \leq 1$. With $\lambda = 1$ the model reduces to Chan, Hao and Suen (2007), where there is only one cohort. We assume that the state of the world is identical for both cohorts, and that the school must decide at the very beginning about one grading policy which applies to both cohorts. While this certainly is a strong simplification, it seems clear that the same mechanisms as analyzed here will still be present in a more general set-up as long as there is some correlation in the state of the world between both cohorts, and as long as it is sufficiently costly for the school to change its grading policy between cohorts.

For the analysis of the potential equilibria of this model, we first consider the posterior probability which employers attach to being in state F when they observe easy grading. Restricting attention to equilibria without grade deflation, in state F the school chooses strategy e with probability one. Therefore, this probability is

$$q(F|e) = \frac{\pi}{\pi + (1-\pi)p}.$$

We consider a competitive labor market with risk neutral employers, where wages are determined by expected productivity of workers. It is assumed that firms place workers from the first cohort with grade A on H-jobs, and workers with grade B on L-jobs until they discover their true ability. In the following section, we will verify that this is indeed the optimal assignment of workers in the equilibria we study. If easy grading was observed, the wage paid to A rated students who are placed on H-jobs is thus

$$w(A|e) = q(F|e)\omega_G + (1 - q(F|e))\bar{\omega}.$$

Here $\bar{\omega}$ is the expected productivity of A-students when the school is already known to inflate grades:

$$\bar{\omega} = \frac{\phi_U}{\phi_F}\omega_G + \left(1 - \frac{\phi_U}{\phi_F}\right)\omega_M.$$

In general, we could introduce analogous definitions for the wages paid to A-students after strategy t, and for the wages obtained by B-students conditional on both strategies. However, we do not allow for a strategy which in the same time rewards some mediocre students with an A and downgrades some good students to B. Thus, with the tough grading strategy, all A-students must be good by assumption, and so their wage will be ω_G. In the same way, since all workers produce ω_0 on job L, and since we assume that B-students of the first cohort are assigned to such jobs, they will be paid a wage of ω_0.

Schools are alumni profit maximizers, that is, they maximize the sum of the expected wages of their graduates. In case of a favorable state the school has one of two payoffs, depending on the strategy:

$$\begin{aligned} V(e|F) = \quad & \lambda[\phi_F\,(\tau_H w(A|e) + (T - \tau_H)\omega_G) + (1 - \phi_F)T\omega_0] \\ & + (1 - \lambda)[\phi_F T\omega_G + (1 - \phi_F)T\omega_0], \qquad (1) \\ V(t|F) = \quad & \lambda[\phi_U T\omega_G + (\phi_F - \phi_U)(\tau_L\omega_0 + (T - \tau_L)\omega_G) + (1 - \phi_F)T\omega_0] \\ & + (1 - \lambda)[\max\{a; b\} + \phi_U T\omega_G], \qquad (2) \\ \text{where} \quad & a = (\phi_F - \phi_U)T\omega_G + (1 - \phi_F)[\tau_H\omega_M + (T - \tau_H)\omega_0], \\ & b = (\phi_F - \phi_U)[\tau_L\omega_0 + (T - \tau_L)\omega_G] + (1 - \phi_F)T\omega_0. \end{aligned}$$

To understand these payoffs, let us first take a look at $V(e|F)$, the payoff procured by the easy grading policy in state F. In the first cohort, which has weight λ, a fraction ϕ_F of students has received As. This fraction only consists of type G students, who first receive the mean payoff $w(A|e)$ and later, when the true ability is observed, they receive ω_G. The rest, consisting of all B students, receive ω_0 in all periods. When the second cohort arrives on the labour market, employers have found out the true ability of all first cohort workers. Since they have not been disappointed by any A student among them, they rightly conclude that the state of nature is F. Hence, all employees in the second cohort, which has weight

$1-\lambda$, are placed on the appropriate job and receive the wage corresponding to their true productivity.

