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Implications of grade inflation: knowledge illusion and economic inefficiency in the knowledge market

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Abstract

In this paper, we adopt the neoclassical model of consumer choice and view students as a utility maximizer to investigate two implied issues caused by grade inflation – knowledge illusion and economic inefficiency in the knowledge market. These issues are important because they negatively impact the quality of higher education and weaken the signaling role of educational credentials in screening workers. More importantly, students eventually suffer a loss in well-being in the knowledge market and become less productive and competitive in the labor market.

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1. Introduction

The relationship between student evaluations of teaching (SET) and grades has been broadly investigated by a number of researchers, such as Voeks and French (1960), Kelly (1972), Nichols and Soper (1972), Soper (1973), Mirus (1973), Tuckman (1975), Kau and Rubub (1976), Danielsen and White (1976), Dilts (1980), Marlin and Niss (1980), Seiver (1983), Nelson and Lynch (1984), Aigner and Thum (1986), Zangenehzadeh (1988), Mehdizadeh (1990), Mason, Steagall, and Fabritius (1995), Krautmann and Sander (1999), Becker and Watts (1999), Grimes, Millea, and Woodruff (2004), Isely and Singh (2005), McPherson (2006), and Lin (2009b). These studies have shown that the grades expected by students and student evaluations are positively and significantly correlated. However, some studies have not found a positive and significant relationship, such as Seiver (1993) and Decanio (1986). In addition to the empirical studies, a few theoretical studies also provided the same conclusion (e.g., Kelly, 1975; McKenzie, 1975; Lichty, Vose and Peterson, 1978; Needham, 1978). Kelly (1975) and McKenzie (1975) used the neoclassical model of consumer choice and viewed students as a utility maximizer. They focused on the influences of grades and grading structures on student evaluations. Lichty, Vose and Peterson (1978) extended the work done by Kelly (1975) and McKenzie (1975) and further tested McKenzie's hypothesis that a number of instructors might attempt to inflate students' grades to maintain or enhance their evaluations from students. They concluded that grade inflation would eventually lead universities into the "Giffen" good case, if the practice never ended.

The most important implication for student evaluations of teaching is grade inflation. Although a positive and significant relationship between professors' overall evaluations and students' grades[1] does not absolutely mean that grade inflation must exist, it does show that professors must have an incentive to inflate grades. Simply speaking, student evaluations of teaching might lead many instructors to intentionally inflate students' grades in order to receive better evaluations from students. Here, it should be pointed out that we define "grade inflation" as instructors intentionally adopting some strategies (e.g., lowering the grading standard, creating easier exams, giving students extra bonuses [e.g., an attendance bonus], curving students' grades, and avoiding some harder teaching materials that should be taught) to raise students' grades while these students do not exactly deserve those improved grades.

Although a fair number of previous studies have examined and discussed the grade inflation issue, none investigated and discussed the implied issues caused by grade inflation, such as knowledge illusion and economic inefficiency in the knowledge market. These two issues are important because they may negatively impact the quality of higher education and thus further weaken the signaling role of educational credentials in screening workers. More importantly, students eventually will suffer a loss in well-being in the knowledge market and become less productive and competitive in the labor market. Therefore, in this paper, we also adopt the neoclassical model of consumer choice and view students as a utility maximizer (as done by Kelly [1975] and McKenzie [1975] previously) to investigate and discuss these two issues –

[1] Lin (2009b) provided two possible explanations for the positive and significant effect: "one possible reason is that students' grades (especially midterm grades) directly affect students' emotional feelings, leading some (or many) students to use student evaluations of teaching to reward or exact revenge on their professors. Another possible reason is contamination of SETs by grades. That is, easy graders may receive better evaluations than hard graders due to their grading more easily."

knowledge illusion and economic inefficiency in the knowledge market. These are the primary contributions of this paper.

This paper is organized as follows. First, we show some survey evidence. Second, the neoclassical model of consumer choice is developed in order to discuss why students will suffer a loss in well-being in the knowledge market. Third, we further investigate why students will have knowledge illusion due to grade inflation, and discuss its effect on students' productivity in the labor market. The conclusion may be found in the final section.

