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The Economic Implications of Training for Firm Performance¹

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Abstract: This paper surveys the emerging economics literature on the relationship between employee training and firm performance. Most studies find very high returns to training, at least from the perspective of firms, indicating that the costs of training can be recouped in short periods of time. These results follow from different identification approaches, including randomised control trials. The training provided is typically of a general nature, which is consistent with employers' labour market power. Several areas for future research are also proposed, including the role of labour market institutions in promoting training and the extent to which the productivity effects of training are shared with employees.

Keywords: Productivity; Skills; Competences; Human Capital; Lifelong Learning; Employment; Public Policy; Programme Evaluation

JEL Codes: M53, I26, J24

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Extended Summary

A small literature on the relationship between employee training and firm performance is currently emerging. This line of research is particularly promising, given the underexplored potential of training in driving productivity and thus wages and employment. Until recently, training was regarded as a potentially very costly and certainly very risky investment as workers may leave their firm after gaining those skills. However, all studies available in labour and education economics find very high returns to training, at least from the perspective of firms, implying that the costs of training are recouped in a relatively short period of time. These results follow from different identification approaches, including a small but growing number of randomised control trials. Most training provided is of a general nature (applicable in other firms), which is at odds with the original theory of training but consistent with novel models that emphasise labour market power. There are a number of possibilities for future research, including a better understanding of the heterogeneity and patterns of training contents and formats across firms and workers, an understanding of the differentiation of the effects of training along such dimensions, the role(s) of labour market competition in driving training, the extent to which the productivity effects of training are shared with employees, the role of labour market institutions (including minimum wages, collective bargaining, and occupational licensing), and the firm performance effects of training provided to unemployed jobseekers (as opposed to employees). Further evaluation of the multiple public programmes around training following the pandemic crisis and new forms of training in the context of the growth of remote work may also be promising areas for research.

Literature background

Firms' investments in their workforce through training can potentially be an important pathway towards increased worker productivity and business performance. To that extent, employee training can be a relevant driver of living standards and merit further research, with considerable business and public policy potential.

While academic and vocational schooling can add considerably to economic productivity, there may remain significant human capital gaps with respect to firm's particular labour needs. Such gaps will be even stronger if the education system and the labour market are not closely linked. In any case, these gaps can only be filled through training or, alternatively and typically more gradually, through on-the-job learning. If not, the resulting labour supply/labour demand mismatches will hurt employment, productivity and working conditions. Moreover, even if the education system and the labour market are closely in tune, as technology evolves and product markets change, employees will still require additional skills and competences. Again, the latter can only be provided satisfactorily through training. On the other hand, training activities in firms do not necessarily always deliver the expected positive results, given the multiple practical challenges that they face.

This essay presents key questions and findings from the small but growing economics literature that studies the link between training and firm performance. The essay also argues that there is a significant need for further research about training. Such need follows from the large gap between the potential private and social relevance of training, on the one hand, and the research available so far, on the other hand. For instance, while schooling may be a more important subject of research in absolute terms, the existing research on training appears to be far smaller in relative terms. While around one quarter of a person's lifetime human capital is accumulated

from on-the-job training (Heckman et al 1998), much less than one quarter of the existing economics research on human capital is concerned with training.

Training is in some ways more heterogeneous than schooling. The contents, duration, delivery methods, and target groups (firms and workers) of training activities can be far more differentiated than in the case of schooling. Training can focus on general or specific skills (more on this distinction below). Training can be formal or informal (or even non-formal) but the literature examined here considers only its formal component. The training market is also typically far more flexible than schooling, leading to a wider range of supply and quality types and possibly greater responsiveness to employer/customer needs by external providers. Large firms often have their own in-house training provision. Employees can receive training of only a few hours in total during a year (or even, possibly in most cases, not training at all) – but can also have training lasting several weeks or more. Training can take place during work hours or outside that period; it can take place at the workplace, in classrooms in training centres or in other locations (e.g., team building exercises).

Understanding the relationship between training and firm performance is also a necessary first step before other research questions can be posed. Examples of complementary questions include the relationship between training and wages and the scope for public funding of training activities. If training does not significantly improve firm performance, it would be surprising to find a true wage effect, and the case for public funding would also be seriously weakened. The essay also discusses some of these related questions and other topics that merit further research. At the same time, the essay is focused exclusively on employee training – the related areas of apprenticeships (and other VET programmes) and the training of the unemployed (involving public employment services) are not covered here, despite their potential relevance as complementary drivers of firm performance.