When the school uses tough grading in the favorable state the utility is $V(t|F)$. Here, the first cohort contains only ϕ_U students with grade A, which are all of the good type G. Employers can derive this at the outset, and so will pay them ω_G throughout their employment spell. Since grades are deflated, there is a share $\phi_F - \phi_U$ of truly excellent students who have been denied the good grade. They start working on L-jobs with productivity ω_0. After τ_L periods, their type is revealed and they are re-assigned to H-jobs, earning ω_G during the remaining $T-\tau_L$ periods. Finally, there is a share $1-\phi_F$ of M-students who obtain a deserved B. These students are employed on $L-$jobs and stay there after their type is revealed, and thus earn ω_0 in all T periods.

When the second cohort arrives, employers have detected that grades have been deflated. They will place A students from the second cohort, whose share is ϕ_U, on H-jobs and pay a wage of ω_G per period. Since among the students with grade B there are some students of type G, it may make sense to allocate students with this grade first to H-jobs rather than to L-jobs as in the first cohort. If this is done, the share $\phi_F - \phi_U$ of B students who are excellent will stay on H-jobs and produce ω_G in all periods. The mediocre students, with a share $1-\phi_F$, will produce ω_M during the first τ_H periods of their employment, will be re-assigned to L-jobs after their type is revealed, and produce ω_0 thereafter. Altogether, if B students of the second cohort are assigned to H-jobs first, then they will produce an expected output of a, which is their aggregate wage. Alternatively, employers might assign B-students of the second cohort to $L-$jobs first. This yields an aggregate expected output, and hence total wage, given by b. Here, every B-student produces ω_0 in the first τ_L periods. After that date, the type of the $\phi_F - \phi_U$ excellent students who were downgraded is revealed, and they produce ω_G for the remaining time after having been reallocated to H-jobs. The remaining $1-\phi_F$ students with grade B are of type M and stay on L-jobs. Depending on the model's parameters, either initial placement of B students of the second cohort can be optimal, so that in the payoff $V(t|F)$, the larger one of the aggregate wages a and b is used.

When the school observes the unfavorable state, it can obtain one of these payoffs:

$$\begin{aligned}
V(e|U) = \quad & \lambda[\phi_U\,(\tau_H w(A|e) + (T-\tau_H)\omega_G) + (\phi_F-\phi_U)\,(\tau_H w(A|e) + (T-\tau_H)\omega_0) \\
& + (1-\phi_F)T\omega_0] + (1-\lambda)[max\{x;y\} + (1-\phi_F)T\omega_0] \qquad (3) \\
\text{where} \quad & x = \phi_U[\tau_H\bar{\omega} + (T-\tau_H)\omega_G] + (\phi_F-\phi_U)[\tau_H\bar{\omega} + (T-\tau_H)\omega_0] \\
& y = \phi_U[\tau_L\omega_0 + (T-\tau_L)\omega_G] + (\phi_F-\phi_U)T\omega_0 \\
V(t|U) = \quad & \phi_U T\omega_G + (1-\phi_U)T\omega_0 \qquad (4)
\end{aligned}$$

Let us take a look at $V(e|U)$, which is easy grading in the unfavorable state and therefore grade inflation. In the first cohort a fraction ϕ_F get A-grades, but only the fraction ϕ_U

deserves it. This fraction ϕ_U obtain the mean output $w(A|e)$ as wage, and later, after they revealed their true high ability, they receive ω_G. The rest of the A-rated students $(\phi_F - \phi_U)$ get the same before τ_H, and later they are placed on L-jobs and receive ω_0. The B-rated students receive ω_0 for all periods. When the second cohort arrives on job market, the employers know that grade inflation took place, and either still place the As on H-jobs (output: x), or they place all employees first on L-jobs until their ability is revealed (output: y).

If tough grading is chosen by the school ($V(t|U)$), the school is honestly grading the students in the unfavorable state. Because tough grading implies that A-students must be good, ω_G is already paid to all A-students of the first cohort, and ω_0 is paid to all B-students. Since employers are not disappointed by the first cohort, they will do the same in the second cohort. At the end all A's get ω_G for all periods and all B's get ω_0 for all periods.