2. Survey Evidence

In August 2008, we developed a questionnaire for another related project. Four of these questions are related to this study and may be used to support our analysis. In that earlier study, we emailed the questionnaire to a random sample of 500 professors across the U.S. In total, 237 professors responded to the questionnaire. The four questions pertinent to this paper were: (1) "*To receive higher ratings from students, did you ever intentionally write easier exams*?" – 16.7% of the sample answered "yes"; (2) "*To receive higher ratings from students, did you ever intentionally curve up students' midterm exam grades*?" – 13.3% answered "yes"; (3) "*To receive higher ratings from students, did you ever intentionally give students extra bonuses (e.g., an attendance bonus)*?" – 23.3% answered "yes"; and (4) "*To receive higher ratings from students, did you ever intentionally avoid some a little bit harder teaching materials that should be taught*?" – 17.3% answered "yes". These numbers (i.e., 16.7%, 13.3%, 23.3%, and 17.3%) do not seem to be large and significant; however, we believe that they would be larger and more significant if we removed the following words: "*To receive higher ratings from students*" and "*intentionally*". One may argue that "*I wrote easier exams, curved up students' grades, or/and avoided some harder teaching materials not because I wanted to receive higher ratings from students, it was because I considered students' quality*" or "*I gave students extra bonuses not because I wanted to receive higher ratings from students, it was because I attempted to encourage students to attend the class and participate the class discussion*", and so did not choose "yes". At any rate, although those numbers (i.e., 16.7%, 13.3%, 23.3%, and 17.3%) are not large and significant, they still show that professors do have incentives to inflate students' grades and grade inflation does exist in colleges and universities.

3. Economic Inefficiency in The Knowledge Market

Since grade inflation does exist, does it cause economic inefficiency (i.e., loss in well-being) in the knowledge market? In discussing this issue, we provide an economic analysis.

We believe that the initial and main purpose of college attendance is to acquire knowledge. Assume that students are a utility maximizer. Therefore, consider that a student can be satisfied by both leisure (denoted by *l*) and knowledge (denoted by *k*). That is, given the student's other activities, it is assumed that a student has two options: leisure or increased effort toward studying. Increased effort is assumed to improve knowledge. Thus, the student can exert preferences over his/her leisure and knowledge, which means that the student's utility function (denoted by *V*) consists of both leisure and knowledge (assuming that both leisure and knowledge are normal goods); that is, $V = V(l,k)$; and $V_l, V_k > 0$; V_{ll}, $V_{kk} < 0$; and $V_{lk} = V_{kl} > 0$. The price of leisure (denoted by P_l) can be viewed as the wage of working outside; and the price

of knowledge (denoted by P_k) can be equal to the opportunity cost of acquiring knowledge. In addition, a student's maximum time available for studying for a class is equal to Ψ, which is the student's maximum opportunity cost for studying for the class; namely, the student's total income. Thus, the student's total budget can be specified as: $P_l l + P_k k = \Psi$. Choosing l and k can solve the student's optimization problem, which maximizes $V = V(l,k)$ subject to $P_l l + P_k k = \Psi$. It is assumed that both leisure and knowledge are continuously divisible. Hence, the first-order conditions for the constrained maximum can be shown as follows:

$$\frac{V_l}{P_l} = \frac{V_k}{P_k} \tag{1}$$

$$\Psi = P_l l + P_k k \tag{2}$$

According to Equations (1) and (2), equilibriums $l^*(P_l, P_k, \Psi)$ and $k^*(P_l, P_k, \Psi)$ can be solved. Meanwhile, we further differentiate Equations (1) and (2) and obtain:

$$\begin{bmatrix} V_{ll}P_k - V_{kl}P_l & V_{lk}P_k - V_{kk}P_l \\ -P_l & -P_k \end{bmatrix} \begin{bmatrix} dl \\ dk \end{bmatrix} = \begin{bmatrix} V_k & -V_l & 0 \\ l & k & -1 \end{bmatrix} \begin{bmatrix} dP_l \\ dP_k \\ d\Psi \end{bmatrix} \tag{3}$$

