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Costs and benefits of an individual learning account (ILA): A simulation analysis for the Netherlands☆

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This study analyses costs and benefits of a public-private funded individual learning account (ILA) for the labour force in the Netherlands. We consider an ILA that is funded by subsidies targeted at low- and medium-educated workers and co-funded by training levies as a share of the wage bill. We simulate two alternative steady-state scenarios about the uptake of resources and increase in training activity, using a lifecycle model of human capital investments. We derive predictions for gross earnings, income inequality and costs (training subsidies and tax deductions) and benefits (tax revenues and fewer unemployment benefits). Our results show how the balance of costs and benefits depends on the interplay between take-up rates, returns to training and the deadweight loss of subsidizing an ILA for the whole labour force. Our model and results contribute to policy trade-offs about the introduction of ILA's to stimulate the resilience of the labour force.

1. Introduction

Globalization, climate change and new technologies have a profound impact on labour demand. The types of jobs that are available and the skills they require are changing, which leads to higher rates of skills obsolescence, demands faster job mobility and new forms of work relations between workers and firms (e.g., Acemoglu and Autor, 2011; Goos et al., 2014; Acemoglu and Restrepo, 2018). The extent to which workers and firms are able to benefit from these changes, depends on workers' abilities and opportunities to acquire and maintain relevant skills. Next to adjusting the formal education of the young, more investments in the education of those already in the labour force seems needed. According to the OECD (2019a), adult learning systems in many countries should make significant improvements to match the changing demand with labour supply. The OECD points to closing the participation gap in training of lower skilled and lower educated workers and aligning training provision with future labour market needs. The identified bottlenecks based on thorough reviews of members' labour markets are threefold: sufficient financials means for those who need education the most, lowering the deadweight loss of government investments and incentivising employers and workers to participate in training.

Against this background, the idea of introducing an individual learning account (ILA) for all people in the labour force has received

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renewed attention in the policy discussion on (financing) lifelong learning.[1] The idea is that an ILA provides workers with individual resources that can be used to improve their skills. Although it shares many similarities with other training instruments targeted at individuals (e.g., training vouchers), the main advantage of an ILA is that it accumulates resources that can be carried over between jobs and employment status. This increases worker autonomy, stimulates career development and encourages participation (e.g., OECD, 2019b). These advantages should be attractive to workers in a world that is characterised by changing demand, increased non-standard forms of employment and faster labour mobility (e.g., ILO, 2016).[2] A number of countries have experimented with ILA's for workers, most notably France, Singapore and the United States. In the European Union (EU), the Commission made a proposal to implement ILA's in EU Member States as a tool to improve access to training (European Commission, 2021). In the Netherlands proposals for an ILA have been put forward by the Committee on the Regulation of Work (2020) and the Platform on the Future of Work (2020) – the former committee was installed by the minster of Social Affairs and Employment to advise about labour-market reforms.[3] Also the Social Economic Council of the Netherlands has advocated further steps to increase participation in schooling of the workforce.

While there is discussion about implementing ILA's, relatively little is known about costs and benefits and ways in which costs and benefits change depending on entitlements and participation, returns to training and deadweight losses. Knowledge about costs and benefits, the way in which they change depending on the design and incentives seems crucial for implementation. In this paper, we analyse the costs and benefits of a public-private funded ILA for workers and job seekers in the Netherlands. The model we build can also be used for cost-benefit analysis in other countries and for alternative ways of implementing ILA's and assigning entitlements.

We consider an ILA funded by subsidies targeted at low- and medium-educated workers and co-funded by compulsory levies imposed on the wage bill. The subsidies are targeted at low- and medium-educated workers because their participation in lifelong learning is below the level which is economically optimal (e.g., Borghans et al., 2014; Fouarge et al., 2018), they are probably more at risk of changes in labour demand (e.g., Frey and Osborne, 2017; Nedelkoska and Quintini, 2018; Pouliakos, 2018) and targeting would likely limit the deadweight loss of the subsidies (e.g., OECD, 2019b). The individual level of the subsidy is based on the difference in total public expenditures of the individual's completed education relative to the costs of a university degree. Private investments are added in the form of compulsory training levies imposed on the wage bill and account for 0.5 percent of workers' gross earnings. This limits the deadweight loss because workers pay a share of the investment costs. Lower educated workers receive more subsidies than they contribute to their account, while the opposite holds for higher educated workers. In sum, resources should be substantial enough to invest in education to improve labour-market outcomes.

To analyse costs and benefits, we apply a lifecycle model of human capital investments, developed by Magnac et al. (2018). We differentiate the model according to workers' education level and calibrate lifecycle profiles of investments and earnings. We simulate two alternative scenarios about the uptake of subsidies and increase in training that aim to reflect what happens with and without additional policies to optimise take-up rates among low- and medium-educated workers. The scenarios include a 'widening gap' scenario assuming a doubling in current training participation of all workers (thereby widening the existing participation gap due to self-selection into training by higher educated workers) and a 'closing gap' scenario assuming a take-up rate of 50 percent of all subsidies (thereby closing the existing participation gap due to the targeting of lower educated workers). We use data from the 2019 wave of the Dutch Labour Force Survey (LFS) to derive predictions from the simulations. Ultimately, we derive predictions for gross earnings, income inequality and the costs (training subsidies and tax deductions) and benefits (tax revenues and fewer unemployment benefits).

The main results show how the cost-benefit balance depends on the interplay between participation rates, returns to training and the deadweight loss, which are the parameters policymakers are concerned about. First, higher participation by lower educated workers (in the closing-gap scenario) results in higher costs because of relatively modest returns to training, but it reduces income inequality. The opposite effect is obtained for higher participation among higher educated workers (widening-gap scenario), even after taking into account a higher deadweight loss. This result suggests that there is a trade-off between maximizing (minimizing) government benefits (costs) and reducing income inequality when targeting subsidies towards lower educated workers. Second, the two ways of funding (training subsidies and training levies) ILA's show that private co-funding reduces the deadweight loss, but also heavily weighs on gross earnings (especially for low- and medium-educated workers) and tax revenues (due to the tax deductibility of training levies) when a large part is not invested in training to yield a return. This result suggests that policies to foster participation are beneficial. Finally, a number of sensitivity analyses have been carried out with regard to the returns to training, deadweight loss and the depreciation rate of human capital to show the results of what happens when additional policies are implemented to improve the system.