For the analysis that follows, it is important that the school has stronger incentive to choose strategy e when in the favorable state than in the unfavorable state. This is a single crossing condition stating that the gain from switching from tough to easy grading in the favorable state, $V(e|F) - V(t|F)$, is larger than the gain procured by the same switch in the unfavorable state, $V(e|U) - V(t|U)$. Since we have the cases x, y and a, b, this must be true in all four cases. In the case $x \geq y$ and $a \leq b$ this restriction reads:

$$\begin{aligned}&[V(e|F) - V(t|F)] - [V(e|U) - V(t|U)]\\&\qquad = (\phi_F - \phi_U)(\tau_L - \tau_H)(\omega_G - \omega_0) + (1-\lambda)(\phi_F - \phi_U)\tau_H(\omega_G - \omega_M) > 0\,.\end{aligned}$$

If $x \geq y$ and $a > b$ we need:

$$\begin{aligned}&[V(e|F) - V(t|F)] - [V(e|U) - V(t|U)]\\&\qquad = \lambda(\phi_F - \phi_U)(\tau_L - \tau_H)(\omega_G - \omega_0) + (1-\lambda)(1 - \phi_U)\tau_H(\omega_0 - \omega_M) > 0\,.\end{aligned}$$

For the $x < y$, $a \leq b$ case the restriction is:

$$[V(e|F) - V(t|F)] - [V(e|U) - V(t|U)] = (1-\lambda)\phi_F\tau_L + \lambda(\phi_F - \phi_U)(\tau_L - \tau_H) > 0\,,$$

and if $x < y$ and $a > b$ we need:

$$\begin{aligned}&[V(e|F) - V(t|F)] - [V(e|U) - V(t|U)]\\&= \lambda(\phi_F - \phi_U)(\omega_G - \omega_0)(\tau_L - \tau_H) + (1-\lambda)\phi_U\tau_L(\omega_G - \omega_0) + (1-\lambda)(1-\phi_F)\tau_H(\omega_0 - \omega_M) > 0\,.\end{aligned}$$

In all cases, the single crossing condition is satisfied, since $1 \geq \lambda \geq 0$, $1 > \phi_F > \phi_U > 0$, $\tau_L > \tau_H > 0$ and $\omega_G > \omega_0 > \omega_M$.

Finally, for later use, we state the threshold where employers decide to switch between x and y. From the definitions above, we derive that $x > (=, <)\ y$ is equivalent to

$$\phi_U\tau_L(\omega_G - \omega_0) > (=, <)\ (\phi_F - \phi_U)\tau_H(\omega_0 - \omega_M)\,. \tag{5}$$

Here, the left-hand-side measures the loss in output incurred if after detecting grade inflation, employers place A-students from the second cohort on L-jobs (choice y). With this choice, the share ϕ_U of workers is wrongly placed on job L instead of H. It takes τ_L periods to reveal the true ability with a loss in output of $\omega_G - \omega_0$ per period. The right-hand-side of the inequality describes the distortion induced by strategy x. Here the share $\phi_F - \phi_U$ of employees is wrongly placed on job H for τ_H periods, resulting in a loss of output $\omega_0 - \omega_M$ per period.

4 Equilibrium analysis

In this section, we provide conditions for the existence of three possible equilibria: a separating equilibrium with honest grading and a semi- or a full-pooling equilibrium with grade inflation. In the separating equilibrium the school employs easy grading in the favorable state of nature and tough grading in the unfavorable state; in the full pooling equilibrium, easy grading is chosen in both states of nature. In the semi-pooling equilibrium, the school uses easy grading in the favorable state and randomizes between both grading strategies, choosing easy grading in state U with probability p.

To show that an inflationary semi-pooling equilibrium exists, we have to show that $V(e|F) \geq V(t|F)$ and $V(e|U) = V(t|U)$, with the payoffs given by (1) to (4). An inflationary full-pooling equilibrium exists if $V(e|F) \geq V(t|F)$ and $V(e|U) \geq V(t|U)$. Moreover, for both equilibria we have to verify that it is indeed optimal to assign A- (B-) workers of the first cohort to H- (L-) jobs, as used in the definition of the payoffs.