- ***What Are The Key Questions/Problems that Have Motivated Research? What are The Main Themes?***

a) Are Training Levels Too Low?

A key motivation behind the evaluation of the impact of employee training on firm performance in economics is the concern that training levels may be too low. This is the case not only from a social perspective but possibly also from a private perspective (namely regarding the firms that train or not their workers). Incidentally, these aspects have been discussed from a theoretical perspective but have received little or no direct empirical analysis.

First, from a private perspective, firms may be subject to liquidity and credit constraints that prevent them from investing in training, even when training would deliver positive returns. After all, training can be costly as it may require trainers, facilities, equipment, on top of the time of the participants (indirect costs, except in hourly wage jobs). It will be the comparison of the marginal benefits and costs of training that will dictate its optimal level. Incidentally, training may be subject to significant fixed costs and economies of scale, which will make it costly for small firms. In general, the direct and indirect costs of training as well as their benefits can vary considerably across and even within firms over time. For instance, some firms may conduct training during periods of low product demand, in which the indirect (opportunity) costs of training may be particularly low. Shocks in the training market may lead to variation in the cost of training and its levels.

Firms may also be unaware of the potential likely contributions of training, perhaps because they assume that the human capital of their workers is not malleable enough. In addition,

training may simply not feature highly enough in the management practices of the industry or region where the firm is located – training may simply be something that “isn’t worth it”, in the same way that a new technology is not yet widely applied because only few firms know about it. These arguments dovetail with evidence of large shares of firms that are relatively poorly managed, particularly but not only in developing countries.

Turning to the social optimality of training, firms may be rightly concerned that such investments are particularly risky. For instance, some of their workers that receive training may subsequently leave the firm, thus wasting the resources invested in them. Even worse, such worker turnover may possibly lead to negative performance effects if those workers join a competitor firm. This situation illustrates a clear mismatch between the private and social perspectives in training decisions: the economy may benefit from training investments even if the individual firms that implement such training do not. These ‘poaching externalities’ introduce a possibly large wedge between private and social returns to training that may lead to suboptimal low levels of training, and which may require government intervention in the training market.

While the relevance of externalities is well understood and largely addressed by public policy in the case of schooling, the involvement of government in the provision of training is much more limited than in the case of schooling. Governments and taxpayers play a substantial role in the provision or even production of schooling, from kindergartens to universities, but this is certainly not the case in training activities. Government intervention in the training market tends to be directed exclusively towards unemployed jobseekers through the activities of public employment services. Such training serves the purpose of updating and upgrading the skills of jobseekers so to make them more employable; in addition, this type of training may also serve

an ‘activation’ role, addressing potential moral hazard problems following from unemployment benefits. Government intervention in employee training can theoretically lead to significant deadweight losses (from supporting training that would take place even without public funding) and qualitative mismatches (when government procures training but has limited information about firms’ needs).

b) How do Economists Think about Training Provision?

The training literature has been framed until recently by a sharp distinction between general and firm-specific training, as originally proposed by Gary Becker. General training refers to skills provided by a firm but that are also valuable in other firms. Examples may include an MBA degree, non-cognitive skills (e.g., improved communication or leadership skills, better understanding of customers’ needs), learning a foreign language, or improved literacy or numeracy competences. In contrast, firm-specific training is valuable exclusively in the firm that provides it. This may involve a better knowledge of a specific software package customised for that firm, operating a particular production line in a factory managed by the firm, or greater understanding of the values and goals of the firm.

While these two groups of examples may fit adequately into each category, it is important to note that many other types of training may not, as they will include both general and firm-specific dimensions. For instance, some (or even most) software tools may be used in multiple firms, in the same or even different industries; training for a particular production line may also increase a worker’s productivity in the production lines of other firms in the same industry. These examples raise practical questions as to the suitability of these two main training

categories. Indeed, it is very hard to think of an example of firm-specific training that does not confer some learning that can be useful in other firms.

