

Lifetime Returns to Schooling*

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Abstract

Ben-Porath (1967) shows how the returns to human capital depend on the number of years left in the labour market, yet few empirical studies relate schooling to length of working life. No studies go on to consider post-retirement income. We analyze changes in schooling attainment following a reform-driven middle school building program which took place in Denmark during the 1930's through 1950's. Compliers eventually attained on average one more year of schooling, yielding a 12 percent earnings return, a retirement delay of 6 months, and a 6 percent pension income return. Non-pension savings and longevity are unaffected. We find lifetime returns are much larger than previously thought.

Keywords: School reform, Instrumental variables, Lifetime outcomes.

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1 Introduction

Understanding the returns to schooling is important since it is likely a key determinant of school attainment and participation (Harmon & Walker 1995), inequality (Katz & Autor 1999), and economic growth (Barro 1991; Topel 1999; Bils & Klenow 2000; Goldin & Katz 2009). Furthermore, many countries have experienced a rapid increase in the enrolment rates of secondary and upper-secondary schooling, leading to a concern about the relative costs and benefits of higher education for those who were not previously receiving it (Card 2001). Most studies of the effect of schooling focus on the private economic return to schooling, which is arguably the single most estimated parameter in social science. In recent years, a strand of literature has emerged related to education focus on the causal effect of education on health (see e.g. Cutler and Lleras-Muney 2010, 2012; and Clark & Royer 2013 for recent contributions and comprehensive reviews); and mortality (e.g. Lleras-Muney 2005; Meghir et al. 2012).

Theoretical contributions recognize other types of effects of schooling. In particular, the theory developed by Becker (1962, 1964), Mincer (1958, 1962) and Ben-Porath (1967) acknowledge that education shall be seen as a rational investment of present resources for the purpose of enjoying future returns. This underscores the importance of a lifecycle view on earnings by linking it to the time profile of investments in human capital. Hazan (2009) incorporate the retirement decision into a version of Ben-Porath's (1967) model, but only few empirical papers have estimated the causal impact of schooling on the length of working life (Meghir et al. 2012).³

³ Other types of returns to schooling include the impact on intergenerational mobility (Currie & Moretti, 2003; Black et al. 2005), teenage pregnancy (Black et al., 2008), marriage (Lefgren and McIntyre 2006), occupational prestige and job satisfaction (Oreopoulos & Salvanes, 2011), time preferences (Becker and Mulligan, 1997), trust and civic participation (Milligan et al., 2004) and crime (Moretti & Lochner, 2004). See Grossman (2006) and Oreopoulos & Salvanes (2011) for excellent surveys and discussions.

In this paper, these different strands of literature are combined in order to compute lifetime returns to schooling. The lifetime returns to schooling computations are based on the impact of schooling on earnings, length of working life, post-retirement income and longevity. This paper contributes to the existing literature in several important ways: It is the first study to estimate a causal effect from schooling on post-retirement income and the first to compute lifetime returns to schooling where time of retirement and longevity are treated endogenously.

Improving our understanding of the value of schooling over a lifecycle is important for a number of reasons. In addition, it allows for a reconsideration of the returns to schooling in a broader and more comprehensive context that explicitly acknowledges the lifecycle dimension. Furthermore, differences in schooling may be a driver of future inequality, especially among elderly people where some rely on public pensions entirely while others in addition have private pension savings. How length of working life is affected by education is important in itself. Ageing populations in many OECD populations put pressure on public finances. Extending the duration of the average working life would be one way to mitigate this problem. However, it is unclear whether a more educated workforce, a political ambition in many countries, has a longer working life and what the causal effect of schooling is in terms of lifetime income.

2 Methodological Approach

Much of the recent literature on returns to education obtain causality through the use of exogenous schooling reforms that break the link between behaviour and unobservables that otherwise give rise to endogeneity concerns, e.g. Black et al. (2005, 2008); Meghir, & Palme (2005); Clark & Royer (2013). In this paper we adapt a similar approach using the Danish school reform of 1937.

2.1 The Danish School Reform of 1937

On May 18, 1937 the Danish parliament passed a new school law. One of the major points in the reform was that Market towns with no Middle School could introduce a voluntary 8th year as could village schools if parents of minimum 15 children requested this.

While the law was passed overnight it took about 25 years to implement it. The years 1937-1942 were characterized by massive building activity and relatively good progress in implementing the reform. Nevertheless, only about 15 percent of the municipalities managed to implement the reform during these years. As a consequence of the outbreak of the war in September 1939 building materials came in short supply, especially iron and concrete, and in the fall of 1942 all new school construction came to a complete halt. The lack of building materials would continue up through the 1950s, partly due to a shortage of housing accommodation which had to be built in the aftermath of the war.