Let $|D|$ be the determinant of the pre-multiplied matrix of vector $[dl \quad dk]$, which can be shown to be positive. Using Cramer's rule, the straightforward comparative static analysis yields:

$$\frac{dl}{dP_l} = \frac{\begin{vmatrix} V_k & V_{lk}P_k - V_{kk}P_l \\ l & -P_k \end{vmatrix}}{|D|} < 0 \tag{4}$$

$$\frac{dl}{dP_k} = \frac{\begin{vmatrix} -V_l & V_{lk}P_k - V_{kk}P_l \\ k & -P_k \end{vmatrix}}{|D|} ? \tag{5}$$

$$\frac{dl}{d\Psi} = \frac{\begin{vmatrix} 0 & V_{lk}P_k - V_{kk}P_l \\ -1 & -P_k \end{vmatrix}}{|D|} > 0 \tag{6}$$

$$\frac{dk}{dP_l} = \frac{\begin{vmatrix} V_{ll}P_k - V_{kl}P_l & V_k \\ -P_l & l \end{vmatrix}}{|D|} ? \tag{7}$$

$$\frac{dk}{dP_k} = \frac{\begin{vmatrix} V_{ll}P_k - V_{kl}P_l & -V_l \\ -P_l & k \end{vmatrix}}{|D|} < 0 \tag{8}$$

$$\frac{dk}{d\Psi} = \frac{\begin{vmatrix} V_{ll}P_k - V_{kl}P_l & 0 \\ -P_l & -1 \end{vmatrix}}{|D|} > 0 \tag{9}$$

As shown in this economic analysis, each student will choose his or her optimal combination of leisure and knowledge (l* and k*) to maximize his or her utility (see Figure 1). Based upon this model, we are able to investigate whether or not grade inflation would cause a loss in well-

being. Usually, there are five strategies for inflating students' grades: (1) lowering the grading standard, (2) writing easier exams, (3) giving students extra bonuses (e.g., an attendance bonus), (4) grading on a curve, and (5) avoiding some more difficult teaching materials that should be taught. Professors may adopt some or all of them simultaneously. Here, we particularly focus on the fifth strategy because it will play a significant role in increasing the price of knowledge ($P_k \uparrow$). When professors intentionally avoid teaching materials that should be taught, students who want to learn those missed materials will need to spend extra time (and even more time) studying by themselves in the future, which will increase their costs of pursuing knowledge (i.e., $P_k \uparrow$). For example, many professors who teach principles of microeconomics might skip the chapter on consumer theory & choices (the theory of marginal utility and indifference curve), since this chapter contains more mathematical and abstract concepts that make it more difficult to teach and understand. Therefore, students who take upper-level economics classes (e.g., public finance[2]) will have a difficult time grasping other concepts in these classes because they will use the theory of marginal utility and indifference curve. As a result, these students may either hire tutors to help them or spend more time studying. As shown in Equation (8), when the price of knowledge goes up, both substitution and income effects lead to a lower level of knowledge.

What about the other four strategies? Will they also create a higher price of knowledge? We believe that the answer is yes. For example, if students know that their professors will create easier exams and curve their grades eventually, they will not have strong incentives to study more and harder. Consequently, they will miss the knowledge that should be acquired. In the future, when they attend upper-level classes, they will face the same problem discussed earlier. Therefore, as long as grade inflation exists, the price of knowledge will increase.

Since the price of knowledge will increase due to grade inflation, given P_l and Ψ, the budget constraint line will move from *a*'*b*' to *a*'*c*'. As a consequence, the student's utility decreases from *V1* to *V2* (see Figure 1), implying that the student has suffered a loss in well-being (i.e., the difference between *V1* and *V2*) in the knowledge market. In other words, grade inflation negatively affects student demand for knowledge, which in turn results in a substitution effect. As long as the substitution effect exists, there will be a loss in well-being (i.e., excess burden or deadweight loss) caused by the substitution effect of price-distorting grade inflation. Simply speaking, economic inefficiency exists in the knowledge market due to grade inflation.

4. Knowledge Illusion

In addition to economic inefficiency in the knowledge market, grade inflation may create knowledge illusion. To discuss this issue, we also provide an economic analysis.

Suppose that grade inflation does not exist initially; thus, we believe that students' grades can exactly reflect the level of knowledge acquired. In other words, given the assumption of no grade inflation, students pursue their knowledge; at the same time, professors give them grades based upon how much knowledge they acquire. For this reason, grade (denoted by *G*) is a function of knowledge, i.e., $G = G(k)$, and $\frac{dG}{dk} > 0$. Thus, the student's utility now consists of both leisure

[2] The prerequisites for public finance are only principles of microeconomics and principles of macroeconomics. Many business major students never take intermediate microeconomics before they take public finance although professors who teach intermediate microeconomics will teach the chapter on the theory of consumer choice in more detail.

