

Higher education fees as signals

by **Steven J. Bosworth**

Discussion Paper No. 2019-16

Department of Economics
University of Reading
Whiteknights
Reading
RG6 6AA
United Kingdom

www.reading.ac.uk

Higher education fees as signals

Steven J. Bosworth*

This version: 19 August 2019

Abstract

This paper argues that the fees paid for a degree may reveal private information about ability. In contrast with traditional signalling models, degrees need not be costlier for low-ability workers to acquire. This result follows when the labour market learns workers' types with delay, but only if their job requires high ability. Fees induce a separating equilibrium when they exceed the benefit of a low ability worker "passing" as high ability early in their career but are less than the life cycle penalty which high ability types would suffer. Raising fees in this setting exacerbates rather than ameliorates inefficient credentialing.

Introduction

The higher education sectors of Anglo-Saxon countries have seen dramatic transformations unfold over the last decades. The first is that participation has increased substantially. In line with this, the costs associated with an undergraduate degree have shot up; and a much greater share of those costs has been shifted onto students. From 2014 caps on student recruitment in UK universities were removed just as fees were raised to £9,000. Most students receive a loan from the government for their studies. Consequently, student debt in both the U.S. and U.K. stands at record levels.

These structural changes have generated a number of criticisms, but the liberal fees model has its defenders. Some claim that the additional revenues brought in by fee-paying students have allowed universities to expand access to traditionally underserved segments of the population.

* University of Reading, Whiteknights, Edith Morley G81, Reading, RG6 6AA, United Kingdom, s.j.bosworth@reading.ac.uk

Though it has been shrinking, the life-cycle wage premium that university graduates can expect remains large, and for most will exceed fees.

Whether increased access represents a welfare gain or loss from a social standpoint ultimately depends on whether the private returns from university education arise from greater human capital or signalling. The human capital literature posits that people acquire skills through education which are valuable in the labour market, hence allowing them to command higher wages. Signalling emphasises rather that people possess valuable but hard to verify labour market skills prior to study. If education is easier to obtain for those with than without these skills then it serves to communicate them to potential employers. The human capital story suggests that valuable skills are added to the economy when people pursue education. Signalling on the other hand points out a positional story: education is valuable because it allows people to distinguish themselves *relative to others*. By pursuing it students thereby impose a negative externality on those who have not.

A debate within the labour economics literature has raged for decades – it is not the place of this article to wade into that debate. We rather accept that education may have *some* signalling value, and therefore that reducing the inefficiency associated with job market signalling may be of concern to policymakers.

One of the most prominent proponents of reducing educational signalling externalities among economists is Bryan Caplan (2018), who argues that increasing fees is a reasonable policy remedy. His intuition is straightforward: university education carries signalling value which is unrelated to its price, its consumption is inefficiently high, and so therefore increasing its price will reduce consumption and the associated externalities.

We argue that such a policy is misguided, for reasons completely independent of education's many documented positive externalities. If the financial cost¹ of university education itself

¹ We are not arguing that the net utility, prior to entry into the labour market, of attending university is totally uncorrelated with ability. Rather, the importance of ability-uncorrelated costs on schooling

constitutes a large share of its signalling value, then allowing universities to increase fees may exacerbate education signalling costs. This is especially true if higher fees cause universities to increase their number of places. It rather argues in favour of a continental model, with subsidised costs and a fixed number of places, to be determined by the skill needs of the workforce and the benefits of an educated citizenry.

Our model allows fees to signal ability by augmenting the standard Spence (1973) setting with a delayed and asymmetric employer learning process. Workers enter the labour market with an unverifiable ability which is complementary to their occupational status: high- and low-ability workers are equally productive in low-skill jobs, but high ability workers are more productive if matched with a high-skill job, which pays a higher wage. Low ability workers are no more or less productive in the high-skill job than the low-skill job, though may desire the high-skill job's wage. After a period of time on the job, productivity is observed. Low ability workers can no longer pass in high-skill jobs and earn the low-skill wage from then on, regardless of their investment in any signal. Crucially, high ability workers will remain undetected if they are working a low-skill job. This gives them an incentive to acquire a costly signal before entering the labour market. Low ability workers do not acquire the signal because it ceases to be valuable to them once the early career stage with unverifiable productivity ends.