The remainder of this paper proceeds as follows. Section 2 examines the policy rationale and the empirical evidence on the effectiveness of an ILA. Section 3 describes the setup of the ILA considered in the cost-benefit analysis. Section 4 describes the simulation model, the simulation scenarios and the considered outcome variables. Section 5 reports and discusses the main simulation results and policy trade-offs. Section 6 reports and discusses the main results from the sensitivity analysis. Section 6 concludes and discusses the policy implications.

2. Background

We start our cost-benefit analysis with an introduction of the main stakeholders involved in lifelong learning and an examination of the policy rationales and the empirical evidence on the effectiveness of ILA's.

2.1. Stakeholders

Classical human capital theory views lifelong learning as a training investment that raises expected future productivity and earnings, but at a cost (e.g., Leuven, 2005, for a review). The early literature analyses investments in human capital as an individual decision in a competitive environment, without any strategic interaction between workers and firms. Later on, the literature also starts to analyse the strategic interaction between employers and workers, with a focus on market failures and information asymmetries. This literature provides arguments for government involvement in lifelong learning. More recently, insights from behavioural economics and nonrational decision-making are included in models of human capital investment as well.

Lifelong learning is often considered as a joint responsibility of workers, employers and the government. This paper focuses on the role

[1] In this paper we focus on ILA's and do not discuss alternative policies to finance and incentivise lifelong learning. Palacios (2003), Schuetze (2007) and Oosterbeek and Patrinos (2009) review alternative schemes.

[2] Non-standard forms of employment include for example temporary employment, part-time and on-call work, temporary agency work and other triangular employment relationships as well as disguised employment and dependent self-employment.

[3] An ILA could either replace or co-exist with the current sectoral training funds (*O&O-fondsen*) and the individual learning and development budget (*STAP-budget*), which was previously an individual tax deduction for training expenses (*scholingsaftrek*).

of the government in mitigating market failures and discusses the rationales for policy intervention in lifelong learning that are provided in the literature. These policy rationales may include several efficiency, equity and paternalistic considerations relevant to the introduction of ILA's, which we discuss in turn.

2.2. Policy rationale

The *efficiency rationale* considers reasons why firms and workers may underinvest in education compared to the socially optimal outcome.[4] Underinvestment in education mainly arises when there are uncompensated costs and benefits of training due to market failures or institutions that drive a wedge between the private and social returns to training. This wedge may affect the trade-off of workers and firms who are only willing to invest in training up to the point where it equals the private returns, leaving potential social returns unrealized.

Sources of underinvestment include market failures resulting from imperfections in the capital, insurance and labour market, such as liquidity constraints, hold-up problems, poaching and other externalities. Additional sources of underinvestment result from distorting institutions, such as minimum wages, unions, unemployment benefits and taxation (e.g., Stern and Ritzen, 1991; Booth and Snower, 1996; OECD, 2001; Leuven, 2005, for reviews). In general, the efficiency rationale would call for directly removing institutional distortions and/or introducing subsidies or levies, which would directly address market failures. These measures could align the private and social returns to training, which would alter the trade-off of workers and firms who are then willing to invest in training up to the point where it equals the social returns. However, the economic significance of this rationale – in order to justify policy intervention in lifelong learning – seems to be challenged by a lack of direct empirical evidence of market failures and underinvestment in training (e.g., Brunello and De Paola, 2009).

The *equity rationale* considers reasons why the market may not provide an equal distribution of opportunities among workers. There are at least two of them. First, liquidity constraints may be more relevant for lower educated workers, either because of their lower income/wealth, which would restrict themselves to invest in training, or due to the rigidity of minimum or union wages, which would limit their employer to invest in training by (temporarily) lowering wages (e.g., Becker, 1962; Acemoglu and Pischke, 1999).[5] Second, employers may have fewer incentives to invest in training for some types of workers because of a shorter time period in which they can recoup their investments (e.g., Arulapalam and Booth, 1998). As a result of less resources and/or employer-provided training, lower educated, temporary and older workers may be less likely to participate in education.

A negative association between labour-market flexibility and employer-provided training is especially relevant in the Dutch labour market because it has a relatively large share of non-standard employment (e.g., Gielen and Schils, 2014). Additionally, lower educated workers are probably more at risk of skills obsolescence which makes them particularly in need of education. There are substantial participation gaps in education along the lines of age, formal education level and labour-market status (e.g., Borghans et al., 2014; Fouarge et al., 2018). The participation of lower educated, non-standard and older workers is lagging behind those of high-educated, permanent and younger workers. A choice experiment among Dutch workers and employers suggests that lower educated workers are especially sensitive to the costs of training, while temporary and older workers rather face a lack of support from their employers (Künn et al., 2018). In general, the equity rationale calls for targeted training subsidies to provide more training opportunities to disadvantaged groups of workers.

The *paternalistic rationale* considers reasons why workers may make suboptimal choices with regard to education and do not maximise lifetime earnings. Suboptimal behaviour results from bounded rationality, including several cognitive biases and heuristics (Kahneman, 2003). The theoretical, experimental and empirical literature suggests several sources of suboptimal behaviour (e.g., Lavecchia et al., 2016, for a review). For instance, workers focus too much on the present, rely too much on routine, focus too much on negative identities, face too many options which leads to suboptimal choices or have too little information to choose effectively. Suboptimal behaviour is more prevalent among lower educated workers. As the benefits compound over time, marginal investments in training become consequential, which lead to regret. Although the paternalistic rationale suggests subsidies as an incentive, suboptimal behaviour also needs to be taken into account when considering the design of the system. For example, the system could affect self-control, reduce inertia, change defaults, strengthen positive identities and simplify choice options. These measures would influence the decision-making process of workers and would elicit better choices with regard to educational investments.

