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2016/06

Impact of apprenticeships
on individuals and firms:
Lessons for evaluating
Modern Apprenticeships in
Scotland

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<https://dx.doi.org/10.1787/5jlpq84v57kg-en>

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DSTI/IND(2016)15/FINAL

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IMPACT OF APPRENTICESHIPS ON INDIVIDUALS AND FIRMS: LESSONS FOR EVALUATING MODERN APPRENTICESHIPS IN SCOTLAND

Matej Bajgar and Chiara Criscuolo (OECD)

ABSTRACT

This review summarises existing studies evaluating the impact of apprenticeships on individuals and firms and provides a brief overview of relevant evaluations in three related policy areas: education; active labour market programmes; and private on-the-job training. Based on the reviewed literature, it draws a number of lessons that are relevant for evaluating apprenticeship programmes in OECD member countries, such as the Modern Apprenticeships in Scotland. First, rigorous evaluation depends on the existence of suitable data that can be accessed, are of good quality and offer good coverage across individuals and over time. Second, the measured effects of apprenticeships depend on the time elapsed since the end of the training period. Third, the outcomes most commonly examined in the existing literature on the impact of apprenticeships on individuals are wages and the probability of employment; some studies also consider subsequent education and training and the likelihood of finding standard employment. Fourth, the impact of apprenticeships on productivity can be either derived from the estimated impact on individual wages or directly estimated using firm-level data; if feasible, the latter approach is preferable. Fifth, it is important to employ methods that take into account not only observed but also unobserved individual characteristics. Finally, evidence coming from comparing apprentices to different “control groups” might provide different and complementary answers to the question on the impact of apprenticeships.

Keywords: Apprenticeship; Impact evaluation; Returns to schooling; Training

JEL Classifications: I26, J24, M53

Acknowledgements

We are grateful to Sarah Box, Jane Duffy, Magdalena Gilek, Nick Johnstone, Dirk Pilat and Lynne Robson for helpful comments on earlier versions of this paper.

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EXECUTIVE SUMMARY

This review summarises existing studies evaluating the impact of apprenticeships on individuals and firms and provides a brief overview of relevant evaluations in three related policy areas: education; active labour market programmes; and private on-the-job training. Based on the reviewed literature, it draws lessons for evaluating the Modern Apprenticeship programme in Scotland. The key lessons emerging from the literature review are as follows.

- Rigorous evaluation depends on the existence of suitable data that can be accessed, are of good quality and offer good coverage across individuals and over time. Continued efforts for creating, maintaining and linking datasets are, thus, essential for evaluation.
- The effects of apprenticeships can change substantially depending upon the time elapsed since the end of the training period. It is, therefore, important to analyse not only the short-term effects of Modern Apprenticeships but also their medium- to long-term effects.
- To the extent that the choice of measured outcomes aims at reflecting the emphasis in the existing literature on the impact of apprenticeships on individuals, an evaluation framework for Modern Apprenticeships should primarily focus on wages and the probability of being employed. Similarly, as secondary outcomes, it should also consider subsequent education and training and the likelihood of finding standard, as opposed to non-standard, employment.
- To the extent that the choice of measured outcomes goes beyond the emphasis in the existing literature, the outcomes should include productivity. The impact on productivity can be either derived from the estimated impact on individual wages or directly estimated using firm-level data. If feasible, the latter approach is preferable but challenging, as witnessed by the scarcity of existing studies estimating the impact of apprenticeships on firm productivity.
- Evaluations that take into account only observed individual characteristics may incorrectly ascribe the effect of unobserved characteristics, such as ability or motivation, to the effect of an apprenticeship. It is, therefore, important to also employ methods that try to control for unobserved individual characteristics, although such methods are sometimes context-specific and are subject to data availability.
- It is important to clearly define the counterfactual relative to which Modern Apprentices are evaluated. The potential comparison groups include (i) all individuals who do not undertake an apprenticeship; (ii) more specific groups of individuals, such as individuals who obtain school-based vocational training instead of an apprenticeship; and (iii) individuals who start an apprenticeship but do not complete it. The evidence coming from comparing apprentices to the different “control groups” might provide different and complementary answers.

1. INTRODUCTION

This review summarises the literature evaluating the impact of apprenticeships on individuals and firms. It highlights the key challenges facing such evaluations, describes the methods and data researchers have used to overcome these challenges, summarizes the key findings of the existing research and points out areas where little evidence exists. In addition, the review briefly discusses relevant evaluations in three related policy areas: education; active labour market programmes; and private on-the-job training.

The aim of the review is to inform the development of a framework for long-term evaluation of the Modern Apprenticeship programme in Scotland. Modern Apprenticeships combine paid work with training that aims to develop transferable skills and occupational competence and leads to an industry-recognised qualification. Since 2008, they have been administered by Skills Development Scotland (SDS). The evaluation framework sets out recommendations for evaluating them, including the evaluation activities to carry out, the outcomes to examine, the data to use and the methods to apply. This review allows the framework to build on the experience of previous evaluations in the UK and other countries and places the framework and its future results in the context of the methodology and results that are standard in the literature.

In order to clearly demarcate the extent of the analysis, this review defines an apprenticeship as “a combination of paid employment within a firm and training usually supplied or financially supported by government, the employer, a training provider or a trade union, primarily targeted at school leavers, aiming at the development of occupational mastery and typically leading to a formal qualification.”