To do this, we first consider the case $x \geq y$. Inserting $w(A|e)$ in the payoffs, replacing $q(F|e)$, and solving the indifference equation $V(e|U) = V(t|U)$ for p yields

$$p_x = \frac{\pi}{1-\pi} \cdot \frac{\lambda(\omega_G - \omega_0) - (1-\lambda)(\omega_0 - \omega_M)}{\omega_0 - \omega_M} \tag{6}$$

for the probability that the school inflates grades in the unfavorable state. In order to have a semi-pooling equilibrium, this value must be between 0 and 1. From $p_x < 1$, one derives that the probability to be in state F must be below this threshold:

$$\pi < \pi_x \equiv \frac{\omega_0 - \omega_M}{\lambda(\omega_G - \omega_M)}\,. \tag{7}$$

Similarly, from $p_x > 0$, one derives

$$\lambda > \lambda_x \equiv \frac{\omega_0 - \omega_M}{\omega_G - \omega_M}. \tag{8}$$

Thus, with $\pi < \pi_x$, $\lambda > \lambda_x$, and $p = p_x$, the school is indifferent between both grading strategies in the unfavorable state. Moreover, from the single crossing condition, $V(e|F) -$

$V(t|F) > V(e|U) - V(t|U) = 0$, so that the school strictly prefers easy grading in state F if $p = p_x$.

In order to verify optimality of the job assignment, observe that students with grade B are believed to be of type M with certainty since grades are not deflated in the semi-pooling equilibrium. Thus, B-students are better placed on L-jobs. When tough grading is observed, all A-students are believed to be of type G, and hence are rightly placed in H-jobs. Finally, when easy grading is observed, inserting $p = p_x$ in $q(F|e)$ shows that placing A-students on H-jobs rather than on L-jobs yields an expected gain in productivity of

$$w(A|e) - w_0 = \frac{(1-\lambda)(\phi_F - \phi_U)}{\lambda\phi_F}(\omega_0 - \omega_M) + \frac{\phi_U}{\phi_F}(\omega_G - \omega_0) > 0\,.$$

Therefore, the job assignment for the first cohort used to compute the payoffs above is indeed optimal, which establishes existence of the semi-pooling equilibrium if $\pi < \pi_x$ and $\lambda > \lambda_x$.

Clearly, $p = p_x$ and the conditions $\pi < \pi_x$ and $\lambda > \lambda_x$ are also necessary for an inflationary semi-pooling equilibrium to obtain under the given job assignment. Also the job assignment of B-students to L-jobs and of A-students to H-jobs when tough grading occurs is necessary in a semi-pooling equilibrium, since in these cases the ability of students is revealed. An inflationary semi-pooling equilibrium which violates one of the conditions (6) to (8) could, however, be supported by changing the job assignment of A-students from the first cohort if easy grading is observed. If these students are placed on L-jobs first, the school's payoff from easy grading in the unfavorable state is

$$\begin{aligned}&\lambda\{\phi_U[\tau_L\omega_0 + (T-\tau_L)\omega_G] + (1-\phi_U)T\omega_0\}\\ &\quad +(1-\lambda)\{\phi_U T\omega_G + (\phi_F - \phi_U)[\tau_H\omega_M + (T-\tau_H)\omega_0] + (1-\phi_F)T\omega_0\}\,.\end{aligned}$$

If it uses tough grading instead, the payoff is $\phi_U T\omega_G + (1-\phi_U)T\omega_0$, which is larger. Thus, with such an assignment, no inflationary semi-pooling equilibrium can exist, implying that the conditions (6) to (8) are also necessary for existence of an inflationary semi-pooling equilibrium.

To construct a full-pooling equilibrium, assume that, out of equilibrium, the employers believe that the state is unfavorable if tough grading is observed. Then, the payoffs $V(e|U)$ and $V(t|U)$ are as above, with $p = 1$. From $V(e|U) \geq V(t|U)$ we get the restriction: $\pi \geq \pi_x$ which is the border for the semi-pooling equilibrium (see (7)). From $\pi \leq 1$, we derive that $\lambda \geq \lambda_x$ must also hold in a fully pooling equilibrium (see (8)). Again, by the single crossing condition, $V(e|U) \geq V(t|U)$ implies that the school strictly prefers easy grading if the state is favorable. Finally, in order to verify that the job assignment is optimal given the pooling strategies, use $q(F|e) = \pi$ to see that $w(A|e) \geq \omega_0$ is equivalent to $\pi\omega_G + (1-\pi)\bar{\omega} \geq \omega_0$.