Our model makes assumptions and predictions which match documented stylised facts from the data. We justify our assumption of asymmetric learning by appealing to the literature showing how early career outcomes have long-lived life cycle earnings consequences conditional on ability. For example, workers who enter the labour market during recessions go on to earn lower wages throughout their careers compared with workers from cohorts before and after (Oreopoulos et al., 2012). The major implication of the model is that there are circumstances in which demand curves for education can slope upwards. We argue that there is indeed evidence

decisions has heretofore been neglected in labour economics. This paper seeks to elucidate their implications.

for this, both by examining the time series and by separating changes in headline fees vs. financial assistance.

The rest of the paper is structured as follows: Section 2 situates the paper in the educational signalling literature; Section 3 documents patterns in the market for university education and argues for the assumptions used in the model; Section 4 presents the model and characterises its equilibrium; Section 5 uses the model to assess policy questions and provides a concluding discussion.

Literature

The literature on signalling has traditionally seen the acquisition of credentials prior to entry into the labour market as a solution to the problem of asymmetric information about skills (see seminally Spence, 1973). Signals' value therefore depend on skills remaining difficult to verify.

A series of papers by Farber and Gibbons (1996) and Altonji and Pierret (1998, 2001) argue that estimates of the coefficient on education in wage equations should fall while those of ability proxies should rise as employers gain information about workers. They document such a pattern using National Longitudinal Survey of Youth (NLSY79) data on U.S. workers which contain AFQT aptitude test scores and wages. Given a wide range of employer learning speeds, signalling explains very little of the wage premium from higher education. Lange (2007) adds some structural assumptions in order to estimate the speed of employer learning explicitly. He finds it to be rapid, and that signalling accounts for no more than a quarter of the private return to education. Habermalz (2011) argues however that signalling may retain value in a labour market where employers learn rapidly only about the subset of skills relevant to their employee's job. Employees may still need to signal to future employers who desire different skills.

Our model is similar in many ways to that of Alós-Ferrer and Prat (2012), who study a signalling market with slow learning about agent types. Separating equilibria in their model, like those in all signalling models, require education to be less costly to high ability types. They find

that delayed employer learning may makes pooling equilibria more stable. The key difference here is that their model relies on Bayesian updating: both high and low types are eventually “discovered”.

Evidence

There is strong reason to believe that early career outcomes exert an influence on life cycle earnings which does not dissipate as workers gain experience. Oreopoulos et al. (2012) track the careers of university graduates in longitudinal data matched to employers, finding substantial penalties for those graduating in a recession. These workers start in lower-paying firms than comparable graduates from other cohorts and are less likely to transition to higher-paying jobs. This penalty is heterogeneous across workers, with some recovering quickly and others never recovering at all. Further evidence on the heterogeneity of employer learning is presented by Arcidiacono and coauthors (2010). They find a strong correlation between AFQT scores and wages for university graduates soon after labour force entry while the relationship between ability and wages remains much weaker for those with only secondary education. This mirrors the assumption made in the model below: those working jobs requiring a university degree have their ability identified quickly while autodidacts languish in low paid work.²

A separate strand of research has tried to identify the price elasticity of demand for higher education. An early paper in this literature by McPherson et al. (1992) finds small (and in some specifications positive) tuition elasticity of demand for U.S. colleges. Pascarella et al. (1992) find high returns (also in the U.S.) from attending a more expensive college. The benefits of attending an expensive college to socioeconomic status and income persist after controlling for a wide range of student and institutional factors. Tang et al. (2004) show a robust prestige-cost gradient, indicating that an institution’s fees are highly salient in the educational marketplace. The relative salience of headline tuition fees should then make students far less sensitive to these costs than

² It should be noted that the model specifies this as out of equilibrium behaviour. Evidence gleaned from optimising agents in the data is therefore harder to identify. Arcidiacono et al.’s signalling estimates can be thought of as lower bounds in light of our model.

to opaque and idiosyncratic financial aid. Canton and de Jong (2005) show just this for students choosing among universities in the Netherlands. While enrolment is highly sensitive to financial aid,³ the headline price elasticity is not significantly different from zero, and positive among some sub-groups. Wakeling and Jeffries (2013) provide time series evidence by studying the effect of government-imposed fee increases in England, Wales and Northern Ireland relative to Scotland and the Republic of Ireland (fees are homogeneous across institutions in each of these countries). Little movement from high fee to low fee markets is evident, and is swamped by rising participation across the board.

Model

Consider a stark model of educational signalling in which obtaining a degree does not make workers any more productive and which is equally costly for people of all skill levels to obtain. That is a degree can be considered evidence of debt incurred and no more.

