Apprenticeship training in Italy – a cost-effective model for firms?

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Preface

In times of rapid technological progress and increasing digitalisation in many areas of work and life, it is more important than ever to provide young people with the best possible skills for their entry into the world of work. It is certainly important to provide them with a solid theoretical knowledge base. However, it is also important to impart practical skills to ensure that they are able to adapt to the needs of the labour market. Post-school education in Italy, while providing good formal skills in this respect, is not sufficiently responsive to the needs of the labour market. With this in mind, dual training models have become politically more attractive in Italy and are already being implemented. But despite political support and the reforms in recent years, the popularity of dual training models has hardly increased.

From an international point of view, this development is hardly surprising. On the one hand, interest in dual vocational training is increasing: learning a trade at two locations – in a company and at a part-time vocational school – means that apprentices gain valuable professional experience while they are still training, which enables a smoother transition to the labour market. As a result, there is less youth unemployment and a better supply of skilled labour for industry.

On the other hand, reforms of this kind often encounter a major obstacle when it comes to practical implementation: a lack of commitment by the companies, especially in countries where an in-company apprenticeship tradition is absent. First and foremost, companies see training as an operational loss: why pay to train an apprentice when qualified employees can be recruited directly on the labour market? What businesses often fail to see is that in-house training does not merely incur costs, but that it also results in monetary benefits, and sometimes in net profits before training has even been completed.

However, the question is: under which conditions? The costs and benefits of training are not invariables, they depend on a wide of variety of parameters such as the level of apprentices' pay, the industry in question, the duration of training, recruiting costs for qualified skilled workers on the labour market – not to mention the quality of the training course.

To examine the situation, this study uses simulations to investigate how these parameters would have to be designed in Italy in order to make dual training more attractive for Italian businesses. The conclusions derived in this report are intended to assist Italian policymakers and employers to make more evidence-based decisions, to ensure that Italy's labour force investments are more likely to yield positive returns.

This study was made possible by the collaboration of the JPMorgan Chase Foundation, the Fondazione Giacomo Brodolini and the Bertelsmann Stiftung, with economists Prof. Dr. Stefan C. Wolter, Prof. Dr. Samuel Mühlemann and Eva Joho. Their specific view on the profitability of training from the point of view of companies contributes to a more nuanced understanding of dual VET, which will in turn offer young people new perspectives and ensure that businesses are supplied with skilled workers with the best possible qualifications. Studies using similar methods have already been submitted for Spain (2016) and England (2018). The results are not only intended to give new impetus to education and training policies in the countries concerned, but also to encourage other countries to adopt similar simulations.

We would like to thank Prof. Dr. Stefan C. Wolter, Prof. Dr. Samuel Mühlemann and Eva Joho for conducting the study, which was made possible by their profound knowledge of vocational training and their experience with the cost-benefit analysis of apprenticeship training systems. We would also like to thank everyone who participated in the workshops carried out during the research process.

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Executive Summary

Countries with a high proportion of young people choosing apprenticeship training rather than either general education or full-time schooling options have not only demonstrated low youth unemployment rates but also distinctively lower ratios of youth unemployment relative to the overall unemployment rates of the country. Therefore, many people consider apprenticeship training as a possible and potentially powerful solution to the problem of an often prolonged and difficult transition for youths from school to the labour market. In recent reports, the OECD diagnosed substantial skills mismatch and skills shortages in Italy, and also proposed to improve the quality of apprenticeship training in Italy, and to promote the dual form of apprenticeship training (OECD 2017a,b). However, apprenticeship systems demand the high involvement of firms, which is not common in countries that do not have a long tradition of apprenticeship training (as is the case in Switzerland or Germany, for example). As many firms fear the costs of training apprentices, and despite political support, the dissemination of apprenticeship models has not enjoyed much success in the last ten years.

If one wants to increase the popularity of the apprenticeship type of training, it is important to provide reliable information to firms about circumstances in which apprenticeship models are a potential win-win-win situation, creating benefits not only for individuals and the state, but also for the training firms. One way of doing this is to measure the costs and benefits of firms that train apprentices; however, representative data are currently only available for Germany and Switzerland and, more recently, for Austria. In this study, we will – for several reasons – not measure the costs and benefits of existing training schemes in Italy, but instead simulate the costs and benefits for Italian firms that would train in one of nine occupations in very different economic sectors. To be able to simulate these outcomes, we use data from Switzerland, where, in the course of a decade, more than twenty thousand training and non-training firms have provided extensive data on their investments, benefits of training, and reasons for either training or refraining from doing so. This study therefore analyses the question of whether an average Italian firm could expect a net benefit when training apprentices in a similar manner to Swiss firms.

The nine occupations for which we simulated the net costs of training are in alphabetical order: Application developers and software engineers, bricklayers, car mechanics, commercial bank employees, cooks, electricians, mechanical technicians, shop salespersons, and waitresses/waiters.

The simulation model consists of three components, for which we use data from the most recent Swiss cost and benefit survey, complemented with Italian wage data. These components are:

1. the costs that arise during the training period,

2. the benefits that firms can generate during the training period by using apprentices as substitutes for unskilled and skilled workers, and

3. the benefits that a firm can potentially generate after the end of the training period i.e. by filling vacancies for skilled workers with their own apprentices.

While we are unable to provide representative figures of the potential size of the hiring costs saved in Italy, we received over 150 responses to our online survey across the various occupations and from the north, centre and south of Italy, as well as from participants from our workshops with sector-level representatives. The results show that potential savings from not having to recruit skilled workers externally are substantial in Italy and may justify a corresponding net investment in apprenticeship training.

Additionally, we also simulate the consequences of our scenarios and models on the private rates of return to education, which is the net benefit that the apprentices could expect over their lifetime. Our simulations show that most Italian firms can only break even by the end of training (having no net training costs) if apprentice wages are significantly below the current minimum wage in Italy[1]. Thus, high expected net training costs are likely to reduce the willingness of firms to participate in apprenticeship training. Moreover, the ability of a training firm to break even is an important factor given recent recommendations to change the current open-ended apprenticeship contracts into fixed-term training contracts similar to those in Switzerland or Germany (Cedefop 2017[2]). An advantage of a fixed-term training contract could be that apprentices are recognized as trainees, and thus receive more and better quality training while they are at the workplace. In turn, more individuals might be interested in applying for apprenticeship positions. Moreover, to the extent that better training leads to higher wages for skilled workers, apprentices would be more willing to accept lower wages during training.

The results of our simulations for all occupations and scenarios show that the net costs in all models using a low apprentice wage scenario are close to zero or even negative in at least one of our proposed training models in five out of nine occupations, in other words they generate a net benefit for the training firm. In the high-wage scenario where apprentice wages are set at 50 % of a skilled worker salary during the entire training period, net training costs are substantial across all training models and in all training occupations. Net training costs are particularly high for application developers and software engineers, car mechanics, commercial bank employees, and mechanical technicians. However, in these occupations, we also observe that firms face very high

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1   Apprentice pay in Italy is set by collective bargaining at the sector level (similar to Germany). To account for such sector-specific differences in apprentice wages, our simulations consider wage scenarios where the apprentice wage is set as a percentage of the relevant skilled worker wage (rather than an absolute wage level that applies to all apprentices).

2   Cedefop (2017), p.63: "The legislation is clear about the prime purpose of Type 1 [apprentice contract], which is to deliver alternative learning pathways for earning a qualification from the formal education and training system (as stated in Legislative Decree MLPS/MIU 81/2015). However, the open-ended nature of the employment contract may appear in contrast with Type 1 prime purpose, although there is a possible option to terminate the contract once the educational qualification is achieved. Most companies tend to consider Type 1 primarily as a standard open-ended employment contract and so as a contractual option for recruitment, rather than a training investment."

hiring costs to recruit qualified workers and incur a substantial productivity loss during the adaptation period until new hires become fully productive. When accounting for the benefit that firms generate when retaining a graduate apprentice as a skilled worker (and consequently not having to pay hiring costs for external hires), we find that all occupations would be profitable for training firms in the low-wage scenario, to the extent that at least 50 % of former apprentices stay on as skilled workers after training.

In the high-wage scenario, we find that potential savings on hiring costs would cover a firm's net costs as long as 100 % of apprentices were retained as skilled workers after training, except for cooks, application developers and software engineers. Therefore, incorporating potential benefits to the firms after training has ended is important to obtain a more complete picture of the financing and the benefits with regard to providing apprenticeship training at the workplace.

Using wage scenarios for apprentices, we also calculate the rates of return to education for apprentices, which is important because talented individuals are only interested in pursuing an apprenticeship if they can expect to acquire a substantial amount of marketable skills that will be useful on the labour market later in their career. We find that even in the high-wage scenario, only four out of nine occupations (application developers and software engineers, car mechanics, commercial employees and mechanical technicians) yield significant returns that exceed 5 % per year of education. On the other hand, we also find substantial expected net costs for firms that train apprentices occupations with high individual returns to apprenticeship training, there would be some scope to lower apprentice wages without discouraging applications from qualified individuals, while at the same time increasing a firm's willingness to offer training positions in these occupations. In the remaining training occupations, the wage differential between skilled and unskilled workers is too small to justify individuals investing more in apprenticeship training (by accepting low pay for 2–3 years). In other words, the training models for which we have made simulations would not allow firms and apprentices to gain sufficient benefits (apart from a firm's savings in future hiring costs), and therefore, the willingness of the firms or potential apprentices to train or receive training in these occupations would be low.

However, one could increase the attractiveness of training in these occupations. Potential apprentices might be willing to accept lower salaries during training as long as firms in turn invest more resources in training. To the extent that better training increases the skills that are also useful in other firms, apprentices could expect to be paid skilled wages that are above the levels observed on the current Italian labour market.

Finally, and not surprisingly, the simulated costs and benefits show a considerable heterogeneity, due to differences in the results per occupation in the Swiss data and to variations in the wage differentials between unskilled and skilled workers in the nine occupations in Italy. Thus, the question whether a training firm would have to expect net costs or whether it could generate a net benefit when applying a Swiss-style training model depends on many factors that will differ from one occupation to another. Furthermore, the simulations show that results may vary considerably within a given occupation due to a different wage structure across firms of different sizes and across regions. In Italy, regional wage differences are large, so we also provide separate simulation results for the three main regions (north, centre, south).

In any case, the simulations show that policies that target an increase in the number of apprenticeships would need to take into account these heterogeneities between occupations, firms and regions.

The four main conclusions that we can draw from our report are the following:

1. The chances of firms breaking even at the end of the training period of an apprenticeship are higher for three-year programmes than in shorter apprenticeships, but only in a scenario where apprentice wages are substantially lower than skilled worker salaries.

2. A firm's costs for hiring qualified workers from the external labour market are substantial. To the extent that training firms can retain apprentices as skilled workers, the savings associated with not having to recruit and train externally are large enough to cover all or most of the firm's training costs. In most of the nine occupations, at least one or two models and scenarios produce net benefits, or firms can expect savings in hiring costs that could offset net costs in a low apprentice wage scenario. However, once apprentice wages increase to 50 % of a skilled worker's wage for that occupation, it becomes very difficult for firms to recover their initial training investment, even assuming that 100 % of apprentices are subsequently retained as skilled workers.

3. Private rates of return to individuals from obtaining a VET qualification are rather low in many occupations and therefore also need to be considered. In some occupations, extending the programme duration to four years may yield even more favourable outcomes for firms.

4. Improvements in the quality of training programmes that subsequently improve the labour market outcomes of apprentices could be a necessity to secure talented applicants for the programmes, and at the same time reduce dropout rates. The latter may hamper the willingness of firms to train for some occupations because they would increase the net costs of training. Conversely, when individuals can expect a high-wage premium from obtaining a VET qualification, they will be more willing to apply for apprenticeships and to partly finance their own education by accepting lower wages during the training period.

1 Introduction[3]

After the outbreak of various financial crises in 2008, persistently high youth unemployment rates in many industrialised countries brought the apprenticeship training models predominantly used in German-speaking countries (Austria, Germany, and Switzerland) to the attention of policy makers, business leaders, academic scholars and the general public (e.g. OECD 2010). Countries with a high proportion of youths who choose apprenticeship training rather than general education or full-time schooling options have not only achieved lower youth unemployment rates but also significantly lower ratios of youth unemployment relative to the overall unemployment rates of the country. In addition, skill shortages or skill mismatches are not as frequent in these countries as in countries with predominantly school-based general education programs.

Firms have to pay

Although many consider apprenticeship training to be a possible and potentially powerful solution to the problem of an often prolonged and difficult transition for youths from school to the labour market, these systems demand the high involvement of firms, which is not common in countries that do not have this tradition of apprenticeship training. Delegating a substantial part of educational responsibilities to firms makes them not only beneficiaries but also providers of education, which comes at a cost. As firms are used to a situation where either the public or the individuals themselves pay for education, it is not surprising that there is a lack of enthusiasm from firms to bear these costs. Looking to countries where apprenticeships are still common does not automatically take away such fears, because cost-benefit analyses in Germany have shown for decades that the average German training firm[4] must bear the net costs of training and that only rather strict (confrontational) labour market regulations allow these firms to recoup these net investments in the long run (for the most recent study, see Schönfeld et al. 2016). In other countries, such as Austria, Denmark or Norway, public subsidies help keep the firms active in the training market. However, the fiscal situation does not allow every country to support training firms, and, in most countries, firms are not particularly eager to pay higher taxes initially to receive some subsidies later. Finally, the political support for apprenticeships is quite often the consequence of empty treasuries and politicians looking for training models that put less strain on the public budgets, which contributes to raising major doubts in economic circles that the

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3   This report follows closely a similar report on England (Wolter and Joho 2018) using data simulations for Italy. Chapters 2–4 are also based on the respective chapters in the simulations for Spain (Wolter and Muehlemann 2015). We follow as closely as possible the lines of argument and the assumptions used in the Spanish and English case to allow for future comparative work between different countries for which we have simulated the costs and benefits of apprenticeship training.

4   A training firm in the German, Austrian, or Swiss context is a firm whose main business is not training but the production of goods and services. Therefore, when we speak of training or non-training firms in this text, this should not be confounded with training providers, whose main business is training students for firms.

support for apprenticeships is just an attempt to shift the costs of training and education from the government to the firms. For these and other reasons, and despite the political support, the dissemination of apprenticeship models has not seen much success in the last ten years.

Therefore, if one wants to propagate the apprenticeship type of training, it is important to provide reliable information to firms about circumstances in which apprenticeship models are a potential win-win-win situation, creating financial benefits not only for individuals and the public, but also for the training firms. One way of doing so is by measuring the costs and benefits of firms that train apprentices; however, representative data are currently only available for Germany and Switzerland and, more recently, Austria. Measuring the costs and benefits of apprenticeship in case studies, covering just a handful of firms, as has been done in some countries, can lead to deceptive results for non-training firms, as the selective cases are usually not representative (e.g. Helper et al. 2016 for the United States). Furthermore, measuring cost and benefits in a country that is in the phase of either introducing or reforming apprenticeships has at least three potential additional shortcomings. Firstly, the training models used by training firms often differ considerably across firms; secondly, in a phase of introduction and reform one cannot always be sure that the models in place are performing as expected; and thirdly, the models are very often not stable over time but subject to constant adaptations and changes. In other words, trying to measure something that displays high diversity across firms, regions, and economic sectors and changes from day to day has limited informational value for non-training firms in their decision-making process and for policymakers evaluating the framework conditions of their system. Therefore, we have adopted a 'simulation' approach for this report.

Measuring costs and benefits

Compared internationally, participation rates in employer-sponsored non-formal training and work-related formal training are low in Italy, despite a large reform in 2003 that was aimed at increasing the participation of firms in the apprenticeship system (Cedefop 2017). In this study, we therefore both propose and test whether apprenticeship training could be a viable way for firms in Italy to expand work-based training and, if so, under what conditions.

Low participation rate of firms

We will not measure the costs and benefits of existing training schemes in Italy, but we will simulate the costs and benefits for Italian firms that would train in ten occupations in very different economic sectors. To be able to simulate these outcomes, we use data from Switzerland,[5] where, over a decade, more than twenty thousand training and non-training firms have provided extensive data on their investments, benefits of training, and reasons for either training or refraining from doing so. We use this data as the base for our simulations, combining it with labour market data from Italy. The advantage of simulating, rather than measuring cost and benefits, is that we can choose different models and parameters and, therefore, measure the sensitivity of outcomes for these assumptions. This allows us not only to make a statement about whether training is beneficial but also to define both the framework and the parameters of a hypothetical model that would work (see Muehlemann and Wolter 2017).

Simulating a Swiss training scheme for Italy

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5   Readers wishing to know more about the Swiss apprenticeship training system may find useful information in this documentation (SERI 2017).

Simulating rates of return to education for individuals

In summary, this study analyses the question of whether an average Italian firm could expect a net benefit when training apprentices using a system similar to Swiss training firms. However, we do not evaluate the current cost–benefit situation of providing apprenticeship training in Italy, nor the effects of the most recent training reform in 2015 (Cedefop 2017).[6] We also (see chapter 6) simulate the consequences of our scenarios and models for the private rates of return to education,[7] which is the net benefit that the apprentices could expect over their lifetime. This addition to the present study is necessary because, as will be shown later, most firms in Italy in most of the occupations for which we run our simulations will only break even (they do not bear any net training costs) if they pay apprentices' salaries that are below the current minimum wage.

6   This study complements a similar earlier study done in Spain (Wolter and Muehlemann 2014) and England (Wolter and Joho 2018), using the same methodology.

7   We are referring to private rates of return to education when we calculate the costs and returns to education from the perspective of the individual in either training or education.

2 The importance of costs and benefits for the decision to train apprentices

The willingness of firms to train apprentices can be described as the "conditio sine qua non" (necessary condition) for the existence of an apprenticeship training system. Irrespective of how much a government desires an apprenticeship training system, it cannot be established without firms that are willing to take on apprentices. Therefore, it is crucial to understand both the motivation of firms to invest in apprenticeship training and the conditions that are necessary to persuade more firms to participate.

Companies' motivations for investment

Training investments, from the perspective of firms, are similar to all other business investments, which means that firms invest if they expect a sufficiently high return on investment (ROI) and that firms refrain from investing if they expect a loss. Empirical analyses[8] of successful apprenticeship training models show that the sustainable engagement of firms mainly depends on training regulations, labour market regulations and institutions, and the education policy of the government. An example for the importance of the latter is the admissions policy and the financing of general education (high school and university). If the standards for admission to general schools are low and the financing of general education is predominantly public, then firms are confronted with a situation in which most of the talented youths will opt for the general education pathway. This would leave only the less talented students for the apprenticeship market, which would in turn lead to a situation in which the training costs for firms might simply be too high (because less talented apprentices would need more support and training[9]) and the productivity of the potential apprentices too low. Even in the case where the net costs of training are bearable, firms might decide not to train because the skill level of the potential apprentices would still be lower than the expected skill level of either university or college graduates after a short period of on-the-job training.[10] In other words, policy makers have many ways of not only directly influencing a firm's costs and benefits of training but also influencing the costs of alternative methods of recruiting skilled workers that could compete with the decision to train apprentices.

Return on investment

A critical point, as with all other investments, is that the costs of training arise early in the investment period, whereas the benefits come either later, sometimes too late, or not at all. The latter may occur because other firms poach the trained workers, because the trained workers leave after training for further education, or for other reasons. In

Risk of losses

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8   Wolter and Ryan (2011) provide an extensive description of the theoretical foundations for analysing firms' decisions on whether to be active in apprenticeship training. Muehlemann and Wolter (2014) provide a literature overview of cost-benefit studies and empirical issues related to the question of how the costs and benefits of apprenticeship training influence firms' training behaviour.

9   Muehlemann et al. (2013) show that Swiss training firms invest additional instruction time in apprentices with low school grades, but only to the extent that firms can still expect to break even by the end of training.

10   During the workshops in Bari, this argument was also made by representatives of the IT industry (the occupations of application developer and software engineer). As a result, many firms in the IT industry prefer to hire university graduates.

such cases, the net investments at the end of the training period are no longer covered by the benefits that would have been generated if the trained worker had stayed with the training company. The uncertainty about the timing of the benefits, the amount of the benefits, or even the risk that no benefits are collected, is therefore crucial for a firm's decision to be active in the apprenticeship training market. A sustainable training system must, therefore, find ways to reduce the risk that the training might not generate a sufficiently large benefit to cover a firm's investment. Looking at the existing models for which we have cost-benefit data, one can see that, broadly speaking, there are three different ways of doing so.

Securing benefits during training (Switzerland)

Firstly, the Swiss model generally allows firms to cover their training expenditures by the time the official training period ends, and the apprentice is free to leave the company. In such a situation, the threat of poaching is no longer a problem for the firm's decision to train because even in the case where an apprentice leaves the company immediately after finishing the apprenticeship, the firm does not incur a loss. The challenge facing firms in Switzerland that train apprentices is to find ways for the apprentices to generate sufficiently high benefits for the firm during the training period while at the same time guaranteeing the provision of high-quality training to the apprentices (because training quality is monitored and enforced). The benefits mainly depend on training regulations that allow apprentices to spend much of their training time with the firm, working while employed by the firm and, finally, being productive while working. Such a system has the additional benefit that it enables high knowledge diffusion among companies, possibly contributing to the innovativeness of an industry as a whole. Rupietta and Backes-Gellner (2018) discuss how apprenticeship systems not only help the diffusion of knowledge from innovative to less innovative companies, but in a second step also increase the probability that training firms will create innovations themselves.[11]

Securing benefits after training (Germany)

The second case is the apprenticeship system in Germany, where labour market regulations at least partially protect the net investments of firms by reducing the labour market mobility of former apprentices (see e.g. Muehlemann et al., 2010). Rigid employment protection rules (like regulations that make dismissals either costly or almost impossible) not only secure stable jobs for the employed, but also reduce the labour market mobility of potentially mobile workers because employment protection reduces the number of job vacancies in the labour market. In such a situation, training firms anticipate that their own apprentices are likely to remain with the training company because the probability of receiving an outside job offer is low, as potential competitors have to retain their own workforce. Thus, a net investment in apprentices protects training firms at least partially from poaching. Informal or semi-formal institutions, such as employer associations, unions, or works councils, also reduce the possibility that other firms will actively poach apprentices after training by offering high wages. If labour markets are deregulated, however, firms must switch to a training policy that allows them to either reduce the net costs of training or even break even so as not to risk losing their investment to non-training firms. The reaction of German training firms during the last decade shows that this is exactly how firms responded to a decrease in the degree of employer protection legislation (Jansen et al., 2015). The fact that German firms have, over the course of the last decade, adopted a training strategy

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11 Rupietta and Backes-Gellner (2018) show that training firms have a higher probability of product and process innovation, and are more likely to apply for patents compared to firms who do not train apprentices.

that increasingly resembles the strategy applied by Swiss firms provides an additional reason to use Swiss data for the simulations in this study.