This definition is in line with existing reviews, such as Wolter and Ryan (2011) and What Works Centre for Local Economic Growth (WWCLEG, 2015). Importantly, it makes apprenticeships distinct from purely school-based vocational training, stand-alone on-the-job training and active labour market programmes.

In addition, this review focuses on “evaluating impact”, in the sense of analysing the causal effects of a specific programme or intervention. We thus will focus on causal (econometric) evaluations that compare outcomes for the units (e.g. individuals, firms) that have been “treated” by the programme, to those of a well-defined control group of units that have not been “treated”. Therefore, the review will generally not focus on i) qualitative descriptions of institutional features and performance of different apprenticeship systems; ii) analyses of factors determining enrolment in and completion of apprenticeships; or iii) process evaluations based on self-reports of treated individuals or firms without a control group.

The following section sets the stage for the subsequent discussion by highlighting the key issues inherent in evaluating apprenticeships. The literature review itself starts in Section 3 with a bird’s-eye view of key lessons from evaluations in three related policy areas that are relevant for designing an evaluation framework for Modern Apprenticeships: (i) education; (ii) active labour market programmes; and (iii) private on-the-job training. Section 4 discusses studies analysing the impact of apprenticeships on individuals, first describing their outcomes variables, methodology, control groups and time horizon, and then summarizing their results. Section 5 discusses existing studies examining the impact of apprenticeships on firms. Lastly, Section 6 summarizes the key lessons for evaluation of Modern Apprenticeships in Scotland.

This review is based on a longer survey of the literature on evaluation of apprenticeships (Bajgar and Criscuolo, 2016), which provides additional details on both the methodologies and the results of individual studies.

2. EVALUATING THE IMPACT OF APPRENTICESHIPS: KEY ISSUES

Evaluating the impact of apprenticeships is a complex task that entails several challenges. A key challenge in evaluating the impact of any intervention such as apprenticeships, education or training is that the individuals who participate in the “treatment”, e.g. apprentices, may systematically differ in their characteristics from those who are not “treated”. Consequently, simply comparing apprentices (the so-called “treatment group”) with non-apprentices (the “control group”) may be misleading, as the differences in the observed outcomes of the two groups may be due to their inherent characteristics rather than to the apprenticeship. Using this “naïve” comparison can lead to over- or under-estimating the true effect of the intervention depending on the unobservable underlying differences between the two groups. In the case of training, for example, if the individuals who get trained have higher ability, are more strongly motivated or are seen to have higher potential by their superiors, a “naïve” comparison of the two groups will overestimate the effect of training by mistakenly interpreting effects of higher ability and other “high quality” characteristics of the trained individuals as effects of training. If, conversely, the trained individuals are those most in need of training or those who have not opted for more ambitious career paths, the comparison would underestimate the effect of training. These sources of bias in the estimates of the causal effect of a policy intervention are commonly known as “omitted variable bias”, as one is not controlling for all relevant characteristics, and “selection bias”, as individuals “self-select” into the programmes and the researcher is not properly controlling for this.

One simple way of addressing this challenge is to try to account for these differences by directly taking into account the observed individual characteristics (e.g. social and economic background, previous education etc.) in a regression framework, often using Ordinary Least Squares (OLS) where an indicator for whether the individual has undergone treatment is included. However, characteristics such as ability or motivation are hard to observe, and taking into account only observed individual characteristics may still lead to incorrect estimates.

One common approach used to improve the estimation is to assume that an individual’s unobserved ability and motivation are fixed over time and, thus, can be purged from the estimation by comparing changes in outcomes for the same individuals before and after training to changes in outcome for those that did not undergo training (this approach is known in the literature as the Difference in Difference model). Unfortunately, applying this approach to the evaluation of apprenticeships is difficult because many young apprentices never worked prior to their apprenticeship.

An alternative is to apply the Instrumental Variable estimation method (IV) based on the use of variables that are correlated with the treatment (education, apprenticeship, training etc.) but do not themselves directly affect the outcome of interest (e.g. wages). For example, in the case of education, being born in a particular month of a year may affect the number of years of schooling that an individual receives but is unlikely to directly increase earnings. The month of birth can, therefore, be used as IV to infer the impact of schooling on earnings (see Angrist and Krueger, 1991).

A different approach tries to solve the problem of “selection” into treatment by randomly assigning some individuals to the “treatment” group and others to a control group that either does not participate or participates in a different programme. These so-called randomised control trials (RCTs) are widely used for testing drugs and are becoming increasingly popular for testing the effectiveness of policies, especially in developing countries (Angrist et al., 2002; Behrman et al., 2005; Attanasio et al., 2011). RCTs are very

effective at providing estimates that capture the causal effect of a programme, but can be costly and may be less suitable for evaluating Modern Apprenticeships, which are highly decentralised and where recruitment is done by individual employers rather than by a central body.¹

Finally, some studies use so-called “quasi-natural experiments”. Like RCTs, “quasi-natural experiments” exploit a random allocation of individuals into a treatment group and a control group, but the allocation is not done by the evaluators and is instead due to, for example, staggered timing of a reform across different regions or an age threshold that effectively turns people just below the threshold age into the treatment group and the people just above the threshold age into the control group. This approach, however, crucially depends on the existence of a suitable quasi-natural experiment in the analysed setting, and, as a result, it may be hard to apply in the Scottish context.

