

# Briefing note: Does education raise people's productivity or does it just signal their existing ability?

Prepared by Gill Wyness, Lindsey Macmillan, Jake Anders



## Summary

- There is a well-established link between education and higher earnings. But this does not necessarily mean that education makes individuals more productive. It may be the case that education merely acts as a signal to employers that an individual is a good worker due to pre-existing traits.
- Understanding the relative importance of these two mechanisms is important for governments' education strategies. If education really does make individuals more productive then this will lead to higher economic growth, and many other benefits, meaning government should invest in it. On the other hand, if education is merely acting as a signal of pre-existing ability then it is less clear that government should spend large amounts of money educating populations.
- The most convincing quantitative studies from the literature suggests that signalling plays a relatively limited role. This, coupled with causal evidence of the wider non-pecuniary benefits of education, implies that failing to invest in education, particularly at critical ages and stages, would be a very risky strategy for governments to adopt.

## Recommendations

- Government should take action immediately to mitigate learning loss from the COVID-19 pandemic.
- Policymakers should continue to pursue ambitious targets for further and higher education participation.
- Inequalities in education outcomes should be tackled, since failure to educate all groups in the population to their full potential is detrimental to economic growth.

## The Issue

As has been widely documented, the COVID-19 pandemic has led to 'significant' learning loss. While many have called for catch-up measures, there are counterarguments based on the hypothesis that education itself is a waste of time and money (Caplan, 2018) which imply that such measures aren't necessary: as long as young people are ultimately awarded educational qualifications (e.g. GCSE and A level grades) reflecting their ability then they will be able to progress in their lives regardless. At the heart of this debate is the fundamental question of whether education is a worthwhile investment from society's perspective, acting to drive economic growth by making individuals happier, healthier and more productive. Or whether it is merely an expensive way for individuals to signal their pre-existing productivity and, hence, to help education institutions and employers choose between applicants.

This question has been the subject of research for many years, and in this briefing note we present the evidence from the most rigorous quantitative studies.

## Why do people with more education earn more?

### Human Capital Theory

One of the most important ideas in labour economics is human capital theory (Becker, 1975). Key to this theory is the proposition that investment in education makes individuals more productive, and it is this that results in higher wages. Individuals invest in education if the benefits – in the form of increased earnings over their lifetime – exceed the costs. Similarly, governments subsidise at least some of the costs of education because of the perceived economic and wider benefits to society. There is a well-established literature establishing a positive return to individuals from investing in education (e.g. Card, 1999, 2001; Blundell et al., 2005), with both years and levels of education being associated with higher earnings. There is also good evidence that the

content of education matters for earnings. For example, Altonji et al. (2012) show substantial differences in the labour market returns to different college majors, and Belfield et al. (2018) show positive returns to both degree subjects and Higher Education Institutions (HEIs), and even impacts of doing particular courses.

As well as the direct effect on individual productivity, education has been shown to fuel economic growth (Aghion et al., 2009; Biasi et al., 2021; Valero and Van Reenen, 2019): human capital and its effects on productivity are central to most macroeconomic models of economic growth. Furthermore, education has been shown to have wider social benefits – more educated societies have higher levels of civic participation (Dee, 2004), better birth outcomes (Currie and Moretti, 2003) and reduced crime (Lochner and Moretti, 2004). Education has also been shown to have important non-pecuniary benefits to the individual, such as making them more patient and goal-oriented (Oreopoulos and Salvanes, 2011).

### Signalling theory

However, it is possible that the higher wages associated with different levels of education are not produced by knowledge and skills gained from education. The fact that more educated individuals have higher earnings may not be because education has made them more productive. There is an alternative explanation of why individuals with more education earn more known as signalling theory (Spence, 1974; Weiss, 1995; Caplan, 2018).