Since $\pi \geq \pi_x$, this inequality is satisfied if $\pi_x \omega_G + (1-\pi_x)\bar{\omega} \geq \omega_0$, or equivalently, after replacing π_x, if

$$\frac{(\omega_0 - \omega_M)}{\lambda}(\phi_F - \phi_U) + \phi_U \omega_G + (\phi_F - \phi_U)\omega_M - \phi_F \omega_0 \geq 0.$$

Since $\lambda \leq 1$, this is implied by $(\omega_0 - \omega_M)(\phi_F - \phi_U) + \phi_U \omega_G + (\phi_F - \phi_U)\omega_M - \phi_F \omega_0 \geq 0$, which reduces to $\phi_U(\omega_G - \omega_0) \geq 0$. Hence, the assignment of jobs is indeed optimal, which establishes existence of the inflationary pooling equilibrium if $\pi \geq \pi_x$ and $\lambda \geq \lambda_x$.

These conditions are also necessary for an inflationary full pooling equilibrium. To see this, observe that in any such equilibrium, after a deviation to strategy t, the A-students will be believed to be of type G with certainty. They are therefore placed on H-jobs and earn ω_G. Depending on the out-of-equilibrium belief, the B-students of the first cohort may be placed on either type of job. If they are placed on L-jobs first, then the payoffs to the school in state U are $V(e|U)$ and $V(t|U)$ from (3) and (4), with $w(A|e) = \pi\omega_G + (1-\pi)\bar{\omega}$. Thus, in such an equilibrium $\pi \geq \pi_x$ and $\lambda \geq \lambda_x$ must hold. If instead, B-students are placed on H-jobs first, the initial wage they obtain must be higher than ω_0, which weakly increases the payoff the school derives from tough grading in state U. Hence, since $V(e|U)$ must be at least as large as this payoff, $V(e|U) \geq V(t|U)$ must hold also with this assignment, and by consequence, $\pi \geq \pi_x$ and $\lambda \geq \lambda_x$ follow again.

When condition $x < y$ applies, we may reiterate the same steps and arrive at similar inequalities characterizing the subset of parameters where both types of equilibria exist. For the semi-pooling equilibrium we need π to be below:

$$\pi < \pi_y \equiv \frac{\lambda\tau_H(\phi_F - \phi_U)(\omega_0 - \omega_M) + (1-\lambda)\phi_U\tau_L(\omega_G - \omega_0)}{\lambda(\phi_F - \phi_U)\tau_H(\omega_G - \omega_M)}, \tag{9}$$

and the share of the first cohort must exceed

$$\lambda > \lambda_y \equiv \frac{\phi_U \tau_L}{\tau_H(\phi_F - \phi_U) + \phi_U \tau_L}. \tag{10}$$

The equilibrium probability that the school inflates grades in the unfavorable state is

$$p = p_y^* \equiv \frac{\pi}{1-\pi} \cdot \frac{(\omega_G - \omega_0)[\lambda\tau_H(\phi_F - \phi_U) - (1-\lambda)\tau_L\phi_U]}{\lambda\tau_H(\phi_F - \phi_U)(\omega_0 - \omega_M) + (1-\lambda)\tau_L\phi_U(\omega_G - \omega_0)}. \tag{11}$$

For the full-pooling equilibrium with $p = 1$, we must have $\pi \geq \pi_y$ and $\lambda \geq \lambda_y$.