Within this framework suppose that there are two types of workers, type H with high productivity and type L with low productivity. The share of workers with type H is p whereas the share of type L is $1 - p$. Workers of all types decide at the outset whether or not to obtain a degree at cost F .

In the next T_1 periods, labour force entrants' type cannot be perfectly observed and so workers are paid their expected productivity conditional on whether they have a degree. If one type obtains a degree while the other does not, then these are w_H for degree holders and $w_L < w_H$ for those without. If both types choose the same degree status then the wage is $\bar{w} = pw_H + (1 - p)w_L$ for everyone.

In the subsequent T_2 periods, the labour market learns the true types of all degree holders, whereas non-degree-holders remain undetected, even if they are of type H . This means type L

³ This is corroborated by the literature. See Deming and Dynarski (2009) for a review. Angrist, Autor, Hudson, & Pallais (2015) provide experimental evidence.

workers continue to receive a wage of w_L regardless of their degree status whereas type H workers will receive w_H if they have a degree and w_L if they do not. The full lifecycle utility of each type / degree-status combination is therefore

$$u = \begin{cases} (T_1 + T_2)w_H - F, & H, \text{ degree} \\ (T_1 + T_2)w_L, & H, \text{ no deg.} \\ T_1w_H + T_2w_L - F, & L, \text{ degree} \\ (T_1 + T_2)w_L, & L, \text{ no deg.} \end{cases}$$

under the scenario where the labour market expects only types H to obtain a degree whereas it is

$$u = \begin{cases} T_1\bar{w} + T_2w_H - F, & H, \text{ degree} \\ T_1\bar{w} + T_2w_H, & H, \text{ no deg.} \\ T_1\bar{w} + T_2w_L - F, & L, \text{ degree} \\ T_1\bar{w} + T_2w_L, & L, \text{ no deg.} \end{cases}$$

if the labour market expects neither or both types to obtain a degree.

Let us first remark that there is a pooling equilibrium for any set of fees and wages F, w_H, w_L . Under this scenario both H and L workers start off with pooled wages, but both types' productivity is eventually revealed, meaning that signalling would not change either type's period 2 wage. From above we see that the potential gain from a high type agent from signalling her ability in the first period is $T_1(w_H - \bar{w})$. However this is exactly the same gain that a low type would get from acquiring the signal. Hence there is no fee which would credibly upset the pooling equilibrium.

Suppose now that we are in a situation where the labour market expects H types to obtain degrees but L types not to. This means that high productivity workers are matched to high skill jobs only if they acquire a degree. Similarly to above, both types would gain $T_1(w_H - w_L)$ from presenting as H upon entering the labour market. Given the market's expectations however, obtaining a degree has an additional benefit of $T_2(w_H - w_L)$ for the worker who is actually type H whereas the L worker's earnings will be T_2w_L regardless of whether she obtains the degree.

The cost of the degree F must therefore be greater than $T_1(w_H - w_L)$ in order to deter the L types from pursuing it but less than $(T_1 + T_2)(w_H - w_L)$ in order to make the degree desirable by the H types. Whenever $T_1(w_H - w_L) < F < (T_1 + T_2)(w_H - w_L)$ it is a best response on the part of all agents to maintain the separating equilibrium which justifies the market perceptions that only high productivity workers obtain costly degrees.

If we break the assumption that only low productivity workers' productivity is discovered then this separating equilibrium falls apart. Since all workers gain the same amount from credentialing in the first period, signalling is only effective because H types *need* to have gone to university in order to access high-skill jobs. The film *Good Will Hunting* earned an Oscar for portraying a janitor who is discovered as a genius – a scenario compelling because it is fantastical. Most models of employer learning embed this fantasy without much consideration (Habermalz, 2011).

Policy implications

Suppose that the government is considering eliminating fees ($F = 0$). We show that this policy would be favoured by both types H and L , therefore constituting a Pareto improvement.⁴ If fees are eliminated the separating equilibrium disappears in the first period and so both earn a wage of \bar{w} . For the H types it is the case that $T_1(w_H - \bar{w}) < \underline{F}$ where \underline{F} was the minimum fee required to screen out the L types. The L types never paid fees in the separating equilibrium anyway and they are now earning a higher wage in the first period.

We can also examine how the set of fees F which yield a separating equilibrium changes when the length of time required to learn skills T_1 increases. Note that as T_1 increases the minimum fee required to signal type goes up whereas the maximum chargeable fee goes up but not by as much.