Crucially, any evaluation depends on the availability of suitable data that can be accessed, are of good quality and offer good coverage across individuals and over time, for both the treatment and control groups. Continued work at creating, maintaining and linking datasets is, thus, essential for evaluation.

In addition, there are a number of other key issues when evaluating interventions such as apprenticeships. First, it is important to determine the outcomes of interest that should be evaluated. This depends crucially on the aim of the evaluation. Second, it is necessary to be clear about the counterfactual, that is, the alternative against which the outcomes for the treatment group are measured. Third, it is important to consider the time-horizon of the evaluation, because the length of the period between the time of the training and the time when the outcome is measured can strongly affect the results. The discussion of literature in the rest of this review aims to provide guidance for addressing these issues.

3. EVALUATING THE IMPACT OF EDUCATION, ACTIVE LABOUR MARKET PROGRAMMES AND PRIVATE TRAINING

Apprenticeships can be seen as a type of education, as they tend to be part of, or alternatives to, the formal education system, and they often lead to formal qualifications, as is the case with Modern Apprenticeships in Scotland. They are also related to active labour market programmes in the sense that they involve publicly subsidised training and use work-based learning to promote a smooth transition to employment. Finally, they resemble on-the-job training as a means of acquiring skills while being employed, either through instruction or through learning by doing. These similarities mean that there are lessons for evaluation of apprenticeships that can be learned from the large literature evaluating these three types of interventions.

However, it is also important to keep in mind the ways in which apprenticeships differ from each of the other interventions and the implications these differences have for evaluation of apprenticeships. For instance, compared to education and many active labour market programmes, they are much less centralised, with a strong role played by the matching between apprentices and employers, which makes them less suited for evaluation using RCTs. Furthermore, they tend to be longer and involve stronger skill-content than most training provided by active labour market programmes, which implies that their benefits may take longer to materialise. Compared to most cases of on-the-job training, apprenticeships tend to be substantially longer, and they require a stronger commitment from both the employer and the apprentice. In addition, unlike private training, they are subject to public oversight over training quality.

Education

The most widely studied outcome of education is its impact on individual earnings. In addition, a much smaller but important literature analyses the impact of education on other outcomes. Several features relevant for Modern Apprenticeships emerge from the literature on education:

- Estimates of wage returns to a year of education in developed economies that take into account only observed individual characteristics and social and economic background, using OLS estimation tend to be on average around 7%, with significant variation across countries, time and educational levels (Ashenfelter et al., 1999; Harmon et al., 2003). Such wage return is, therefore, a natural, even though very rough, point of comparison for wage returns that may accrue from apprenticeships.
- Estimates of returns to education that try to take into account biases coming, for example, from the correlation of wages and education outcomes with unobserved individual ability² tend to be similar or larger.³ This suggests that wage returns estimated by OLS may, in some contexts, provide reasonable estimates similar to those from more advanced econometric techniques.
- Returns to education differ strongly across individuals (Dickson and Harmon, 2011). Thus, rather than attempting to reach a single estimate for the return to education (or apprenticeships), it is important to measure the returns for various sub-groups defined by characteristics such as gender, age, social background and previous educational performance. A second element of heterogeneity might come from the employer where the apprenticeship

has been completed. Thus, to the extent possible, it might be interesting to see how size, age and sector of activity affect the returns to apprenticeships. In addition, for policy makers, it might be particularly important to have an idea of the returns for those “marginal” individuals whose participation in the apprenticeship is likely to be affected by a potential extension or reduction of the scheme.

- Non-wage returns to education, such as life and job satisfaction, are likely to be as important as or even more important than the wage returns.⁴ This suggests that, to the extent that data allow it, evaluations of the impact of apprenticeships on individuals should also consider outcomes other than earnings.

Active labour market programmes

Active labour market programmes (ALMP) that are most directly related to apprenticeships include publicly subsidised classroom or on-the-job training, and publicly subsidised private- or public-sector employment. Studies evaluating ALMP provide the following lessons for evaluating Modern Apprenticeships:

- The majority of evaluations find positive impacts of Active Labour Market Programmes, and the positive results are more common for programmes involving training or private-sector employment (WWCLEG, 2014; OECD, 2015; Card et al., 2015). This suggests that positive impact can also be expected from apprenticeships, which combine these two elements.
- The positive effects of skills-oriented interventions often materialise only in the medium term (WWCLEG, 2014; OECD, 2015). These findings emphasize the importance of looking not only at the short term impact of apprenticeships but also at their medium to long term effects.
- On-the-job training tends to be more effective than classroom-based training (WWCLEG, 2014; Card et al., 2015). An interesting implication for Modern Apprenticeships is that the impact of apprenticeships in different sectors and at different levels can differ based on the content of on-the-job and classroom-based training.
- Use of randomised control trials is relatively common among ALMP evaluations, and experimental and non-experimental ALMP evaluations lead, on average, to similar results (Greenberg et al., 2006; Card et al., 2015). The optimistic implication of these findings is that in contexts where the nature of the programme, financial constraints or other factors make randomised experiments not a viable option, non-experimental evaluations can still serve as an informative source of information on programme impact.