According to pure signalling theory, education does not increase individuals' productivity. Rather it signals individuals' pre-existing ability. This only works because firms have imperfect information about potential workers – they cannot tell whether an individual will be a good worker at face value and have to rely on signals when making a hiring decision. A signal must be something that is costly to obtain – but less costly for high productivity workers. In order to compete in the labour market, individuals choose whether or not to obtain education in order to signal that they are a "good bet". But as the cost of acquiring this education is lower to the more productive workers, they are

happy to bear the relatively low cost of investing in their education in order to raise their future earnings. Meanwhile, the higher cost of obtaining this education to a low productivity worker means potential wage gains are less likely to compensate a low productivity worker enough to make this larger upfront investment.

Often confused with signalling is the role of employers' use of statistical discrimination by educational qualification in setting initial wages. Statistical discrimination is consistent with human capital theory, rather than pure signalling, in that it describes how employers deal with risk and information costs associated with varying degrees of certainty about different groups' productivity levels i.e. potential for human capital accumulation, but recognising difficulties in employers observing this directly – especially at first. Arcidiacono et al. (2010) show that there are differences in the link between ability and pay for college graduates and high school graduates: while college graduates abilities are more closely tied to wages from the outset reflecting their productivity, high school graduates' wages are initially unrelated to their own ability with this being revealed gradually as they spend more time in the labour market. This means that differences in initial wages depending on qualification is not necessarily a signalling effect – but could be that employers are statistically discriminating by offering a lower wage to the more varied high school graduate group until they can effectively reward their observed productivity levels. As discussed above, signalling effects go beyond this, positing that individuals acquire credentials in order to signal their ability and the process of acquiring the signal does not affect their ability.

## Testing the theories

Human capital theory and signalling are not mutually exclusive. It is perfectly possible that education's effect on wages is caused partly by raising productivity and partly by signalling effects. The relative importance of their effects is also likely to differ across different levels of education and even different qualifications at the same level.

Understanding which of these mechanisms dominates – i.e. whether productivity is mainly driven by human capital accumulation or whether it is mostly that latent productivity is rewarded through signalling – is not particularly important for individuals. Either way, they face a similar decision as to whether or not to invest in education in order to raise future wages, knowing the costs to them personally. Put differently, there are private returns to education either way. However, to policymakers the implications of the different theories matter a great deal because they are interested in the social returns to education, which differ substantially between human capital and signalling theories.

If education truly improves individuals' human capital, making them more productive, then education is a worthwhile investment for the state to make, given the role of productivity for economic growth. This argument is bolstered by the suite of wider social benefits of education. However, if education is merely signalling workers' pre-existing productivity, then subsidising education for entire populations (to the value of billions of pounds) is an extremely expensive way to facilitate this process for sorting workers into jobs based on their innate ability, and it is arguable as to whether the state should subsidise education at all. It may also distort that process by lowering the cost of education to lower productivity workers, making it harder for firms to distinguish between them and higher productivity workers. Moreover, pure signalling theory suggests that there can be no social benefits to education. Those that appear to exist are purely illusory based on those innate differences between those who sort into higher and lower education. This would further undermine the need for governments to invest in education.

Most immediately, whether the government should invest in additional resources to help students catch up on lost learning due to COVID-19 (e.g. the National Tutoring Service) is called into question by signalling theory. If education is just signalling then there is no important learning loss to worry about, as long as pupils can still be assessed in a way that sorts individuals with differing productivity levels and

high productivity workers gain the qualifications (signals) necessary to allow them to progress and be identified by employers.

While it is challenging to do so because many of the predictions of the two theories are so similar (Lazear, 1977), careful empirical work has attempted to distinguish between the human capital and signaling theories, using a variety of methods that focus on areas where they do predict differing outcomes.

## The signalling value of qualifications

One potential approach to test the relative importance of signalling versus human capital accumulation is known as the “sheepskin effect”. If there are discontinuities in the returns to schooling at points where qualifications are typically given out, this would suggest the existence of a signalling effect. Chevalier et al. (2004) test this theory using data from the UK, and while they do find some evidence of increased rates of return to education coinciding with qualification points, they do not conclude that this is convincing evidence of signalling – they continue to alternative tests to which we return below.