2.3. Empirical evidence

In most advanced economies, the government is involved in stimulating lifelong learning, which often reflects a mix of efficiency, equity and paternalistic considerations. Although only a few adult learning systems include an ILA to stimulate participation in lifelong learning, training subsidies and training levies are common policy instruments in many countries. Empirical evidence on the effectiveness of an ILA is scarce and mainly descriptive (e.g., Cedefop, 2009; OECD, 2019b, European Commission, 2021, for reviews). There is (causal) evidence on the effectiveness of subsidies, such as training vouchers (e.g., McCall et al., 2016; Tomini et al., 2016) and tax deductions (e.g., Leuven and Oosterbeek, 2004, 2012; Van den Berge et al., 2017), as well as on training levies (e.g., Dar et al., 2003; Cedefop, 2008; Müller and Behringer, 2012, for reviews).

Empirical evidence shows that ILA's, training subsidies and training levies can be potentially effective instruments to stimulate participation in education. The effects depend on the specific design and the economic and institutional context. The instruments come with a significant deadweight loss due to the substitution of education that would have been paid for by employers or workers themselves. A review by Tomini et al. (2016) reports a deadweight loss between 30 and 59 percent for training vouchers. Furthermore, there is only limited evidence that these instruments increase earnings and employment probabilities among participants. If so, this will be most likely the case in the medium term, similar to active labour-market policies (e.g., Kluve, 2010; Card et al., 2010, 2018, for reviews). Additionally, self-selection into training by higher educated workers is likely to exacerbate participation gaps and increase labour-market inequalities. However, the main advantage of an ILA is that it accumulates resources that can be carried over between jobs and employment status, which increases worker autonomy, stimulates career development and encourages participation, have not been studied yet.

Overall, OECD (2019b) suggests several design issues in realizing maximum effectiveness and efficiency of an ILA and other related schemes. First, the resources of an ILA should be substantial to incentivise workers to use it and to make a significant difference in participation, acquired skills, qualification levels and labour-market outcomes. These resources should be accompanied by paid leave if workers are unable to work during their education investments. In addition, targeting the resources of an ILA at lower educated workers limits the deadweight loss and decreases the participation gap in lifelong learning,

[4] With perfect competition and skills that are either general or specific, private parties invest the socially optimal amount in training since the costs and benefits of training are fully compensated. Workers bear all the costs and benefits of general training, while firms and workers share both the costs and benefits of specific training (e.g., Becker, 1962).

[5] Acemoglu and Pischke (1999) also discusses reasons why minimum and union wages could actually induce employer-provided training.

although take up could still be an issue. Third, an ILA should be kept simple and needs to be accompanied by additional policies (e.g., effective information, advice and guidance) to increase participation rates. Fourth, assuring training quality (e.g., certification of providers) and aligning training provision with labour-market needs (e.g., restrictions on types of training) could improve the effectiveness of an ILA in terms of labour-market outcomes. Finally, funding has implications for redistribution. Public funding is more redistributive, but makes the instrument sensitive to budgetary constraints, while private funding earmarks resources and limits deadweight losses, but could form a barrier to participation.

3. Individual learning account

We build a model which considers a public-private funded ILA for all workers and job seekers in the Netherlands. We consider an ILA funded by subsidies targeted at lower educated workers and co-funded by compulsory training levies imposed on the wage bill of firms or turnover of self-employed. This setup provides substantial resources to invest in education among workers, which would positively affect individual trade-offs, increases human-capital levels and improves labour-market outcomes. Targeting lower educated workers decreases the participation gap in education, while the public-private design limits the deadweight loss. This would improve the trade-off of the government in terms of equity and efficiency of the system.

3.1. Training subsidies

Subsidies are granted to workers and job seekers upon entering the labour market. This would directly reduce the private costs of training and increase the incentive to further invest in education. The simplest way to grant subsidies is to determine the level of subsidies by the difference between total public expenditures on completing the observed level of education and completing higher education (higher vocational and university education). Moreover, differentiating subsidies between education levels is both equitable and efficient since it closes gaps in training opportunities and limits deadweight losses. In the model we distinguish three levels of education.[6] According to the 2020 budget, public expenditures for completing lower and intermediate levels of education are on average € 90,000 and € 115,000 per individual, compared to € 140,000 in higher education (Ministry of Education, Culture and Science, 2019). In the model low-educated and medium-educated workers would then be granted € 50,000 and € 25,000 over the lifecycle, while high-educated workers receive no subsidies. In practice, ILA's set a lower maximum value to the subsidy and do not exclude high-educated workers (e.g., OECD, 2019b). Hence, we adjust the maximum to € 37,500 for low-educated workers (1.5 times the amount granted to medium-educated workers) and introduce a floor of € 7500 euro for high-educated workers (a fifth of the subsidy granted to low-educated workers).

3.2. Training levies

Training levies are imposed on the wage bill of employees or on the turnover of self-employed workers and are put directly into the ILA. This would set aside financial resources and stimulate investments in further education. The amount of levies account for 0.5 percent of workers' gross earnings (or turnover for the self-employed) and are deductible from taxable income. In absolute terms these contributions to the ILA increase with workers' education level. In contrast to many traditional levy schemes, there is no mutualisation of resources in a central fund which allocates resources towards those who undertake training (e.g., Cedefop, 2008; Müller and Behringer, 2012). Training levies paid directly into an ILA instead of a central fund increase worker autonomy with respect to training decisions and career development. It also ensures that resources can be carried over between jobs and employment status, without workers losing resources earmarked to a particular employer or sector. ILA's could hence stimulate labour mobility and increase workers' sustainable employment.

3.3. Total resources

Table 1 provides an overview of the total resources of the ILA by type of funding and workers' education level. Total resources are € 45,000 for low-educated workers, € 34,000 for medium-educated workers and € 21,500 for high-educated workers. This corresponds to 3.2 percent, 2.0 percent and 0.8 percent of their average lifetime earnings. To retain their real value during working life, the resources are converted into training hours at a rate of € 15 per hour.[7] This way individuals receive entitlements in terms of hours that can be invested in training.