Private on-the-job training

Apprenticeships can also be seen as a special type of employer-sponsored on-the-job training.⁵ Evaluations of such training schemes offer the following implications for evaluation of Modern Apprenticeships:

- The primary outcome of interest for studies evaluating on-the-job training is productivity. Since productivity of individual workers is hard to measure, these studies either examine the effect of training on wages, assuming that wages are related to productivity, or they measure productivity at the firm level. These two approaches could represent viable options for estimating the productivity impacts of Modern Apprenticeships.⁶

- Most studies that estimate the effect of apprenticeships on wages of individuals find positive returns that are larger than typical returns to education. However, some studies using more advanced econometric techniques find smaller or even no effect of training on wages.⁷ The reason for this difference may be that more motivated or able individuals are more likely to be trained, and the studies using less robust methods mistakenly ascribe the positive influence of the trained individuals' characteristics to the impact of training. In contrast to some of the points mentioned above in relation to education and ALMP, simple OLS estimates may, therefore, be unreliable in the case of on-the-job training.
- Firm-level studies overwhelmingly find a positive effect of training on firm productivity and, somewhat less robustly, also on wages. Findings from three separate studies using comparable measures of training suggest that a 1-percentage-point increase in the share of workers trained over a one-year period corresponds to a 0.05%-0.32% increase in productivity and a 0.025%-0.17% increase in wages.⁸ This provides a general indication of the order of magnitude of improvements in firm-level productivity and wages that can be expected as a result of taking on apprentices. This indication should, however, be treated with caution. On one hand, the number of apprentices in a typical firm will usually be substantially smaller than the number of all employees receiving training. On the other hand, importantly, the training that an apprentice receives is more comprehensive than most other on-the-job training.
- Studies that examine the effect of training on both productivity and wages tend to find the effect on productivity about twice as large as the effect on wages.⁹ These studies could be relevant for a potential translation of wage effects of Modern Apprenticeships into productivity gains in different sectors.¹⁰ Caution is, nevertheless, needed when extrapolating results of these studies, focusing on on-the-job training, to apprenticeships. Apprentices represent a relatively small share of employees in most firms and they tend to occupy relatively junior jobs, whereas on-the-job training may cover large numbers of employees, including managers. If feasible, directly estimating the wage and productivity effects specifically for Modern Apprenticeships using Scottish firm-level data would be preferable.

4. IMPACT OF APPRENTICESHIPS ON INDIVIDUALS

The longer literature survey by Bajgar and Criscuolo (2016) reviews 29 studies that evaluate the impact of apprenticeships on individuals.¹¹ These studies are summarized in the Appendix. While the survey does not necessarily capture all existing apprenticeship evaluations, it covers all, or almost all, of the studies that employ more advanced identification strategies such as randomised control trials, natural experiments or instrumental variables. It should, therefore, provide a good overview of the results from current best practice in the literature. The following discussion provides an overview of how these studies have addressed several key decisions that need to be made in any apprenticeship evaluation and which are also at the heart of the evaluation framework for Modern Apprenticeships. These decisions are the choices of outcomes of interest, methodologies, counterfactuals and time horizon over which impacts are evaluated.

Outcomes

The two most common outcomes of interest in the reviewed studies are wages and the probability of employment. A number of studies also analyse the likelihood of obtaining permanent or formal employment and subsequent education. In addition, one study examines the probability of working in a non-routine occupation and two studies ask to what extent the skills gained from apprenticeships are transferable. If what is common in the literature is to be taken as guidance, this suggests the evaluation framework for Modern Apprenticeships should primarily focus on wages and the probability of being employed, and, as additional outcomes, it should also consider subsequent education and the likelihood of finding standard, as opposed to non-standard, employment.

Methodologies

The fundamental challenge in trying to identify the effect of apprenticeships is that the decision and the opportunity to undertake an apprenticeship are not random, and characteristics that make individuals more or less likely to do so can be correlated with the outcomes of interest. This can lead to a bias in “naive” estimates of the effect (such as OLS). The identification is further complicated by the fact that individuals typically do not have any work experience prior to undertaking an apprenticeship, and it is, therefore, usually not possible to control for time-invariant individual characteristics. The reviewed studies have taken a range of approaches to overcome these challenges.

Four studies are based on two different randomised controlled trials. A study of US apprentices by Schaeffer et al. (2014) analyses the impact of CRAFT – a 6-month employment programme in the construction sector – on a sample of 97 high-risk juvenile offenders. The remaining three studies explore the impact of a programme in Colombia which was targeted to poor urban youth and consisted of a 3-month classroom-based training followed by a 3-month apprenticeship in a company operating in a formal sector of the economy.¹² The four studies using RCTs provide rigorous and rich evidence on the impact of the evaluated programmes, but the generalisability of their findings is limited by the highly specific target population (Schaeffer et al., 2014) or by the developing-country focus (the studies on Colombia). Furthermore, in the Colombian programme, the work experience follows *after* the classroom-based training, which makes it different from typical apprenticeships where both components take place over the same period.