Jaeger and Page (1995) also examine credential effects, using data from the US Current Population Study which contains information on individuals’ years of schooling and diplomas received. Their work finds evidence of signalling effects: there are significant credentialing effects associated with Associate’s degrees (for some students) and Bachelor’s degrees. Several other papers examine sheepskin effects in a similar manner (i.e. by estimating models which model separately the returns to years of education and the returns to qualifications), and generally do find evidence of such effects (e.g. Park, 1999; Ferrer and Riddell, 2002; Dickson & Smith, 2011).

However, the effects that these papers attribute to sheepskin effects could also be due to a) statistical discrimination by employers discussed above or b) unobserved productivity-related factors – such as motivation and perseverance – that are correlated with qualification attainment. A number of studies at-

-tempt to avoid the second issue by using more rigorous approaches such as utilising random shocks to compare similar people in different cohorts, or by comparing individuals who barely pass or fail a qualification and, as such, will be very similar in terms of those unobserved factors.

Maurin and McNally (2007) use the impact of the 1968 riots in Paris to show a lasting effect on wages of higher education for the one specific cohort affected. To the extent that employers were aware that this specific cohort benefited from easy exams and can distinguish between the productivity of workers from different cohorts, this evidence supports the effect of human capital on wages, rather than signalling.

A more recent examination by Clark and Martorell (2014) compares individuals either side of a cut-off with very similar underlying characteristics. Specifically, they study the earnings of those with and without a US high school diploma. Through this method they are able to isolate the pure effect of the diploma and do not find much evidence of signalling effects. Machin et al. (2020), using a similar approach, find evidence that falling either side of this type of boundary cut-off matters for future education pathways, although this does not provide a guide for future impacts on labour market returns.

Similarly, Kane and Rouse (1995) find little evidence that the certification value of a US degree (either 2 or 4 year) is small relative to coursework – the average associate’s (2 year) and bachelor’s (4 year) degree holders earned no more than those with similar amounts of 2-year or 4-year college credits. These results are supportive of the predominance of human capital theory.

## Spillover effects of increases in the minimum level of schooling

Another way of testing the existence of signalling involves examining spillover impacts of increasing the education levels of the population as a whole. The idea is that, if education makes people more productive, a compulsory

increase in education levels should have no effect on the decisions of others. On the other hand if there is a signaling effect, a general increase in education will lead more able individuals to acquire even more education to maintain the signal of their ability above that now commonly obtained. This is first tested by Lang and Kropp (1986) who exploit compulsory attendance laws (CALs), which vary by US state. Their results show that compulsory attendance laws do increase enrollment rates in age groups they do not affect directly – a result consistent with signalling.

In the UK, Chevalier et al. (2004) exploit the raising of the minimum school leaving age in England and Wales (known as the RoSLA, or Raising of the School Leaving Age) in 1973 to perform a similar test. The authors find that the RoSLA only increased education acquisition for the very lowest educated – suggesting limited importance of signalling in this context.

## Employer learning

Other papers have tried to distinguish between the two theories of signalling and human capital by looking for signs of employer learning. If human capital theory is driving wages, as employers learn more about their productivity on the job, the correlation between wages and education should weaken, while the correlation between wages and underlying metrics of productivity, such as cognitive scores, should strengthen. Studies of employer learning (Altonji and Pierret, 2001; Galindo-Rueda, 2003) find evidence in support of human capital theory – the relationship between wages and education decreases over time while the relationship between wages and productivity indicators (underlying ability) strengthen. A recent paper from Denmark uses a reform which changed students' grade point averages in a way that is unrelated to their underlying ability. They find evidence that this increased wages immediately after graduation (consistent with either signalling or statistical discrimination) but that this effect quickly faded away as employers learned more about the productivity of their workers (only consistent with statistical discrimination) (Hansen et al., 2021).

## Differences in degree class

Individuals can also have different signals if they hold similar degrees with different classifications. Thus, comparing the earnings of such individuals could offer insights into the existence of signalling. Feng and Graetz (2017) test whether an individual's degree class in itself increases the probability of them working in a high-wage industry when they actually achieved very similarly in their examinations: they compare students at the London School of Economics who obtained very similar points in their degree exams, but who obtained either a first or a 2.1 degree. They find that a higher degree classification positively affects a graduate's probability of working in a high-wage industry, and in turn improves their earnings after graduation. However they point out that their results are consistent with both signalling and statistical discrimination.