The third model is the Austrian VET model. In Austria, firms generally bear substantial net costs, albeit somewhat lower than for German firms. However, there are two important differences compared to the German training system. Firstly, the reason for the net costs is not so much a result of apprentices not being used extensively in productive work, but rather the result of high relative apprentice pay compared to skilled workers. Secondly, public wage subsidies cover part of the net costs (similar to Denmark) and may be partly the reason why we observe high-wage levels in the first place. A comparison with Swiss firms that train apprentices in the same occupations shows that, if Austrian firms switched to relative apprentice pay levels comparable to Switzerland, most Austrian companies could break even at the end of the training period (see Moretti et al., 2017). The reason why Austrian firms are paying high apprentices' salaries and accepting net training costs is likely related to the competition for talented apprentices. Since individuals can enrol in full-time vocational schools and also obtain a VET qualification, they might prefer that option if apprentice wages in the dual VET system were very low (in Switzerland full-time vocational schools are much less common). However, the empirical evidence shows that Austrian firms can recoup most of their training costs after the training period due to savings on future hiring costs

Securing benefits with public subsidies (Austria)

In addition to systemic parameters that influence the average training pattern and strategies in a country as a whole, one can also observe differences in training strategies between firms of different sizes, sectors, occupations, and geographic locations that are related to differences in expected post-training benefits.

Other influential factors

Very small firms are usually unable to offer future employment to (all of) their apprentices, and therefore need to break even by the end of the training period; otherwise, they are almost certain to lose their investment (see Muehlemann and Wolter, 2014, p. 16ff). The lower the chances that these firms can break even by the end of training, the lower the participation rate of small firms in apprenticeship training will be. As small firms are the backbone of the economy in many countries, the possibility of achieving net benefits within a short time frame is essential for the emergence of apprenticeship training.

Company size

Firms operating in sectors or training occupations that offer the possibility to learn skills specific to the training firm or occupation are better protected against the poaching of their trained apprentices, as apprentices would lose a considerable part of their skills when moving to another sector or firm. In particular, skilled workers in technically advanced firms operating at the forefront of technological progress are in such a position.

Firm specific skills

The degree to which a firm can protect itself against losing its skilled workers also depends on the geographic location of the firm (Muehlemann and Wolter, 2011; Muehlemann et al., 2013). Although most firms do not use uniquely firm-specific skills, depending on their geographic location they might be just far away enough from the next firm that uses a similar set of skills that most employees would not accept the costs of either commuting or moving to another region for only a small salary increase. However, most firms operate either in economic regions with dense economic activity

Geographic location

or in sectorial clusters that come with a high risk that there will be several employers looking for the same set of skills. In this situation, in order to have an incentive to be active in training, even bigger firms need the possibility to break even with their investments before the training ends.

Framework conditions

Finally, even if the framework conditions in a country enable some firms to earn a net benefit from apprenticeship training, this is usually not the case for all firms, because the specific situation differs considerably between individual firms with respect to their potential to run an apprenticeship training programme profitably (see Wolter et al., 2006). The challenge for countries is that the framework conditions should be good enough for a sufficiently large share of companies to offer training positions. There will always be companies for which "buying" i.e. recruiting skilled workers from other firms is cheaper than training their own personnel internally (see Blatter et al., 2016). However, the higher the probability that a training company can finish a training programme with a net benefit, the higher the chances that the training decision will not be affected by other firms' recruitment strategies.

The following chapter provides an overview of the most important components of the costs and benefits arising from apprenticeship training that a potential training firm must take into consideration when calculating its return on investment (ROI).

3 The cost-benefit model and its components

A cost-benefit model to calculate the net costs (or benefits) from the perspective of a firm has been used several times over the last two decades in Germany, Switzerland, and more recently Austria, to gather representative data on the costs and benefits of apprenticeship training. The model has been refined over time but has remained stable and supported for the most part since its conception in the 1970s. The lessons from the application of the model in different countries during different periods of the business cycle, and in hundreds of different occupational profiles covering most of the economic sectors in a modern economy, helps us to identify the most relevant parameters of the model to simulate net cost scenarios for a dual apprenticeship system outside the German-speaking countries, in this case for Italy.

The model consists of three components, for which we use data from the most recent Swiss survey (Wolter and Strupler 2012) complemented by Italian wage data. The three components are (i) the costs that arise during the training period, (ii) the benefits that firms can generate during the training period by substituting apprentices for unskilled and skilled workers, and (iii) the benefits that a firm can potentially generate after the training period has ended i.e. by filling vacancies for skilled workers with their own apprentices.

In particular, a firm's cost components of apprenticeship training (as described in Muehlemann and Wolter, 2014, p.3) consist of the following categories:

1. Wages of apprentices: regular wage payments, irregular wage payments, and compensation for food, travel costs, or living expenses.

2. Costs of training personnel: costs for full-time, part-time, and external training personnel for the period in which they are unable to work productively because they are instructing apprentices.

3. Recruitment and administrative costs: wage costs for administrative tasks and recruitment related to apprenticeship training.

4. Costs of infrastructure: machinery/appliances for apprentices at the workplace, rent for premises necessary for apprenticeship training, cost of premises and infrastructure for company training centres.

5. Cost of supplies: costs of supplies used for non-productive activities in the workplace; costs of books, learning software and videos; costs of working equipment.

6. Other costs: costs of fees (e.g. exams), costs of recruitment/administration related to apprenticeship training, and costs of external courses, duties, and taxes to third parties.

Benefit components

A firm's benefit components of apprenticeship training consist of the following categories:

1. The value of having apprentices perform skilled tasks is calculated as the time that apprentices spend on such tasks multiplied by the wage that a firm would need to pay skilled workers if no apprentices had been hired. That value, however, is further multiplied by the productivity of an apprentice relative to that of a skilled worker.[12]

2. For unskilled tasks, the value to the firm of having an apprentice perform such work is simply the wage that the firm would have had to pay to an unskilled worker.[13]

Ultimately, the difference between the costs and benefits of training results in net benefits (or net costs) for the firm by the end of the training period.

Net benefits or break even

As described in the previous chapter, there are many reasons why most firms need to either achieve net benefits or at least break even by the time the training contract ends, because all investments not covered by then are at risk of being lost if the trainee moves to another company or quits for other reasons. The current situation in Italy, however, does not imply an automatic termination of the contract between the apprentice and the training firm after training, because it is an open-ended contract (Cedefop 2017). If apprentices are more likely to stay on, savings in future hiring costs for skilled workers are a relevant element in the cost-benefit calculation of firms, as elaborated in the next subsection.

Apprenticeships can lead to savings in future hiring costs

For those firms that can expect all or at least some of their apprentices to stay with them for at least some time, an important additional (post-training) benefit comes into play. If a firm can fill vacancies for skilled workers with their own apprentices, they can save on hiring costs, which would then even justify a net investment by the time the formal training period has ended (see Muehlemann and Strupler Leiser, 2018). Although hiring an apprentice is costly, hiring skilled workers is usually much more expensive. Therefore, in the cost-benefit model, we also calculate the following costs that would arise from recruiting a skilled worker on the external labour market:

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12 Thus, if it takes an apprentice twice as long to complete a certain task than it does a skilled worker, the relative productivity is 50 %, which means that the value to the firm of having an apprentice performing skilled work is half of the wage costs associated with employing a skilled worker.

13 Although unskilled work is not the goal of apprenticeship training, it can be an important element – at least at the beginning of the training period – for both the firm and the apprentice. For the apprentice, it does not matter much whether he or she learns behavioural skills, such as punctuality and precision, which are important in the work environment, by doing either skilled or unskilled work. What is more important is the fact that the apprentice has the opportunity as early as possible in the training period to learn these skills both effectively and efficiently. For the firms, the possibility of having apprentices do unskilled work offers an opportunity to improve the cost-benefit balance. As apprentices usually need some learning time before they can be entrusted with skilled tasks, in the absence of the availability of unskilled tasks, the apprentices would be unproductive for too long, thereby increasing the net costs and risk for a firm, so that it may refrain from offering training positions in the first place. Therefore, using apprentices to perform unskilled tasks is not bad overall, but quality assurance systems are certainly needed to ensure that apprentices are not mainly used as cheap labour.

1. Search costs (job advertisements, job interviews, etc.).

2. Costs that stem from an initially lower productivity during the adaptation period, until a new hire reaches full productivity. Such costs only arise for external hires because they need to learn firm-specific processes and technologies.

3. Costs associated with the external training of newly hired workers.

4. Disruption costs due to informal training, as externally hired employees interrupt the work of other workers because they need instruction and help during the adaptation period.

A firm can save all of these costs if it can successfully fill a vacancy with a former apprentice.

In this study, we are unable to provide representative figures of the potential amount of hiring costs in Italy because such data is not available. For that reason, we conducted our own survey in Italian firms as a part of this project. With the exception of the occupation waitresses/waiters, we could obtain a sufficient number of responses to our survey to report average hiring costs (based on a total sample of 158 firms). Thus, for 8 out of 9 occupations, we can report the search, adaptation and disruption costs associated with successfully filling a skilled worker vacancy by hiring a qualified worker from the external labour market.

Problems eliciting hiring costs for Italy

The impact of the degree of loyalty to the training firm is, of course, decisive. If, as in Switzerland, two-thirds of the apprentices leave their training company after the end of training, a firm needs to train three apprentices to fill one vacancy (if the apprentices leave their training company voluntarily). In other words, the saved hiring costs for one vacancy, on average, would need to be high enough to compensate for the net costs of training three apprentices in Switzerland, which shows that saved hiring costs are an argument mainly for either (large) firms with an internal labour market or firms with very firm specific human capital and, therefore, also a reasonably high retention rate.

Mobility of apprentices after training

However, given that apprenticeship contracts are open-ended in Italy, it is quite likely that the proportion of apprentices who continue to work with the training firm even after having obtained a VET qualification is considerably higher than in Switzerland. Nonetheless, if apprentice contracts were fixed-term contracts as in Switzerland (and as recommended by Cedefop 2017), the turnover rate of former apprentices may increase, which in turn would make it more important for firms to be able to break even by the end of training (probably by being able to adjust apprentice wages downwards compared to the current situation).

4 The simulation model, data, and assumptions on the parameters

In this chapter, we provide arguments for the scenarios we have used to simulate the costs and benefits of potential apprenticeship models from the perspective of firms. The scenarios do not represent the current training models in Italy and are therefore not evaluations of the Italian apprenticeship system. However, they could fit into the Italian context, and we will provide arguments for our scenarios based on the experiences in Switzerland. We will elaborate on certain questions, such as why the duration of an apprenticeship may or should differ from occupation to occupation; what level of payment of a salary for apprentices would guarantee firms breaking even at the end of the training period; and how the quality, quantity, and specificity of training that a firm provides is reflected in the hiring costs of skilled labour. We will also provide information on issues that do not directly relate to the cost-benefit simulations but to the actual outcomes, such as the selection of apprentices and the matching of firms and apprentices in the apprenticeship labour market. These issues relate to our assumptions about the parameters in the models, and therefore call for an explanation. We conclude this chapter with information about the sources of the data used in our study.

4.1   The simulation models

Three different training models
We calculate the costs and benefits of apprenticeship training for three different scenarios (models). Model 1 comes closest to the Swiss apprenticeship model, where apprentices enter training at the end of compulsory schooling as an alternative to full-time general education. In Model 2, we assume that young people have completed an upper-secondary education and enter an apprenticeship programme as an alternative to studying at a university. Finally, Model 3 is a one-year extension of Model 2. Again, we base Model 3 on the assumption that apprentices enter the programme after having completed general upper-secondary education. The reason for extending Model 2 is that the framework of Model 2 might be too rigid in two respects. Firstly, apprentices may not be able to acquire the required work skills in a programme that lasts for only two years, not because of a lack of time spent in formal training, but because of a lack of time spent practising the newly acquired skills in the workplace. Secondly, firms that provide (and pay for) a substantial amount of workplace training might not be able to break even financially within a two-year training period because the apprentices do not spend enough time on productive tasks at the firm.

Model assumptions
We base all our calculations regarding off-site instruction times on numbers similar to Swiss, German, or Austrian practice (and Spanish training programmes). All the plans are set for a two-year programme that totals 2,000 hours of training and work experience, of which, depending on the occupation, approximately 1,600 to 1,700

hours are formal instruction in vocational schools, and the remaining hours reflect work experience in a firm. In Model 1, we assume that the training plan for the off-site education covers not only vocational skills but also some general skills, e.g. maths, mother tongue and foreign languages, that are necessary not only as a foundation to learn other skills, but also to be able to progress further in the educational system after an apprenticeship and to enter careers that include management responsibilities. In Models 2 and 3, we assume that the individuals have acquired all the necessary general skills before entering the apprenticeship programme and that the provider of education covers mostly vocational skills.

The detailed assumptions in the three models for which we calculate the costs and benefits are as follows (see Table 1 for an overview).

In **Model 1**, we propose a training duration of three years, which is the minimum duration of many apprenticeship programmes in Switzerland for the training occupations for which we calculate the net costs in Italy. This model would be most appropriate for school-leavers after compulsory schooling (at the age of 16), who, similar to the German-speaking countries, would follow apprenticeship programmes instead of pursuing other full-time schooling options.[14] The curricula used in the German-speaking countries, therefore, also leaves room for learning general skills, such as mathematics and foreign languages. Therefore, to follow a Swiss training programme as closely as possible, we make the following assumptions: of the approximately 1,600 hours learning vocational skills, 600 hours are delegated to firms and are taught by in-firm trainers, which corresponds to approximately five hours of weekly instruction time at the firm (which comes close to the Swiss average). The rationale for delegating a considerable part of the vocational programme to firms is as follows: depending on the technologies used in the trained occupation, the quality of in-firm training should be superior to the same training in a vocational school, as firms are usually at the forefront of technological developments. Moreover, the public authorities experience substantial savings if they do not need to buy expensive machinery and tools for vocational schools. Such a situation is also beneficial for apprentices, as they have the opportunity to use the most up-to-date equipment in firms. An additional benefit of in-firm training is that, on most occasions, the training in firms is 1-to-1 teaching, whereas in schools, the same skills are not taught individually but rather in a class of up to 20 or more students. Given the nature of some skills, practical exercises are often necessary to become proficient; thus, the instruction of one apprentice (or a very small group) by one trainer in a firm seems to be much more appropriate than training a full class.[15]

Model 1

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14 The four main explanations in support of an "early" apprenticeship programme are as follows. Firstly, school-leavers confronted with another three years or more of general schooling and, therefore, with the risk of dropping out of the educational system after compulsory schooling, are more likely to remain in the education system. Switzerland, which has one of the highest completion rates of upper-secondary education in the industrialised world (OECD, 2017a), shows that this strategy can be successful in reducing early educational dropouts. Secondly, at a young age, and when they are still living with their parents, an apprentice's pay can be lower than that required for older students, and even a small amount of pay compares favourably relative to the prospect of not earning anything when attending a full-time school programme. Thirdly, training firms like to take in apprentices at a younger age because they can be socialised more easily to the work and to the firm's requirements and realities. Fourthly, working together with adults and being tutored by older apprentices in a real-life environment stimulates the learning motivation of young adults and leads to better learning outcomes for those who may have problems with self-motivation in a school environment.

15 Often, 1-to-1 teaching in firms is the standard case, as many training firms only train one apprentice at a time. Larger firms usually train more than one apprentice in the same occupation and the same training year and have the opportunity to group apprentices where both possible and necessary, which explains why larger firms can exploit economies of scale when training apprentices.

General education in school

In Model 1, the vocational education that apprentices receive at the workplace is not a substitute for the general education that is taught in vocational schools.[16] Thus, the amount of time spent in school remains the same (approximately 1,600 hours), but it is now spread over three years. In addition, apprentices receive 600 hours of formal vocational instruction at the firm, so that the firm spends approximately 5 hours of instruction time per apprentice for every week that the apprentice is not in school – leading to a total of approximately 2,200 hours of formal instruction time over three years. The remainder of the time at the workplace is used for both working and practising, thereby providing not only a financial return to the training firm, but also a private return for apprentices by acquiring additional on-the-job skills through informal learning.

Model 2

Model 2 targets approximately 18-year-old individuals who already hold a general upper-secondary qualification and would, therefore, not need to spend more time in general education during an apprenticeship. Thus, apprentices receive only 1,000 hours of formal (non-general) education in vocational school, and the remaining 600 hours of formal instruction take place at the firm, leading to a total of 1,600 hours of formal education. It is important to note here that, while firms training apprentices in Switzerland also believe that an apprentice can either learn while working or is working while learning, there are legal obligations in Switzerland for apprentices to receive a minimal amount of formal in-firm instruction. The time spent in the firm is, therefore, not merely learning by doing. In this spirit, in all three models we calculate, for the delegated hours of formal training from schools to firms, the costs of having an in-firm trainer spending his or her time educating the apprentices in theory and practical skills. Firms are expected to provide their part of the training at their own expense, but at the same time, they have the opportunity to train the apprentices in their technologies and business processes and thereby save expensive adaptation costs compared with hiring someone either directly from school or from the external labour market. As in Model 1, apprentices spend the rest of their time at the firm working and practising, thereby not only acquiring additional vocational skills through informal learning but also acquiring work-related social skills (which are increasingly in demand by firms in today's labour market, cf. Deming 2017).

Model 3 as an extension of Model 2

Finally, **Model 3** is identical to Model 2 in the first two years of training, but it contains an additional third year. In Model 2, while apprentices accumulate all the required formal human capital in the first two years, relatively little time remains for productive work at the firm. Thus, for most occupations (at reasonably high apprentice wages), firms will not find Model 2 profitable. Moreover, while apprentices acquire substantial theoretical knowledge, firms may want to provide additional general and specific training so that their apprentices can successfully perform the required skilled tasks in the firm. Therefore, most apprenticeship programmes in the German-speaking countries last for at least three years and even for four years (3.5 years in Germany and Austria) in

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16 The 600 hours of general schooling in firms is not equivalent to what a student would acquire when attending an upper-secondary school in general education and, therefore, is not enough to qualify to enter a general (academic) education programme in higher education. However, given the extensive amount of vocational training, the student would certainly qualify for professional education programmes at the level of tertiary education. The same is true in the case of Austria, Germany, and Switzerland. In Switzerland, for example, apprentices have the opportunity to acquire an extra year of general education, either during or after the apprenticeship, to acquire a professional baccalaureate. This certification allows students to continue their studies at a university of applied sciences. If, however, they want to transfer to a classic, academic university, they would have to attend another year of general education.

practically all the technical occupations in Switzerland. Even if we assume – contrary to Swiss apprentices – that Italian apprentices would enter training with an already completed general education at the upper-secondary level, two years of vocational training would not be enough time to learn the necessary vocational skills and attain the performance level of a fully trained skilled worker in skill-intensive occupations if the expected skill levels for skilled employees should be comparable to Swiss VET graduates. In the additional year that the apprentices spend in training (compared to Model 2), they receive the equivalent amount of formal in-firm training as an apprentice in an average Swiss firm in a comparable training occupation (approximately 200 hours on average). Moreover, an apprentice could work and continue to acquire important vocational and professional skills by informal learning for approximately 1,500–1,600 hours in the last year of training.

TABLE 1 **Assumptions of the baseline simulation models for net training costs in Italy**

Model 1	Model 2	Model 3
Three years of training	Two years of training	Three years of training
1,600 hours formal education in vocational school	1,000 hours formal education in vocational school	The first two years as in Model 2
Approx. five hours per week of formal training for each apprentice (approx. 600 hours in total) + workplace experience	Approx. 600 hours of formal workplace education + workplace experience	In the third year, firms provide formal workplace training similar to a Swiss firm in a comparable training occupation (approx. 200 hours on average)
Total amount of formal school and firm training: approx. 2,200 hours	Total amount of formal school and firm training: approx. 1,600 hours	Total amount of formal school and firm training: approx. 1,800 hours

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4.2   Parameters and further assumptions

Apprentice wages

In countries with an apprenticeship tradition, firms pay apprentices' wages in every month of the training period, irrespective of whether the apprentice is working for the firm or attending vocational school. Conversely, in countries where work experience is viewed as complementary to a predominantly school-based vocational education, apprentices are usually only paid for the duration of the time spent as an intern at the firm. While being occupied at the firm in the latter form of training mainly serves the purpose of acquiring work experience, the wage level during these months is usually also higher than the average apprentice's salary in the classic apprenticeship model. Thus, one could consider that the two models of paying apprentices are roughly equivalent, meaning that paying less over a longer period equals paying more over a shorter period. However, even if the total value in terms of cash payments to the apprentices is the same in both payment schemes, there may be important differences not directly related to apprentices' pay.

Two models of apprentice pay

In particular, paying an apprentice a salary for the whole duration of a training programme radically changes the nature of the relationship between the firm and the

Monthly pay = better matching

apprentice in many ways. The changed nature of this relationship becomes apparent before the apprentice starts working for the firm. When a firm is paying an apprentice a monthly salary in each month of the training period, the apprentice is considered to be a regular employee. Employees are recruited and hired by firms and not by schools. In addition to other benefits, this recruitment has a positive impact on the matching of firms and apprentices, both in terms of quality and quantity. In quantitative terms, if many school leavers would like to obtain training in occupation A, but firms would rather hire apprentices in occupation B, letting the firms recruit apprentices would lead to more training in occupation B. Conversely, in a school-driven system, schools would have an incentive to offer (too) many training places in occupation A, thus creating a mismatch in the labour market later on. Concerning the match quality, allowing firms to recruit their apprentices at the beginning of the training period provides incentives to firms to pay attention to the individual match and to select suitable candidates from the pool of applicants. In the school-driven model, even if there were no mismatch in quantitative terms, it may be that the firms would have selected different apprentices than those that the schools have allowed into their training programmes. As a result, when subsequently confronted with a pool of potential interns, the firms are no longer willing to offer internships, despite having vacant training places (for suitable candidates).

More loyalty and motivation

Moreover, the fact that the apprentice is responsible to the firm from the moment he or she has signed the training (and work) contract is crucial. Even if the apprentice spends most of his or her time in school at the beginning of the training period, the firm has the right to monitor the educational progress of the apprentice and intervene if necessary. For the schools, the employer replaces the parents and becomes the main contact person, and employers ensure that the content and quality of the school instruction matches their expectations. The employee–employer relationship in this type of apprenticeship also has a positive impact on the apprentices' motivation and loyalty to the training company.

Right to training

Finally, but also important, if the firm pays the apprentice a monthly salary that is somewhat lower than that it would pay an intern, the firm also must recognise that the apprentice is not at the firm solely to work but is also entitled to receive formal instruction and training during the entire training period.

Salary: two levels

In Switzerland, there is no binding minimum wage, and apprentices are paid irrespective of whether they are in the firm – if they are in the firm they receive a monthly wage, irrespective of whether they are working or practising.

We make the following assumptions for our simulation models:

In the **low-wage scenario**, we assume that apprentice pay is equal to the average break-even wage of the three models in the nine occupations in relation to the skilled worker wages in the particular occupation.