Other studies try to identify the causal impact of particular schemes through exogenous variation from natural experiments that include an educational reform (Malamud and Pop-Eleches, 2010), differences across Italian regions in terms of the maximum age at which people are eligible to participate in apprenticeships (Picchio and Staffolani, 2013) and firm closures as an instrument for apprenticeships duration (Clark 2000; Fersterer et al., 2008). The first two types of natural experiments are highly context specific and cannot be readily transferred to the Scottish context, and the potential use of firm closures as an instrument is complicated by the effort to place Modern Apprentices who are laid off with new employers. Furthermore, estimation based on similar natural experiments is sometimes challenging to use for evaluations repeated over time. However, if feasible, estimation based on a suitable natural experiment would be a valuable way of cross-validating impact estimates obtained through other methodologies.

A different avenue taken in the literature is to exploit differences in the ease of finding an apprenticeship. In particular, some of the existing studies rely on the assumption that individuals growing up in regions with higher number of apprenticeship vacancies or with a higher ratio of work-based rather than school-based training are more likely to enter an apprenticeship rather a vocational school.¹³ It would be worth exploring the feasibility of using a similar strategy as part of an evaluation framework for Modern Apprenticeships.

As pointed out earlier, it is usually not possible to control for unobserved individual characteristics, such as ability, motivation etc. because the work-related outcomes of interest, such as wages, are typically not observed before the apprenticeship. Three studies manage to undertake estimation for a sub-sample of individuals who worked prior to their apprenticeships, but this is either made possible by a relatively old target group (Reed et al., 2012),¹⁴ or at the cost of a dramatic reduction in sample size (Veum, 1995; Bibby et al., 2014).¹⁵ The feasibility of this approach in the case of Modern Apprenticeships depends on the number of Modern Apprentices with previous work experience. If sample size allows taking this route, it should be kept in mind that the impact of the apprenticeships on older workers with previous working experience may differ from the impact on apprentices starting their apprenticeships shortly after leaving school.

The remaining reviewed studies rely on including observable individual characteristics as controls in a regression framework.

Counterfactuals and control groups

A key question when evaluating apprenticeships is what their counterfactual should be, that is, to which alternative they should be compared. The possible counterfactuals include i) working without an apprenticeship; ii) undertaking another type of training; and iii) being unemployed or non-active. The choice of counterfactual is, in turn, closely related to the choice of the control group to which apprentices are compared. The specific nature of apprenticeships, which are a cross between formal education, training and work, means that it is not straightforward to determine what the counterfactual and the control group should be.

The reviewed studies vary widely in this respect. Most often, studies compare outcomes for former apprentices to outcomes for all individuals of working age who did not do (or complete) an apprenticeship.¹⁶ The advantage of using such a broad control group is that it potentially allows a comparison of apprenticeships to several different alternatives. By taking into account information on other qualifications completed by each individual, it allows apprenticeships to be compared both to working without training and to undertaking other types of training. However, the disadvantage of using such a broad group for comparison is that the group can include individuals who are very different from apprentices in their ability, motivation and other characteristics, and it may, therefore, lead to misleading estimates of the effects of apprenticeships.

A number of other studies compare apprentices specifically to individuals who, instead of doing an apprenticeship, obtained school-based vocational training, continued with general education or worked under other types of temporary contracts. The advantage of focusing on individuals in such more specific control groups is that they may be more similar to apprentices in their characteristics. However, comparing apprenticeships to, for instance, school-based vocational training provides only an estimate of the difference between the effects of the two types of training but not the full effect of doing an apprenticeship.

Finally, some studies compare apprenticeship completers to individuals whose apprenticeships ended prematurely. The control group based on non-completers has the advantage that it includes individuals who are likely to be, in many respects, similar to those who completed their apprenticeship. However, availability of detailed information on the reason for non-completion would substantially increase the reliability of estimates based on such analysis. A potential drawback of comparing apprenticeship completers to non-completers is that even non-completers are likely to benefit from participating in an apprenticeship. The difference between the two groups, thus, captures only the additional benefit of completion rather than the full effect of an apprenticeship. Reliable information on the share of apprenticeship done by the non-completers could help to partly overcome this drawback.

Overall, the wide range of counterfactuals used in the literature emphasizes the importance of clearly defining the alternative relative to which the impact of apprenticeships is evaluated. The evidence coming from comparing apprentices to the different control groups might provide different and complementary answers.

Time horizon

The reviewed studies vary greatly in terms of the time horizon they consider. On one side of the spectrum, a number of studies focus on the immediate transition from training to work or on the period shortly after training. Analysing the medium term, several other studies either measure outcomes up to 2 years after training or focus on outcomes for young people up to the age between 20 and 25. Finally, slightly less than half of all studies examine outcomes also in the long term. Among these, five studies explicitly analyse how the effects change with the time since training,¹⁷ while the other studies simply pool all working-age individuals together, implicitly assuming that the proportional effect of apprenticeships does not change during workers' careers. The time-horizon is strongly related to the evaluated outcome. While over three quarters of studies examining the effect on employment focus on the period of less than 5 years after training, the ratio is completely reversed for studies looking into wage effects.