⁴ This of course assumes that there is no productivity loss associated with low ability types attempting to pass in high-skill jobs. If this were the case then the Pareto-optimal policy would be to charge an arbitrarily small fee to obtain the degree, compress all early career wages to \bar{w} and then require the credential in order for H types to receive w_H in their later career stages. This would ensure sorting in the first T_1 periods at minimal signalling cost.

As the first period becomes increasingly longer (i.e. $T_1/(T_1 + T_2) \rightarrow 1$) the H types will find themselves forced to pay their entire life-cycle wage premium for a degree.

One trend featured in both the U.K. and U.S. labour markets over the last decades has been the increase in returns to high vs. low skill labour. Whether this stems from skill-biased technological change or increased rent seeking by elites, it has never been more important to sort oneself into the higher ranks of society. We can see this in the set of permissible fees yielding a separating equilibrium. An increase in $(w_H - w_L)$ both raises the minimum fee necessary to achieve separation *and* increases the maximum willingness to pay for a degree. There are substantial entry costs associated with provision of higher education and very little room for competition on price (since price is a signal). The model predicts escalating fees in this environment, which is borne out in the data.

Liberalising the higher education sector, removing maintenance grants, and hiking fees thus has the potential to exacerbate signalling externalities. Caplan (2018) has argued that price increases in the tertiary education sector may discourage participation, but this is not manifest in the aggregate. Rather we have seen the return to study net of costs fall substantially as participation rises. For the economist wary of over-credentialing in the labour market caution is therefore warranted. We should want as many people as possible to acquire the skills which will give them a fulfilling life. For many, this will be a university education. For others it may not. The net social benefits of various career paths should also inform policy. Increasing fees has the potential to increase socioeconomic and intergenerational inequality, distort choices, and worsen internal university governance. A critical review is needed.

References

- Alós-Ferrer, C. & Prat, J. (2012). Job market signaling and employer learning. *Journal of Economic Theory*, 147, 1787-1817.
- Altonji, J. G. & Pierret, C. R. (1998). Employer learning and the signalling value of education. In: *Internal Labour Markets, Incentives and Employment*, I. Ohashi & T. Tachibanaki (Eds.), pp. 159-195. London: Palgrave Macmillan.
- Altonji, J. G. & Pierret, C. R. (2001). Employer learning and statistical discrimination. *Quarterly Journal of Economics*, 116(1), 313-350.
- Angrist, J., Autor, D., Hudson, S., & Pallais, A. (2015). Evaluating econometric evaluations of post-secondary aid. *American Economic Review: Papers & Proceedings*, 105(5), 502-507.
- Arcidiacono, P., Bayer, P., & Hizmo, A. (2010). Beyond signaling and human capital: Education and the revelation of ability. *American Economic Journal: Applied Economics*, 2, 76-104.
- Canton, E. & de Jong, F. (2005). The demand for higher education in the Netherlands, 1950–1999. *Economics of Education Review*, 24, 651-663.
- Caplan, B. (2018). *The Case Against Education: Why the education system is a waste of time and money*. Princeton: Princeton University Press.
- Farber, H. S. & Gibbons, R. (1996). Learning and wage dynamics. *Quarterly Journal of Economics*, 111(4), 1007-1047.
- Habermalz, S. (2011). The speed of employer learning and job market signalling revisited. *Applied Economics Letters*, 18, 607-610.
- Lange, F. (2007). The speed of employer learning. *Journal of Labor Economics*, 25(1), 1-35.
- McPherson, M. S., Schapiro, M. O., Kletzer, L. G., & Behrman, J. R. (1992). The college investment decision: Direct and indirect effects of family background on choice of postsecondary enrollment and quality. *Williams Project on the Economics of Higher Education*, DP-18.
- Oreopoulos, P., von Wachter, P., & Heisz, A. (2012). The short- and long-term career effects of graduating in a recession. *American Economic Journal: Applied Economics*, 4(1), 1-29.
- Pascarella, E. T., Smart, J. C., & Smylie, M. A. (1992). College tuition costs and early career socioeconomic achievement: Do you get what you pay for? *Higher Education*, 24(3), 275-290.
- Spence, M. (1973). Job market signaling. *Quarterly Journal of Economics*, 87(3), 355-374.
- Tang, T. L.-P., Tang, D. S.-H., & Tang, C. S.-Y. (2004). College tuition and perceptions of private university quality. *International Journal of Educational Management*, 18(5), 304-316.
- Wakeling, P. & Jefferies, K. (2013). The effect of tuition fees on student mobility: The UK and Ireland as a natural experiment. *British Educational Research Journal*, 39(3), 491-513.