The average break-even wage in a particular occupation i is defined as:

$$\overline{w}_{BE,i} = (w^{M1}_{BE,i} + w^{M2}_{BE,i} + w^{M3}_{BE,i})/3$$

We then denote the relative break-even wage as the ratio of the average break-even wage and the average skilled worker wage in a particular occupation i:

$$w^r_{BE,i} = \overline{w}_{BE,i} / \overline{w}_{skilled,i}$$

In a last step, to calculate the wage for the "low-wage" scenario, we calculate the average of the relative break-even wages across the nine occupations:

$$\overline{w}^r_{BE} = \frac{1}{9} \sum_{i=1}^{9} w^r_{BE,i}$$

Depending on the region, we find that the average relative break-even wage is between 25 % and 30 % of a skilled worker's wage. This figure is similar to the observed ratio of the apprentice wage and the skilled worker wage in Germany and Austria, but considerably higher than in Switzerland, where the average relative apprentice pay is around 15 % of a skilled worker's wage, depending on the occupation. Thus, our low-wage scenario can be interpreted as a hypothetical setting in which Italian firms would train according to a Swiss-style training system but where apprentices receive a wage that is similar compared to the German and the Austrian apprenticeship system.

In the **high-wage scenario**, we assume that the apprentice wage is 50 % of the average skilled worker wage in a particular occupation. While this figure is considerably higher compared with Germanic apprenticeship systems, it is still considerably lower compared to the current minimum apprentice wage in most occupations in Italy. Thus, the goal of our simulations is not to mirror the current situation in Italy, but instead to show how different wage scenarios would affect a firm's cost-benefit situation. As discussed extensively in Cedefop (2017), changing the apprentice contract from an open-ended to a fixed-term contract is a scenario that is currently open for discussion in order to boost the number of dual apprenticeship positions in Italy. As we will discuss in the results section, it is nearly impossible for a firm to break even at current minimum apprentice wages when adopting a Swiss-style apprenticeship model. Therefore, it is important to also consider alternative wage scenarios in different contractual settings.

These assumptions lead to the following patterns of apprentices' wages: In both the low and the high-wage model, we define wages in relative terms, meaning that absolute apprentice wages differ across occupations – which reflects the current situation in Italy. While the low-wage scenario by definition results in occupations that incur net costs and others that can generate net benefits because the simulated apprentice wage depends on the average break-even wages across all occupations, this is not necessarily the case in the high-wage scenario.

Consequences of the salary models

Of course, guaranteeing a functioning apprenticeship market not only requires firms to break even, but also to be attractive to potential apprentices. Therefore, we decided to simulate the impact of these different wage scenarios on the private rates of return to training for the apprentices (see chapter 6).

Private rates of return to education for apprentices

In Switzerland, individual firms set the apprentices' pay; therefore, apprentices earn very different wages, depending on the firm and the occupation for which they are

Break-even salary

trained. Apprentice pay may even depend on individual productivity, and many firms offer apprentices performance-based salaries (see Backes-Gellner and Oswald 2014). Therefore, we complement our analyses with the calculation of break-even salaries. The break-even salary corresponds to the salary that a firm would be able to pay an apprentice if the goal is to have zero net costs (or net benefit) by the end of the training period. Although firms who expect an additional benefit after training could even pay a higher wage than the break-even wage, this wage gives a good indication of the differences between sectors and occupations and demonstrates that a uniform apprentice wage is not efficient, neither in absolute nor in relative terms (relative to the occupation specific skilled wage).

"Fair pay"

The "right" salary

Regarding relative wages for apprentices (relative to skilled or unskilled workers), it is quite common for legislators and social partners to set arbitrary ratios or absolute levels that they consider to be a fair wage.[17] The problem with these ratios is that they are usually based on the assumption that apprentices primarily work and that learning either takes place before the apprenticeship or is just learning by doing. In other words, so-called "fair pay" assumes that firms do not have extra training expenditures. In doing so, legislators and social partners often overlook the fact that setting ratios in this way actually forces firms that are interested in training apprentices to reduce their training expenditures to a minimum. Therefore, we propose calculating "fair pay" as the relative wage that a firm can pay an apprentice conditional to the expenditures that the firm must make to ensure high standards of training. These wage levels correspond to the break-even wages that we have simulated for all scenarios, models and occupations.

Performance levels (relative productivity)

Using relative productivity

The advantage of our simulation model is that we do not have to assume that the productivity levels are the same in Italy and in Switzerland – even though the occupations for which we use Swiss data are very similar to the Italian occupations. Using the relative level of productivity of Swiss apprentices to Swiss skilled workers as an indication of the learning progress of Italian apprentices merely assumes that Italian firms would be able to train their apprentices in such a way that they would progress in relation to Italian expectations (i.e. the productivity level of skilled workers in Italy), just as is in the case in Switzerland. The relative measure also has the advantage that differences in productivity between either firms or regions that are reflected in the differences in salaries for skilled labour are taken into account through the salary level. Firms operating at lower productivity levels can only afford to pay lower salaries; consequently, the benefit of the work of an apprentice in monetary terms is also lower. However, we assume – as observed in the Swiss, German, and Austrian data – that the apprentices reach comparable levels of relative productivity, irrespective of the absolute level of productivity in a given firm or occupation (Dionisious et al., 2009; Moretti et al., 2017). In other words, a firm trains apprentices with the aim of reaching the same productivity level with that apprentice as the firm has with a skilled worker.

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17   In Germany the new government is currently discussing the introduction of a national minimum apprentice wage that is substantially above the going wage levels. The current minimum apprentice wages are subject to collective bargaining agreements at the sector level and may differ across regions.

Although the differences in absolute productivity between Swiss and Italian firms in the same economic sector are not important for our calculations, we need to address one potential source of bias. A bias can occur if the competition between the school system and the apprenticeship system is such that the school system has an advantage in attracting the more talented and more highly motivated students, thereby leaving the apprenticeship training system with the less talented and less motivated students. In such a situation, firms may decide not to train at all, wait for the students to leave college or university, and then offer them an internship instead of a formal dual training programme.[18] For firms that still wish to offer a dual programme to the available applicants, such a situation would generate higher net costs, because either the productivity levels of the apprentices would be lower than the comparable Swiss situation, or firms would have to spend more money on internal training to reach comparable productivity levels – or both (see for example Muehlemann et al., 2013). In other words, we base our calculations on the assumption that Italian firms would be able to attract apprentices into their programmes who are similarly able to those attracted by Swiss firms today.

Thus, for the three-year programmes (Models 1 and 3), we assume that the levels of relative productivity exactly correspond to the levels observed in similar three-year programmes in Switzerland. In Model 2, we calculate a lower threshold for the net costs of training and assume that the progress in relative productivity between year 1 and year 2 corresponds to the progress made by a Swiss apprentice between year 2 and year 3 of the training period. One argument that could support this assumption is that, unlike Swiss apprentices, the typical Italian apprentice in these programmes would have already graduated from upper-secondary school.

Given that the true level of productivity of apprentices in Italy is not only difficult to forecast, there would also be a natural and probably considerable heterogeneity between apprentices and training firms, we always complement our simulations with sensitivity checks on different levels of relative productivity of apprentices. Thus, we can at least simulate whether deviations from our parameters that correspond to the Swiss averages would lead to sizeable changes in the net costs of training.

Dropout rates

In many countries, firms face high dropout rates, mainly due to a negative selection of students for work-based training programmes, but sometimes also because of either the poor quality or the bad reputation of programmes, firms face high dropout rates. Dropouts can also be a consequence of the duration of training programmes. If a long duration is not necessary to acquire the skills required to be a professional in the occupation, apprentices have a higher tendency to drop out prematurely. These dropouts may have a negative impact on the firms' willingness to provide future training places, not only because of the cost to their reputation, but also because firms cannot recoup their training investments if apprentices drop out too early. To calculate the potential additional costs of providing training places caused by dropouts, we simulate the impact of dropout rates of 25 % and 50 % of apprentices after the first year of the programme. In other words, if training one apprentice successfully in the full programme also means

	Potential biases
	Progress of productivity over time
	Sensitivity checks
	Dropouts may cause additional costs

18   Based on the discussion in our workshops with industry representatives, such a situation is currently observed for the application developer/software engineer occupations in the south of Italy.

training an additional apprentice unsuccessfully for one year, the potential costs of this additional apprentice must either be added to the costs for the successful apprentice or, in the case of net benefits, be deducted from the net benefits. The reason we are writing about potential costs is because dropouts generate additional costs only in programmes where apprentices cause net costs in the first year of training. If, however, the training scheme allows the firm to cover the training investments very quickly with the productive contribution of the apprentices, dropouts might even increase the net benefit (reduce the net costs) of the overall programme. Although, in the latter case, the firm has an incentive to discontinue the training if problems arise, the firm would still face the reputational costs of high dropout rates, which, in turn, would reduce the chances of attracting good apprentices in the first place.

Other expenditures

Similar to Switzerland

In addition to training expenditure and other personnel costs, as well as the apprentices' salaries, firms that train apprentices also incur other costs e.g. for tools, materials, and machinery, that they have to buy either for the purpose of training or that are not used exclusively for production when being used by apprentices for training. While personnel costs and apprentices' wages can be calculated using Italian wage data, expenditure for tools or machinery in Switzerland are difficult to transfer to the Italian context because the price level is different between the two countries. Therefore, we assume that the remaining expenditure, other than personnel costs and apprentices' salaries, correspond to the same share of these costs in terms of a skilled worker's salary in Switzerland. Although there is a certain amount of uncertainty attached to this assumption, the impact on our simulations is limited, as personnel costs and apprentices' wages already constitute between 85 % and 90 % of the total gross costs of training in Switzerland.

Costs for off-site education and training

Public provision of school-based education

In the German-speaking countries, off-site training and education is usually provided by public schools and fully paid for by the state. In other words, firms do not face direct costs for the education and training provided by schools but must, of course, factor in additional absences of apprentices from the workplace, which means less time for productive work for the firm. For this reason, it is not always clear ex ante if the training and education provided free by schools either decreases or increases the net costs of training for firms. As a rule of thumb, one can say that, if the training provided (free) by schools had to be provided in any case to attain the expected levels of skills and productivity, the public provision would lower the net costs of training for firms. However, if some or much of the content learned in school does not translate immediately to higher productivity of the apprentices, the additional absences from the workplace create additional net training costs for the firm. Because of the complex interplay of factors, one can easily understand why firms in countries with well-developed apprenticeship systems sometimes resist the transfer of training and education to off-site providers, while, in other instances, they lobby for more training and education to be taken over by publicly financed schools.

To make the simulations comparable not only with all the countries for which we are conducting simulations, but also with the empirical data collected in Austria, Germany, and Switzerland, we assume that off-site education is paid for by the government and that the training firms do not have to cover any additional costs for this part of the training programme.

No additional costs for training firms

4.3   Data

We use three major sources for the data in our simulations.

Data sources

The first source is the most recent cost-benefit survey data from Switzerland (see Strupler & Wolter, 2012), which collected data on the costs and benefits of apprenticeship training from a representative set of approximately 2,500 Swiss training firms. This study was the third to be conducted within one decade in Switzerland (see Schweri et al., 2003 and Muehlemann et al., 2007 for previous results), and the results remained remarkably stable over the business cycle.

Cost-benefit survey data (Switzerland)

This source is used to obtain all the necessary data regarding the following investments in training and the productive contributions of apprentices: the weekly number of training hours that a firm invests per apprentice; the number of hours spent by other personnel (such as HR services) involved in hiring and training apprentices; the proportion of unproductive time spent by apprentices in the firm (mainly used for practice); the number of hours apprentices substitute for unskilled workers while in the firm; the number of hours apprentices substitute for skilled workers while in the firm; the productivity levels in a given year of training relative to skilled workers in the same occupation; and, finally, the amount of money invested in material, tools and machinery and other expenditure related to apprenticeship training. All the relevant data are averages for Swiss firms training apprentices either in the same occupation or in the occupation that is most similar to the Italian occupation.

Investments in time and productive contributions

The second data source is Italian wage data for the economic sectors and occupations for which we run our simulations in Italy.[19] To calculate the productive contribution of the apprentices, we used the average wages of skilled workers in the same occupation in addition to the wages earned by young unskilled workers in the same economic sector. In some sectors, the reported data show that currently, an average unskilled worker earns almost as much or, sometimes, as much as an average skilled worker in the same economic sector. The most likely explanation for this result is a difference in years of tenure between an average older unskilled worker and a younger skilled worker. In our simulations, when calculating the productive contribution of an apprentice performing unskilled labour, we assume that the value of this work is equal to what a firm would have to pay a young unskilled worker hired today from the labour market. Given that the unemployment rate of young people in Italy is high, such an assumption seems justified.

Italian wage data

As for training and personnel expenditure, we used the salary data for skilled workers in the training occupation, in addition to other categories of workers (such as HR personnel) involved in either the training or the management of apprentices.

Other personnel categories

19   Wage information was kindly provided by the Foundation Giacomo Brodolini based on the Italian Labour Force Survey 2015.

Hiring costs

We collected data on hiring costs, as there are no Italian data available on the hiring costs of new workers. As the labour market situation differs considerably between Switzerland and Italy, we were also not able to use existing Swiss data for this purpose. The data were collected at the end of each sectorial workshop (by means of a pencil and paper questionnaire) as well as by means of an online survey. While the results are not representative for Italy because we could not apply a random sampling strategy, we obtained a sufficiently high number of responses that allows for a more detailed analysis of hiring costs in Italy, which we provide in Chapter 5.[20]

Big firms typically have higher takeover rates

The degree to which a firm can save on hiring costs per trained apprentice depends on many factors, such as the labour market situation for apprentices who finish the program, the loyalty of apprentices to the training firm, and the in-house opportunities for apprentices. The experiences in Austria, Germany and Switzerland show that larger firms with internal labour markets have higher takeover rates than small firms. Large firms typically required more firm-specific knowledge and can therefore expect higher savings in hiring costs.

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20 Except for the occupation waitresses/waiters, we received a sufficient number of responses to provide estimates for hiring costs for the remaining 8 occupations in our project.

5 Simulating net training costs –
   a detailed analysis

In this chapter, we illustrate the simulations of the costs and benefits of various training models in detail for the occupation of a commercial bank employee and provide additional descriptive statistics. We present all detailed results of the other eight training occupations (but without further explanations) in the appendix.

1. We estimate the net training costs for all three baseline models, as outlined in the previous chapter (Chapter 4) for this occupation.

2. We provide a sensitivity analysis regarding the productivity of apprentices relative to skilled workers at the beginning of an apprenticeship. Thus, we show how the net training costs change when we allow for different assumptions of the productivity parameter.

3. We present a break-even analysis for apprentice wages, showing at what level of monthly apprentice's pay a firm could offer apprenticeship training at zero net costs, and also in relative terms compared to the skilled worker wage in the training occupation.

4. We discuss how net costs vary by firm size, as large firms typically offer higher wages, particularly for skilled workers.

5. We show how different dropout rates affect the net costs of training.

Net training costs for apprentices

When looking at the results for the three baseline models (see Table 2) with two different apprentice wage scenarios, it immediately becomes clear that, from the firm's perspective, net training costs vary greatly not only due to the different apprentice wages but also between the different scenarios. In the high-wage scenario in Model 3, net training costs are higher than € 30,000. Conversely, a firm can expect to generate a net benefit of around € 3500 from training an apprentice according to the same Model 3 in the low-wage scenario. Thus, setting apprentice pay at 50 % of skilled worker pay (high-wage scenario) compared to about 25 % (low-wage scenario) adds an extra 12,000 euros to the yearly apprentice wage bill. As the skilled worker salary of a trained commercial bank employee is clearly among the highest in Italy, the difference between the low-wage and the high-wage scenario is more pronounced compared to other occupations.[21]

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21 In reality, we might expect that higher wages could attract better qualified candidates. In our simulations, however, we assume that the qualification level of a candidate remains stable (i.e. corresponds to the average qualification level of a Swiss apprentice).

The differences in net training costs between training models, however, require a more detailed explanation. As the training duration in Model 2 is only two years, the net costs are typically much higher compared to Model 3, where training lasts three years. In particular, because apprentices are not absent from the workplace in the third year and already have a relatively high productivity, the benefit of their productive work clearly outweighs the training costs and therefore allows the firm to recoup at least part of their initial training investment.

However, the results from the high-wage scenario clearly show that whether Model 3 is more beneficial than Model 2 also depends on the level of apprentice wages. In the case of the commercial bank employee, the apprentice's productivity is simply not high enough to cover the apprentice wage costs in addition to the costs for workplace training (as highly paid instructors also make training more expensive). Thus, for Model 3 to yield sufficient benefits, it is important to ensure that apprentice salaries are not set at too high a level. Otherwise, a longer training duration simply translates into higher losses for the company.

TABLE 2 **Net training costs – Commercial bank employee – Italy**

Wage level	Model 1	Model 2	Model 3
low	8,241	4,419	–3,486
high	43,537	27,950	31,810
Source: own calculations			Bertelsmann**Stiftung**

Substantial potential savings in hiring costs due to apprenticeship training

Our survey results show that firms training commercial bank employees face substantial hiring costs when hiring externally. Besides the usual recruitment costs, the hiring firm also incurs costs due to lost productivity during the adaptation period (i.e. until a new hire becomes fully productive), and disruption costs because incumbent employees provide informal training to new hires. In Switzerland, an average firm across all occupations faces hiring costs of about 4 monthly salaries of a skilled worker (Muehlemann and Strupler Leiser 2018). In Italy, however, hiring costs tend to be even higher, but there is a large variation across occupations. For commercial bank employees, the results of our survey indicate that hiring costs amount to 8.6 months of a skilled worker's salary (Table 3), or about 29,000 euros.

TABLE 3 **Hiring costs – Commercial bank employee – Italy**

Hiring costs	Search costs	Adaptation costs	Disruption costs
8.6 months of a skilled worker's salary	8.4 %	74.5 %	17.1 %
Source: own calculations			Bertelsmann**Stiftung**

The data for hiring costs reveal, similarly to Switzerland, that the search cost component is typically the least important component of hiring costs. As new hires, even when qualified in terms of the educational requirements, also need to acquire firm-specific knowledge and familiarize themselves with the work environment during the onboarding process, the initial adaptation period until a new hire becomes fully productive results in substantial costs for the hiring firm. Conversely, when retaining a former apprentice, such costs typically no longer arise or are kept to a minimum.

Moreover, incumbent workers often need to provide instruction to new external hires, which leads to disruption costs (due to incumbent workers not being able to carry out their regular tasks). In relative terms, adaptation costs are the most important hiring cost component in all occupations in our study, but the relative importance varies to some extent across the different occupations. For commercial bank employees (Table 3), search costs account for only 8.4 % of hiring costs, whereas the remainder is due to adaptation costs (74.5 %) and disruption costs (17.1 %).

Thus, to the extent that training firms were able to retain apprentices after training, and if subsequent turnover rates did not exceed those of external hires, then all training models (except for Model 1 in the high-wage scenario) became profitable or close to the break-even point when taking a longer-term perspective that also incorporates future savings on hiring costs. However, it also becomes evident that if firms faced high turnover rates of apprentices after training, these additional benefits would disappear immediately.

Net training costs also change by the year of training (Figure 1): in the first and second year, training costs clearly exceed the benefit, but in the third year, net costs are almost zero. The main reason why net costs decrease is the corresponding increase in the value of productive tasks because apprentices become more productive in skilled work. It should also be noted that apprentice wages are constant in our simulations, while in Switzerland apprentice wages are structured so that they increase during the course of an apprenticeship programme. An advantage of such a wage structure is that net costs are lower in the beginning of an apprenticeship (thereby reducing the costs for the training firm when dropouts occur), and also correlate with an apprentice's productivity (possibly having a positive effect on an apprentice's motivation).

Net costs evolution

FIGURE 1 **Gross costs, productivity, and net training costs by year of training – Commercial bank employees – Italy**
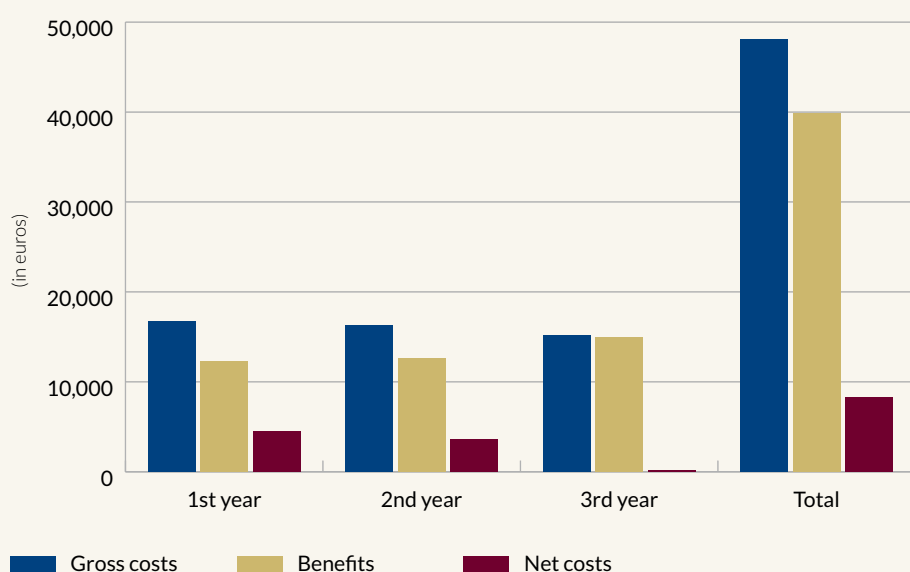
Source: own calculations, based on model 1 (low-wage scenario)　　Bertelsmann**Stiftung**

Costs of instruction time

Instruction time at the workplace, another important cost component, is assumed to be constant across the different years of training. The reason for this assumption lies in the observation that the instruction time in Swiss firms varies very little in the different years of an apprenticeship programme.

Sources of benefits

As apprentices become more experienced in difficult tasks usually performed by skilled workers, firms also allocate a higher fraction of such tasks to apprentices (relative to unskilled tasks). Figure 2 shows the composition of training benefits by training year stemming from apprentices substituting skilled and unskilled workers. While almost all the training benefits in the first year of training are due to low-skilled tasks, only about 30 % of training benefits result from low-skilled tasks in the third year of training. Thus, as apprentices become more productive in skilled tasks, firms also allocate more time for apprentices to carry out skilled rather than unskilled tasks.

Nonetheless, when high-skilled tasks are very difficult to perform, the productivity of the apprentices is initially very low compared to experienced skilled workers. Moreover, if the wage levels for unskilled workers is close to that of skilled workers, then the share of the monetary benefits accruing from low-skilled work may still surpass that from high-skilled work in the short term, even if the firm uses apprentices predominantly for skilled activities.