The available evidence suggests that the time when the outcome is observed relative to the point at which training was realised can have a substantial effect on the impact estimates. For example, in the case of employment significant effects are often observed immediately after training, but they typically disappear within the first few years after training.¹⁸ For wages, on the contrary, the changes in apprenticeship effects may go in the opposite direction and materialise over a much longer time horizon.¹⁹ These findings strongly emphasize the need to measure outcomes also in the medium or long term, rather than only shortly after the end of training, when evaluating Modern Apprenticeships.

Summary of results of the impact of apprenticeships on individual outcomes

Several findings emerge from the combined results of the reviewed studies. See the full survey by Bajgar and Criscuolo (2016) for more details.

- The reviewed studies overwhelmingly find positive effects of apprenticeships. This is true for all outcome variables and for all counterfactuals except for the comparison to general education.
- Estimated annual wage returns from apprenticeships are somewhat lower, but comparable, to returns to schooling commonly found in the literature.
- Apprenticeships increase the probability of employment immediately after training, but this employment advantage fades away after a few years. This suggests that the positive employment effects are driven by apprentices who stay on with their employer after they complete the training.
- Evidence comparing apprenticeships in different industries is limited. Existing studies suggest large differences across industries, with manufacturing apprenticeships leading to better outcomes than other apprenticeships. This highlights the advantages of an evaluation framework that allows for comparing the outcomes of difference Modern Apprenticeship frameworks.

5. IMPACT OF APPRENTICESHIPS ON FIRMS

When examining the impact of apprentices on firms, it is important to distinguish between the short term effects during the period when an apprentice is in training and the long term impacts of taking on apprentices.

Several studies calculate the net costs imposed by apprenticeships during the training period. The effect of taking on an apprentice on immediate profitability depends on several factors. On one hand, employing an apprentice involves direct training costs and indirect costs related to apprentices spending only part of their time engaged in productive activities and initially having lower productivity than regular workers. On the other hand, employing apprentices is often cheaper thanks to lower mandated minimum wages than for other workers and thanks to government subsidies. Lerman (2014) provides an overview of studies that put numbers on these effects, mostly based on firm surveys. Their results suggest that the net costs of employing apprentices become smaller with time and, for many firms, turn into net profits either already during the apprenticeship or shortly after its end. These results highlight the fact that the relationship between employing an apprentice and firm profits or productivity crucially depends on the stage of the training, and any potential estimation of an impact of taking on Modern Apprentices on firms needs to take this into account.

In theory, the benefits to firms after the end of training could include better qualified and therefore more productive employees, lower hiring costs, saved firing costs due to longer tenure and the option value of having skilled workers that the firms can choose to keep or not to keep depending on market conditions. Most empirical evidence on long-term benefits to firms is based on effects self-reported by employers. The most commonly cited benefits include improvements in productivity, quality, staff morale, staff retention and public image. On the contrary, relatively few firms report that employing apprentices helped them to achieve a lower wage bill (e.g because of the lower minimum wage for apprentices, the lower wage paid during the apprenticeship training period etc.). These findings emerge from employer surveys in Scotland (SDS, 2015b) as well as, for example, in England (Department for Business, Innovation and Skills, 2013) and in the United States (Lerman et al., 2009).

The only direct firm-level evidence of a productivity enhancing effect of apprenticeships comes from Cappellari, Dell'Aringa, and Leonardi (2012). They analyse the impact of a reform legislated in Italy in 2003, which loosened regulations on apprenticeship contracts. Using random staggering of the roll-out of the policy across Italian regions and industries as a natural experiment, the authors find hiring apprentices instead of external workers to be related with an increase in firm productivity.

6. KEY LESSONS FOR EVALUATION OF MODERN APPRENTICESHIPS

A number of important lessons for evaluation of the Modern Apprenticeships in Scotland emerge from the literature review presented above:

- Given the numerous challenges related to evaluating apprenticeships, having a detailed ex ante evaluation strategy is of utmost importance. In addition, continued work at creating, maintaining and linking datasets is essential for evaluation, as shown by the policy relevance of the recent results based on linked administrative microdata in England.
- The effects of apprenticeships can change substantially with time passed since the end of the training period. It is, therefore, important to analyse not only the short-term effects of Modern Apprenticeships but also their medium- to long-term effects.
- To the extent that the choice of measured outcomes aims at reflecting the emphasis in existing literature on the impact of apprenticeships on individuals, an evaluation framework for Modern Apprenticeships should primarily focus on wages and the probability of being employed. As additional outcomes, it should also consider outcomes such as subsequent education and the likelihood of finding a standard, as opposed to non-standard, employment.
- To the extent that the choice of measured outcomes goes beyond the emphasis in the existing literature, the outcomes should include productivity. The impact on productivity can be either derived from the estimated impact on individual wages or directly estimated using firm-level data. The latter approach is preferable but challenging, as witnessed by the scarcity of existing studies estimating the impact of apprenticeships on firm productivity.
- Evaluations that take into account only observed individual characteristics may incorrectly ascribe the effect of unobserved characteristics, such as ability or motivation, to the effect of an apprenticeship. It is, therefore, important to also employ methods that try to control for unobserved individual characteristics, although such methods are subject to sometimes context-specific and are subject to data availability.
- It is important to clearly define the counterfactual relative to which Modern Apprentices are evaluated. The potential comparison groups include i) all individuals who do not do an apprenticeship; ii) more specific groups of individuals, such as individuals who obtain school-based vocational training instead of an apprenticeship; and iii) individuals who start an apprenticeship but do not complete it. The evidence coming from comparing apprentices to the different “control groups” might provide different and complementary answers.