Overall, the total resources are equivalent to 3000 h of training for low-educated workers, 2267 h for medium-educated workers and 1433 h for high-educated workers during over the lifecycle. This would mean an average of 67 h, 50 h and 32 h of training per year, assuming an average lifecycle of 45 years. For comparison, current training participation among low-, medium- and high-educated workers is 12 h, 16 h and 22 h respectively (see Appendix A, Table A1).

4. Methodology

To perform cost-benefit analysis, we simulate a lifecycle model of human capital investments. Since an ILA influences individuals' education decisions at various stages of the lifecycle, this has an impact on lifetime earnings and employment probabilities. Changes in earnings and employment have an effect on a country's tax revenues and welfare expenditures.

4.1. Empirical model

We simulate a lifecycle model of human capital investments similar to the one – but less involved than – developed by Magnac et al. (2018). It shares common features of the canonical model of Ben-Porath (1967) of human capital investments. The model describes the optimal lifecycle profile of education investments for individuals who maximise their lifetime utility in a partial-equilibrium setting. Individuals start with a particular level of human capital obtained during initial education (i.e., before entering the labour market) and obtain returns to investments in further education (such as training), face depreciation of the stock of their human capital, investment costs and terminal values of human capital stocks that are all individual specific.

Individuals enter the labour market at period $t = 1$ and retire at period T. The decision to enter is endogenous and depends on ability and human capital accumulation. We take the initial levels of education, the time of entry in the labour market and the retirement date all as given in the model. This means that initial education decisions are not influenced

[6] We differentiate between three levels of education. Low-educated workers are workers whose highest level of education is primary education (ISCED 1) or preparatory secondary vocational education (ISCED 2). Medium-educated workers are educated at higher general secondary education, preparatory university education or secondary vocational education (ISCED 3). High-educated workers have completed higher vocational education or university (ISCED 5 or higher).

[7] For comparison, the unit costs of initial education are on average € 5 per hour in the Netherlands. These unit costs are calculated by dividing the total public expenditure on respectively lower, intermediate and higher education by the number of enrolled students and the average nominal study duration in hours (1 ECTS = 28 h), as reported by the Ministry of Education, Culture and Science (2019).

Table 1
ILA resources by type of funding and workers' education level.

	Training subsidies			Training levies			Total		
	euros	%	hours	euros	%	hours	euros	%	hours
Low-educated	37,500	2.7	2500	7500	0.5	500	45,000	3.2	3000
Medium-educated	25,000	1.5	1667	9000	0.5	600	34,000	2.0	2267
High-educated	7500	0.3	500	14,000	0.5	933	21,500	0.8	1433

by ILA's; the same goes for retirement ages. From $t = 1$ onwards, individuals can acquire human capital by investing in additional education. In the Ben-Porath model individuals do not invest in additional education, but we consider the fact that there is uncertainty about returns to human capital and depreciation as a result of exogenous shocks, which makes pre-cautionary investments attractive (Gould et al., 2001).

Human capital investments during the life cycle of work are defined as the fraction of time devoted to education $\tau_{i,t}$. Earnings are determined by the individual stock of human capital $H_{i,t}$ multiplied by the rental rate of human capital $\delta_{i,t}$, which yields in log form $\ln y_{i,t} = \delta_{i,t} + \ln H_{i,t}$. Individuals face uncertainty about the rental rate because of shocks during the life cycle of work and spend time to invest in education. This means that current log earnings are described by:

$$\ln y_{i,t} = \delta_{i,t} + \ln H_{i,t} - \tau_{i,t} \quad (1)$$

Equation (1) shows that investments decrease current earnings, for instance because of unpaid leave, but provide future returns through increased human capital. The production of human capital is given by

$$H_{i,t+1} = H_{i,t} e^{\left(\rho_i \tau_{i,t} - \lambda_{i,t}\right)} \quad (2)$$

where $H_{i,t}$ is the stock of human capital, ρ_i is the return to investments which is specific to the individual's level of education, and $\lambda_{i,t}$ is the depreciation rate of human capital. Workers also face uncertainty about the shocks to depreciation as a result of for example new technologies entering the market which make part of their human capital stock obsolete.

In the model we consider three types of workers i to distinguish between low-, medium- and high-educated workers: $i = l, m$ or h. These workers enter the labour market with different levels of human capital, which we define as their years of education. These years of education are optimally chosen depending on their ability levels, as in the Ben-Porath model. We also consider different rates of returns to investments, different time costs of investments and different rates of depreciation depending on the level of education. Next, we also consider terminal values of human capital which are individual specific. In a Ben-Porath model the terminal values of human capital would become similar for all types of workers, in practice the levels of human capital at the point of labour-market exit differ by level of education.

Each individual maximizes discounted expected utility:

$$V_t\left(H_{i,t}, \tau_{i,t}\right) = \delta_{i,t} + \ln H_{i,t} - \tau_{i,t} + \beta E_t\left[W_{t+1}, H_{i,t+1}\right] \quad (3)$$

where β is the discount rate, which is assumed to the 5 percent. We assume that investments in human capital remain positive until labour-market exit at time T. Equation (3) shows that the value of the stock of human capital in period t depends on the rental rate, previous investments, current investment and the value of future investments. The value of future investments also depend on the way human capital is depreciated – cf. equation (2).

Solving equation (3), log earnings in period t are then determined by the *initial level* of human capital upon labour-market entrance ($t = 1$), the *slope* of the growth of human capital is determined by the returns to, the costs of the investments while working and the individual specific rate of depreciation which are a function of time (t) and the *curvature* of the earnings profile is determined by the discount rate (similar to all workers and set at 5 percent) and the individual specific terminal value of human capital upon labour-market exit:

$$\begin{aligned} \ln y_{i,t} &= f\left(\ln H_{i,1}\right) + f\left(\rho_i, \tau_{i,t}, \lambda_{i,t}\right)t + f\left(\ln H_{i,T}\right)\beta^{-t} \\ &= \alpha_1 \qquad\quad = \alpha_2 t \qquad\qquad = \alpha_3 \beta^{-t} \end{aligned} \quad (4)$$

4.2. Model calibration

We use data from several sources to calibrate the model. First, we use data on current training participation by age and education level to determine the baseline investments in training. This data is obtained from Fouarge et al. (2018) who report these statistics based on the 2017 wave of the ROA Lifelong Learning Survey (see Appendix A, Table A1). We construct a measure of current training participation by multiplying the participation rate with the average number of training courses and median instruction hours by each education level. Second, we use data on annual gross earnings by age and education level to calibrate the lifecycle profile of earnings. This data is obtained from Statistics Netherlands (CBS) for 2016, which is the most recent year for which detailed information by age and education level is available (see Appendix A, Table A2). We adjust these data for the average wage increase in collective labour agreements since 2016, to obtain an estimate of 2019 earnings. Finally, we use data on the Dutch labour force by age, education level and working hours to get an estimate of the number of participating workers and job seekers of the ILA (see Appendix A, Table A3). This data is obtained from the 2019 wave of the Dutch Labour Force Survey (LFS), which is administered by Statistics Netherlands (CBS). This enables us to derive macro predictions from our micro simulations, using population data as an input.