FIGURE 2 **Composition of training benefits by year of training – Commercial bank employees – Italy**

Benefits from unskilled tasks   Benefits from skilled tasks

Source: own calculations, based on model 1 (low-wage scenario).   Bertelsmann**Stiftung**
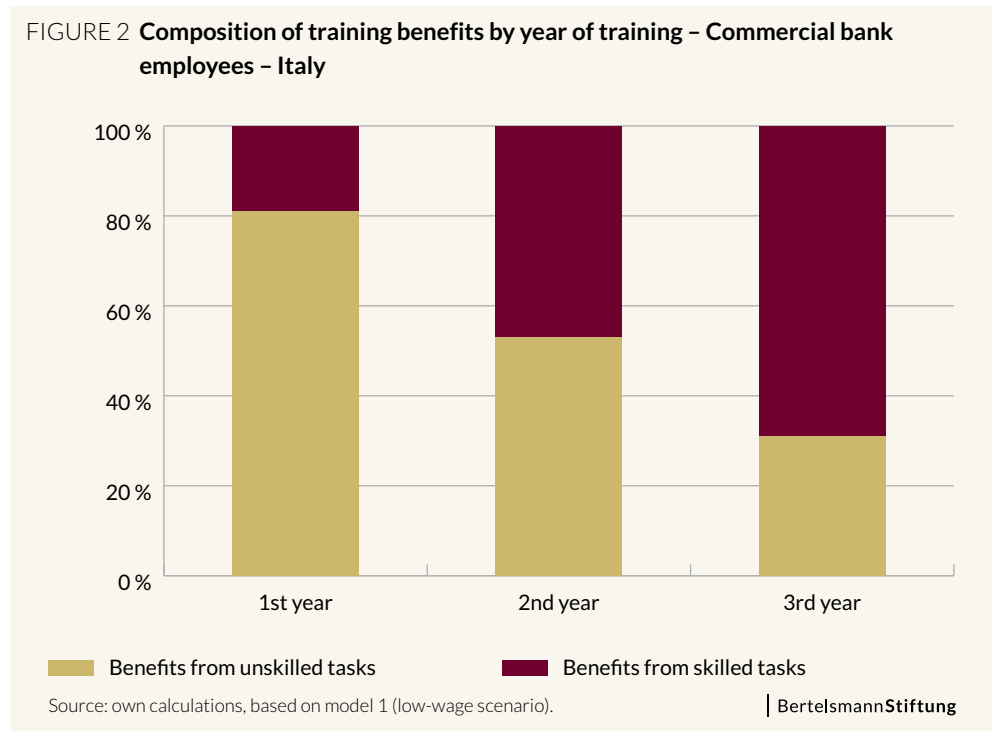
FIGURE 3 **Composition of gross training costs – Commercial bank employees – Italy**

54 %

29 %

17 %
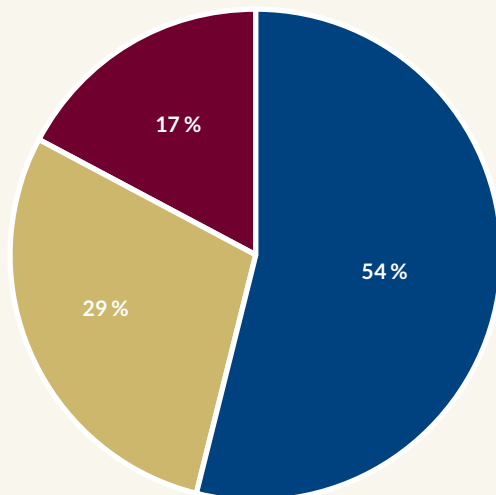
■ Apprentice labor costs   ■ Personnel costs   ■ Other costs

Source: own calculations, based on model 1 (low-wage scenario).   BertelsmannStiftung

Regarding the components of the gross training costs, Figure 3 shows that most training costs are in fact wage costs for apprentices and training instructors. In the case of Model 1, apprentice wage costs account for 56 % of total training costs. Conversely, the costs for instruction at the workplace amount to 28 % of total training costs, leaving less than 20 % for other expenditure, such as infrastructure or materials used for training purposes. The respective proportions are very similar for Model 2 and Model 3, and also correspond closely to the results obtained for Swiss training firms (Strupler and Wolter 2012).

Cost components

Sensitivity analysis of apprentice productivity

The purpose of training for the apprentices is to be hired as skilled workers at the end of their training period by either the training firm or an outside firm. In order to learn the necessary skills, they must not only follow a theoretical education but also be able to practise their newly acquired skills during training. The benefit created for the firm by letting apprentices substitute for skilled workers depends crucially on the relative performance (productivity) of apprentices compared to skilled workers. As we cannot directly measure the productivity of Italian apprentices, we use the levels of productivity of Swiss apprentices in our calculations. Thus, our estimates rely on the assumption that the relative productivity of apprentices in skilled tasks compared to experienced skilled workers (but not the absolute levels of productivity) would be the same for Italian and Swiss apprentices. This might be a good assumption to start with, but there are many reasons why in the real case of introducing a Swiss apprenticeship model in Italy, we would not see exactly the same levels of relative productivity. Therefore, it is necessary to run sensitivity analyses in order to see by how much the net costs or net benefits of training would change if we deviated (+/− 10 percentage

Sensitivity checks

points in the first year of training[22]) from the Swiss assumptions about the relative productivity levels of apprentices.

FIGURE 4 **Sensitivity analysis of apprentice productivity – Commercial bank employees – Italy**

Source: own calculations (low-wage scenario)

BertelsmannStiftung
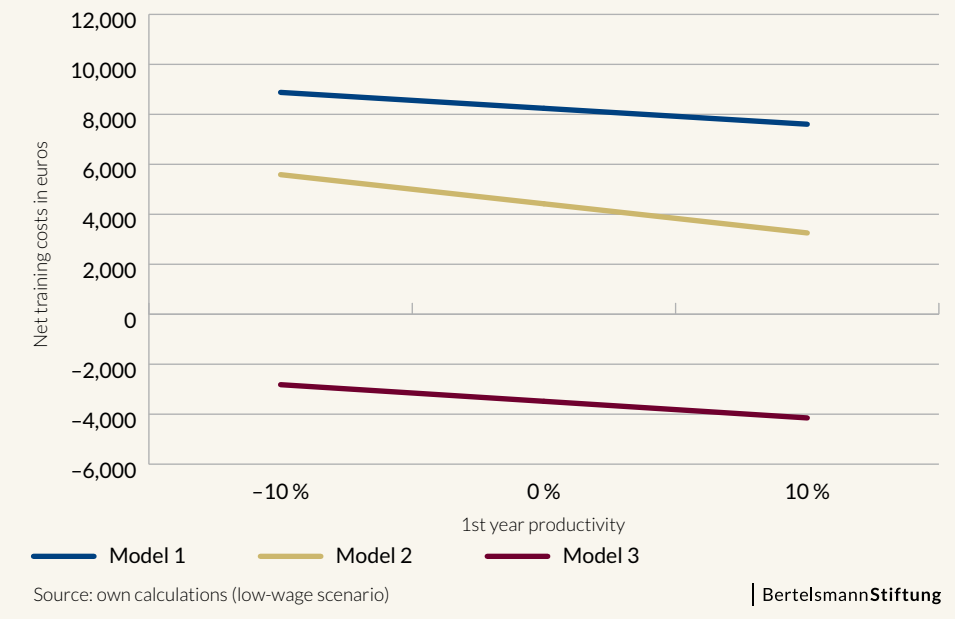
The net costs change similarly to changes in the assumption about the relative productivity of apprentices across the different training models (Figure 4). The changes, however, are not very large: increasing the relative productivity of an apprentice by 10 percentage points (e.g. from 30 % to 40 % compared to that of a skilled worker) by € 1,200 in Model 2, but only by about € 600 in Models 1 and 3. Net costs in Model 2 react somewhat more sensitively to changes in the assumption about the relative productivity of apprentices because we assume that, due to prior education and the advanced age, firms replace skilled workers with apprentices more quickly, and apprentices in turn begin to work at higher levels of productivity faster. Nonetheless, even for Model 2, the results are not affected very strongly by changes in the relative productivity parameters.

Break-even analysis for apprentice pay

Break-even monthly pay lies between € 500 and € 800

The break-even analysis illustrates the linear relation between the apprentice's monthly wage and the firm's net training costs, holding all other factors constant. The break-even analysis serves to show the salary level at which a firm would just have zero net costs in training apprentices. Additionally, it also helps to understand the average amount by which apprentice pay would have to be increased or reduced if additional benefits or costs accrued, although they are currently not included in our model. Technically, a € 1

22 In Model 1 and 3 with a training duration of three years, we also change the second-year relative productivity by +/– 5 percentage points.

increase in the monthly apprentice wage leads to a € 36 increase in net costs for Models 1 and 3 (36 months of training), while it increases net costs by € 24 in Model 2 (24 months of training). Thus, apprentice pay is a decisive factor for a firm's cost-benefit ratio, and net training costs are highly sensitive to how we set apprentice pay.

The calculation of the break-even wage (Figure 5) shows that net training costs would be zero for monthly apprentice wages between € 500 (Model 1) and € 800 (Model 3). Although these break-even wages are substantially lower than current (minimum) apprentice wages in Italy, the fact that our simulations are relevant for a scenario where apprentices sign a training contract that is automatically terminated at the end of their training has to be taken into account. Thus, to the extent that apprenticeship training is supposed to attract a substantial number of firms, such a contractual setting is probably important, because not all firms may want to retain apprentices after training. In Switzerland, almost two thirds of apprentices leave the training firm within a year after training. Similarly, in Germany the retention rate is higher but still about 40 % of apprentices leave the training firm within a year after training. Therefore, it is important that particularly small training firms can break even (or come close to break-even point) by the end of training, because otherwise they are unlikely to participate in the apprenticeship training system, as is currently the case in Italy.

Break-even pay is below the minimum apprentice wage

FIGURE 5 **Break-even analysis of apprentice wage – Commercial bank employees – Italy**

Source: own calculations

Bertelsmann**Stiftung**
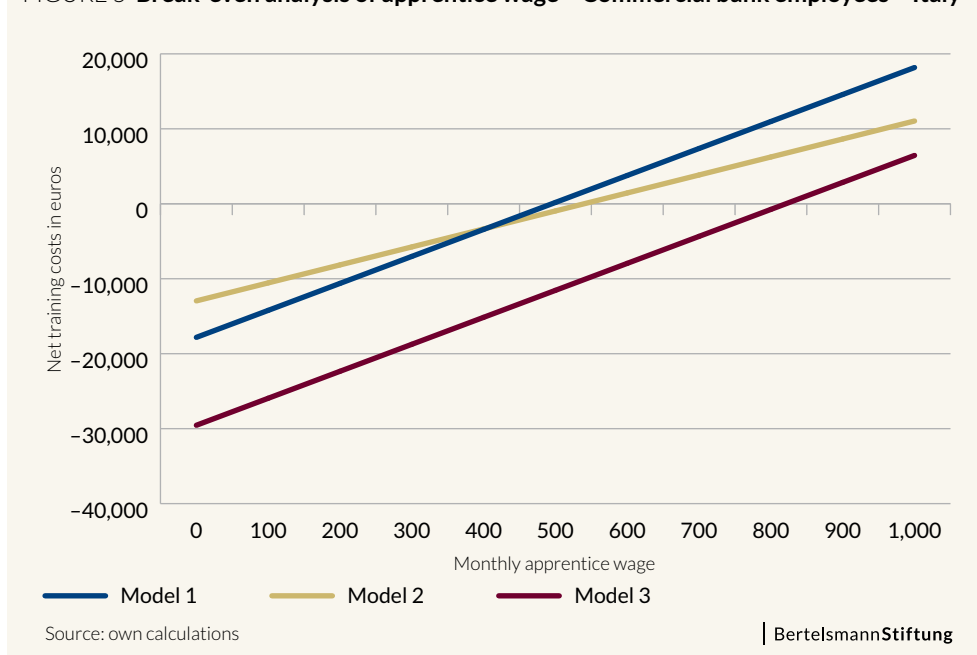
In relation to unskilled and skilled wages, break-even wages are between 15 % and 33 % for each category (Figure 6). One can see from the calculations that, even relative to unskilled wages, break-even wages would need to be substantially below these wage levels for firms to be able to pay for their training expenditure. Taking into account the reflections on 'fair pay' (see Chapter 4, assumptions on wages), this is, however, not surprising. Even if we excluded any training expenditure by the firms, 'fair pay' for an apprentice relative to a skilled worker would need to take into account four factors

Break-even pay relative to skilled and unskilled wages

that push the ratio down. Firstly, an apprentice is not always working because he/she spends some time in off-site schooling. Secondly, when the apprentice is at the firm, he/she is not always working but also needs 'unproductive' time to practise. Thirdly, when working, the apprentice is also doing unskilled work that would be remunerated at a lower pay level and, most importantly, when substituting a skilled worker, the apprentice works at an average at a productivity level that is significantly lower compared to a skilled worker. The four factors taken together easily explain why the break-even wages even in the best case (Model 3) do not surpass 25 % of an average wage for a qualified commercial bank employees.

FIGURE 6 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Commercial bank employees – Italy**

Source: own calculations

BertelsmannStiftung
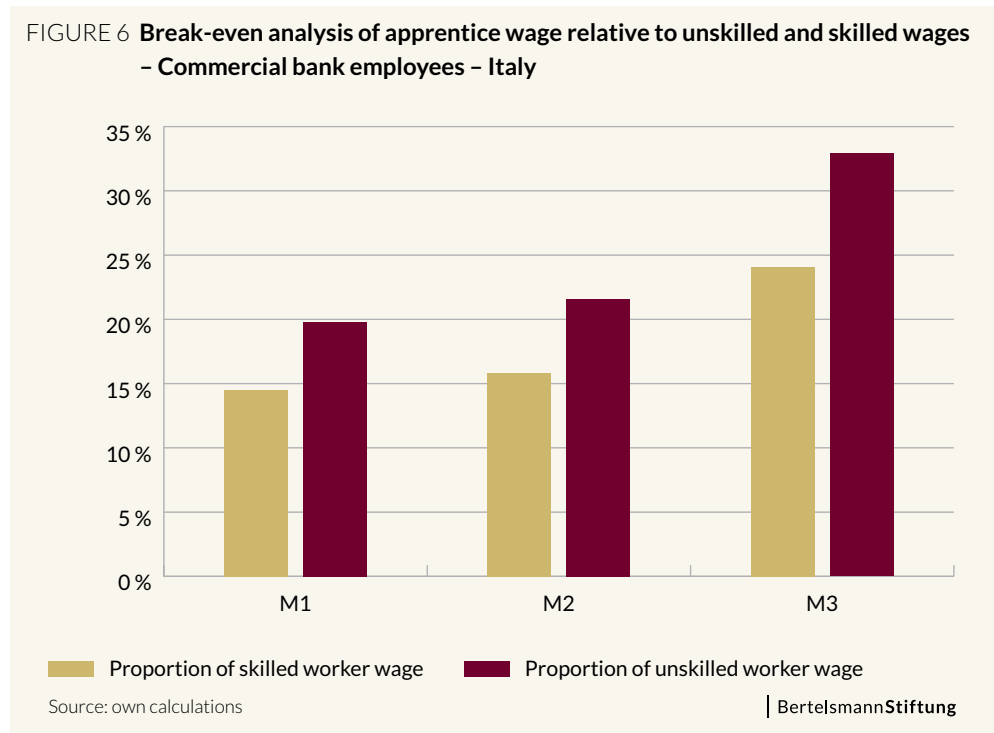
Wage structure within a firm – how net costs differ by firm size

Firm size can matter While apprentice pay is an important cost component, the wage structure for low- and high-skilled workers also strongly affects the value of an apprentice´s productive contribution (the benefit side). The value of having an apprentice work productively for one hour in an unskilled or skilled activity corresponds to the unskilled or skilled wage (adjusted for the relative productivity of the apprentice, as discussed in Chapter 4) for a worker of that particular firm. Thus, the higher the pay for unskilled and skilled workers, the more beneficial it is for a firm to use the trainee for productive work (all other things remaining equal[23]). Firms differ not only by wage levels (which reflect differences in the overall productivity of the firm) but often also in respect to the ratio between unskilled

23 A firm's provision of workplace training may depend on the firm size for various reasons and not only because of levels and differences between unskilled and skilled wages. Looking at the Swiss data, we find that the differences in the training hours provided to apprentices do not vary much by firm size, and this lack of variation is the reason why we assume in the simulations that all other factors besides the wage structure remain constant across firm sizes.

and skilled worker pay. Hence, the latter also determines a firm's optimal allocation of skilled and unskilled tasks to an apprentice.

To illustrate this in detail, let us consider the extreme and hypothetical case where unskilled and skilled wages are equal. In that scenario, a firm that wants to minimise net training costs has an incentive to allocate as few skilled tasks as possible to the apprentice, because the productivity of an apprentice in skilled tasks is lower compared to a skilled worker, while an apprentice – by definition – is assumed to be equally productive in unskilled tasks compared to an unskilled worker. However, if unskilled pay is much lower than skilled pay, then a profit–maximizing firm has an incentive to allocate skilled tasks to apprentices early on, so that their productivity in these tasks increases faster. Again, let us consider an extreme case where the productivity of an apprentice in the last year of training is equal to that of a skilled worker. In this case, the firm's benefit from having the apprentice carry out the skilled tasks is simply the difference in hourly pay between the skilled worker and the apprentice, and by assuming that the skilled wage is higher than the unskilled wage, a firm will no longer have an incentive to use apprentices for unskilled tasks.

Incentives to use apprentices for skilled tasks

Looking at the Italian wage data, we observe that the wage level in small firms is generally lower than in large firms, as is the case in almost all countries. Moreover, the differences between skilled and unskilled pay may change across firm size categories. While unskilled workers also earn more in large firms compared to small firms, the magnitude of the firm size wage premium differs by the qualification level across the different occupations.

Skills premium higher for big firms

As we assume in our simulations that firms pay the same apprentice pay irrespective of their size, observed differences in our simulated net costs arise due to wage differences of unskilled and skilled workers. A change in wages has ambiguous effects. As outlined above, higher skilled and unskilled wages increase the value of the allocation of productive tasks to apprentices. However, an increase in skilled worker pay increases training costs, because each hour of instruction time becomes more costly. Thus, depending on the amount of training provided at the workplace and on the extent to which apprentice are used in the production process, an increase in skilled worker wages can have a positive or a negative effect on net training costs. For commercial bank employees, the results show that the differences across firm sizes are very small (see Figure 7). However, in other occupations we find at times considerable differences in net training costs across firm size categories (see Appendix).

Expected net benefits do not differ much between firms of different sizes

It is important to note that in reality, bigger firms often pay higher apprentice salaries than small firms, which affects net training costs (but possibly also facilitates the recruitment of suitable apprentices).
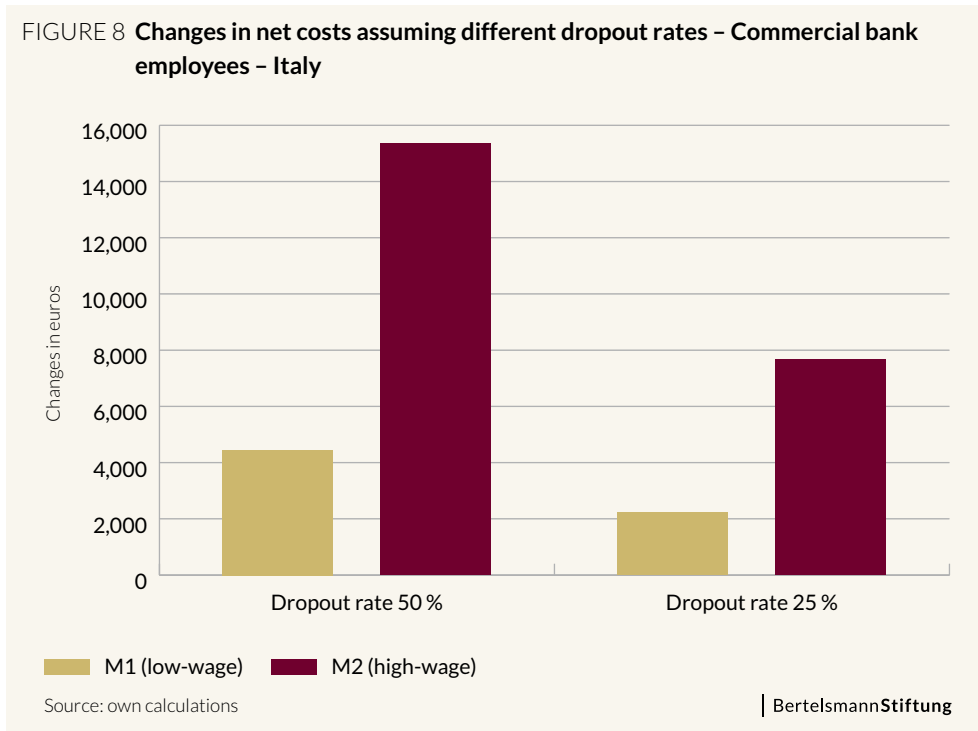
FIGURE 7 **Net costs by firm size – Commercial bank employees – Italy**

Source: own calculations, based on model 1 (low-wage scenario)

BertelsmannStiftung
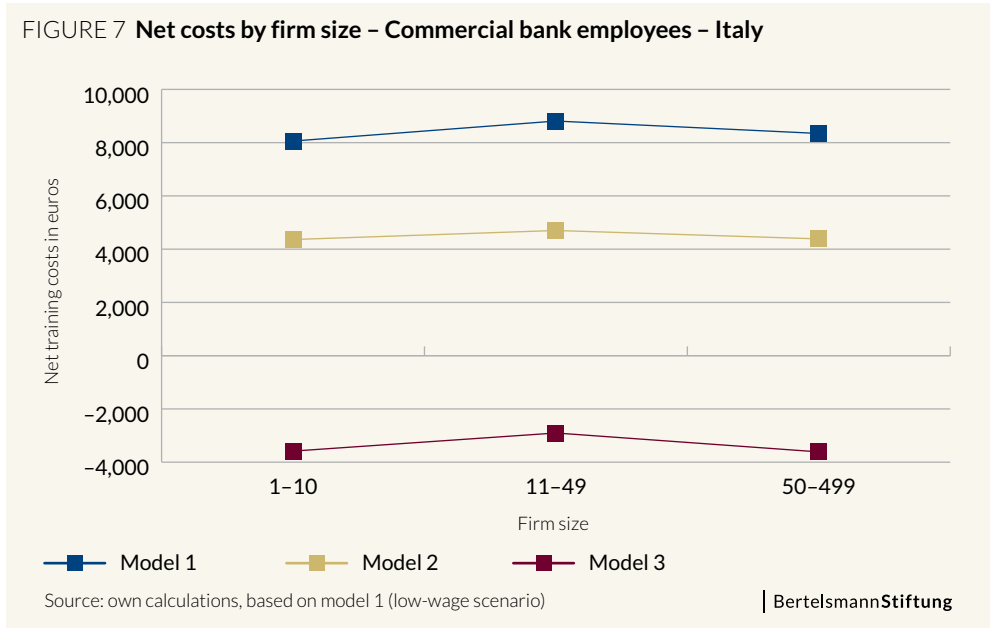
Micro firms may face more difficulties

Small firms typically face a higher risk of being unable to retain their apprentices after the training period (or may have no vacancies to fill) and therefore cannot factor in additional benefits after training, or only to a lesser degree. Conversely, very small firms would need to adhere to the low pay scenario if they do not want to risk losing money by training apprentices. Although big firms could easily run a Swiss-type apprenticeship model given the Italian wage structure, micro-firms would have difficulty doing so.[24]

Dropouts increase the net costs

Finally, we analyse what impact apprentice dropouts would have on the net costs of training of one successful apprentice after the first year of training. Figure 8 compares our basic scenario with a zero-dropout rate to calculations where every fourth (25 %) or every second (50 %) apprentice would quit the training programme after the first year for Model 1 with low pay and for training Model 2 with high pay. Since in our simulations the training firm faces net costs after the first year, such dropout rates would increase the overall net costs per successful apprentice. Across the different models, a 50 % dropout rate would increase the net costs for successful training of an apprentice by roughly 50 % (because net costs are almost identical in the first two years of training, and close to zero in the third year, as shown in Figure 1). Thus, paying a lower apprentice salary in the first year of training (with a corresponding increase in the second and third year of training) would clearly reduce dropout costs from the firm's perspective.