APPENDIX

Table A.1. Studies evaluating the impact of apprenticeships on individuals

Authors	Country	Identification	Comparison	Wages	Employment	Other
Booth and Satchell (1994)	UK	competing risks model	non-achievers and those who started working at 16 without training (latter group as baseline)	x	increases probability of keeping the first job	X
Krueger and Pischke (1992)	Germany	OLS	other workers (unskilled as baseline)	total wage return 14% in East Germany and 19% in West Germany	x	X
Veum (1995)	US	DiD	other workers (unskilled as baseline)	total wage return 3% (not sign.) for men, 11% for women	x	X
Clark (2000)	Germany	OLS; OLS on sample changing firms for exogenous reasons	other workers w/o higher degree (unskilled as baseline); other apprentices	total wage return 15%	x	no wage effect of firm change if within 1-digit occupation, 15% wage drop if outside 1-digit occupation
Franz et al. (1997)	Germany	grouped hazard rate model	school-based vocational training	x	decreases non-emp. spell duration after training	X
Dolton, Makepeace, and Gannon (2001)	UK	OLS, IV (career plan variables, age, type of school attended at 16), probit	other workers (unskilled as baseline)	total wage return 9% for men, -4% (not sign.) for women	no effect on probability of unemp. for men	X
Bonnal, Mendes, and Sofer (2002)	France	simultaneous maximum likelihood	school-based vocational training	x	increases probability of emp. immediately after training (mostly through stayers), but increases unemp. duration if do not have job immediately	x
Fersterer and Winter-Ebmer (2003)	Austria	OLS	other workers (unskilled as baseline)	total wage return 14-16%	x	x
Cooke (2003)	Germany	OLS	other workers w/o higher degree (unskilled as baseline)	increase in initial wage 3-12% (not sign.); increase in wage change over 13 years 129 p.p.	x	x

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Authors	Country	Identification	Comparison	Wages	Employment	Other
McIntosh (2005)	UK	OLS	other workers (unskilled as baseline)	total wage return 5-7% for males, 0% for females	x	x
Adda et al. (2006)	Germany	IV (number of apprenticeship vacancies)	school-based vocational training	total wage return 10% after 5 years and 25% after 20 years for men	x	x
Neumark and Rothstein (2006)	US	OLS	other youth not in high school (not participating in school-to-career programmes as baseline)	x	increases probability of emp. by 13 p.p. for men, no effect for women	no effect on college attendance for men, increases probability of attending college by 10 p.p. for women
Fersterer, Pischke, and Winter-Ebmer (2008)	Austria	natural experiment (firm failures as instruments for apprenticeship duration)	apprenticeship cut short due to firm closure	annual wage return 2-4%, selection not important	x	x
Parey (2008)	Germany	IV (number of apprenticeship vacancies)	school-based vocational training	annual wage return 3% (not sign. with IV) for men	initially reduces probability of unemp. by 15 p.p. per year of training, fades out over time	x
Malamud and Pop-Eleches (2010)	Romania	natural experiment (1973 reform)	general education	no causal difference; higher wages with general education driven by selection	no causal difference; higher probability of emp. with general education driven by selection	x
Boothby and Drewes (2010)	Canada	OLS	other workers (unskilled as baseline)	total wage return 22% for men and -4% for women	x	x
Attanasio, Kugler, and Meghir (2011)	Colombia	RCT	non-participants among pre-selected candidates	increases earnings by 5% (not sign.) for men and by 20% for women; increases formal earnings by 23% for men and by 33% for women	no effect on probability of emp. for men, increases probability of emp. by 7 p.p. for women	increases probability of formal emp. by 5 p.p. for men and by 7 p.p. for women (after one year)
Støren (2011)	Norway	multinomial logit	other youth not proceeding to higher education	x	increases probability of emp.	x
Alet and Bonnal (2011)	France	IV (number of apprenticeship vacancies)	school-based vocational training	x	x	increases probability of completing high school diploma and of staying in education; selection effects important
Göggel and Zwick (2012)	Germany	OLS	other apprentices	x	x	effect of employer or occupation change positive for industrial occupations but negative for construction, commerce and crafts