An advantage of the specific/general approach is the clarity of its predictions regarding the funding of each type of training. Specifically, it predicts that general training is paid by the worker. If, in contrast, general training were paid by the firm, then the worker could leave to receive a higher salary in another firm after gaining the additional skills. (By training being paid by the firm, it is meant that the worker does not pay her share of the direct training costs nor any indirect costs, i.e., training is conducted during normal work hours or, if not, the worker is paid for the additional time she spends when receiving the training). Such higher salary would follow from the worker's higher productivity in a different firm after receiving such general training, without facing the cost of its training.

In contrast, this approach predicts that firm-specific training would be paid by the firm, which recovers its investment through the increased productivity of the worker. As the outside productivity of the worker is not affected by firm-specific investment, such increased productivity would not be matched by increased wages in other firms. However, worker turnover could lead to cases in which the investment would not be recovered. At the same time, the firm could be willing to match some job offers that workers receive, to the extent that the higher wage would still be below the new productivity of the worker. In the latter case, wages would increase following the provision of firm-specific training. Incidentally, if turnover can be reduced through higher wages, then firms that want to invest in training may also raise their wage levels as the opportunity cost of turnover increases.

In conclusion, this benchmark approach predicts that firms would invest optimally in firm-specific training, as they would consider both its full benefits and full costs. However, exceptions to this would arise in the cases of credit constraints or poor management practices. Moreover, the private and social optimal levels of firm-specific training would coincide as there are no benefits from firm-specific training outside the firm. Similarly, while firms would not invest at all in general training, workers would again consider both its benefits (in terms of higher wages in the same or in a different firm) and costs, leading to both privately and socially optimal levels. On the other hand, credit constraints that prevent individuals from paying the direct and indirect costs of training (and uncertainty about their returns) could be more pressing factors in the case of individuals' decision-making. This would lead to *de facto* suboptimal levels of general training.

It should also be noted that this competitive model of training has been challenged on multiple occasions, as we see in more detail below. An early and important example is Autor (2001), which finds that most temporary work agencies in the US offer free general computer skills training to their workers, unlike the predictions discussed in the paragraphs above. Autor (2001) argues that this arises from asymmetric information and serves the dual purposes of inducing self-selection and screening ability (attracting and assigning workers with adequate profiles). This result thus indicates that there may be positive levels of general training for which the firm can reap the full private benefits because of information asymmetries. Moreover, employment law can also require firms to provide a minimum amount of training to each one of their workers (at least five days of training per worker per year, in the cases of Belgium and Portugal).

c) *What is the Role of Labour Market Competition?*

The implications of the general/specific approach above have been challenged by the view that labour markets are generally not always competitive. Moreover, the resulting positive levels of employer market power introduce a degree of firm specificity into otherwise general training. Such employer market power and the resulting discretion in wage rates can follow from the compression of wage distributions (perhaps because of collective bargaining or a different labour market institution) or the lack of alternative employers within a given local labour market (Salop and Salop, 1976). These cases restrict the ability of the worker to translate its increased general training into higher wages in other firms, making *de jure* general training become *de facto* firm-specific training (Acemoglu & Pischke, 1999). This implies that firms may find it worthwhile to invest in their workers' general training, unlike in the benchmark competitive case described above.

From the perspective of the discussion on the optimal provision of training above, diminished labour market competition can increase (general) training, reducing or even eliminating the inefficiency that would otherwise apply, namely if workers are credit constrained. Another perspective is that reduced competition makes it easier for new or deviating firms to hire workers with the skills required, making training less necessary (Blatter et al, 2016). In any case, it is unclear if workers are better off in this case: the gains from increased levels of training in this context (namely higher wages, assuming some sharing of the resulting productivity surpluses) would need to compensate the wage losses from fewer labour market alternatives.

- ***What are the Connections between this Research Agenda and Others, in Economics or Other Disciplines?***

While training and productivity is a research agenda firmly set in labour and education economics, it also connects with different areas of economics and other disciplines. In the first case, training could also feature heavily in the related area of personnel economics. While personnel economics has been focused on different aspects concerning the internal labour markets of firms - recruitment, separations, promotions, wage levels and growth, etc -, training is so far relatively absent from this literature (Lazear, 2009, is one exception). However, training can be an important part of all the dimensions above. For instance, wage dispersion across workers can be closely related to the provision of training. The relationship between training and separations could also be very important from the perspective of understanding if worker turnover may indeed be a significant deterrent of training provision.