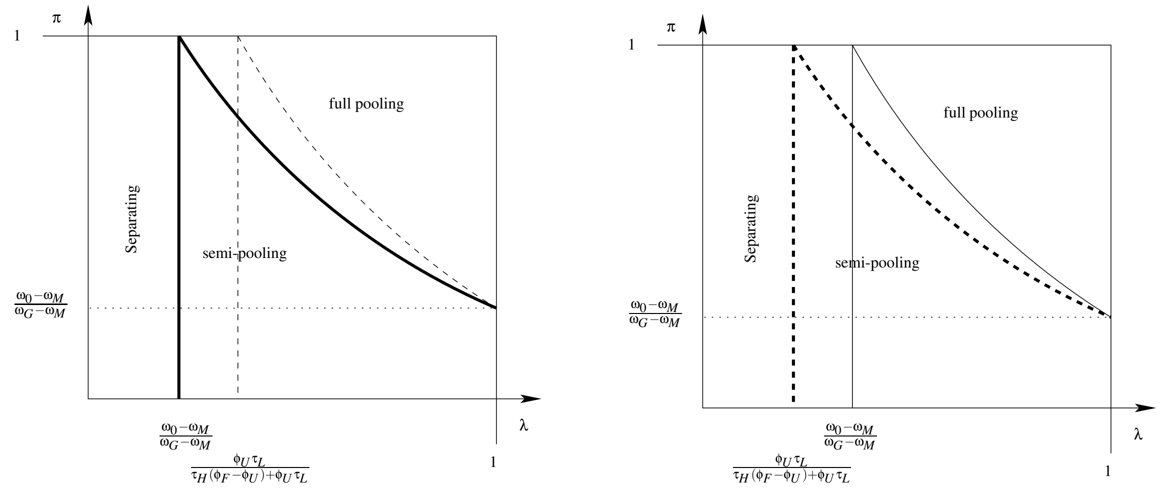
Depending on the parameters of the model, both cases $x \geq y$ and $x < y$ can arise. By rearranging the inequalities $\pi_x < (=,>)\ \pi_y$ and $\lambda_x < (=,>)\ \lambda_y$, one can however show that these are equivalent to (5), hence to $x > (=,<)\ y$. Thus, whatever case arises, it is the smaller of the limiting parameter values which delineates the two kinds of equilibria. Moreover, for the semi-pooling equilibrium, one can manipulate the inequality $p_x > (=,<)$ p_y so as to find that it, too, is equivalent to (5), implying that whenever $x > (=,<)\ y$, then $p_x > (=,<)\ p_y$. These equivalences mean that grade inflation tends to be more likely if the larger one of the two values x and y is used for second cohort wages in $V(e|U)$. Intuitively, this fact arises from the strategic reaction of the school to the employers' choice to make best use of the second cohort after grades have been inflated. By allocating A-workers of the second cohort to the jobs where they are most productive and paying them accordingly, employers help to reduce the damage which the loss of reputation inflicts on second cohort workers. Consequently, the incentives to avoid bad reputation, that is, to grade honestly, are reduced compared to a situation where the placement of second cohort workers is suboptimal.

Combining these observations, we can define $\pi^* = \min\{\pi_x;\pi_y\}$, $\lambda^* = \min\{\lambda_x;\lambda_y\}$ and $p^* = \max\{p_x;p_y\}$ in order to state the first result on semi and full pooling equilibria.

Proposition 1 *(i) There is an inflationary semi-pooling equilibrium if and only if* $\pi < \pi^*$ *and* $\lambda > \lambda^*$*, with a unique probability* p^* *to inflate the grades in the unfavorable state.*
(ii) There is an inflationary full-pooling equilibrium where the school uses easy grading in both states of nature if and only if $\pi \geq \pi^*$ *and* $\lambda \geq \lambda^*$.

This result, which is illustrated in figures 1(a) and 1(b), shows how concerns for reputation mitigate the extent of grade inflation. Inspecting the critical values π_x and π_y, we observe that π^* is decreasing in λ. Thus, compared to the case with $\lambda = 1$, which has been analyzed by Chan, Hao and Suen (2007), the range of π supporting the semi-pooling equilibrium expands at the expense of the range supporting the full pooling equilibrium once a second cohort is introduced. That is, when the school cares for its reputation, there are fewer cases where grades are always inflated and more cases where honest grading occurs at least with some probability. Similarly, from the expressions for p_x and p_y we see that p^* is increasing in λ. Thus, once we are in a semi-pooling equilibrium, the equilibrium amount of grade inflation is reduced when a second cohort is present.