We specify the values of the parameters such that the model provides an empirically sound prediction for the current average lifetime training participation and lifetime earnings of low, medium and high-educated workers. The model parameters are summarized in Table 2.

First, we set the period of our model, t, to be one year and assume that all individuals enter the labour market at period $t = 1$ at the age of 25 and retire at period $T = 45$ at the age of 70. In practice, however, individuals enter and leave the labour market at different ages with both the age of entry and retirement generally increasing with a worker's education level. Hence, the age upon which workers enter the labour market should be seen as the age from which those in the labour force become eligible for the ILA.

Second, we define the initial stock of human capital ($H_{i,1}$) such that it provides a good prediction of the current average gross earnings at the age of 25 for each education level. As a result, the initial human capital stock increases with education level, which is reflected by years of schooling from the age of four onwards. Specifically, we set $H_{l,1} = 11.50$, $H_{m,1} = 13.50$ and $H_{h,1} = 18.75$ for low, medium and high-educated workers.

Third, we assume heterogeneous returns to education during working life (ρ_i) which increases with education level. Specifically, we set $\rho_l = 0.030$, $\rho_m = 0.038$ and $\rho_h = 0.050$ for low, medium and high-educated workers. This is equal to about half the average return to initial schooling in the Netherlands (Hartog and Gerritsen, 2016). Empirical research shows variation in the returns to schooling across education levels, with generally higher returns for high-skilled and high-educated workers (see e.g., Gunderson and Oreopolous, 2020; for a review). We assume that the returns to education are lower during

Table 2
Parameter values.

	T	$H_{i,1}$	ρ_i	λ_i	β_i	α_1	α_2	α_3
Low-educated	45	11.50	0.030	0.030	0.95	2.44	0.055	−0.09
Medium-educated	45	13.50	0.038	0.025	0.95	2.59	0.057	−0.12
High-educated	45	18.75	0.050	0.020	0.95	2.92	0.065	−0.17

working life because it becomes harder to acquire new skills when the brain gets older and physical strength becomes harder to maintain. Investment costs (τ_i) increase with education level.

Fourth, we assume heterogeneous depreciation rates of human capital, λ_i, which decrease with education level. Specifically, we set $\lambda_l = 0.030$, $\lambda_m = 0.025$ and $\lambda_h = 0.020$ for low, medium and high-educated workers. Human capital depreciation embeds both technical skills obsolescence, such as wear and atrophy, and economic skills obsolescence induced by technological change (see e.g., De Grip and Van Loo, 2002). The skill bias in technological change likely induces variation in the depreciation rate across skill levels (see e.g., Acemoglu and Autor, 2011), with potentially higher depreciation rates for low-skilled and low-educated workers.

Fifth, like Magnac et al. (2018), we assume a homogeneous discount rate and fix it at $\beta = 0.95$, that is a discount rate of 5 percent. We determine the terminal values of the human capital stock by looking at wages upon retirement (at $t = 45$), which value decreases with education level.

Finally, the α-parameters of the lifecycle profile of earnings predict the starting values, growth rate and the curvature of the current average lifetime earnings for each education level. We fix these parameters to obtain a good fit with the data. The fixed values are consistent with the parameter estimates derived by Magnac et al. (2018) based on French panel data on male lifetime earnings.

Fig. 1 compares our baseline lifecycle profile of earnings with the current gross earnings by age and education level and also shows the fit to the data. The model captures the overall pattern of gross earnings, which is increasing with both age and education level, but slightly underestimates (overestimates) gross earnings in earlier (later) years.

4.3. Scenarios and outcomes

We develop two alternative scenarios about the uptake of resources and the corresponding increase in training. These scenarios reflect what happens with and without additional policies to increase take-up rates (i.e., share of resources invested in training) and to increase training participation among low- and medium-educated workers. We have selected scenarios that seem realistic in terms of the increase in training and which do not maximise benefits. Fig. 2 shows for both scenarios the average current training participation (black) and the assumed average increase in training participation due to utilizing the training subsidies (dark grey) and training levies (light grey) by each education level.

In the first ‘widening-gap’ scenario, we assume that the ILA leads to a doubling in current training participation of all workers, with an equal uptake of training subsidies and training levies. The uptake of resources could be enforced, for instance, by requiring a co-financing rate of 50 percent, which is common practice.[8] Since high-educated workers currently participate more in training than low-educated workers, they will also invest more in training in this scenario. This would likely happen when there are no additional policies in place to stimulate the take-up rates among low- and medium-educated workers, which is the current experience with ILA’s and other related schemes (OECD, 2019b). Specifically, this scenario implies an average increase in annual training participation of 12 h (0.006 fte) for low-educated workers, while for high-educated workers annual training participation increases by 22 h (0.011 fte) on average.[9] As a result, training participation between high-educated workers and low and medium-educated workers diverges, which widens the existing participation gap in lifelong learning.

In the second ‘closing-gap’ scenario, we assume that 50 percent of all dedicated resources (both training subsidies and training levies) are invested in training. Since low and medium-educated workers receive substantially more training subsidies, they will also invest considerably more in education in this scenario. This could potentially happen when there are effective additional policies in place to stimulate the take-up rates among those groups of workers. Specifically, this scenario implies an average increase in annual training participation of 33 h (0.016 fte) and 25 h (0.012 fte) for low and medium-educated workers, while high-educated participate only 15 h (0.007 fte) more in training on average. As a result, low and medium-educated workers are catching up with high-educated workers, with all workers participating on average between 37 and 45 h (0.018–0.022 fte) per year in training.