(l) and grade (G), which can be rewritten as: $V(l,G)$, and $V_l, V_G > 0$; V_{ll}, $V_{GG} < 0$; and $V_{lG} = V_{Gl} > 0$. The price of leisure is still P_l; and the price of grade is P_G (i.e., the opportunity cost of studying for the class to get a grade). The student's total budget constraint does not change, but can be rewritten as: $P_l l + P_k k = \Psi = P_l l + P_G G$. Now the student can choose l and G to solve his/her optimization problem, which maximizes $V = V(l,G)$ subject to $P_l l + P_G G = \Psi$. Note that one may argue that students' grades are given by teachers rather than students, so how can a student choose his/her optimal grade to maximize his/her utility? As a matter of fact, students determined their grades, since with their initial human capital they determine the time and effort devoted to taking the class and studying for the exam. Teachers only determine the price of getting a grade. That is, teachers determine the grading standard, teaching materials, exam contents and so on. In addition, it is also assumed that both leisure and grade are continuously divisible. Hence, the first-order conditions for the constrained maximum therefore can be specified as follows:

$$\frac{V_l}{P_l} = \frac{V_G}{P_G} \tag{10}$$

$$\Psi = P_l l + P_G G \tag{11}$$

Based upon the first-order conditions shown above (Equations [10] and [11]), we are able to solve equilibriums $l^*(P_l, P_G, \Psi)$ and $G^*(P_l, P_G, \Psi)$, which are the student's optimal combination of leisure (l*) and grade (G*) that maximize his or her utility (see Figure 2). Moreover, we further differentiate Equations (10) and (11) and obtain:

$$\begin{bmatrix} V_{ll}P_G - V_{Gl}P_l & V_{lG}P_G - V_{GG}P_l \\ -P_l & -P_G \end{bmatrix} \begin{bmatrix} dl \\ dG \end{bmatrix} = \begin{bmatrix} V_G & -V_l & 0 \\ l & G & -1 \end{bmatrix} \begin{bmatrix} dP_l \\ dP_G \\ d\Psi \end{bmatrix} \tag{12}$$

Let $|D|$ be the determinant of the pre-multiplied matrix of vector $[dl \quad dG]$, which can be shown to be positive. Using Cramer's rule, the straightforward comparative static analysis yields:

$$\frac{dl}{dP_l} = \frac{\begin{vmatrix} V_G & V_{lG}P_G - V_{GG}P_l \\ l & -P_G \end{vmatrix}}{|D|} < 0 \tag{13}$$

$$\frac{dl}{dP_G} = \frac{\begin{vmatrix} -V_l & V_{lG}P_G - V_{GG}P_l \\ G & -P_G \end{vmatrix}}{|D|} ? \tag{14}$$

$$\frac{dl}{d\Psi} = \frac{\begin{vmatrix} 0 & V_{lG}P_G - V_{GG}P_l \\ -1 & -P_G \end{vmatrix}}{|D|} > 0 \tag{15}$$

$$\frac{dG}{dP_l} = \frac{\begin{vmatrix} V_{ll}P_G - V_{Gl}P_l & V_G \\ -P_l & l \end{vmatrix}}{|D|} ? \tag{16}$$

$$\frac{dG}{dP_G} = \frac{\begin{vmatrix} V_{ll}P_G - V_{Gl}P_l & -V_l \\ -P_l & G \end{vmatrix}}{|D|} < 0 \quad (17)$$

$$\frac{dG}{d\Psi} = \frac{\begin{vmatrix} V_{ll}P_G - V_{Gl}P_l & 0 \\ -P_l & -1 \end{vmatrix}}{|D|} > 0 \quad (18)$$