In a similar vein, human resource management can also profit from economic studies on the relationship between employee training and firm performance, including the evidence on its effects and different empirical approaches towards its measurement. Conversely, the economics literature on this subject may learn from the management issues that arise in the provision of training in firms, including assessments of needs, development of contents and implementation of training programmes. There are currently few bridges between labour economics and human resource management in the context of training, despite their contrasting approaches. For instance, while economics is mostly concerned about ‘poaching’ following training, management highlights the potential positive retention effects from training. Personnel economics may be best positioned to develop these connections between the two disciplines.

The field of industrial relations is also connected to the research theme of this essay. For instance, social partners (employers' and workers' representatives) tend to be greatly interested in training, given its potential in driving firm performance and better working conditions (Martins 2019). Most collective agreements are thought to include training provisions, of different levels of ambition, depending on the characteristics of the firms and sectors involved. These provisions may include the requirement that participating firms provide a given minimum number of hours of training per year to all or most of their workers. Training can also be required before some types of dismissal can be concluded. An understanding of these dimensions can potentially pay off in other approaches. For instance, the variation in training provisions in collective agreements may be useful in the econometric analysis of the effects of training on productivity or wages.

Another management and economics area in which training is very relevant is that of entrepreneurship. For instance, in the context of developing economies, training entrepreneurs by providing them with more advanced business skills may accelerate productivity growth. For instance, McKenzie & Puerto (2021) finds evidence of such effects in the context of a randomised control trial in Kenya. Moreover, these positive outcomes do not appear to drive negative impacts on similar entrepreneurs that do not receive such training – in other words, the positive effects of training programmes lead to overall market growth and not merely market 'stealing'. See also Camuffo et al (2020), Fairlie et al (2015) and Lyons and Zhang (2017).

A related perspective, in a different branch of labour economics, is that of active labour market programmes (ALMPs), which support jobseekers in their search of new jobs. Training is an

important dimension of such ALMPs, together with counselling, monitoring, hiring incentives, workfare, and other programmes. So far, the evaluation of such ALMPs, and training in particular, has been focused on its effects on individual participants, namely their probabilities of being employed following their involvement in each programme. In the context of the research discussed in this article, another promising avenue for research would involve the analysis of the effects of ALMP training upon the performance of the firms that hire these individuals.

A final connection may involve the field of the economics of innovation. Training is an important form of intangible investment (Haskel & Westlake, 2018), together with research and development, software, design, market research, new business processes, etc. Its measurement can thus affect the estimates of overall investment and productivity from a macroeconomic perspective. Training can also foster innovation in firms, in both its product and process dimensions (Dostie, 2018).

- ***What are the Various Types of /Methods that have been Used?***

The empirical study of the impact of training on firm performance should ideally be based on randomised control trials, the gold standard of policy and programme evaluation (Imbens and Rubin, 2015). This approach entails that a randomly selected group of firms (workers) is assigned to participate in training while the remaining firms (workers) do not (or only participate at a later stage, following the first part of the evaluation). By comparing the job performance of the two groups, researchers could rigorously estimate the effect of training from the perspective of the firm.

This approach addresses the non-random selection of training participants that is likely to apply in the case of observational studies. Firms can be expected to direct their training investments towards a particular group of their workers, who may have different job performance trajectories compared to their colleagues even in the absence of training (and similarly in the case of comparisons across firms) that are difficult to capture with observable characteristics. For instance, these workers may be recently hired, whose job performance may increase considerably in any case, even without training, in their first months with the firm. Moreover, if all new hires are trained, there will not be a good comparison group to estimate the effects of training. Alternatively, workers selected for training may be older individuals moving to new occupations, and possibly exhibiting low performance levels, or high-flyers that may require training support in new technologies but that again would do very well even in the absence of training. These examples illustrate the potential heterogeneity of the selection of training participants across firms (and time periods) and the likely biases, of different signs and magnitudes, that may be present in studies that are not based on randomised control trials or suitable quasi-experimental approaches. Moreover, external validity concerns can apply even in randomised control trials. The results obtained on a subset of workers that received training may not translate to a different subset of workers within the same firms or to similar subsets of workers in different firms.