There were two other major problems that delayed the implementation. Firstly, the 20th century was characterized by large fluctuations in birth cohorts. After World War 1 the cohorts increased but the great depression starting around 1929 resulted in a decrease in the number of school aged children in the years 1934 to 1943. Every year after 1943 up until 1957 more children would enter first grade than would leave school. These fluctuations were very pronounced. In 1934 there were 457,000 pupils in the compulsory school age, i.e. age 7-14. This number dropped to 378,000 in 1943 and then soared to 579,000 in 1957.⁴ The number of 7-14 year-olds thus increased by more than 50 percent from 1943 to 1957, which in turn strained the number of class rooms, teachers and school resources in general during these years.

⁴ Sources: "Børneskolen i Aarene 1932-1936", "Børneskolen i Aarene 1937-1941" and "Børneskolen i Aarene 1942-1946".

Secondly, the supply of teachers was in dire distress. During all of the 1950s there was serious shortage of teachers across the entire country although the problem was most severe in rural areas. This had direct consequences for the implementation of the reform. For instance, out of about 3,000 rural schools only 27 offered mathematics in 1956.⁵

2.2 Identification

The expansion of Danish middle schools is applied as an instrument for educational achievement. For the purpose of this study the exact timing of each individual middle school build-out has been identified and subsequently coded in data. Based on coordinates of each parish and each municipality we compute with-in parish average distances to nearest middle school and how these distances gradually decreased with schooling expansions over the years 1930-1964. We rely on parish of birth as the place of living at age 14. While geographical mobility was limited in those days there was nevertheless some degree of urbanisation in response to the increased mechanisation of farming. In order to account for this and for other types of municipality specific impact on schooling we allow for a municipality specific intercept as well as a municipality specific trend and quadratic trend.

3 Empirical Approach and Data

3.1 The Data

This paper is based on administrative records of unusual richness. The central administrative database, the Central Personal Register (CPR), contains an entry for each individual in Denmark; each individual has a unique CPR number. This CPR number can then be

⁵ Sources: Børneskolen (1952-56: 59-61), Nørr (2009: 218).

matched to the administrative IDA⁶ database, maintained by Statistics Denmark, which contains labour-market information on all individuals aged 15 to 74 (demographic characteristics, education, labour market experience, tenure and earnings) and employees in all workplaces in Denmark over the period 1980-2010. Central to this paper, the database also has records on parish of birth.

The administrative register data have been linked to historical records, which allows for a complete track of the timing of middle school build-out across the country.

4 Results

We find that school proximity explains schooling differences. Having access to middle school teaching in the municipality raised schooling attainment by one year on average. We find an earnings return to schooling of 12 percent, a retirement delay of 6 months, a pension income return of 6 percent, but no longevity effects.

⁶ *Integreret Database for Arbejdsmarkedsstatistik* (Integrated Database for Labour Market Statistics).

6 References

- Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics*, **106**(2): 407-43.
- Becker, G. S. 1962. Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy*, **70**(5): 9–49.
- Becker, G. S. (1964). Human Capital. New York, Colombia University Press.
- Becker, G. S., & C. B. Mulligan. (1997). The Endogenous Determination of Time Preference. *Quarterly Journal of Economics*, **112**(3): 729--58.
- Ben-Porath, Y. (1967). The production of human capital and the life cycle of earnings, *Journal of Political Economy*, **75**, pt. 1, 352-365.
- Bils, M. & P. Klenow (2000). Does Schooling Cause Growth? *American Economic Review*, **95**: 1653-1672.
- Black, S., P. J. Devereux & K. G. Salvanes (2005): Why the Apple doesn't fall far: Understanding Intergenerational Transmission of Human Capital. *American Economic Review*, **95**(1), 437-449.
- Black, S., P. J. Devereux & K. G. Salvanes (2008). Staying in the classroom and out of the maternity ward? The effects of compulsory schooling laws on teenage births'. *Economic Journal*, **118**(530): 1025-1054.
- Card, D. E. (1999). The Causal Effect of Education on Earnings. In Handbook of Labor Economics, Vol. 3A, edited by Orley Ashenfelter and David Card, 1801–63. Amsterdam: Elsevier.