Table 3 summarizes both scenarios with regard to the uptake of resources and the increase in training. In the widening-gap scenario, the increase in training is assumed to be fixed, which implies a certain take-up rate, while in the closing-gap scenario, the uptake of resources is assumed to be fixed, which implies a certain increase in training. High-educated workers have to utilize almost all their training subsidies to double their participation, while low-educated workers almost triple their training participation when they utilize 50 percent of the dedicated resources.

As suggested by empirical evidence, not all uptake of training subsidies results in additional investments in training. There is always some degree of deadweight loss due to subsidizing training that would have taken place even in the absence of an ILA. Thus, training subsidies substitute some of the current training that used to be financed by employers or workers themselves instead of triggering additional investments in training. This deadweight loss may be substantial and likely increases with education level. Experimental evidence shows deadweight losses up to 59 percent for training vouchers (e.g., Tomini et al., 2016), which may strongly vary between education levels (e.g., Messer and Wolter, 2009). Therefore, we assume the deadweight loss to be $\Delta_l = 0.20$, $\Delta_m = 0.33$ and $\Delta_h = 0.50$ for low, medium and high-educated workers when all training is financed by training subsidies. When considered together with the training levies, we assume a 50 percent lower deadweight loss due to the co-financing of training by workers themselves.[10]

We define several outcome variables for our cost-benefit analysis. Specifically, we derive the effects on individual gross annual earnings (ΔY), income inequality (ΔINQ), tax revenues (ΔTR), unemployment benefits (ΔUB) and the costs (ΔC) for the government in a steady state. The net balance of costs and benefits (NB) is then calculated by

[8] Most current ILA’s and other related schemes include some form of cost-sharing between the government and the individual benefiting from the scheme. For example, schemes in Germany, Upper Austria and Flanders require financial participation by individuals ranging between 40 and 70 percent of the total costs of training. In schemes in the United States and Canada, individual participation varied from one quarter to half of the resources and from one sixth to half of the training costs respectively.

[9] We consider 1 fte to be equal to 52 weeks * 40 h = 2080 h.

[10] Below we also explore the sensitivity of our results to alternative choices with regard to the deadweight loss.

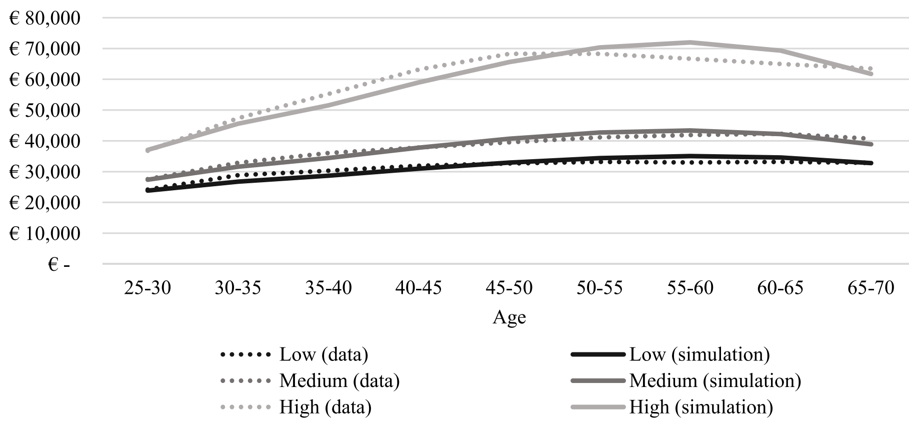


Fig. 1. Lifecycle profile of earnings (euros) by education level.

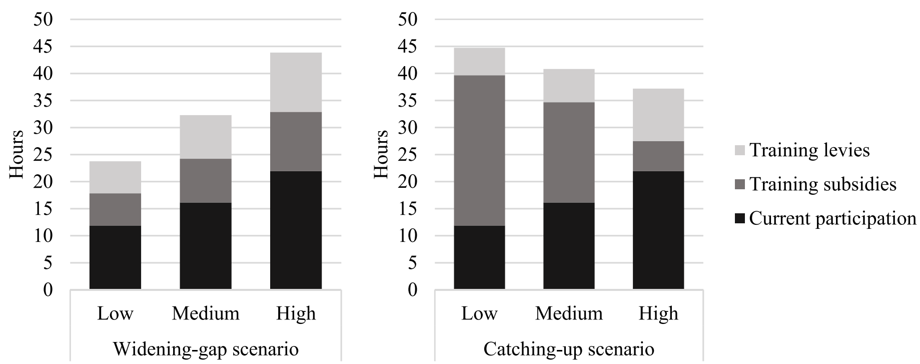


Fig. 2. Average annual training participation (hours) by scenario and education level.

Table 3
Simulation scenarios.

	Widening-gap scenario			Closing-gap scenario		
	Increase training	Take-up rate subsidies	Take-up rate levies	Increase training	Take-up rate subsidies	Take-up rate levies
Low-educated	100%	11%	58%	277%	50%	50%
Medium-educated	100%	22%	65%	153%	50%	50%
High-educated	100%	99%	56%	70%	50%	50%

Note: In the widening-gap scenario, the take-up rate is calculated based on a 100 percent increase in training at a rate of € 15 per hour and equally divided by the training subsidies and training levies for each education level. In the closing-gap scenario, the increase in training is calculated based on a 50 percent uptake of resources and converted in training hours at a rate of € 15 h.

$$NB = TR - UB - C \tag{5}$$

The effect on individual gross annual earnings (ΔY) directly follows from our model (see equation (4)) since additional investments in training yield a return and result in increased gross annual earnings for workers ($y_{i,t}$). This increase is multiplied by the number of participating individuals by age and education level (see Fig. 3) to obtain the aggregate increase in gross annual earnings

$$\Delta Y = \int_{i=l}^{i=h} \left(\int_{t=1}^{T=45} (\Delta y_{i,t}) dt \right) di \tag{6}$$