We know of four studies that evaluate firm performance effects of employee training using randomised control trials, two of which are peer reviewed. Most focus on employee performance, which is a very good indicator of firm performance (even if possibly biased downward compared to the latter, in the case of positive productivity externalities within the firm – two of the studies below also consider this channel).

The first study, De Grip & Sauermann (2012), examines the impact of a one-week training course provided in 2009 to experienced call centre operators in a multinational firm in the Netherlands. The study compares the performance of a treatment group composed of 28 individuals against a control group of 35 individuals. The findings indicate a 10% increase in the average performance of trained workers, over a period of two months following the training, when compared to the control group. It is interesting to note that the contents of the training, around improvements in conversation techniques, were occupation-specific (call-centre operators) but easily applicable in different firms. This motivated the selection of workers that had already spent a number of years with the firm, as these were regarded to be less likely to leave to another firm. In any case, while the training was not certified, the additional skills gained could presumably be inferred from interviews with a different firm and facilitate a job offer with possibly better terms.

The second study, Lyons (2020), involves app-based training provided in 2015 to insurance mediators in a firm based in Kenya. In contrast to the case above in which firms paid for both the direct and indirect costs of training, here workers spent their own time gaining largely firm-specific skills from the app (while the firm covered the direct training costs related to the development of the app). This sharing of the training costs may reflect the different bargaining power of firms in developing countries, which have a limited number of formal jobs (even jobs of a temporary nature, as the ones examined here). As in the previous study, here the RCT effects also indicate very large increases in worker performance following the provision of training. Comparing a treatment group of 223 agents against a control group of 73 agents, sales increase by up to nine times. Interestingly, the results also highlight significant heterogeneity in the effects as they come mostly from the most experienced individuals. The findings may be

related to the salesperson nature of the jobs and the large percentage of (mostly unexperienced) workers that do not achieve any sales over the reference period.

There are two additional RCT studies, currently in working paper format, that also deserve attention. Both papers consider multiple establishments of individual firms based in developing or emerging economies (India and Chile) and training based on soft skills (of a general, not firm-specific, nature). The first study, Adhvaryu, Kala and Nyshadham (2019) finds a 20% increase in productivity of the treated workers (operators in garment production lines) but very small wage increases. When also considering the cost of the training intervention (up to two hours of training per week for one year, only one hour of which was paid by the firm), the authors a very large net return for the firm from the training, in excess of 250%.

The second study, Prada, Rucci and Urzúa (2019), considers the case of large retailer and training provided to managers and sales associates with a total duration of between two and five days. Again, the results indicate large positive effects of training on multiple indicators of individual and establishment (store) performance. The positive effects across all periods following treatment even in high-frequency (e.g., weekly) data indicates that training has little if any ‘lock-in’ effects. This is in contrast to the case of training provided to the unemployed by public employment services, typically of a much longer duration, which can hurt their job search and affect negatively the jobseekers’ transitions to employment.

Following the ‘gold standard’ above of RCTs, a second stream of research is based on quasi-experiments, in this case difference-in-differences methods (we do not know of studies that draw on other methods, such as instrumental variables or regression discontinuity). Here, firms in the treatment and control groups are not necessarily statistically identical (as is the case

under randomisation). However, if their differences can be argued to be stable before training, then any emerging difference between the two groups after the intervention can be interpreted as effects from training.

In an early contribution in this approach, Holzer, Block, Cheatham and Knott (1993) compare firms that successfully applied to a training grant provided in Michigan against those that saw their applications rejected. The results indicate that the first group of firms increases their amount of training and also their product quality compare to the second group of firms.

More recently, Martins (2021) conducts a similar analysis based on training grants provided in Portugal. Again, the results indicate positive effects on take up (training hours and training expenditure), with limited deadweight. (This result is in contrast to the analysis of a similar programme in the UK – Abramovsky, Battistin, Fitzsimons, Goodman and Simpson (2011)). Drawing on richer data, the analysis in Martins (2021) also indicates that the additional training led to increased sales, value added, employment, productivity, and exports in the firms that received these grants. These effects tend to be of at least 5% and, in some cases, as high as 10%.