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24   We call SMEs with less than 10 employees 'micro-firms'.

FIGURE 8 **Changes in net costs assuming different dropout rates – Commercial bank employees – Italy**

Source: own calculations

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Besides the financial costs that dropouts generate for training firms, there would certainly also be a negative psychological factor affecting the willingness to train and, as mentioned before, damage to the firm's reputation to take into account.

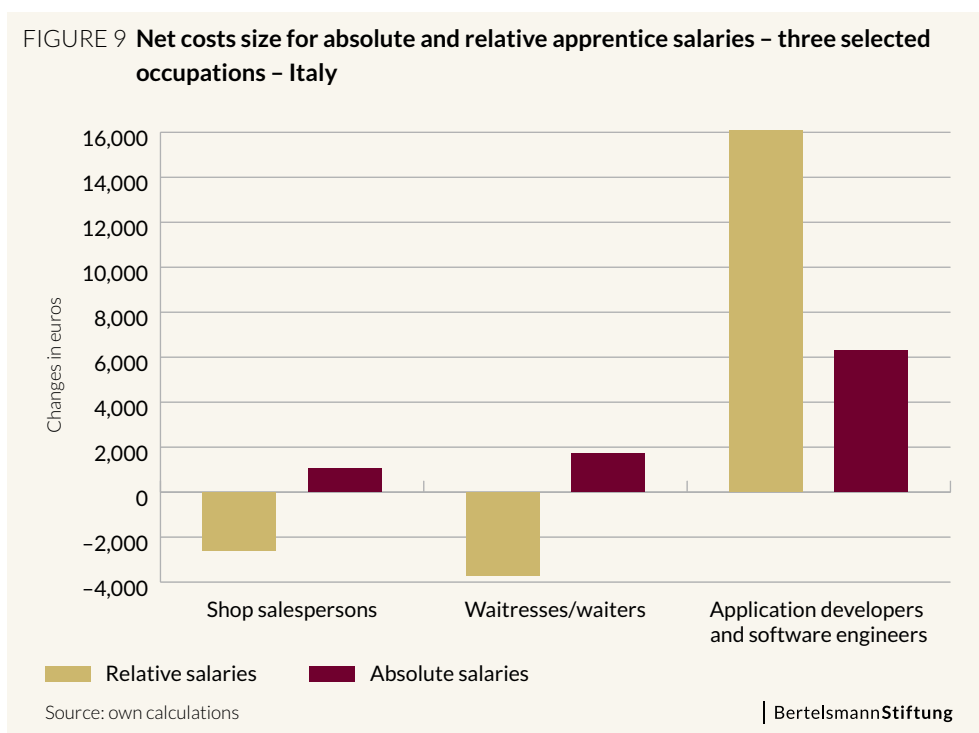Reputational risks

6 Setting apprentice wages and potential effects on training quality

Absolute vs. relative minimum apprentice wages

There are two basic options when it comes to setting minimum apprentice wages: firstly, apprentice wages may be set at a certain absolute level that applies to all apprenticeship occupations. In our simulation results for Spain (Wolter and Muehlemann 2014) we followed such a strategy, also because minimum wages for young people in Spain were set as absolute minimum wages, although they can differ from region to region.[25] Similarly, because of a national youth minimum wage in England that comes close to break-even wages or sometimes would even be higher than break-even wages, we have also used absolute wages in the simulations for English firms (Wolter and Joho 2018).

Conversely, in Italy minimum wages are set at the sector level, so there are differences across the nine occupations for which we simulate net training costs. For that reason, we assume that apprentice wages are a certain fraction of the skilled worker wages in the corresponding occupations. In the low-wage scenario, that fraction was about 25 % (the average break-even wage), whereas it was 50 % of a skilled worker's salary in our high-wage scenario.

Figure 9 illustrates that choosing an absolute (for reasons of illustration, we assume a wage of 530 euros per month, which corresponds to the high-wage scenario of Wolter and Muehlemann 2014), rather than a relative apprentice pay setting (25 % of skilled worker pay) can strongly influence the outcomes with regard to net training costs, but the direction of that change must not be the same for all cases. In the occupation shop salesperson, the absolute and relative apprentice wages are quite similar, and as a result the net costs do not change much. In the occupation waitresses/waiters, the effect is already larger because the relative apprentice wage is significantly lower than 530 euros. The most striking consequence is observed in the occupation application developer and software engineer, because skilled worker wages are very high. As a result, apprentice wages as a fraction of skilled worker salaries are considerably higher than 530 euros, adding up to a difference in net training costs of 12,000 euros over a three-year apprenticeship programme. Thus, a consequence of setting apprentice wages at an absolute level (in euros) rather than as a percentage of skilled worker wages in a particular occupation is that the rank of occupations in terms of net training costs can change if there are large differences in skilled worker salaries across training occupations. In the cases illustrated here, the move from relative salaries to absolute salaries would increase the net costs for two occupations, while reducing the net costs substantially for the third occupation.

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25 In particular, we made simulations for a low-wage model with 300 euros monthly apprentice wages, and a high-wage scenario where apprentice wages were set at 530 euros (which was the minimum wage for youths in Catalonia).

FIGURE 9 **Net costs size for absolute and relative apprentice salaries – three selected occupations – Italy**

Relative salaries

Absolute salaries

Source: own calculations

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While our aim, as previously stated, is not to assess the current cost-benefit situation in Italy, we nevertheless provide an analysis in this chapter of how net costs change when we use actual minimum wages for apprentices in Italy.[26] As actual minimum apprentice wages yield net training costs that are often higher compared to our high-wage scenario, we provide a simulation of how firms could reduce training costs even if they have to pay minimum wages to their apprentices (Figure 10).

Simulation 1 calculates net training costs for a scenario where firms have to pay apprentices a wage corresponding to the relevant Italian minimum apprentice wage. As illustrated in Figure 10, such a scenario results in substantial net costs for all occupations.

Simulation 2 is a scenario in which firms would react to the high net costs by deciding not to provide training at the workplace longer and therefore also dispense with any practise time. However, as a consequence of reducing the training at the workplace, we have to further assume that the relative productivity of apprentices is 50 % of the relative productivity used in Simulation 1, where we use the respective values from Swiss training companies. This assumption reflects the fact that apprentices still learn because they receive formal training at the school, but that they accumulate skills much more slowly compared to a situation in which they also receive formal training at the workplace.

Simulation 3 additionally assumes that while at the workplace, apprentices spend all of their time with simple tasks that are usually allocated to unskilled employees. The firms

How firms could decrease training quality as a reaction to high net training costs

26 The relevant minimum wages for apprentices in the corresponding occupations were kindly provided by the Fondazione Giacomo Brodolini.

realize that the progress and the levels of productivity of the apprentices (assumptions in Simulation 2) are too low to generate a satisfactory added value when doing skilled work, and therefore decide to use the apprentices only to substitute for unskilled labour. Thus, in this case apprentices are exploited as cheap labour and do not have the opportunity to acquire occupational skills by means of formal training or informal learning at the workplace. In this case, learning takes place only at the school.

FIGURE 10 **Net costs for differing scenarios for intensive training in the firm simulations based on Model 1 – Italy**

Source: own calculations

BertelsmannStiftung
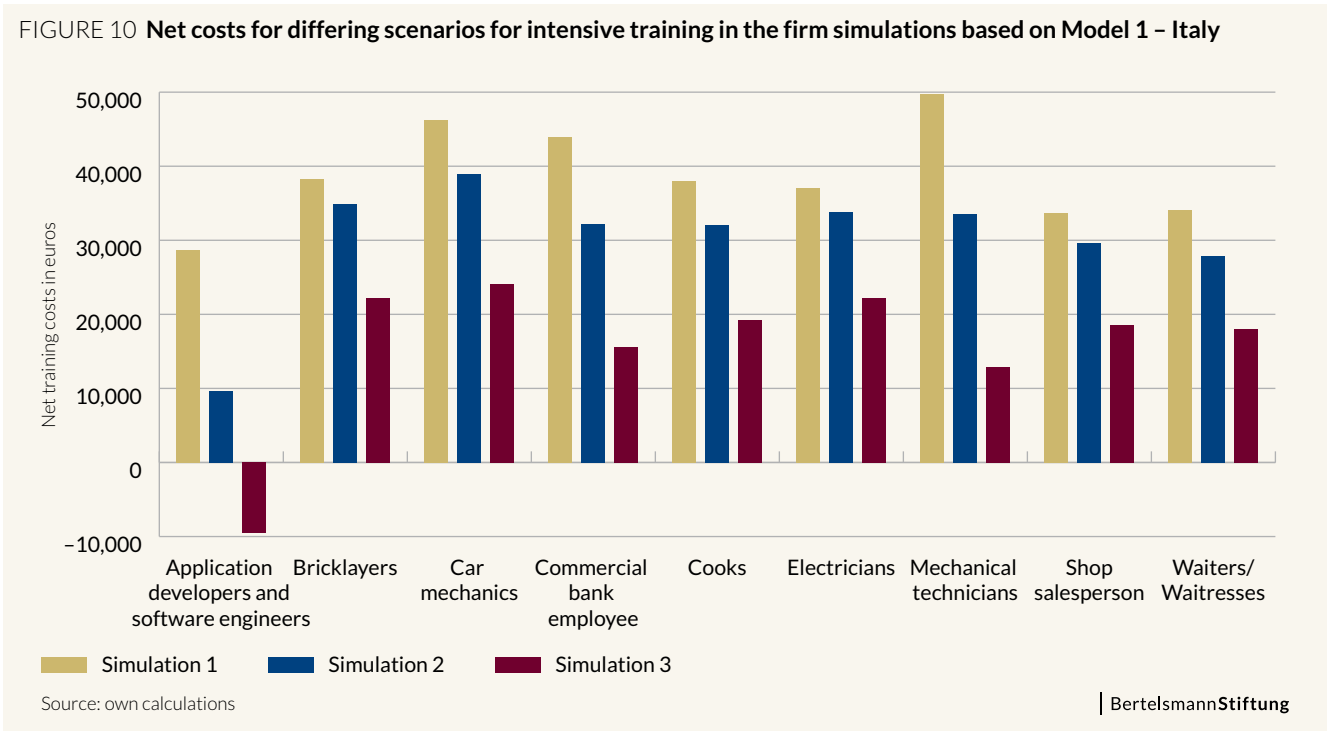
The results show that the substantial net costs observed in Simulation 1, with a highest value of almost 50,000 euros for the occupation mechanical technicians, could be reduced considerably by applying the decisions that underlie the assumptions in Simulations 2 and 3. For some occupations, the elimination of formal training at the workplace already reduces the net costs substantially e.g. in the case of application developers and software engineers, whereas for other occupations, like bricklayers and shop salespersons, the impact would be smaller. However, the switch from using apprentices to substitute for skilled workers to a policy under which apprentices would be solely used to substitute for unskilled workers would produce substantial reductions in the net costs for all occupations. This is the result of the fact that when the relative productivity of apprentices falls because of the lack of formal training at the workplace, the added value provided by the work of apprentices when substituting skilled workers falls below the value added when apprentices replace unskilled workers. To sum up, the simulations show that firms could reduce net training costs drastically by not offering training or learning opportunities at the workplace, even when forced to pay the minimum apprentice wage. Or in other words, firms that are forced to pay minimum wages that lie substantially above break-even wages have an incentive to cut training expenditures and make changes in the use of apprentices in the production process in order to reduce the expected net costs of training and thereby would automatically impair training quality.

The implications of our simulations are that it is important to not only establish training curricula that specify what skills apprentices need to acquire at the workplace, but also to ensure that monitoring agencies are in place to enforce firms' compliance with the training regulations. As our results in Figure 10 show, training firms clearly would have financial incentives to reduce the training quality when net costs are too high (if all firms did not refrain from participation in the apprenticeship system in the first place).

Monitoring agencies are necessary to enforce training quality

7 Results of a simulation of private rates of return to education for apprentices

Does it pay off for apprentices?

Observing that some wage scenarios (low, high, and break-even) assume apprenticeship wages that are only a relatively small fraction of unskilled and skilled wages, a question arises as to whether training is worthwhile for the apprentices at such levels of apprentice pay. The lower the pay during the training period, and the longer the duration of the apprenticeship programme, the higher the wage differential between the unskilled and the skilled wage must be for the rest of the apprentice's working life to generate a positive return to education. Given that apprentices in Italy start their training much later compared to countries like Switzerland and Germany, the wage aspect of apprenticeship training is also much more important.

Simulations using break-even wages

Although we are using real labour market data on Italian wages in this study, we need to simulate these rates of return to education because these calculations should mirror our assumptions in the cost-benefit simulations for firms. In other words, we need to simulate whether apprentices can expect positive returns to education if they follow an apprenticeship as designed in our models and are paid the apprentice wage as assumed in the cost-benefit simulations for firms. The results shown in Table 4 use the break-even wages calculated for all models and occupations. In the break-even scenario, firms would not incur net costs after training and would therefore not need to rely on additional benefits after training. Thus, it is most interesting to see whether scenarios that are attractive for firms to offer apprenticeships are also attractive for potential apprentices.

Additional assumptions

For the calculations of the rates of return to education for apprentices, we need to make some additional assumptions. Firstly, the alternative wage for a young person who chooses to forgo an apprenticeship would be the wage for an unskilled employee in the same economic sector as the apprenticeship. A stronger assumption, however, is that we use the current wage levels of skilled people as the expected wages after training. We chose to use this assumption as a lower threshold for our calculations, presuming that a student facing the decision to start an apprenticeship does not use the current wage levels observed for trained workers as the benchmark in his/her decision process. We could, of course, assume that if Italian apprentices were trained similarly to Swiss apprentices, their levels of productivity would increase compared to workers in the same occupations in Italy today and they would earn a skill premium. For the firms – as described above – changes in the assumptions influencing the impact of training on skilled wages do not alter the net costs of training much, whereas for the apprentices, such increases would translate directly into higher rates of return to education. However, we cannot know the amount by which the productivity of apprentices would rise in reality, or how such increases would translate into higher salaries for skilled workers. For these reasons, we chose to adhere to the conservative assumption that, in the short term, wage levels for skilled people would not change.

The calculations were made using the average salaries per occupation and sector for skilled and unskilled workers. We transform these averages into lifetime earning streams with a convex shape using information about the impact of experience (and experience squared) from Mincer earnings regressions (e.g., Polachek 2008). Thus we assume that wages increase steeply in the first years of working life, flatten in the middle, and may even decrease when approaching retirement. We then calculate the interest rate that would be needed to equalise the income stream for the unskilled and the skilled person for each of the occupations and models.

Lifetime earnings

The rates of return to education differ between the models not only because of differences in the apprentice pay but also because in Model 1 we assume that apprentices start their apprenticeship directly after finishing lower secondary education and then earn the skilled wage until the end of their working life. Conversely, in Model 2 and 3 the apprentices would spend an additional three years in upper secondary education (without pay), which shortens the time available to earn the skilled wage. Rates of return to education differ among the occupations mainly because of the different skill premium observed today on the Italian labour market and, to a small extent, because of different break-even wages paid during the apprenticeship.

Rates of return depend on the duration of training models

From the empirical literature, we know that most people have rates of time preference above 5 %. In other words, they prefer an instant reward to a later payment, even if the later comes with a surplus of 5 %. Reading the results in Table 4, we therefore interpret rates of return to education that do not exceed 5 % as critical (numbers in bold in Table 4), because these rates of return to education would most probably be too small to attract average students.

Rate of return should exceed time preferences

TABLE 4 **Rates of return to education in percent – break-even wage scenario for firms – Italy**

Occupations	Model 1	Model 2	Model 3
Application developers and software engineers	21.5 %	14.3 %	12.5 %
Bricklayers	5.0 %	3.5 %	3.1 %
Car mechanics	6.0 %	5.1 %	4.6 %
Commercial bank employees	23.7 %	14.1 %	12.9 %
Cooks	4.4 %	3.0 %	2.6 %
Electricians	5.1 %	3.5 %	3.2 %
Mechanical technicians	12.7 %	11.1 %	8.9 %
Shop salespersons	5.3 %	3.6 %	3.3 %
Waitresses/waiters[1]	0.7 %	0.0 %	0.0 %

1) The rate of return is so low for waitresses/waiters because the difference between skilled and unskilled wages is too small to justify the initial investment (in terms of forgone earnings during the training period).
Source: own calculations; red numbers show rates that do not surpass the threshold of 5 %. | Bertelsmann**Stiftung**

With the exception of cooks and waitresses/waiters (and bricklayers and electricians at the margin), apprenticeships of the Model 1 type generate rates of return to education that are sufficiently high. In Models 2 and 3, the rates of return to education also fall below the critical threshold of 5 % for the occupations of bricklayers, electricians and shop salespersons. For five out of the nine occupations which we used to simulate the costs and benefits of training for firms, apprentice pay guaranteeing zero net costs for the firms would be too low to generate rates of return to education for apprentices that we consider high enough to attract sufficiently talented youths into these programmes.

High returns for individuals in most occupations

8 Summary analyses of the results

Summary of results
In this section, we provide a summary of the results of the net cost simulations for all occupations and scenarios, separately for the North (Table 5), Centre (Table 6) and the South of Italy (Table 7). We provide the simulations at the regional level because of the large observed differences in regional wage levels, which can potentially affect expected net training costs.

As the colours in the table show, there are no substantial qualitative differences in occupational net costs across the different regions, although the level of net training costs is highest in Northern Italy. The reason why wage levels have only a moderate effect (if any) on net training costs is that the wage effects on the costs (higher wages increase training expenditure) and on training benefits (higher wages increase the value of apprentices' productive work) are almost identical in a training model that resembles that of Switzerland.[27]

We mark net costs in red where they are above € 3,000. Conversely, we mark net costs in light green when they are close to zero (more precisely, a bandwidth of +/– € 3,000). Finally, we mark net benefits that are above € 3,000 in dark green. As can easily be seen from the colour pattern, net costs in all models using the low-wage scenario are (except for mechanical technicians) in green or light green in at least some of the models, whereas in the high-wage scenario, all occupations in all models show red, meaning net costs are above € 3,000. Thus, as wages in the high-wage scenario are still substantially below current minimum apprentice wages, it becomes apparent that introducing a dual apprenticeship system similar to Switzerland would require lower apprentice wages for firms to break even by the end of training. Interestingly, mechanical technicians is the occupation with the highest net training costs for firms in the low-wage scenario, but also the occupation with the highest individual rate of return (Table 4). Thus, based on our simulation results, it would be possible to shift some of the training costs to the individual by lowering apprentice wages accordingly. As a result, we would expect lower net training costs to incentivize more firms to train apprentices in that occupation. Moreover, the occupation of mechanical technicians is demanding in terms of the amount of skills that apprentices need to acquire before they become fully proficient in skilled tasks. For that reason, the average relative productivity is lower in the third year of training compared to other occupations. As a result, Model 3 does generate additional net benefits for the training firm because, even in the low-wage scenario, the value of an apprentice's productive tasks in the third training year does not exceed the sum of the wage costs and the costs for training instructors. Thus, for that occupation, the training duration might need to be extended

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27 Higher wages result in lower net costs in a training model where firms only provide little instruction (in terms of training hours) at the workplace and mainly use apprentices for productive tasks (i.e. as "cheap labour").

to four years to enable firms to break even by the end of the training period. However, as shown below, savings on future hiring costs may allow firms to recoup a significant fraction of the initial training investment.

TABLE 5 **Net training costs for all occupations and scenarios – Northern Italy**

Occupation	Low-wage			High-wage		
	M1	M2	M3	M1	M2	M3
Application developers and software engineers	18,611	8,178	6,045	6,5272	39,285	52,705
Bricklayers	−1,318	−2,490	−9,433	23,784	14,244	15,668
Car mechanics	9,851	4,459	3,954	34,963	21,200	29,065
Commercial bank employees	6,832	3,362	−5,218	45,924	29,424	33,874
Cooks	−1,142	−2,230	−8,996	21,522	12,880	13,669
Electricians	7,769	4,445	492	49,399	32,198	42,122
Mechanical technicians	16,305	7,869	7,738	46,349	27,899	37,782
Shop salespersons	−4,050	−4,605	−12,725	19,862	11,337	11,187
Waitresses/waiters	−5,255	−4,052	−12,507	15,174	9,567	7,922

Source: own calculations | Bertelsmann**Stiftung**

The main reason why net benefits are high in the low-wage scenario in Model 3 is the relation of apprentice wages and the productivity of apprentices. Compared to the high-cost scenario it becomes clear that the pay level for apprentices is a crucial factor in Italy. In the low-wage scenario, apprentice pay corresponds to about 25 % of a skilled worker's wage, whereas in the high-wage scenario apprentices receive a wage equal to 50 % of a skilled worker's wage in the corresponding occupation.