Nevertheless, grade inflation occurs (e.g., lowering the grading standard, creating easier exams, giving students extra bonuses [e.g., an attendance bonus], curving students' grades, and avoiding some harder teaching materials that should be taught). Therefore, the price of the grade goes down (i.e., $P_G \downarrow$), and hence the budget constraint line moves from *a'b'* to *a'd'* so that the student's utility increases from *V1* to *V3* and the grade inflates from *G** to *G**** (see Figure 2 – both substitution and income effects lead to a higher grade, as shown in Equation [17]). However, as discussed earlier, when grade inflation occurs, the price of knowledge will increase (i.e., $P_k \uparrow$). If we take a closer look at this viewpoint – knowledge level, the student's budget constraint line indeed moves from *a'b'* to *a'c'*. Thus, the student's utility decreases from *V1* to *V2* and the knowledge level diminishes from *k** to *k*** (see Figure 2). Ironically, after grade inflation occurs, the student is happy to receive a higher grade ($G^{***} > G^*$) but does not realize that he/she has acquired a lower level of knowledge ($k^{**} < k^*$). The most problematic outcome is that the student thinks that his/her knowledge level also has been enhanced from *k** to *k****, because he/she has received a higher grade (*G****). For this reason, we may conclude that grade inflation leads students to inaccurately assess their level of knowledge.

5. Conclusion

The initial purpose of student evaluations of teaching is to assess faculty performance in the classroom. Given that quality of teaching service cannot be easily monitored by a third party (including deans and department heads), the school authority believes that student evaluations can be an effective mechanism by which to control the moral hazard of teachers. However, according to our analysis, student evaluations of teaching are an incentive for teachers to inflate students' grades, and in turn create knowledge illusion and economic inefficiency in the knowledge market. The main problem for this system is that the school authority may ignore the fact that both students and teachers are economic individuals and thus will respond to each other via economic behavior (Lin, 2009a).

Grade inflation is an important issue in higher education because the impacts of grade inflation not only eventually lead universities/colleges into the Giffen good case (Lichty, Vose and Peterson, 1978) but also lead students to hold illusions about their knowledge and suffer a loss in well-being in the knowledge market. Students who have knowledge illusion will not be inclined to learn and study more, and thus will be less productive and competitive in the labor market. More importantly, such inflation will weaken the signaling role of educational credentials in screening workers because it may foster a loss of trust in students from certain universities and colleges.

Finally, given that student evaluations of teaching cannot be replaced, we suggested that the school authority reduce the weight attached to teaching evaluations in annual faculty evaluations and tenure and promotion, because doing so will decrease teachers' incentives to inflate grades.

Once the incentives are reduced, grade inflation will improve, and therefore knowledge illusion and economic inefficiency in the knowledge market will also eventually amend.

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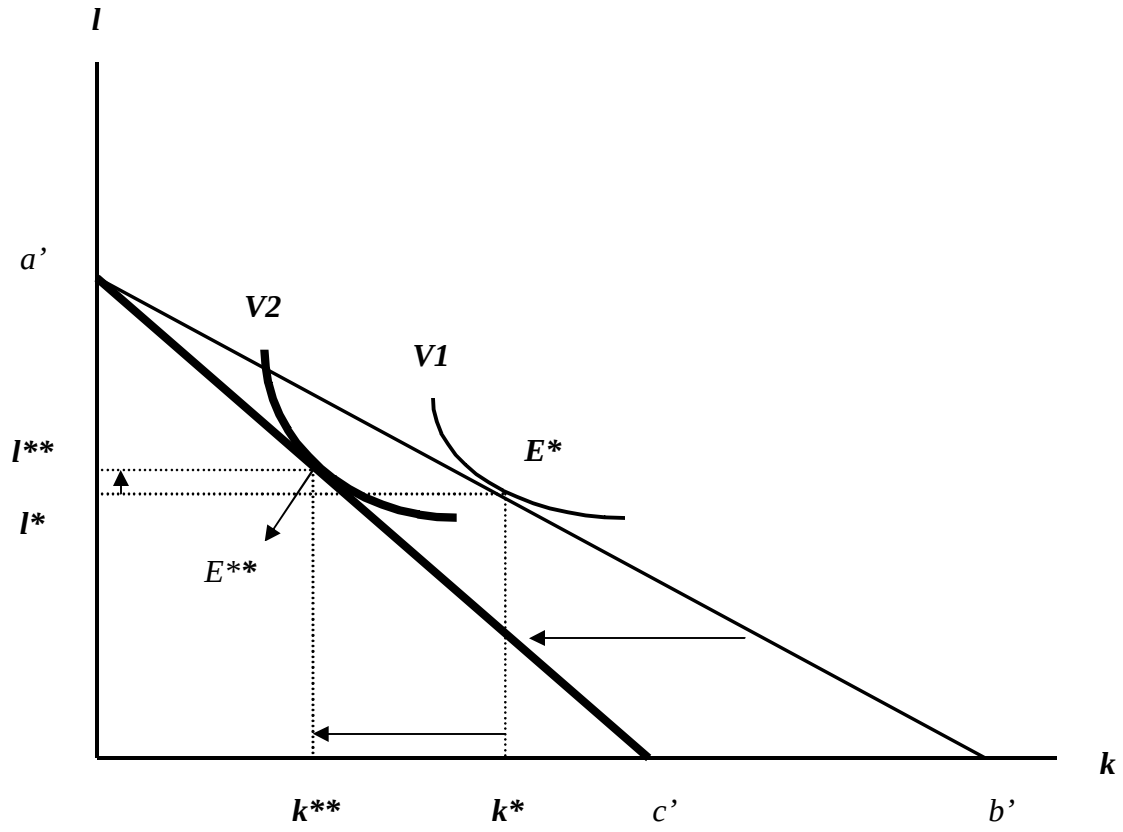