A third and more popular stream of research involves the consideration of extended sets of control variables to compute counterfactuals. One such control variable is the firm fixed effect, allowing one to compare the performance of each given firm over time, namely when the firm invests different financial amounts in the training of its workforce. It is important to note that, given the potential selection effects mentioned above, both within and across firms, this approach is likely to deliver weaker results from the perspective of internal validity. On the other hand, the empirical analysis conducted under this stream typically draws on much larger data sets, sometimes covering most firms in a country over several years. This can provide

much stronger external validity than in the cases of studies based on (potentially unrepresentative) single firms and a (potentially selected) subset of their workers, as was the case under the first stream. Even the second stream (based on wider and in some cases fairly large samples of applicant firms) may offer less external validity than the third stream because the former are based on a subset of firms that are likely to benefit more from training than a typical firm as the former set of firms deliberately seek support for their training activities.

Two key studies under this third stream are Almeida and Carneiro (2009) and Konings and Vanormelingen (2015). The first case draws on a five-year (1995-99) panel of 1,500 Portuguese manufacturing firms with at least 100 workers, including information on training hours and costs. Interestingly, their data indicates that almost half of these firm-years report no training at all, a percentage that may increase when considering small firms and those in the services sector. Under their central value for the depreciation of human capital, Almeida and Carneiro (2009) estimate a marginal return to training (from an additional training hour for all employees of a firm) of 8.6% when considering only firms that already provide training. This result, comparable or even higher than the returns to investment in schooling or physical capital, is further evidence of the significant potential role of training towards firm performance.

However, this marginal return drops to -0.3% when considering all firms, including the many that do not provide training at all. This much lower and even negative return highlights the heterogeneity of firms, and the potential limitations in extrapolating from the existing research towards large scale programmes, in line with the external validity point above. Interestingly, Almeida and Carneiro (2009) also estimate that direct training costs in their sample account for around 75% of total training costs. This result implies that it may not be possible to infer the

return to training from its coefficient in a productivity or wage equation, in contrast to the case of schooling (when its direct costs can be assumed to be relatively negligible).

The second article, Konings and Vanormelingen (2015), one of the most cited in this literature, studies the effects of training on a sample comprising over 130,000 Belgian firms followed during the 1997-2006 period. Their data includes training hours, the number of employees that receive training, and training costs. Their key finding is that training increases both productivity and wages but more so in the first case. This ranking of effects is consistent with some degree of employer-employee surplus sharing in firm-specific training. More specifically, ‘effective labor input [labour augmented by training] increases by 1.7% to 3.2% in response to an increase of 10 percentage points in the fraction of workers who receive training, while the average wage increases by only 1% to 1.7%.’ From a different perspective, their results indicate that, ‘on average, the marginal product of a trained worker is around 32% higher’ than that of an untrained worker. Of course, as both papers examine firm-level only (not matched employer-employee data), part of their findings can be driven by composition effects, namely the hiring of lower-productivity workers in firms that increase training activities.

While not yet sufficiently large to be regarded as a ‘stream’, one should also mention the promising causal machine learning approach, as in the recent study by Cockx, Lechner, and Bollens (2020) of (jobseekers) training. Another dimension of research, not considered here, but of relevance in particular in the context of the third stream above, concerns the different approaches towards the estimation of firm performance, from labour productivity to more complex methods, considering in different ways the range of complementary inputs used by the firm.

- *What Significant Questions Remain, are being or should be Addressed by Researchers?*

Research on training and firm performance is still in its early stages. Perhaps this is commensurate with the practice of training itself across many firms. In any case, this area of research is clearly of great potential. Moreover, studies on these themes may also exhibit considerable research impact perspectives: new research that can have greater external validity – and ideally internal validity that as close as possible to new stream of randomised control trials – may influence new policies and business practices in these areas, leading to increased levels of productivity and pay. Future research may also scrutinise the conditions and formulations under which training is more effective, which can support better targeted public policy and more informed decision-making by firms. Some additional guidance on the multiple avenues ahead can be inferred from the growth of economics of education studies around schooling and schools.

Perhaps even before the above, further descriptive studies that explain the heterogeneity of training across firms can also be very useful. How much training is typically provided by firms of different types to their workers? What percentage of working time is spent receiving (formal) training by different types of workers? What types of training are offered and to which workers, along training's main dimensions: firm-specific vs general, internal or external provider (including public employment services), working hours or after work delivery, etc. New population-level data sets are increasingly more available to research, some of which include accounting variables that may proxy training quantity and quality relatively well.