Although grade inflation is reduced by reputation in the equilibria considered so far, it is still present. Contrary to that, in the separating equilibrium we analyze in the following, the school grades honestly even in the unfavorable state of nature. In a separating equilibrium, the probability p for the school to inflate the grades in state U is zero. Thus, $q(F|e) = 1$ and grades fully reveal the true type of students in both states of nature. Clearly, with these beliefs, it is optimal to place A- (B-) students of the first cohort on H- (L-) jobs and paying them a wage of ω_G (ω_0). To establish existence, it has to be shown that $V(e|F) \geq V(t|F)$ and $V(t|U) \geq V(e|U)$, where payoffs are given by (1) to (4) with $w(A|e) = \omega_G$. Solving the second inequality for the case $x \geq y$, we find $\lambda \leq \lambda_x$, and solving for the case $x < y$, we find $\lambda \leq \lambda_y$. To see that also in the favorable state of nature, the school grades honestly, we rearrange inequality $V(e|F) \geq V(t|F)$. If $a \leq b$, this inequality is equivalent to



(a) $x > y$ (b) $x < y$

Figure 1: **Separating, semi- and full-pooling equilibria.** The lines delineate the regions in λ-π-space which support the three types of equilibria studied. The solid (dotted) lines are derived from computing payoff $V(e|U)$ in (3) using x (y) for the wages of A-students in the second cohort. The downward sloping lines display π_x and π_y, the vertical lines are drawn at λ_x and λ_y respectively. The effective boundaries $\pi^* = \min\{\pi_x;\pi_y\}$ and $\lambda^* = \min\{\lambda_x;\lambda_y\}$ between the equilibria are drawn as bold curves in both parts of the figure. Part (a) illustrates the case $x > y$, where the solid lines are left of the dotted lines, so that π_x determines the border between the semi- and the full-pooling equilibria and λ_x delineates the separating and the semi-pooling equilibria. Part (b) displays the case with $x < y$, where λ_y and π_y apply.

$(\phi_F - \phi_U)\tau_L(\omega_G - \omega_0) \geq 0$, and if $a > b$, then it is equivalent to $\lambda(\phi_F - \phi_U)\tau_L(\omega_G - \omega_0) + (1-\lambda)(1-\phi_F)\tau_H(\omega_0 - \omega_M) \geq 0$. Thus, the inequality is true in both cases, showing that if $\lambda \leq \lambda^*$, a separating equilibrium with honest grading exists.

To see necessity, observe that in an equilibrium with honest grading, grades must reveal true productivity and no other assignment of workers to jobs can be optimal. Therefore, in any equilibrium with honest grading the payoffs in the unfavorable state are given by $V(e|U)$ with $w(A|e) = \omega_G$ and $V(t|U)$, so that $\lambda \leq \lambda^*$ follows. We so have:

Proposition 2 *There exists a separating equilibrium with honest grading if and only if* $\lambda \leq \lambda^*$.

This result shows that in a model where schools care for their reputation, grade inflation is not unavoidable. If such concerns are important enough, as expressed by a relatively large second cohort, honest grading obtains in equilibrium (see figures 1(a)) and 1(b)). Remarkably, whether honest grading can be supported in equilibrium does not depend on the prior probability π of the favorable state, but is exclusively determined by the relative size of both cohorts. One might expect that if this probability is very large the incentives to inflate grades are substantial, since the posterior belief for the favorable state remains high even when firms observe many A's. However, the reward of grade inflation being limited to the first cohort, even with high π such a policy does not pay off when this cohort is small.

5 Conclusion

In this paper a model is presented which shows that grade inflation is not unavoidable in any situation. While there is a disposition to inflate grades on the part of the school in order to help some mediocre students and raise aggregate earnings of graduates, the reputation the school can build up by grading honestly reduces the amount of grade inflation. This result therefore helps to explain why grade inflation is not as pervasive as one might expect.

The model suggests a number of extensions. For example, the effect of reputation is possibly stronger if more than two generations of students are considered. The model could be extended to include an infinite amount of cohorts, allowing for changes in grading policy from time to time, or at a cost. Another research direction could consist in having competing schools. In this context, it could be of particular interest to investigate the interaction between schools which pursue different objective functions, for example private versus public schools. Another promising line of research might address the impact of school competition on the incentives to inflate grades in the presence of reputational concerns.

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