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Authors	Country	Identification	Comparison	Wages	Employment	Other
Reed et al. (2012)	US	OLS controlling for initial earnings; propensity-score matching	non-participants; non-achievers	participation increases earnings by about 50% compared to non-participants and completion by about 80% compared to non-completers after 6 years; effects slightly smaller after 9 years	participation increases probability of emp. by 9 p.p. compared to non-participants and completion by 15-16 p.p. compared to non-completers	x
Horn (2013)	Hungary	multinomial logit	school-based vocational training	x	increases probability of emp. by 10-15 p.p.	x
Picchio and Staffolani (2013)	Italy	RDD based on regional age cut-offs in eligibility	workers with other types of temporary contracts	x	x	increases propensity to get permanent contract after 2 years
Bibby et al. (2014)	UK	OLS; DiD with matching for other qualifications	non-achievers	total wage returns 11% for level 2 and 16% for level 3	initially increases probability of emp. by 3 p.p., fades out over time	x
Schaeffer et al. (2014)	US	RCT	control (attending standard public schools)	no effect on wages	increases probability of emp. by 26 p.p. and probability of emp. in construction by 27 p.p.	increases enrolment in General Equivalency Diploma by 24 p.p.; no effect on high-school graduation rate
Noelke and Horn (2014)	Hungary	DiD	school-based vocational training	x	10% increase in ratio of school- to employer-provided places corresponds to initial decrease in unemp. by 3 p.p., fades out over time	no effect on probability of working in non-routine occupation
Riphahn and Zibrowius (2015)	Germany	OLS, IV (father has vocation education; conflict with father at age 15)	other workers w/o higher degree and not from abitur track (unskilled as baseline)	total wage return 11%	increases probability of emp. by 5 p.p.	increases probability of permanent emp. by 24 p.p.
Kugler et al. (2015)	Colombia	RCT	non-participants among pre-selected candidates	total wage return 6% if formally employed	x	increases probability of formal emp. by 5 p.p. and days in formal emp. by 13%; increases probability of completing secondary school by 1.4 p.p., probability of enrolling college by 3.5 p.p. and probability of staying in college after 5 years by 1.6 p.p.
Attanasio et al. (2015)	Colombia	RCT	non-participants among pre-selected candidates	x	x	increases probability of formal emp. by 4 p.p.

NOTES

¹ An exception is represented by certain training providers who undertake the recruiting on behalf of employers.

² Such studies usually use an Instrumental Variable estimation method based on the use of variables that are correlated with education but are unlikely to have an independent effect on earnings, such as the month into which an individual was born (Angrist and Krueger, 1991), incentive to enrol school to avoid military service (Angrist and Krueger, 1992) or changes in minimum school-leaving age (Harmon and Walker, 1995).

³ See Ashenfelter et al. (1999); D. Card (1999) and Harmon et al. (2003).

⁴ Other outcomes that have been found to be related to education include employment, happiness, working in occupations providing strong sense of achievement, health, and absence of negative outcomes such as crime and teenage pregnancy (Oreopoulos and Salvanes, 2011).

⁵ Private on-the-job training, as discussed in this subsection, is sometimes subsidised by governments through grants or tax incentives, but, unlike public training schemes, it is organised and at least partly financed by the employer.

⁶ The number of apprentices in each firm tends to be substantially lower than the number of employees receiving training. This can make precise estimation of the firm-level effects of apprenticeships more challenging than in the case of on-the-job training.

⁷ See Leuven and Oosterbeek (2004), Leuven and Oosterbeek (2008), Görlitz (2011), Schwerdt et al. (2012) and Kaplan et al. (2015).

⁸ Conti (2005); Dearden, Reed, and Van Reenen (2006) and Konings and Vanormelingen (2014).

⁹ See Dearden et al. (2006); Ballot et al. (2006) and Konings and Vanormelingen (2014). Konings and Vanormelingen (2014) analyse separately manufacturing and non-manufacturing firms and find the difference between productivity and wage premia to be larger in the non-manufacturing sector.

¹⁰ Estimating the net present value of further education qualifications in England, Department for Business, Innovation and Skills (2015) use the baseline results of Dearden et al. (2006) as a basis for assuming that the additional value added generated by training is twice as large as the estimated wage premia. However, there have been concerns as to whether the interpretation of Dearden et al.'s (2006) results implied by this approach is correct.

¹¹ These studies were identified through online search, a review by WWCLEG (2015) and references in and citations of the already identified studies. Eight of the studies focus on Germany, four studies come from each of the United Kingdom and the US, two from each of Austria, France and Hungary and one from Canada, Italy Norway and Romania. Three studies on Colombia are also included because they evaluate both short-term and long-term effect of apprenticeships using a randomised control trial and, thus, provide some of the richest evidence on the effectiveness of apprenticeships currently available.

12 See Attanasio et al. (2011, 2015).

13 See Adda et al. (2006); Parey (2008); Alet and Bonnal (2011) and Noelke and Horn (2014).

14 Participants in Registered Apprenticeships, evaluated by Reed et al. (2012), are, on average, approximately 31-year-old, while only a fifth of Modern Apprentices started their training aged 25 or more in 2014/2015 (SDS, 2015a).

15 Bibby et al. (2014) produce estimates of the impact of further education qualifications controlling for individual fixed effects, but they do not do so in the part of their study where they analyse apprenticeships. Although the reason is likely to be related to sample size, it is not clear whether this is indeed the case.

16 Some studies exclude individuals who have continued to higher education or had taken the more academic track at high school and some studies specifically focus on young people who just left school.

17 See Cooke (2003); Adda et al. (2006); Bibby et al. (2014); Kugler et al. (2015) and Attanasio et al. (2015).

18 See Bonnal, Mendes, and Sofer (2002); Parey (2008); Bibby et al. (2014); Noelke and Horn (2014).

19 The studies of Germany by (Cooke (2003) and Adda et al. (2006), looking respectively at the periods of up to 13 and 20 years after training, suggest that the apprenticeship premia can increase dramatically over time. Bibby et al. (2014) do not find an increase in apprenticeships wage premia over time, but they only estimate the premia up to 5 years after training.

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