Explanations for high net benefits

TABLE 6 **Net training costs for all occupations and scenarios – Central Italy**

Occupation	Low-wage			High-wage		
	M1	M2	M3	M1	M2	M3
Application developers and software engineers	7,995	3,246	−1,389	36,862	22,490	27,479
Bricklayers	−499	−1,621	−7,334	19,065	11,422	12,230
Car mechanics	10,392	5,063	5,243	31,403	19,070	26,254
Commercial bank employees	7,252	3,858	−4,255	41,679	26,809	30,172
Cooks	1,383	−684	−6,419	23,164	13,836	15,363
Electricians	−1,744	−1,743	−7,924	17,820	11,299	11,641
Mechanical technicians	20,859	10,878	12,682	50,285	30,495	42,108
Shop salespersons	−3,395	−4,050	−11,962	18,405	10,484	9,838
Waitresses/waiters	−3,961	−3,188	−11,162	15,203	9,587	8,002

Source: own calculations | Bertelsmann**Stiftung**

In Switzerland, many firms can generate a net benefit from training apprentices. It is, however, important to bear in mind that those net benefits are not simply a cash profit for firms, but in turn may serve as a competitive advantage for training firms, because they can charge lower prices for their products and services than competing firms that

do not train apprentices. Therefore, a substantial part of the net benefit shown here is actually a gain for the customers.[28]

However, in Italy, the private rates of return to education (Table 4) are not particularly high, and in fact they are lowest in those occupations for which we simulate the highest net training benefits in the low-wage scenario of Model 3. Thus, a fraction of the expected net benefits that training firms could expect should be used for higher apprentice salaries. Moreover, as apprentices receive better training in our simulated models, they should become more productive after completing training compared to the current situation in Italy, which should also lead to a higher future wage differential between skilled electricians and unskilled individuals who work in that sector.

TABLE 7 **Net training costs for all occupations and scenarios – Southern Italy**

Occupation	Low-wage			High-wage		
	M1	M2	M3	M1	M2	M3
Application developers and software engineers	12,180	5,160	−366	51,207	31,178	38,661
Bricklayers	1,178	−488	−4,681	18,708	11,198	12,849
Car mechanics	8,603	4,000	3,613	27,767	16,776	22,778
Commercial bank employees	6,521	3,479	−4,509	39,038	25,157	28,008
Cooks	3,367	658	−3,080	22,271	13,261	15,824
Electricians	402	−323	−4,771	17,932	11,364	12,759
Mechanical technicians	15,608	7,697	7,729	40,750	24,458	32871
Shop salespersons	−2,044	−2,919	−9,118	16,238	9,269	9,165
Waitresses/waiters	−2,726	−2,304	−8,885	13,983	8,835	7,824

Source: own calculations   Bertelsmann**Stiftung**

Explanations for high net costs

Different explanations are needed for the cases in which net costs in the high-wage scenario are extremely high, as is the case for mechanical technicians and car mechanics, commercial bank employees, or application developers and software engineers. A main explanation is a higher amount of practising that reduces the training benefits and would therefore legitimise a lower apprentice wage. In the case of bricklayers, cooks, shop salespersons and waitresses/waiters, it is the small differential between unskilled and skilled salaries that pushes down the break-even salaries. If the wage differential between skilled and unskilled salaries is small, then the productive contribution of apprentices, when substituting skilled labour at low productivity rates, is also very low. If, however, the wage differential is large, a firm earns more when letting the apprentice substitute for skilled workers instead of executing unskilled work even at low productivity rates in the first year(s) of the apprenticeship training. To give an idea of the heterogeneity in the wage data used for these simulations, we used an observed skill premium (the ratio between skilled workers in the occupation and unskilled workers in the same economic sector) that ranges from almost 55 % for application developers and software engineers to just 7 % for waitresses/waiters.

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28 Conversely, one could also argue that in markets where firms have substantial monopoly power, any costs related to apprenticeship training could simply be charged to the customer. However, given the ongoing deregulation in product markets, and the fact that very few Italian firms train apprentices, it seems unlikely that this is a realistic scenario.

The net costs in Tables 5–7 are calculated at the end of the training period, and because additional benefits can accrue after this point, we compare these net costs with potential savings in hiring costs if the firm is able to keep the apprentices and employ them as skilled workers after the training contract has ended. Table 8 displays the long-term net training costs when also incorporating savings on future hiring costs (because a firm does not need to hire externally to fill a vacancy). In this scenario we assume that a firm can retain all apprentices after training (i.e. the retention rate is 100 %). As we do not have sufficient observations to calculate such hiring costs for every occupation in every region, Table 8 displays the results for Italy in general.

Green shows all the cases where there is already a net benefit of > € 3,000 by the end of the training period or where potential savings in hiring costs would cover the net costs incurred, assuming that a firm will always be able to retain an apprentice. Light green indicates the cases where total net costs are close to zero (+/– € 3,000), and red highlights the cases where the hiring costs do not cover the net costs (i.e. total net costs > € 3,000). Table 8 clearly shows that all occupations in the low-wage scenario could be profitable given that a firm can retain a graduate apprentice. In the high-wage scenario, even when accounting for hiring costs, the occupations of application developers, software engineers and cooks never become profitable in any training model. Moreover, Model 1 never becomes profitable in the high-wage scenario even when accounting for future savings in hiring costs.

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Potential savings in hiring costs

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TABLE 8 **Total net training costs when including savings on hiring costs (retention rate = 100 %) – Italy**

Occupation	Low-wage			High-wage		
	M1	M2	M3	M1	M2	M3
Application developers and software engineers	–12,388	–21,158	–24,195	26,686	4,891	14,878
Bricklayers	–9,623	–10,801	–16,821	10,857	2,852	3,658
Car mechanics	–15,808	–21,103	–21,196	5,520	–6,884	132
Commercial bank employees	–21,028	–24,849	–32,754	14,268	–1,319	2,542
Cooks	–8,174	–10,141	–15,620	12,492	3,636	5,046
Electricians	–12,134	–12,130	–18,649	8,346	1,524	1,831
Mechanical technicians	–21,119	–30,344	–29,498	7,084	–11,541	–1,294
Shop salespersons	–13,360	–14,244	–21,482	7,518	–325	–605

Source: own calculations. Waitresses/waiters are excluded from this table because we do not have data on hiring costs.

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In reality, however, firms will never retain all of their apprentices. In Switzerland, only about 35 % of apprentices are still employed with the training firm one year after graduation, whereas in Germany the corresponding proportion is about 60 %. Some apprentices will leave the firm, while the training firm may decide that some apprentices are not a good match, or because they do not have any skilled worker vacancies to fill. Therefore, we also show how the results change when we assume a retention rate of only 50 % (Table 9). The results show that even when only retaining half of the apprentices after training, all occupations in the low-wage scenario become profitable from the firm's perspective (except for application developers and software engineers in Model 1). In the high-wage scenario, however, only training electricians would be profitable from the firm's perspective.

TABLE 9 **Total net training costs when including savings on hiring costs (retention rate = 50 %) – Italy**

Occupation	Low-wage			High-wage		
	M1	M2	M3	M1	M2	M3
Application developers and software engineers	1,839	−6,931	−9,968	40,913	19,118	29,106
Bricklayers	−5,067	−6,245	−12,266	15,413	7,408	8,214
Car mechanics	−2,832	−8,128	−8,221	18,496	6,091	13,107
Commercial bank employees	−6,393	−10,215	−18,120	28,902	13,316	17,176
Cooks	−3,422	−5,389	−10,868	17,244	8,388	9,798
Electricians	−6,985	−6,980	−13,500	13,495	6,673	6,980
Mechanical technicians	−1,191	−10,415	−9,569	27,013	8,388	18,635
Shop salespersons	−7,989	−8,873	−16,112	12,889	5,045	4,766

Source: own calculations. Waitresses/waiters are excluded from this table because we do not have data on hiring costs.

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Motivations to train in occupations with net costs

To sum up, the savings in hiring costs have the potential to cover the net costs in the low-wage scenario across all occupations, provided the firms are able to retain at least half of their apprentices after training, but savings on hiring costs are not sufficiently high to cover a firm's initial net investment in the high-wage scenario.

In the final step, we compare the perspective of the firm to that of potential apprentices. Based on the high-wage scenario in Model 2, we only find a rate of return that is above 5 % for the occupations application developer & software engineer, car mechanic, commercial bank employee and mechanical technician. The comparison of net costs for firms (including potential savings in hiring costs, as shown in Table 9) shows that the training firms would have the scope to raise apprentice wages above 50 % of the skilled worker wages in the training occupations cook, electrician and shop salesperson, so that individual rates of return would be sufficiently high to encourage more individuals to apply for apprenticeship positions.

However, training firms could find a way to increase the attractiveness in occupations that currently result in expected net costs for firms as well as low rates of return to education for individuals. Potential apprentices would probably be willing to accept low salaries during training if firms were to invest sufficiently in training, so that apprentices could expect skilled wages after training that are above currently observed levels on the Italian labour market. Firms would not incur higher net costs and therefore would not need to fear poaching from competitors, and potential apprentices could compensate the lower salaries during training through better salary prospects for the following years of their professional life.

9 Conclusions and recommendations based on the analyses

The simulated cost and benefits of apprenticeship training in this study show the potential outcomes for firms from the hypothetical situation in which firms in Italy were to adopt an apprenticeship training model that resembles the Swiss one. Not surprisingly, these simulated costs and benefits show a considerable heterogeneity due to differences in the results per occupation in the Swiss data and due to variations in the wage differentials between unskilled and skilled Italian workers in the nine training occupations. Thus, the question whether a training firm would have to expect net costs or could rather enjoy a net benefit when applying a Swiss-style training model depends on many factors that will differ from one occupation to another. Furthermore, the simulations show that, within a given occupation, results may vary across regions between firms of different sizes. In any case, the simulations show that policies aimed at increasing the number of apprenticeships would need to take into account these heterogeneities between occupations, firms, and regions.

The four main conclusions that we can draw from our simulations are the following:

1. In five out of the nine occupations, at least one of the models in the low-wage scenario produces net benefits for the training firms, but not for any occupation in the high-wage scenario. The setting of apprentice wages is paramount when it comes to ensuring that firms are able to break even by the end of apprenticeship training. This finding is of particular importance with regard to the current situation in Italy, where apprentices receive an open-ended contract.

2. In all of the nine occupations, at least two models in the low-wage scenario produce net benefits when including savings in future hiring costs. Such hiring costs are substantial and range, depending on the occupation, from 3 to 15 months of skilled worker salaries. From a firm's perspective, we find that they could offset initial net training costs if they retained at least 50 % of their former apprentices after graduation. In the high-wage scenario, the occupations application developer, software engineer and cook are no longer profitable for firms even if they retained 100 % of their apprentices after training.

   As recently discussed (Cedefop 2017), switching to fixed-term apprenticeship contracts, as in Germany or Switzerland, might be an effective strategy to increase the number of apprenticeship places in Italy. However, fixed-term apprenticeship contracts might also increase the post-training mobility of apprentices and therefore firms would need to be able to train in a cost-effective manner – which would not be possible given the high level of current minimum wages for apprentices. Moreover, some occupations, such as mechanical technician, produce simulation outcomes that

show difficulties for firms to break even, except in a low-wage scenario when the retention rate of graduate apprentices is close to 100 %. Thus, for such occupations, a training duration of four (rather than three or only two) years might be more appropriate.[29]

In large-scale apprenticeship systems such as Switzerland or Germany, small firms train a significant proportion of all apprentices and are therefore an important pillar for the functioning of a dual apprenticeship system. Unlike large firms, however, small benefit less from post-training benefits in the form of savings in future hiring costs, because small firms not only have fewer vacancies to fill, but also face a higher probability that apprentices will move on to other (often larger) firms after training. Therefore, to ensure that as many firms as possible participate in an apprenticeship system and provide high-quality training, it is important that training policies allow small firms to train apprentices cost-effectively (e.g., by ensuring that minimum apprentice wages are not set too high).

Individual rates of return to an apprenticeship qualification are low

3. Our simulated rates of return to a VET qualification are particularly low (a rate of return <5 %) in the occupations bricklayer, cook, electrician, shop salesperson and waitresses/waiters (even in a high-wage scenario). Therefore, apprenticeship training provides little financial incentive for individuals and partly explains why the proportion of apprenticeships in Italy is currently very low, despite the fact that actual apprentice wages are even higher compared to our simulated high-wage scenario. High apprentice wages, however, might also be a reason why there are not enough firms willing to train apprentices in the first place.

Increases in the quality of training crucial

4. Improvements in the quality of apprenticeship programmes that lead to better labour market outcomes for individuals could be a necessity to secure talented applicants for the programmes and simultaneously reduce dropout rates during training.

One of the major challenges for a successful expansion of an apprenticeship training system in Italy that will create a win-win situation for firms and apprentices is a quality improvement in programmes (see also OECD 2017b). For some of the occupations, training that translates into substantial increases in productivity compared to the current situation is needed to make these programmes attractive for both potential training firms and apprentices. As better training quality has its price, some firms may be less willing to hire apprentices. Therefore, a consequence of switching to a higher-quality apprenticeship system would be to shift some of the training costs to individuals by lowering training wages.

However, as high-quality training is likely to attract better apprentices, firms may have an incentive to invest in even more training, particularly when they intend to retain an apprentice subsequently as a skilled worker. As a result, apprentices would be more productive, not only in the training firm, but in all firms that demand skilled workers in a particular occupation, leading to better employment opportunities for apprentices. In turn, the productivity of an industry as a whole would increase, and therefore also the individual's skills wage premium associated with an apprenticeship qualification.

29 Note that the training duration in Swiss occupations is also subject to ongoing reforms. The training duration in a number of occupations that currently lasts three years may possibly be increased to four years.

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List of Figures and Tables

Figures

Tables

Appendices

Application developers and software engineers

TABLE A1 **Net training costs – Application developers and software engineers – Italy**

Wage	Model 1	Model 2	Model 3	Hiring Costs
low	16,067	7,296	4,259	7.5
high	55,140	33,346	43,333	

Source: own calculations. Net training costs in euros. Hiring costs in months of skilled worker wages. | Bertelsmann**Stiftung**

FIGURE A1 **Gross costs, productivity, and net training costs by year of training – Application developers and software engineers – Italy**
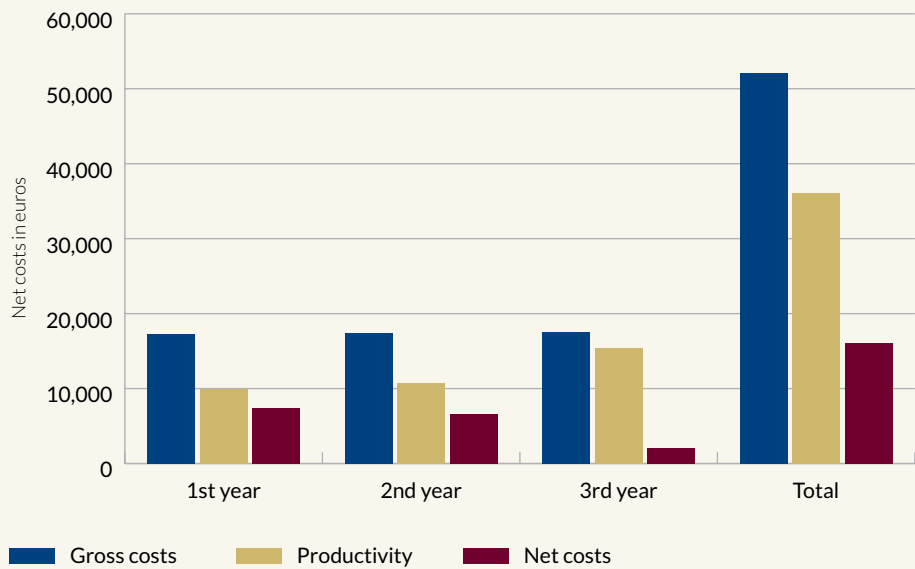
Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A2 **Net costs by firm size – Application developers and software engineers – Italy**
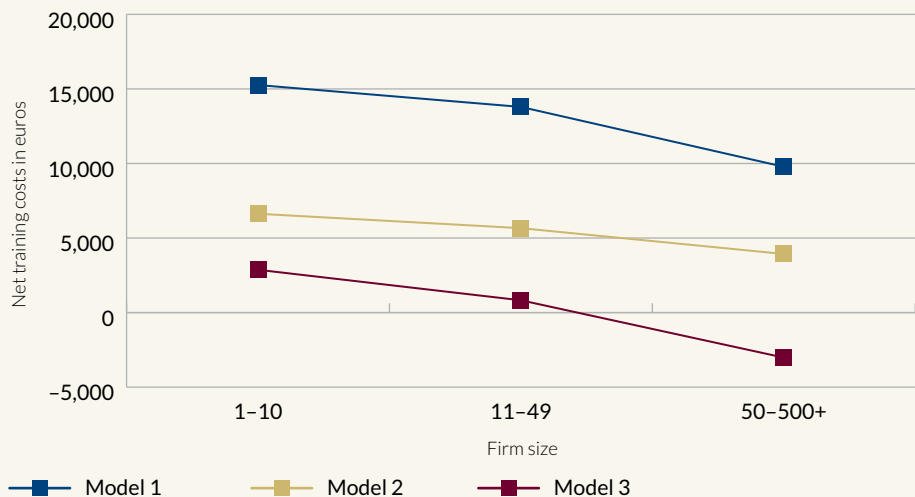
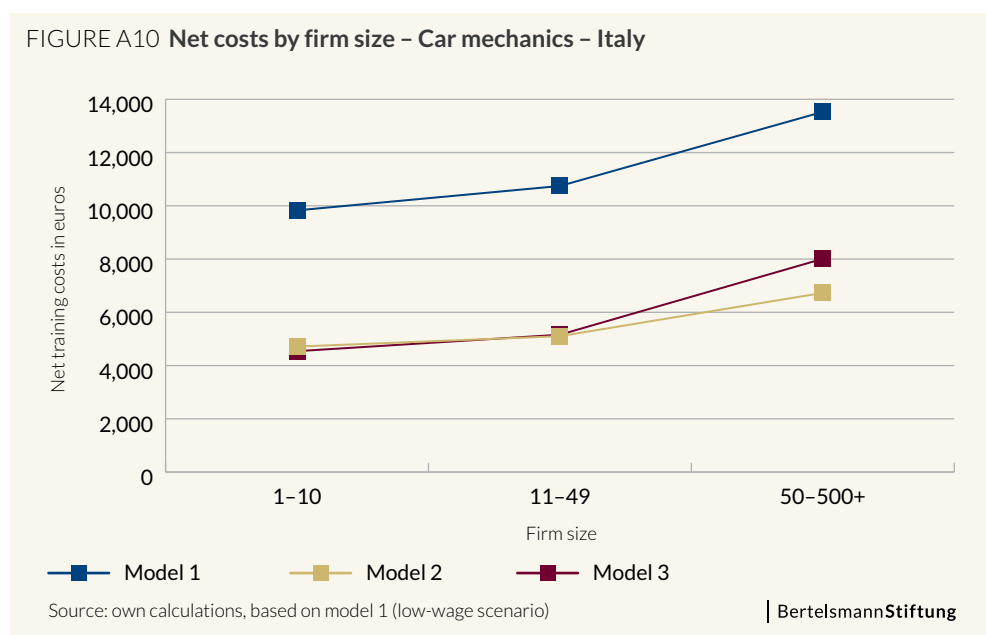Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A3 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Application developers and software engineers – Italy**

Proportion of skilled worker wage   Unskilled worker wage

Source: own calculations

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FIGURE A4 **Net costs assuming different dropout rates – Application developers and software engineers – Italy**
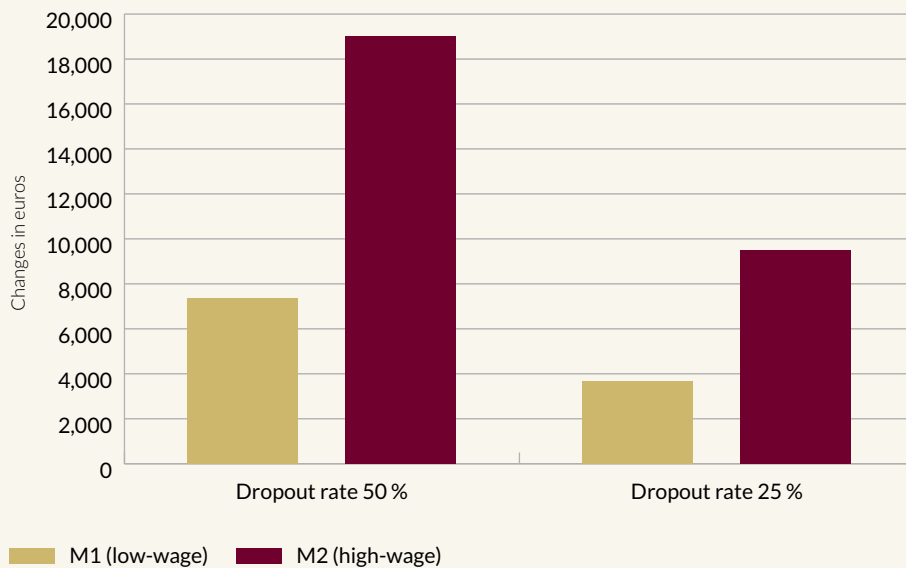
M1 (low-wage)   M2 (high-wage)

Source: own calculations, based on model 1 and 2 (low- and high-wage scenario)

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Bricklayers

TABLE A2 **Net training costs – Bricklayers – Italy**

Wage	Model 1	Model 2	Model 3	Hiring Costs
low	−511	−1,689	−7,710	4.6
high	19,968	11,964	12,770	