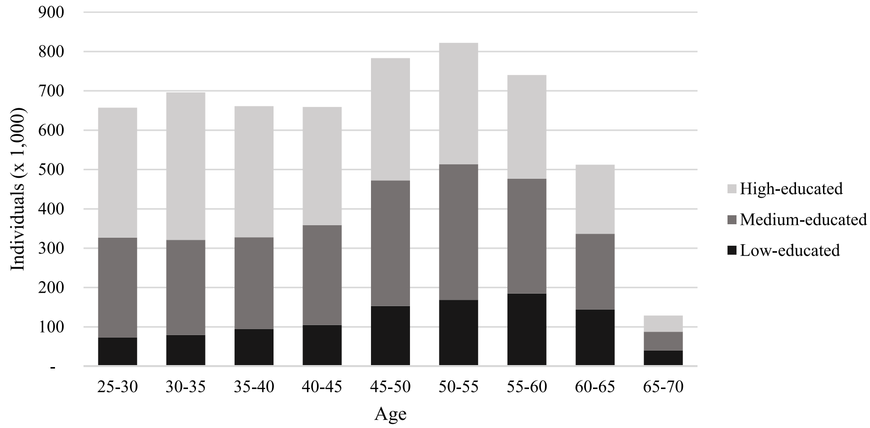
The effect on income inequality (ΔINQ) is calculated by taking the difference in percentage increase in gross annual earnings between high-educated workers and low-educated workers ($\Delta Y_h - \Delta Y_l$). Thus, a higher increase in gross earnings for high-educated workers compared to low-educated workers means an increase in income inequality and vice versa.

Note: The amount of participating individuals is calculated as the sum of the number of full-time employed workers, half the number of part-time employed workers and the number of job seekers (see Appendix A, Table A3-5).

Source: Own calculations based on Dutch Labour Force Survey (2019)

The effect on tax revenues (ΔTR) is derived by applying the (effective) marginal tax rate (corresponding to the applicable income bracket) (τ_{EMTR}) to the increased gross earnings that result from the additional investments in training ($y_{i,t}$).[11] This increase is also multiplied by the amount of participating workers and job seekers by age and education level (see Fig. 3) to obtain the aggregate increase in tax revenues

[11] In 2019, the marginal tax rate was 36.65% for the 0–20,384 income bracket, 38.10% for the 20,385–68,507 income bracket and 51.75% for the income bracket above 68,508 euro. Additionally, there are income dependent tax deductions, which decrease the effective marginal tax rate. We only deduct the general tax credit (*algemene heffingskorting*), which is 2477 euro and decrease to 880 euro in the 34,301–68,507 income bracket, and the labour tax credit (*arbeidskorting*), which builds up from 0 to maximum 3399 euro, from taxable income.



Note: The amount of participating individuals is calculated as the sum of the number of full-time employed workers, half the number of part-time employed workers and the number of job seekers (see Appendix A, Table A.3-5).

Fig. 3. Participating workers and job seekers by age and education level.

Table 4
Costs and benefits of an ILA funded by training subsidies.

	Δ TR	Δ UB	Δ C	NB	Δ Y	Δ INQ	Δ Y_l	Δ Y_m	Δ Y_h
Widening-gap scenario	572	−184	1.152	−396	0.6%	−0.3%	0.7%	0.8%	0.4%
Closing-gap scenario	525	−202	1.267	−549	0.5%	−1.3%	1.5%	0.7%	0.2%

Note: TR = Tax revenues; UB = Unemployment benefits; C = Costs for the government; NB = Net balance (TR – UB–C); Y = Gross earnings; INQ = Income inequality (Y_h – Y_l).

Table 5
Costs and benefits of an ILA funded by training levies (x €1000).

	Δ TR	Δ UB	Δ C	NB	Δ Y	Δ INQ	Δ Y_l	Δ Y_m	Δ Y_h
Widening-gap scenario	426	−272	0	698	0.3%	0.4%	0.1%	0.1%	0.5%
Closing-gap scenario	44	−145	0	189	−0.1%	0.2%	−0.2%	−0.2%	0.0%

Note: TR = Tax revenues; UB = Unemployment benefits; C = Costs for the government; NB = Net balance (TR – UB–C); Y = Gross earnings; INQ = Income inequality (Y_h – Y_l).

$$\Delta TR = \int_{i=l}^{i=h} \left(\int_{t=1}^{T=45} \left(\Delta y_{i,t} * \tau_{EMTR} \right) dt \right) di \tag{7}$$

The effect on unemployment benefits (ΔUB) is calculated by lowering the number of benefit recipients ($BR_{i,t}$) by the assumed increase in employment probability due to additional training (π_i), which is determined by multiplying the percentage increase in training participation ($\Delta\tau_{i,t}$) by the return to training (ρ_i) in each scenario. As a result, the employment probabilities range between 5 and 13 percent over the scenarios and workers' education levels, corresponding to a decrease in total unemployment of 0.2 and 0.4 percentage point in the widening-gap and closing-gap scenario respectively. The resulting savings on unemployment benefits account for 50 percent of the gross annual earnings of those workers who become employed ($y_{i,t}/2$) with the social assistance level as a minimum ($sa_{i,t}$)

$$\Delta UB = \int_{i=l}^{i=h} \left(\int_{t=1}^{T=45} \left(\pi_i \left(\rho_i, \Delta\tau_{i,t} \right) * BR_{i,t} * \max \left(sa_{i,t}, \frac{y_{i,t}}{2} \right) \right) dt \right) di. \tag{8}$$

The costs for the government (ΔC) are calculated by multiplying the assumed uptake of training subsidies per scenario ($\Delta\tau_{subsidy,i,t}$) with the amount of participating workers and job seekers by age and education level and the assumed unit costs of training (c)

$$\Delta C = \int_{i=l}^{i=h} \left(\int_{t=1}^{T=45} \left(\Delta\tau_{subsidy,i,t} * c \right) dt \right) di \tag{9}$$

Since the training subsidies are financed by the government through distortionary taxes, this would result in a marginal excess burden and increase the costs for the government, which we do not take into account in this cost-benefit analysis. However, some argue that the marginal excess burden of distortionary taxes is zero by definition because it equals the marginal distributional gain at the optimal tax system (see e.g., Jacobs, 2018).[12] Additionally, the training levies are deducted from taxable income and therefore directly decrease tax revenues. Furthermore, we assume that any administrative costs and operating expenses of the ILA are already reflected in the unit costs of training.