## Summary

It is well documented that more educated workers are rewarded with higher earnings. The leading explanation for this is that education improves productivity, which allows for those higher wages. But there is an alternative explanation. It may be the case that individuals always had whatever level of productivity they have, and merely use education to signal that innate ability.

Understanding the relative importance of these mechanisms is important for governments' education strategies. If there really are productivity benefits to education then governments should invest in it, because this implies social returns to education. On the other hand, if education is merely acting as a (very costly) signal of pre-existing ability then this calls into question the value of large amounts of spending on education. This is particularly relevant in the current climate, where the COVID-19 pandemic has led to widespread learning loss across the world. Should governments invest in expensive catch-up programs to help pupils' learning recover? Or should they simply concentrate on the much cheaper task of working out how best to allocate signals (i.e. exam grades) to facilitate sorting into further

education and, ultimately, higher or lower wage jobs?

While it has proved challenging for researchers to disentangle these two theories because their empirical predictions are so similar, the most convincing empirical attempts to do so in the literature suggest a relatively limited role is played by signalling. Moreover, as the evidence that Oreopoulos and Salvanes (2011) supports, the existence of causal evidence on non-pecuniary benefits of schooling provides further weight to the theory that schooling does contribute to skill development. It is not easy to explain why education would result in individuals changing their preferences if it were just a signalling device.

Taken together, there is a clear picture of substantial importance for human capital theory as a dominant part of the link between education and later earnings. This implies that reducing investment in education in general, and failing to invest appropriately in post-COVID catch-up in particular, would be a very risky strategy for a government to adopt, particularly in the context of a highly competitive globalised marketplace. Given major investment in education by countries around the world, increasingly at the level of further and higher education, falling behind in this respect would threaten our country's ability to compete, particularly in a way that supports high living standards.

## References

- Aghion, P., Boustan, L., Hoxby, C., & Vandenberg, J. (2009). *The causal impact of education on economic growth: evidence from US*. Brookings papers on economic activity, 1, 1-73.
- Altonji, J. G., & Pierret, C. R. (2001). Employer learning and statistical discrimination. *The quarterly journal of economics*, 116(1), 313-350.
- Altonji, J. G., Blom, E., & Meghir, C. (2012). Heterogeneity in human capital investments: High school curriculum, college major, and careers. *Annu. Rev. Econ.*, 4(1), 185-223.
- Arcidiacono, P., Bayer, P., & Hizmo, A. (2010). "Beyond Signaling and Human Capital: Education and the Revelation of Ability." *American Economic Journal: Applied Economics*, 2 (4): 76-104.
- Becker, G. (1975). *Human capital*. Second edition. New York: Columbia.
- Becker, G. (2009) *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago press.
- Belfield, C., Britton, J., Buscha, F., Dearden, L., Dickson, M., Van Der Erve, L., Sibiet, L., Vignoles, A., Walker, I. & Zhu, Y. (2018). *The relative labour market returns to different degrees*. [https://dera.ioe.ac.uk/33021/1/The\\_impact\\_of\\_undergraduate\\_degrees\\_on\\_early-career\\_earnings.pdf](https://dera.ioe.ac.uk/33021/1/The_impact_of_undergraduate_degrees_on_early-career_earnings.pdf)
- Biasi, B., Deming, D. J., & Moser, P. (2021). *Education and Innovation* (NBER Working Paper No. 28544; NBER Working Paper Series, p. 18).
- Blundell, R., Dearden, L., and Sianesi, B. (2005) 'Measuring the Returns to Education', in S. Machin and A. Vignoles (eds.) *What's the Good of Education?*, Princeton University Press, Princeton, US.
- Caplan, B. (2018). *The Case against Education: Why the Education System Is a Waste of Time and Money*. Oxford: Princeton University Press. doi:10.2307/j.ctvj7wq2j
- Card, D. (1999). The causal effect of education on earnings. *Handbook of labor economics*, 3, 1801-1863.
- Card, D. (2001). Estimating the return to schooling: Progress on some persistent econometric problems. *Econometrica*, 69(5), 1127-1160.
- Carlsson, M., Dahl, G. B., Öckert, B., and Rooth, D. O. (2015). "The Effect of Schooling on Cognitive Skills." *Review of Economics and Statistics* 97 (3): 533-547.
- Chevalier, A., Harmon, C., Walker, I., & Zhu, Y. (2004). Does education raise productivity, or just reflect it?. *The Economic Journal*, 114(499), F499-F517.
- Clark, D., & Martorell, P. (2014). The signaling value of a high school diploma. *Journal of Political*