Source: own calculations. Net training costs in euros. Hiring costs in months of skilled worker wages. | Bertelsmann**Stiftung**
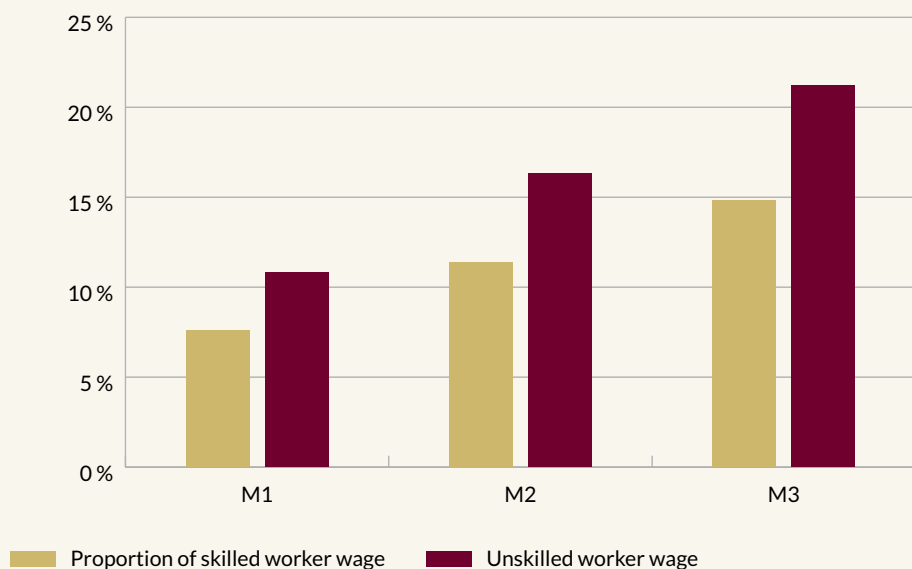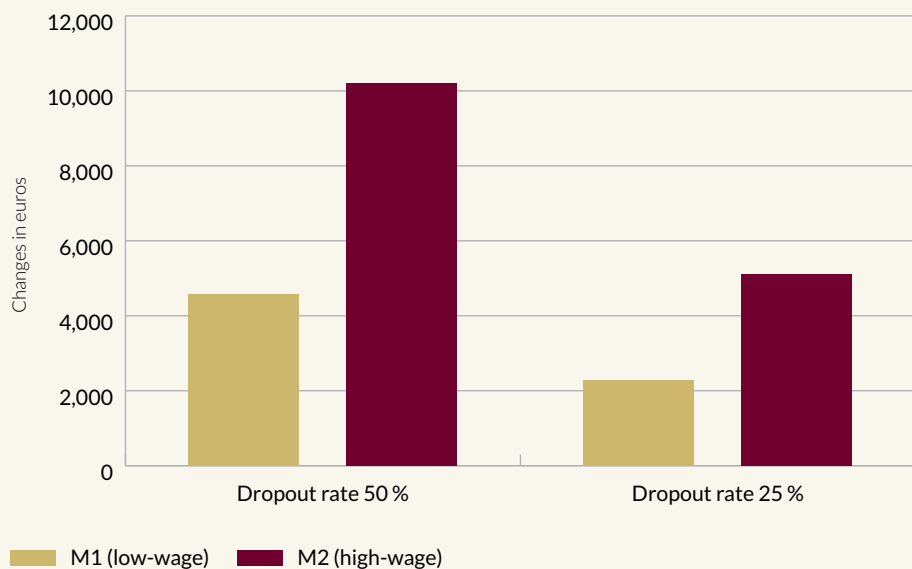
FIGURE A5 **Gross costs, productivity, and net training costs by year of training – Bricklayers – Italy**
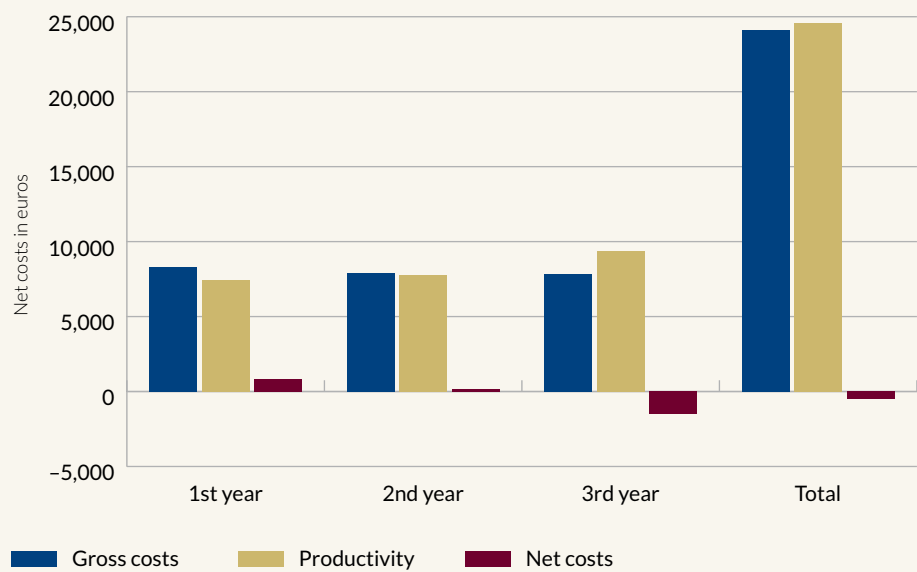
Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A6 **Net costs by firm size – Bricklayers – Italy**
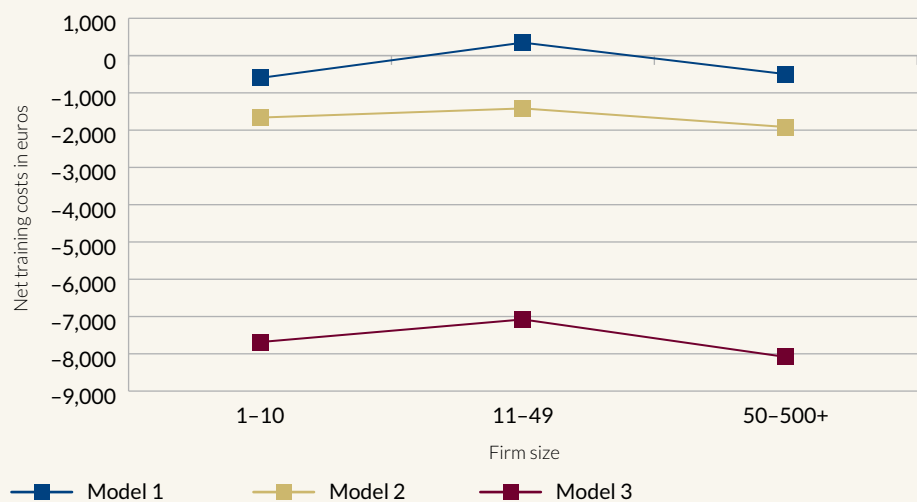
Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

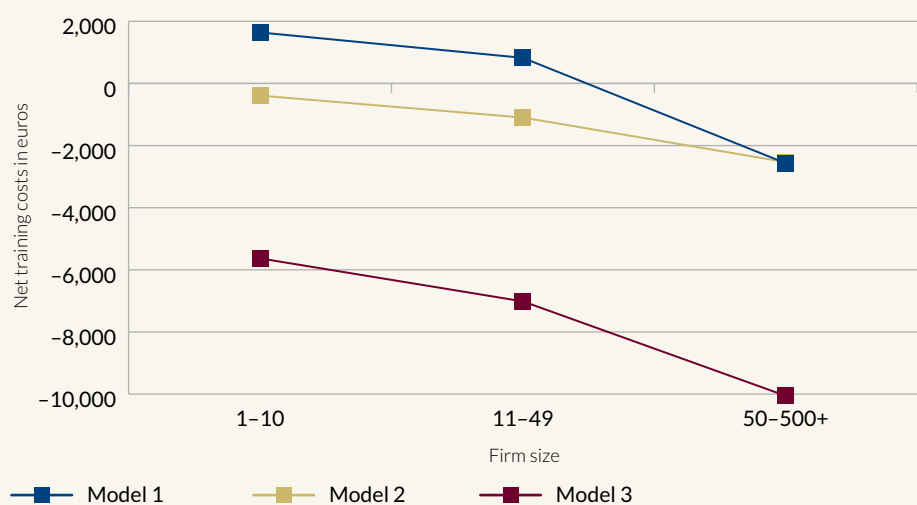FIGURE A7 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Bricklayers – Italy**

Proportion of skilled worker wage   Unskilled worker wage
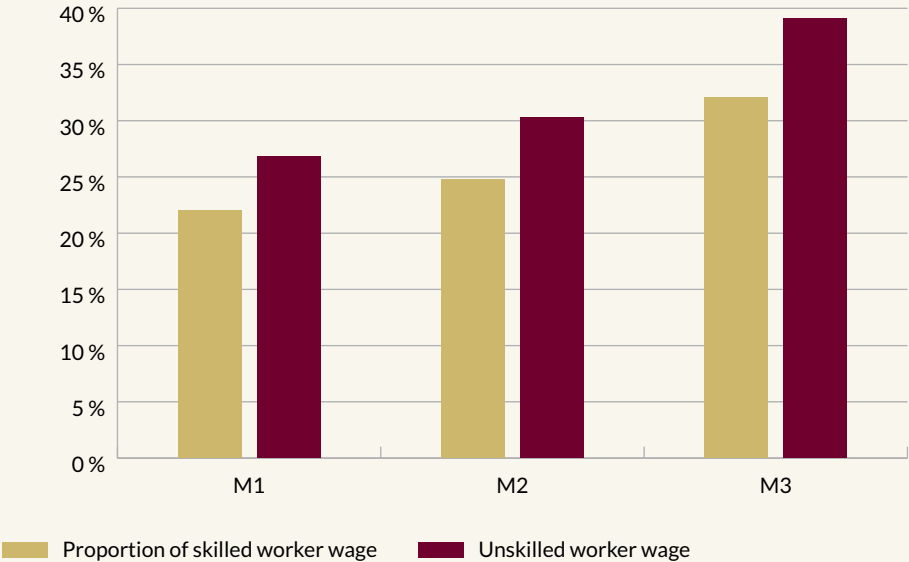
Source: own calculations

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FIGURE A8 **Net costs assuming different dropout rates – Bricklayers – Italy**
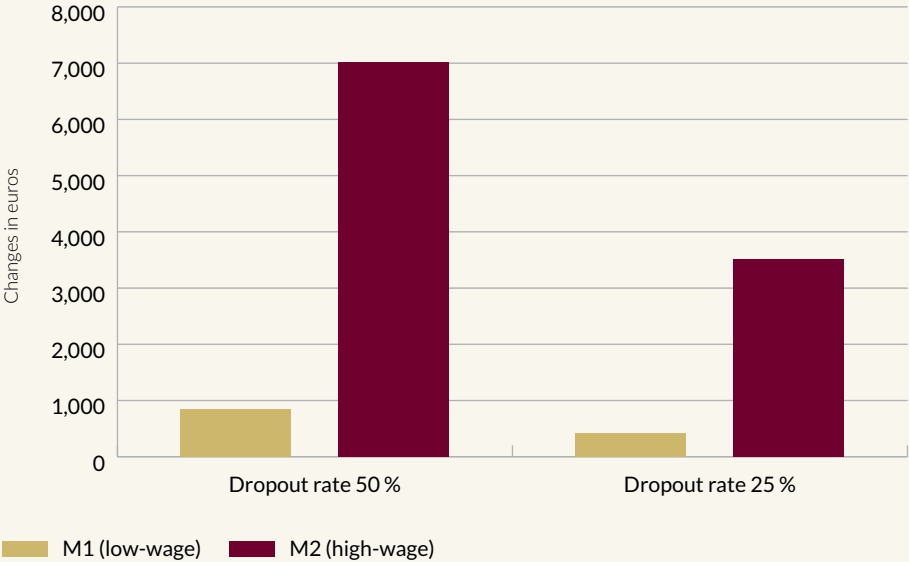
M1 (low-wage)   M2 (high-wage)

Source: own calculations, based on model 1 and 2 (low- and high-wage scenario)

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Car mechanics

TABLE A3 **Net training costs – Car mechanics – Italy**

Wage	Model 1	Model 2	Model 3	Hiring Costs
low	10,143	4,848	4,754	12.6
high	31,471	19,067	26,083	

Source: own calculations. Net training costs in euros. Hiring costs in months of skilled worker wages. | Bertelsmann**Stiftung**

FIGURE A9 **Gross costs, productivity, and net training costs by year of training – Car mechanics – Italy**

Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A10 **Net costs by firm size – Car mechanics – Italy**

Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**
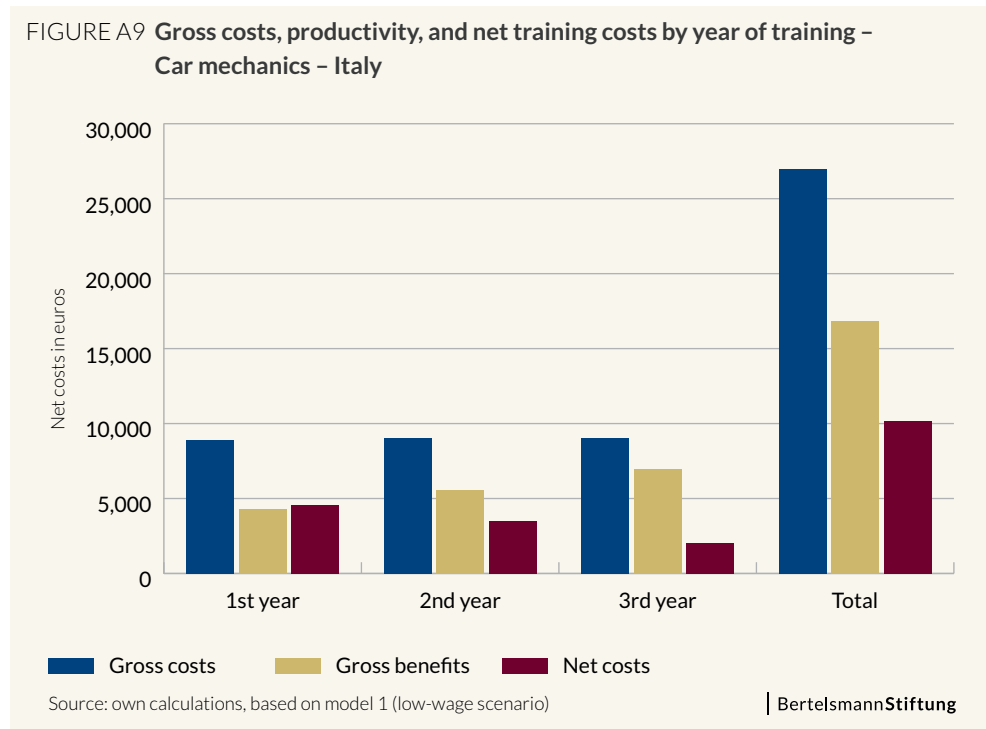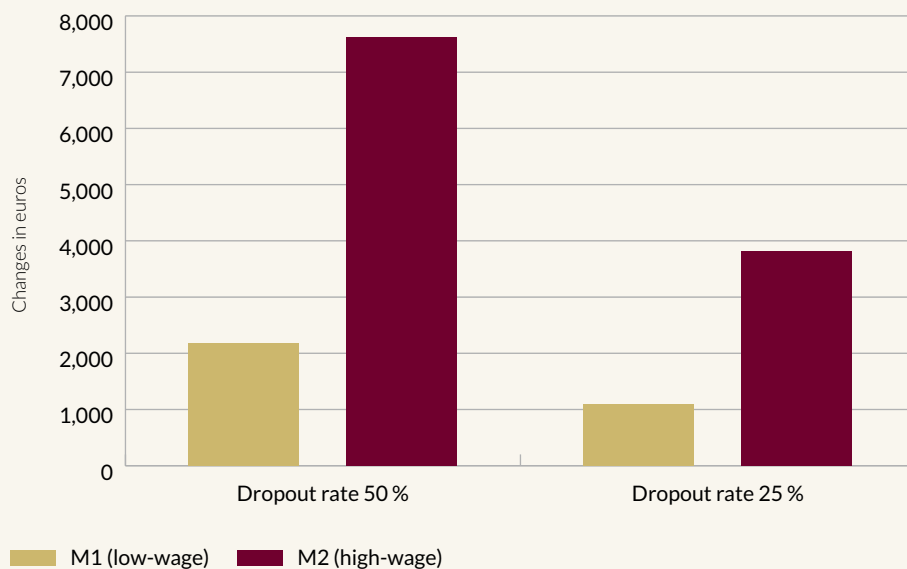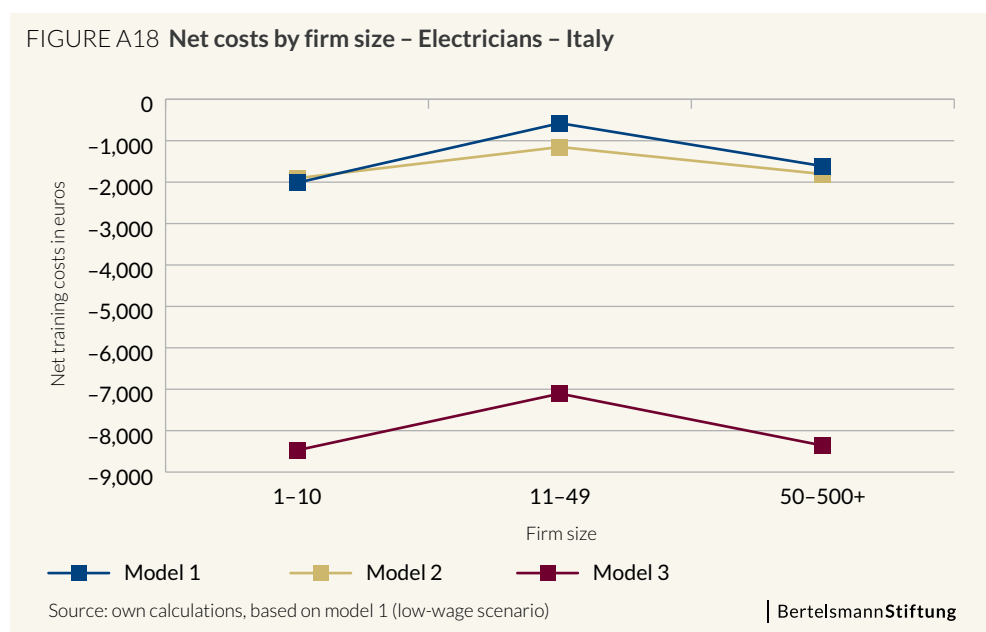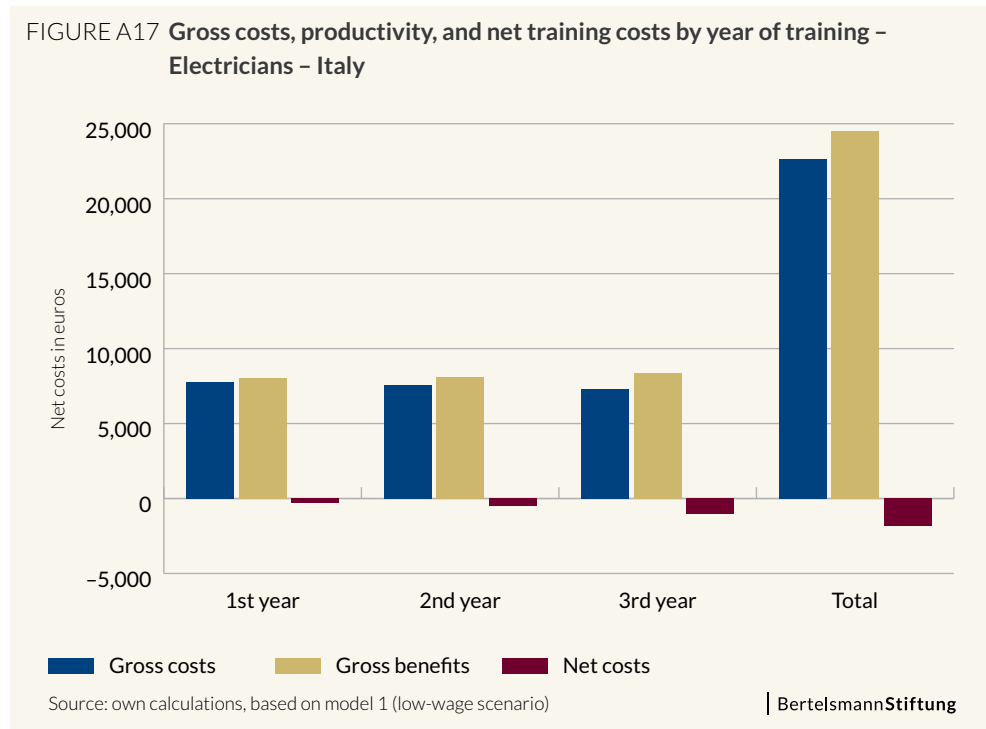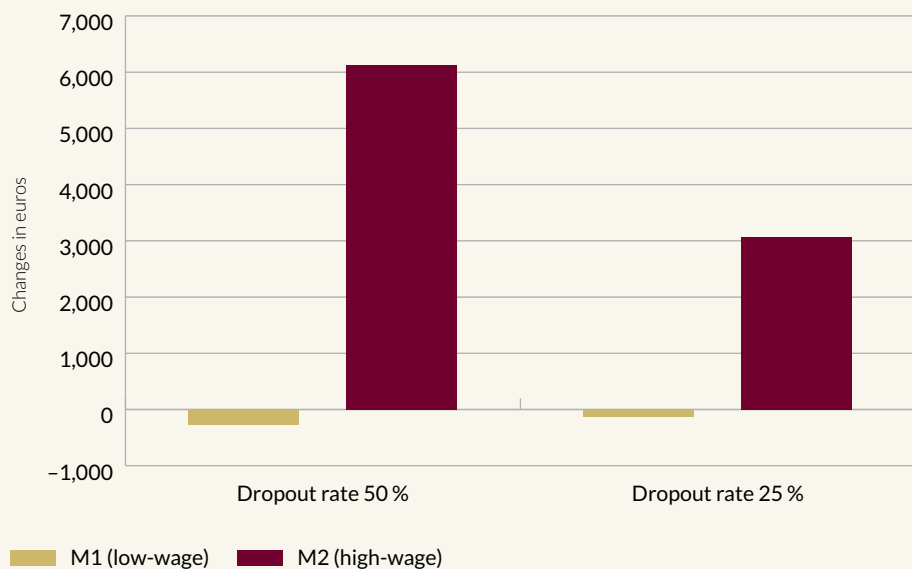
FIGURE A11 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Car mechanics – Italy**

Source: own calculations

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FIGURE A12 **Net costs assuming different dropout rates – Car mechanics – Italy**

Source: own calculations, based on model 1 and 2 (low- and high-wage scenario)

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Cooks

TABLE A4 **Net training costs – Cooks – Italy**

Wage	Model 1	Model 2	Model 3	Hiring Costs
low	1,330	−637	−6,117	4.8
high	21,996	13,140	14,549	

Source: own calculations. Net training costs in euros. Hiring costs in months of skilled worker wages. | Bertelsmann**Stiftung**

FIGURE A13 **Gross costs, productivity, and net training costs by year of training – Cooks – Italy**
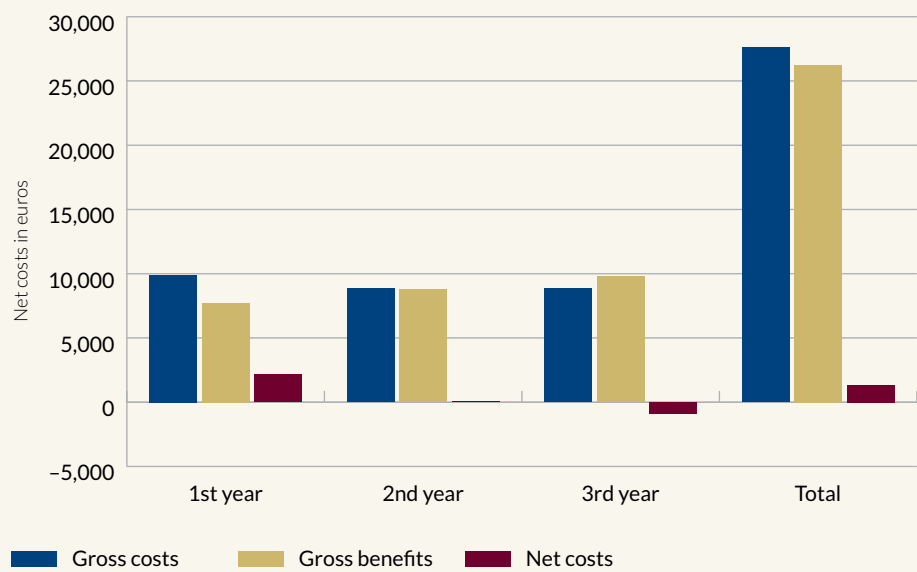
Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A14 **Net costs by firm size – Cooks – Italy**

Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A15 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Cooks – Italy**

Proportion of skilled worker wage ■ Unskilled worker wage

Source: own calculations

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FIGURE A16 **Net costs assuming different dropout rates – Cooks – Italy**

M1 (low-wage) ■ M2 (high-wage)

Source: own calculations, based on model 1 and 2 (low- and high-wage scenario)

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Electricians

TABLE A5 **Net training costs – Electricians – Italy**

Wage	Model 1	Model 2	Model 3	Hiring costs
low	−1,836	−1,831	−8,351	5.2
high	18,644	11,822	12,129	

Source: own calculations. Net training costs in euros. Hiring costs in months of skilled worker wages. | Bertelsmann**Stiftung**

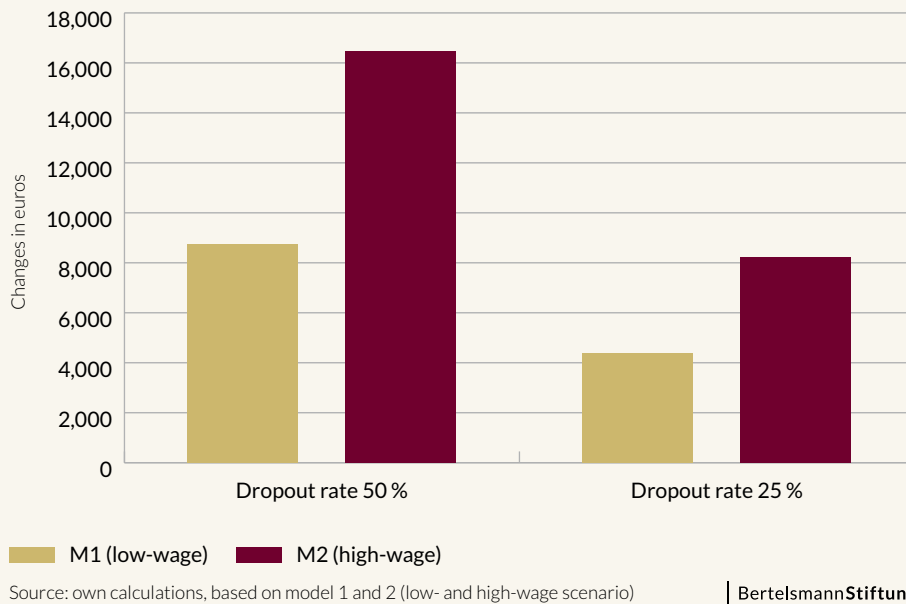FIGURE A17 **Gross costs, productivity, and net training costs by year of training – Electricians – Italy**

Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A18 **Net costs by firm size – Electricians – Italy**

Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A19 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Electricians – Italy**

Proportion of skilled worker wage   Unskilled worker wage

Source: own calculations

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FIGURE A20 **Net costs assuming different dropout rates – Electricians – Italy**

M1 (low-wage)   M2 (high-wage)

Source: own calculations, based on model 1 and 2 (low- and high-wage scenario)

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Mechanical technicians

TABLE A6 **Net training costs – Mechanical technicians – Italy**

Wage	Model 1	Model 2	Model 3	Hiring Costs
low	18,738	9,514	10,360	14.6
high	46,942	28,317	38,564	

Source: own calculations. Net training costs in euros. Hiring costs in months of skilled worker wages. | Bertelsmann**Stiftung**

FIGURE A21 **Gross costs, productivity, and net training costs by year of training – Mechanical technicians – Italy**

Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A22 **Net costs by firm size – Mechanical technicians – Italy**

Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**
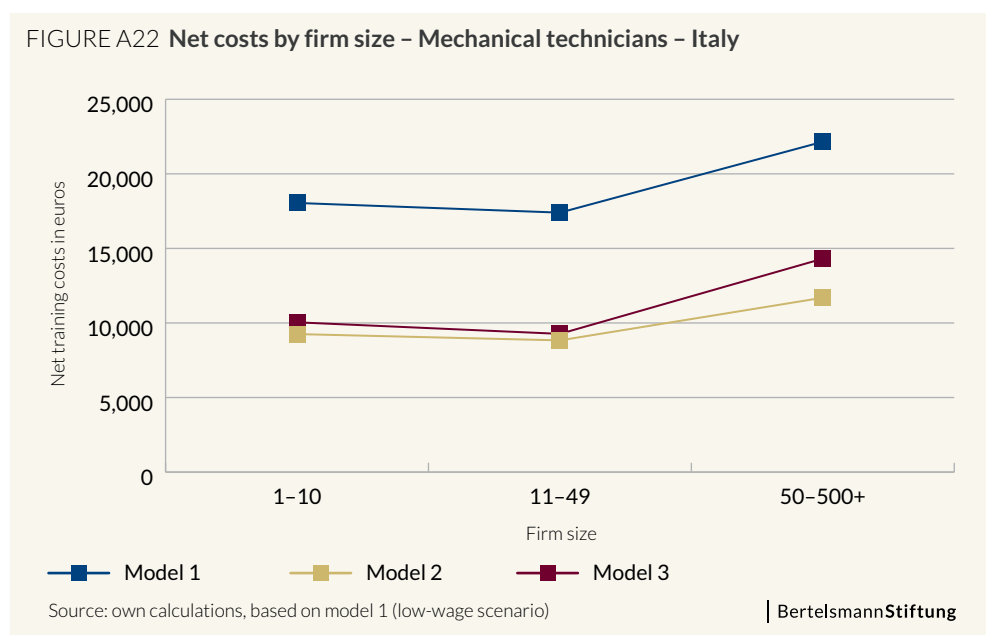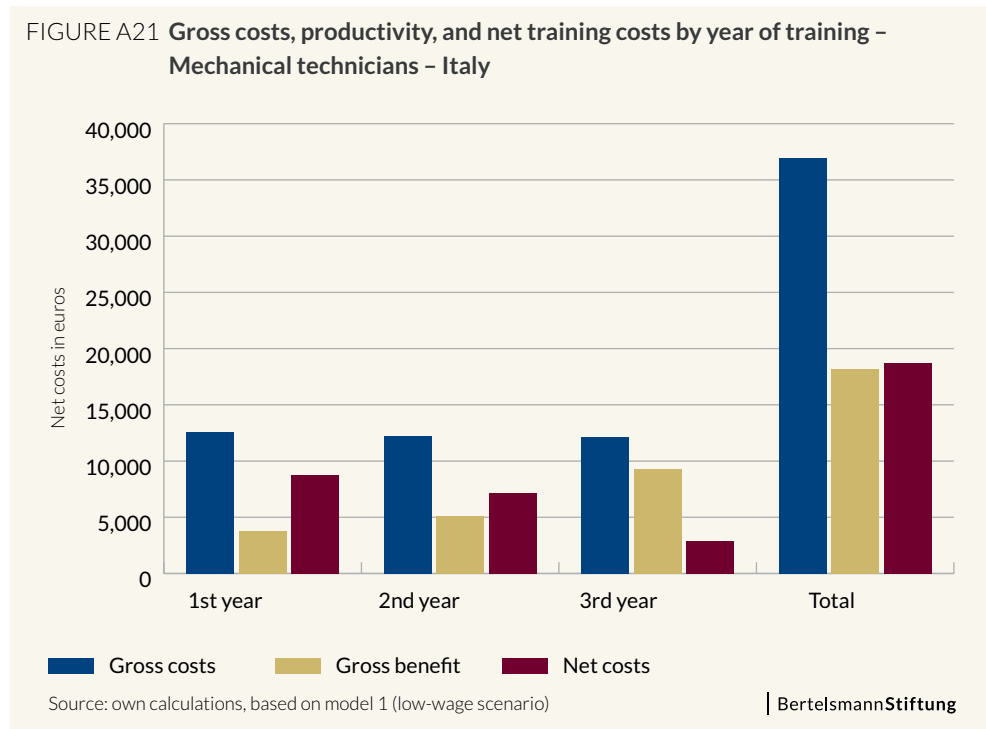
FIGURE A23 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Mechanical technicians – Italy**

Proportion of skilled worker wage ■ Unskilled worker wage

Source: own calculations

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FIGURE A24 **Net costs assuming different dropout rates – Mechanical technicians – Italy**

M1 (low-wage) ■ M2 (high-wage)

Source: own calculations, based on model 1 and 2 (low- and high-wage scenario)

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Shop salesperson

TABLE A7 **Net training costs – Shop salesperson – Italy**

Wage	Model 1	Model 2	Model 3	Hiring Costs
low	−2,618	−3,503	−10,741	5.3
high	18,259	10,416	10,136	

Source: own calculations. Net training costs in euros. Hiring costs in months of skilled worker wages. | Bertelsmann**Stiftung**

FIGURE A25 **Gross costs, productivity, and net training costs by year of training – Shop salesperson – Italy**
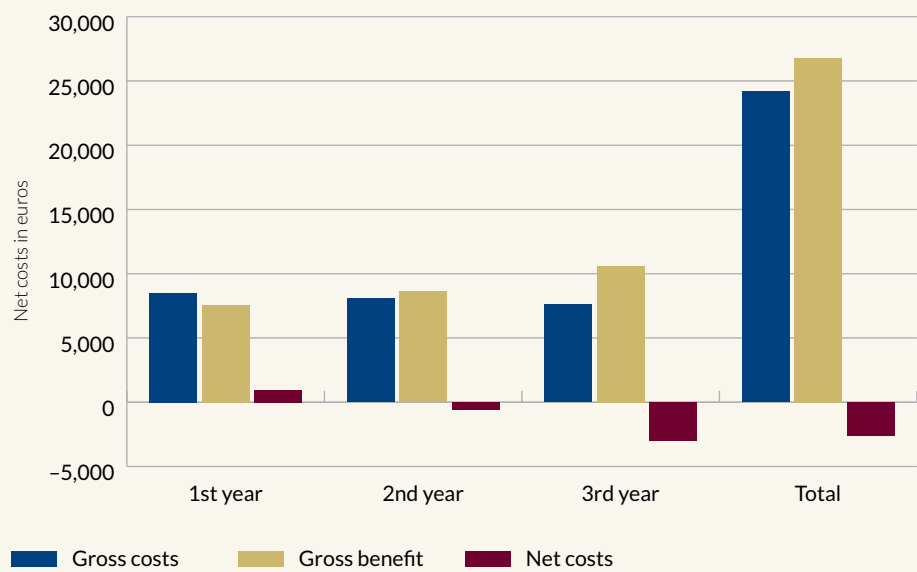
Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A26 **Net costs by firm size – Shop salesperson – Italy**
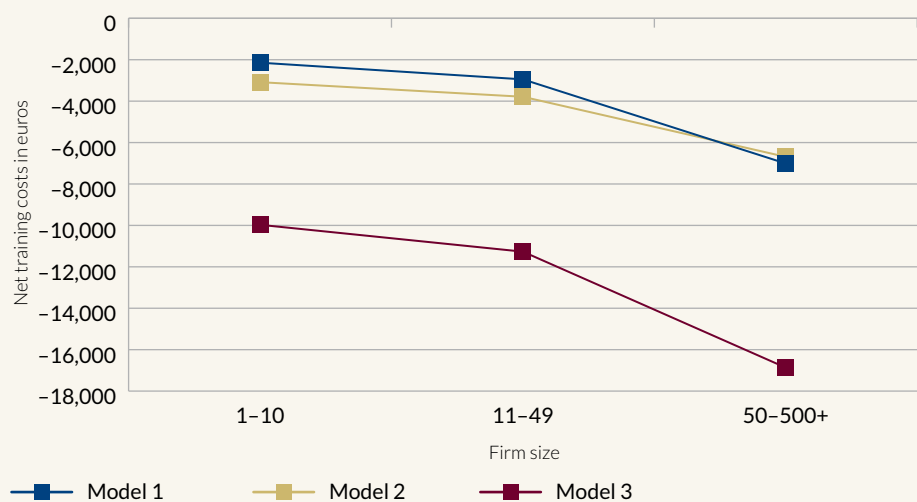
Source: own calculations, based on model 1 (low-wage scenario) | Bertelsmann**Stiftung**

FIGURE A27 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Shop salesperson – Italy**

Proportion of skilled worker wage   Unskilled worker wage

Source: own calculations

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FIGURE A28 **Net costs assuming different dropout rates – Shop salesperson – Italy**
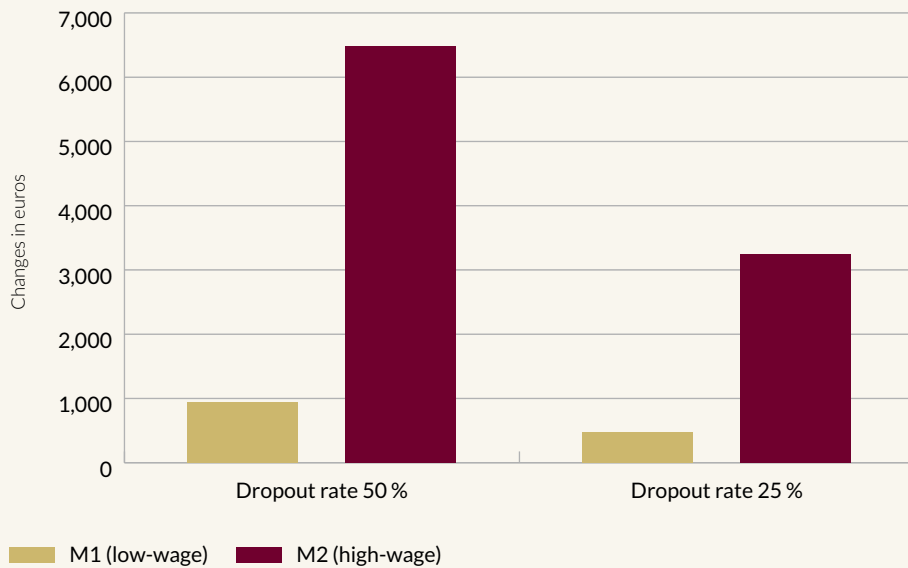
M1 (low-wage)   M2 (high-wage)

Source: own calculations, based on model 1 and 2 (low- and high-wage scenario)

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Waitresses/waiters

TABLE A8 **Net training costs – Waitresses/waiters – Italy**

Wage	Model 1	Model 2	Model 3
low	−3,697	−2,997	−10,664
high	14,805	9,338	7,839

Source: own calculations. Net training costs in euros. Unfortunately, we did not receive any responses about hiring costs for this occupation.

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FIGURE A29 **Gross costs, productivity, and net training costs by year of training – Waitresses/waiters – Italy**

Source: own calculations, based on model 1 (low-wage scenario)

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FIGURE A30 **Net costs by firm size – Waitresses/waiters – Italy**

Source: own calculations, based on model 1 (low-wage scenario)

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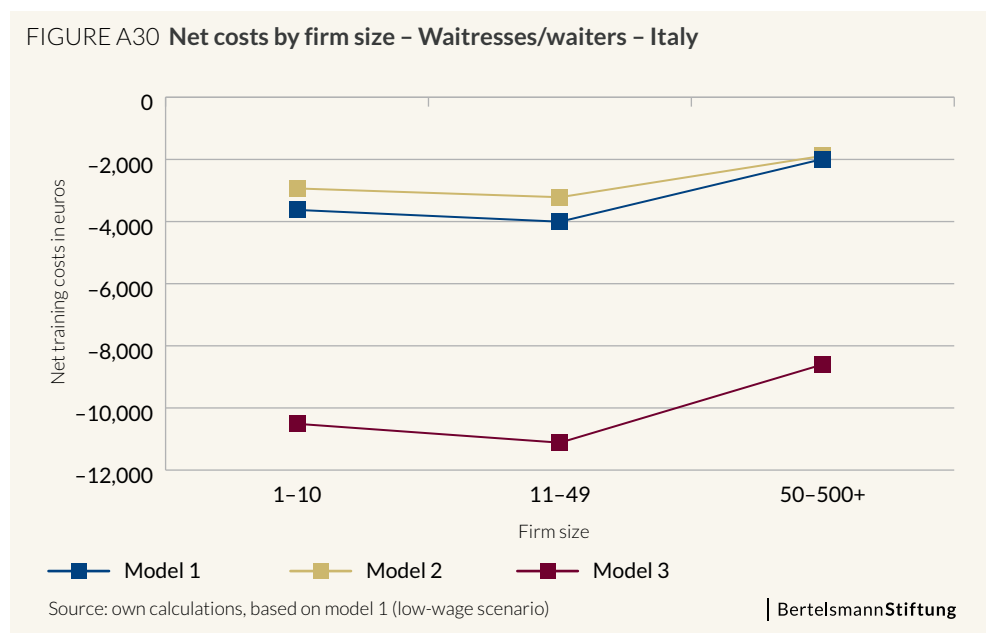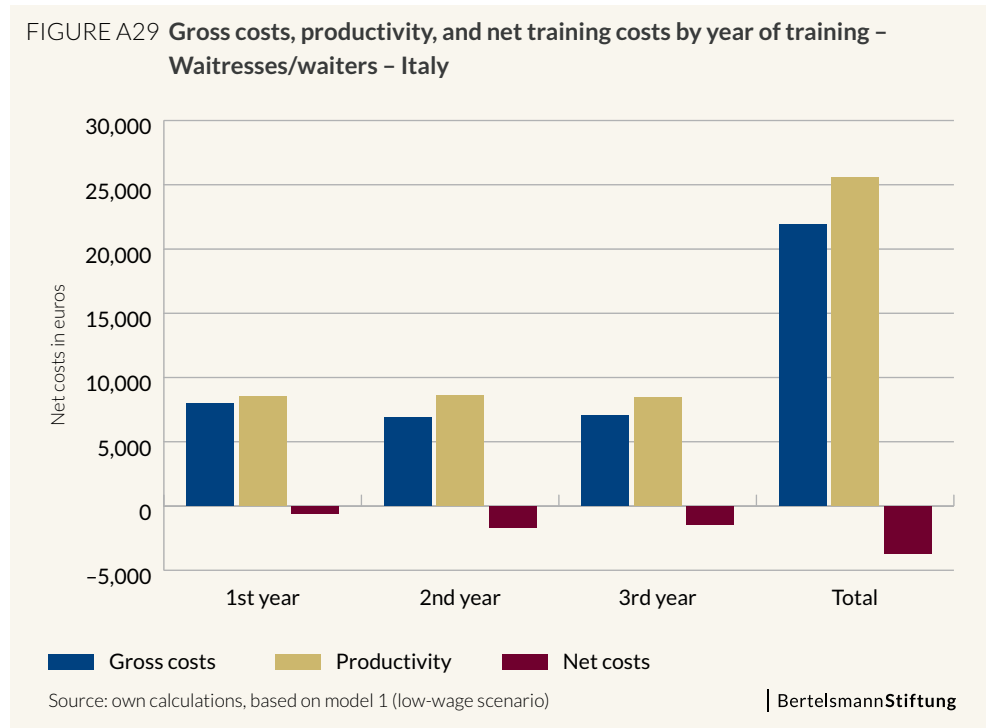
FIGURE A31 **Break-even analysis of apprentice wage relative to unskilled and skilled wages – Waitresses/waiters – Italy**

Proportion of skilled worker wage   Unskilled worker wage

Source: own calculations

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FIGURE A32 **Net costs assuming different dropout rates – Waitresses/waiters – Italy**
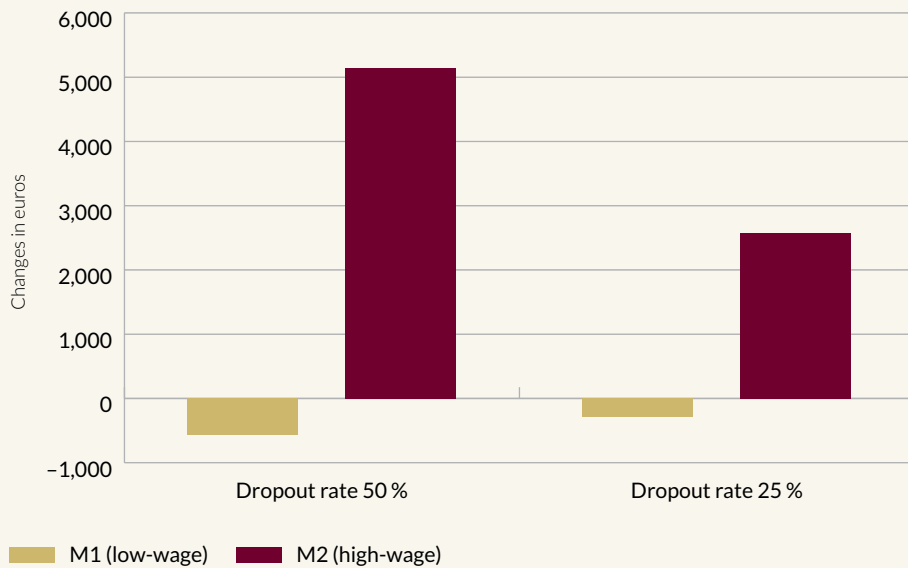
M1 (low-wage)   M2 (high-wage)

Source: own calculations, based on model 1 and 2 (low- and high-wage scenario)

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Prof. Dr. Samuel Muehlemann is a Professor of Human Resource Education and Development at LMU Munich. In 2013/14 he was a visiting scholar at the University of California, Berkeley (Institute for Research on Labor and Employment), and in 2009 he was a visiting academic at King's College London. He is also a research fellow at IZA Bonn. He received his Ph.D. in Economics from the University of Bern in 2008. His research interests include Vocational Education and Training, Labor Economics and Personnel Economics. Among other works, he has published articles in the European Economic Review, Industrial and Labor Relations Review, Industrial Relations, Labour Economics, or Oxford Economic Papers.

Prof. Dr. Stefan C. Wolter is a renowned expert in economics of education with a particular focus on vocational education and training. He is the executive director of the Swiss Coordination Centre for Research in Education, holds a professorship at the University of Bern, acts as permanent visiting professor at the University of Basel and serves in numerous expert boards on education. Among others, he is Chair of the Expert Group on Vocational Education and Training and Adult Education of the OECD, member of the Education Policy Committee as well as member of the board of the Centre for Educational Research and Innovation (CERI) of the OECD in Paris. He has published numerous books and more than 50 peer-reviewed scientific publications in journals such as the American Economic Review, the Journal of Public Economics or the Industrial and Labor Relations Review. Most relevant for this project are his several large-scale surveys for the measurement of costs and benefits in dual vocational education in Switzerland, and his comparative studies with Austria and Germany, as well as two recent simulation studies for England and Spain.

Eva Joho holds a Master's degree in Applied Economic Analysis with Specialization in Regional Economic Development from the University of Bern, where she worked as a research assistant at the Centre for Research in Economics of Education. Eva Joho's main areas of research include economics, regional economics and personnel economics.

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