- Card, D. E. (2001). Estimating the Returns to Schooling: Progress on Some Persistent Econometric Problems. *Econometrica*, **69**(5): 1127-1160.
- Clark, D. & H. Royer (2013). The Effect of Education on Adult Mortality and Health: Evidence from the United Kingdom. *American Economic Review*, **103**(6): 2087-2120.
- Currie, J. & E. Moretti (2003): Mother's Education and the Intergenerational Transmission of Human Capital: Evidence from College Openings. *Quarterly Journal of Economics*, **118**, 1495-1532.
- Cutler, D. M., & A. Lleras-Muney (2010). Understanding Differences in Health Behaviors by Education. *Journal of Health Economics*, **29**(1): 1–28.
- Cutler, D. M. & A. Lleras-Muney (2012). Education and Health: Insights from International Comparisons. National Bureau of Economic Research Working Paper 17738.
- Goldin, C. & L. F. Katz (2009). *The Race Between Education and Technology*. Harvard University Press.
- Grossman, M. (2006): Education and Nonmarket Outcomes. Chapter 10 in Handbook of the Economics of Education, vol. 1, ed. Eric Hanushek and Finis Welch. Elsevier.
- Harmon, C. & I. Walker (1995). Estimates of the Economic Return to Schooling for the United Kingdom. *American Economic Review*, **85**(5): 1278–86.
- Hazan, M. (2009). Longevity and Lifetime Labor Supply: Evidence and Implications. *Econometrica*, **77**(6): 1829-1863.
- Katz, L. F. & D. Autor (1999). Changes in the Wage Structure and Earnings Inequality, in *Handbook of Labor Economics*, **3A**, edited by Orley Ashenfelter and David Card. Amsterdam and New York: North Holland.

- Lefgren, L. & F. McIntyre (2006). The Relationship between Women's Education and Marriage Outcomes. *Journal of Labor Economics*, **24**(4): 787-830.
- Lleras-Muney, A. (2005): The Relationship Between Education and Adult Mortality in the United States. *Review of Economic Studies*, **72**, 189-221.
- Meghir, C. & M. Palme (2005): Educational Reform, Ability, and Family Background. *American Economic Review*, **95**(1): 414--424.
- Meghir, C., M. Palme & E. Simeonova (2012): Education, Health and Mortality: Evidence from a Social Experiment. NBER Working Paper 17932.
- Milligan, K., E. Moretti & P. Oreopoulos (2004). Does education improve citizenship? Evidence from the United States and the United Kingdom. *Journal of Public Economics*, **88**:1667--95.
- Mincer, J. (1958). Investment in Human Capital and Personal Income Distribution. *Journal of Political Economy*, **66**(4), 281-302.
- Mincer, J. (1962). On-the-Job Training: Costs, Returns, and Some Implications. *Journal of Political Economy*, **70**(5), 50-79.
- Moretti, E. & L. Lochner (2004). The effect of education on criminal activity: evidence from prison inmates, arrests and self-reports. *American Economic Review*, **94**(1): 155-89.
- Oreopoulos, P. & K. G. Salvanes (2011): Priceless: The Nonpecuniary Benefits of Schooling. *Journal of Economic Perspectives*, **25**(1): 159-184.
- Topel, R. H. (1999). Labor Markets and Economic Growth, in Handbook of Labor Economics, **3C**, edited by Orley Ashenfelter and David Card. Amsterdam and New York: North Holland.

Appendix

The Danish School Reform of 1937

Years of discussions and political negotiations about the future of the Danish school system preceded the passage of the school law of 1937. Starting with The Great School Commission, constituted in the years 1919-1923, politicians, union leaders and other interested parties discussed the future of the public school system in Denmark. The debate included a discussion of whether or not an 8th year of schooling should be made compulsory and how village schools could be improved. Among the major political parties Social Democrats were generally in favor of more schooling while the Liberal Party, which traditionally were strongly represented in rural areas, were against a compulsory 8th year. One reason was that the opportunity cost of foregone earnings during an 8th year would be costly especially to parents in rural areas. However, the main argument against a compulsory 8th year was that the Liberal Party wanted parents to have the opportunity to choose for themselves. Negotiations continued up through the 1930s until the passage of the law of May 18, 1937.

The Letter of the Law

With the new schooling law the Middle School and the Folkeskole became one organizational unit with a common school commission. One of the major points in the reform was that a 3 or 4 year non-exam line Middle School was to be established appealing to craftsmanslike inclined pupils. All market towns with an exam-line Middle School had to also open a non-exam line Middle School. The 1937-law also expanded the minimum standards of annual periods. The intention of the law was to raise the minimum number of hours notably in nonmarket town schools to obtain a more equal education across the two types of schools.

Market towns with no Middle School could introduce a voluntary 8th year as could village schools if parents of minimum 15 children requested this, and if a majority in the school commission recommended it. In reality very few did this.

The 1937-reform also introduced new subjects such as handicraft instruction; and domestic science became compulsory. In many cases this required new buildings and more teachers. Furthermore, new subjects were introduced, including mathematics (beyond calculus), language classes and history with social studies. A number of timelines for the required developments were initially set, but in many cases amended as it became apparent that they could not be met.

The Actual Implementation of the Reform

While the law was passed overnight it took about 25 years to implement it. The years 1937-1942 were characterized by massive building activity and relatively good progress in implementing the reform. Nevertheless, only about 15 percent of the municipalities managed to implement the reform during these years. As a consequence of the outbreak of the war in September 1939 building materials came in short supply, especially iron and concrete, and in the fall of 1942 all new school construction came to a complete halt. The lack of building materials

would continue up through the 1950s, partly due to a shortage of housing accommodation which had to be built in the aftermath of the war.

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