A third dimension concerns the role of labour market competitiveness. While this aspect is critical from a theoretical perspective, it has not been examined empirically. Future studies may follow the recent developments in the study of the effects of employer market power on wages (and on the interaction effects of minimum wages on employment), considering as well its effects on training. A related aspect concerns labour market segmentation (around fixed-term contracts and other forms of non-standard work) and its possibly negative effects on training. Employee representatives (trade unions and worker councils) may counteract some of forces above in pushing for higher training levels (Martins 2019) – while employers’ associations may prompt lower levels of poaching and thus increase incentives for training.

Another area which, to our knowledge, has not been covered at all is the impact of the training of unemployed jobseekers on firm performance, in the context of active labour market programmes (ALMPs). In some cases, this training is conducted under partnerships between Public Employment Services and employers’ and business associations in order to increase the labour market relevance of the training contents. Excluding the case of apprenticeships, training from ALMPs has been evaluated from the perspective of the employment (and wages) outcomes of jobseeker participants – but not from the perspective of the firms that eventually employ them. While this approach may be demanding (possibly requiring a comparison of the outcomes of firms that recruit ALMP workers against the firms that do not), its findings will fill an important, sometimes unrecognised gap in the literature. Of course, the subject of the training of unemployed jobseekers is close to related subjects of adult education and the recognition of informal and non-formal learning. While the latter are outside the scope of this review, they could of course also be of considerable relevance for firm performance.

Finally, all the points above have a strong policy relevance, given the suspected inefficient levels of training provision in most countries. As indicated in the first section, there are likely

important externalities from training which dissuade firms from investing in this area. For instance, the European Social Fund in the European Union is a multi-billion euro mechanism to address this inefficiency but has seldom been evaluated along this dimension – studies in this area, possibly drawing on different quasi-experimental methods, would be particularly welcome, especially now that many European Union countries are receiving new funding for training under the recovery plans following the pandemic. Training can also be a useful tool in the case of international trade shocks (e.g., following China’s emergence in the world economy since the early 2000s) or the major structural changes in the context of the pandemic crisis (remote work), together with long-term trends such as automation, artificial intelligence, ageing, and migration. Training by firms can convert workers from occupations subject to negative shocks to different roles that show greater potential - but further research on the desirable design and implementation of such programmes can be very useful.

REFERENCES AND FURTHER READING

- Abramovsky, Laura & Erich Battistin & Emla Fitzsimons & Alissa Goodman & Helen Simpson (2011) ‘Providing Employers with Incentives to Train Low-Skilled Workers: Evidence from the UK Employer Training Pilots’, *Journal of Labor Economics*, 29(1), 153-193
- Acemoglu, D. & Pischke, J.-S. (1999) ‘The structure of wages and investment in general training’, *Journal of Political Economy*, 107(3), 539-572
- Adhvaryu, Achyuta & Namrata Kala & Anant Nyshadham (2019) ‘Returns to On-the-job Soft Skills Training’, Working Paper, University of Michigan.
- Almeida, R. & Carneiro, P. (2009) ‘The return to firm investments in human capital’, *Labour Economics*, 16(1), 97–106.
- Autor, D. H. (2001) ‘Why do temporary help firms provide free general skills training?’ *Quarterly Journal of Economics* 116(4), 1409–1448.
- Blatter, M., Muehlemann, S., Schenker, S. & Wolter, S. C. (2016) ‘Hiring costs for skilled workers and the supply of firm-provided training.’ *Oxford Economic Papers* 68(1), 238-257.