- Economy*, 122(2), 282-318.
- Currie, J., & Moretti, E. (2003). Mother's education and the intergenerational transmission of human capital: Evidence from college openings. *The Quarterly journal of economics*, 118(4), 1495-1532.
- Dee, T. S. (2004). Are there civic returns to education?. *Journal of Public Economics*, 88(9-10), 1697-1720.
- Dickson, M., & Smith, S. (2011). What determines the return to education: An extra year or a hurdle cleared? *Economics of Education Review*, 30(6), 1167-1176.
- Feng, A., & Graetz, G. (2017). A question of degree: the effects of degree class on labor market outcomes. *Economics of Education Review*, 61, 140-161.
- Ferrer, A. M., & Riddell, W. C. (2002). The role of credentials in the Canadian labour market. *Canadian Journal of Economics/Revue canadienne d'économique*, 35(4), 879-905.
- Galindo-Rueda, F. (2003). *Employer Learning and Schooling-Related Statistical Discrimination in Britain*. IZA DP No. 778
- Hansen, A. T., Hvidman, U., and Sievertsen, H. H. (2021). *Grades and Employer Learning*. Discussion Paper 21/740, University of Bristol.
- Jaeger, D. A., & Page, M. E. (1996). Degrees matter: New evidence on sheepskin effects in the returns to education. *The review of economics and statistics*, 733-740.
- Kane, T. J., & Rouse, C. E. (1993). *Labor market returns to two-and four-year colleges: is a credit a credit and do degrees matter?* (No. 4268). National Bureau of Economic Research.
- Lang, K., & Kropp, D. (1986). Human capital versus sorting: the effects of compulsory attendance laws. *The Quarterly Journal of Economics*, 101(3), 609-624.
- Lazear, E. (1977). 'Academic achievement and job performance', *American Economic Review*, vol. 67, pp. 252-4.
- Lochner, L., & Moretti, E. (2004). The effect of education on crime: Evidence from prison inmates, arrests, and self-reports. *American economic review*, 94(1), 155-189.
- Machin, S., McNally, S., & Ruiz-Valenzuela, J. (2020) Entry through the narrow door: The costs of just failing high stakes exams. *Journal of Public Economics*, 190.
- Maurin, E. and McNally, S. (2007) Vive la Revolution! Long-Term Educational Returns of 1968 to the Angry Students. *Journal of Labor Economics*, 26(1).
- Oreopoulos, P., & Salvanes, K. G. (2011). Priceless: The nonpecuniary benefits of schooling. *Journal of Economic perspectives*, 25(1), 159-84.
- Park, J. H. (1999). Estimation of sheepskin effects using the old and the new measures of educational attainment in the Current Population Survey. *Economics Letters*, 62(2), 237-240.
- Spence, M. (1973). Job market signaling. *Quarterly Journal of Economics*, 87(3), 355-374.
- Valero, A., & Van Reenen, J. (2019) 'The economic impact of universities: Evidence from across the globe.' *Economics of Education Review* 68, 53-67.
- Weiss, A. (1995). Human capital vs. signalling explanations of wages. *Journal of Economic perspectives*, 9(4), 133-154.



Prepared by: Gill Wyness, Lindsey Macmillan, Jake Anders

**Contact for further information:**  
Centre for Education Policy and Equalising Opportunities (CEPEO)

[www.ucl.ac.uk/ioe/cepeo](http://www.ucl.ac.uk/ioe/cepeo)  
email: [cepeo@ucl.ac.uk](mailto:cepeo@ucl.ac.uk)  
Date: April 2021