Figure 1: Student’s Indifference Curve when $P_k \uparrow$

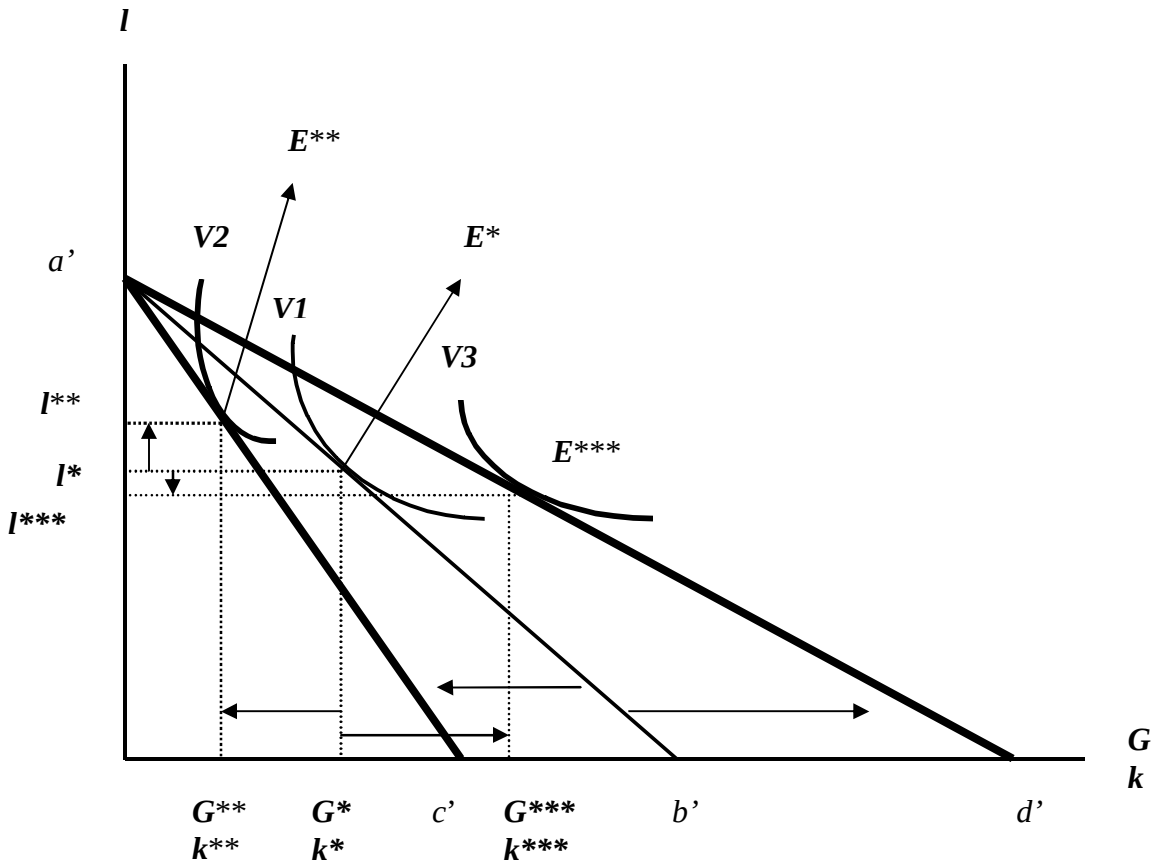

Figure 2: Student's Indifference Curve when $P_G \downarrow$ and $P_k \uparrow$