- Brunello, G. & Wruuck, P. (2020) 'Employer provided training in Europe: Determinants and obstacles', European Investment Bank Discussion Paper 2020/03.
- Camuffo, A., Cordova, A., Gambardella, A. & Spina, C. (2020) 'A scientific approach to entrepreneurial decision making: Evidence from a randomized control trial.' *Management Science* 66(2), 564-586.
- Card, D., Kluve, J. & Weber, A. (2010) 'Active labour market policy evaluations: A meta-analysis', *Economic Journal* 120(548), F452–F477.
- Cockx, B., Lechner, M. & Bollens, J. (2020) 'Priority to unemployed immigrants? A causal machine learning evaluation of training in Belgium', arXiv 1912.12864.
- Cui, Ying & Martins, Pedro (2021) 'What drives social returns to education? A meta-analysis', *World Development*, 148, 105651.
- Dostie, Benoit (2015) 'Who benefits from firm-sponsored training?', *IZA World of Labor* 2015:145
- Dostie, Benoit (2018) 'The impact of training on innovation', *Industrial and Labor Relations Review*, 71(1), 64–87.
- Fairlie, R. W., Karlan, D. & Zinman, J. (2015) 'Behind the GATE experiment: Evidence on effects of and rationales for subsidized entrepreneurship training.' *American Economic Journal: Economic Policy* 7(2), 125-61.
- Fialho, P. & Quintini, G. & Vandeweyer, M. (2019) 'Returns to different forms of job-related training', *OECD Social, Employment and Migration Working Paper* 231, OECD, Paris.
- Haskel, Jonathan & Stan Westlake (2018) 'Capitalism without capital: The rise of the intangible economy', Princeton University Press.
- Heckman, James J. & Lance Lochner & Christopher Taber (1998) 'Explaining Rising Wage Inequality: Explorations with a Dynamic General Equilibrium Model of Labor Earnings with Heterogeneous Agents', *Review of Economic Dynamics*, 1(1), 1-58.
- Holzer, Harry J. & Richard N. Block & Marcus Cheatham & Jack H. Knott (1993) 'Are Training Subsidies for Firms Effective? The Michigan Experience', *Industrial and Labor Relations Review*, 46(4), pages 625-636
- Imbens, G., & Rubin, D. (2015). 'Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction'. Cambridge: Cambridge University Press.
- Konings, J. & Vanormelingen, S. (2015) 'The impact of training on productivity and wages: Firm-level evidence', *Review of Economics and Statistics*, 97(2), 485–497.
- Lazear, E. P. (2009) 'Firm-specific human capital: A skill-weights approach.' *Journal of Political Economy* 117(5), 914-940.

Lechner, M. & Wunsch, C. (2009) 'Are training programs more effective when unemployment is high?', *Journal of Labor Economics*, 27(4), 653–692.

Leuven, E. (2005) 'The economics of private sector training: A survey of the literature', *Journal of Economic Surveys*, 19(1), 91–111

Lyons, Elizabeth (2020) "The impact of job training on temporary worker performance: Field experimental evidence from insurance sales agents", *Journal of Economics and Management Strategy*, 29, 122–146.

Lyons, E. & Zhang, L. 'The impact of entrepreneurship programs on minorities.' *American Economic Review* 107(5), 303-07.

Martins, Pedro S. (2019) 'The Microeconomic Impact of Employee Representatives: Evidence from Membership Thresholds', *Industrial Relations*, 58(4), 591-622.

Martins, Pedro S. (2021) 'Employee Training and Firm Performance: Evidence from ESF Grant Applications', *Labor Economics*, 72, 102056.

McKenzie, David & Susana Puerto (2021) 'Growing Markets through Business Training for Female Entrepreneurs: A Market-Level Randomized Experiment in Kenya', *American Economic Journal: Applied Economics*, 13(2): 297–332

Mehra, A. & Langer, N. & Bapna, R. & Gopal, R. (2014) 'Estimating returns to training in the knowledge economy: A firm-level analysis of small and medium enterprises', *Management Information Systems Quarterly*, 38(3), 757–772.

Prada, Maria F. & Graciana Rucci & Sergio Urzúa (2019) 'Training, Soft Skills and Productivity: Evidence from a Field Experiment', IZA Discussion Paper 12447, Institute of Labor Economics.

Salop, J. & Salop, S. (1976) 'Self-selection and turnover in the labor market.' *Quarterly Journal of Economics*, 619-627.

Saraf, Priyam (2017) 'On-the-Job Training: Returns, Barriers to Provision, and Policy Implications', Policy Research Working Paper 8090, World Bank.

Zwick, Thomas (2006) 'The Impact of Training Intensity on Establishment Productivity', *Industrial Relations*, 45(1), 26–46.