5. Results

We simulate the costs and benefits of the ILA in both scenarios by type of funding (training subsidies and training levies) separately as well as together. We report and discuss the simulation results for the outcome variables, as defined in previous section.

5.1. Training subsidies

First, we consider the costs and benefits of an ILA that is only funded by training subsidies targeted at low- and medium-educated workers, as

[12] For the same reason, the Working Group on the Costs of Taxation and SCBA's (*Werkgroep Kosten van belastingheffing en MKBA's*) proposes to disregard the costs of taxation in (social) cost-benefit analyses.

reported in Table 4.[13] The costs for the government (*C*) of such a scheme is 1.2 billion euro per year in the widening-gap scenario (and is mainly attributable to high-educated workers due to a higher uptake of training subsidies) and 1.3 billion euro per year in the closing-gap scenario (and is mainly attributable to low- and medium-educated workers due to a higher uptake of training subsidies). In both scenarios, these costs are partly recouped by the government because annual gross earnings (*Y*) increase on average by 0.6 and 0.5 percent, which, in turn, increases tax revenues (*TR*) by 0.6 and 0.5 billion euro per year.[14] Additionally, employment levels increase as well, which yields annual savings on unemployment benefits (*UB*) of 0.2 billion euro in both scenarios.

As a result, the net costs and benefits (*NB*) of an ILA that is only funded by training subsidies are −0.4 billion euro per year in the widening-gap scenario and −0.5 billion euro per year in the closing-gap scenario. Income inequality (*INQ*) decreases in both scenarios because of targeting the training subsidies at low- and medium-educated workers, but much more in the closing-gap than in the widening-gap scenario since the uptake of subsidies by low- and medium-educated workers is in that case much higher compared to the uptake by high-educated workers.

5.2. Training levies

Second, we consider the costs and benefits of an ILA that is only funded by compulsory training levies imposed on the wage bill, as reported in Table 5.[15] Since the training levies are imposed on workers' gross earnings, there are no direct costs for the government (*C*). However, there are indirect costs for the government because the training levies are deductible from taxable income. Furthermore, the training levies may reduce gross earnings (*Y*) when not all accumulated levies are invested in training and yield a return, which is the case in the closing-gap scenario (see Table 6). Consequently, annual tax revenues (*TR*) hardly increase in this scenario.

Overall, the net costs and benefits (*NB*) of an ILA that is only funded by training levies are 0.7 billion euro per year in the widening-gap scenario and 0.2 billion euro per year in the closing-gap scenario and depends on the amount of accumulated levies that is actually invested in training. In contrast to training subsidies, however, income inequality (*INQ*) increases in both scenarios because high-educated workers have more resources to invest since the training levies account for 0.5 percent of workers' gross earnings, which increases with workers' education level.

Table 6
Share of accumulated training levies invested per scenario (x €1000).

	Accumulated training levies	Invested training levies		Non-invested training levies	
Widening-gap scenario	1198	1198	100%	0	0%
Closing-gap scenario	1244	622	50%	622	50%

5.3. Individual learning account

Finally, we consider the costs and benefits of the full ILA that is funded by both targeted training subsidies and compulsory training levies, as reported in Table 7. We compare these results to the ILA that is only funded by targeted training subsidies. In the widening-gap scenario, part of the fixed increase in training investments is now co-financed by training levies (which only converts some of the dead-weight loss into additional investments), while in the closing-gap scenario the additional private co-funding also results in substantial additional training investments (since the uptake of resources remain fixed) (see section 4.3). As a result, the direct costs for the government (*C*) reduces to 0.8 billion euro (compared to 1.2 billion euro) per year in the widening-gap scenario, while these costs remain 1.3 billion euro per year in the closing-gap scenario.

In the widening-gap scenario, the costs are now fully recouped by the government because of a lower assumed deadweight loss due to private co-financing: the net costs and benefits (*NB*) are 0.1 billion euro (compared to −0.4 billion euro) per year. A lower deadweight loss mainly results in more additional training investments and gross earnings for high-educated workers (Y_h), while the increase in gross earnings for low- (Y_l) and medium-educated workers (Y_m) is rather tempered by the imposed training levies. This is because not all accumulated levies are invested in training and yield a return (see Table 8).

On average, the increase in gross earnings (*Y*) is 0.5 percent (compared to 0.6 percent), which, in turn, increases tax revenues (*TR*) by 0.6 billion euro (compared to 0.6 billion) per year and reduces unemployment benefits (*UB*) by 0.3 billion euro (compared to 0.2 billion) per year, which is enough to offset the costs. However, income inequality (*INQ*) increases by 0.5 percentage point (compared to −0.3 percentage point).

In the closing-gap scenario, a larger share of the costs are now recouped by the government, but they are still not outweighed by the benefits: the net costs and benefits (*NB*) are −0.3 billion euro (compared to −0.5 billion euro) per year. Although gross annual earnings (*Y*) increase on average by 0.6 percent (compared to 0.5 percent), this increase is tempered by the imposed training levies, especially for low-educated workers. This is because not all accumulated levies are invested in training and yield a return (see Table 8). As a result, tax revenues (*TR*) only increase by 0.6 billion euro (compared to 0.5 billion euro) per year and the savings on unemployment benefits account for 0.4 billion euro (compared to 0.2 billion euro) per year. However, income inequality (*INQ*) still decreases because of targeting the training subsidies at low- and medium-educated workers, although by less due to the relatively heavy weight of training levies on their gross earnings.

5.4. Policy trade-offs

We assess the trade-off for policymakers between private and public funding of the ILA model. In the policy analysis we keep the time investment of the full ILA model fixed for both types of funding, but once consider financing through training subsidies and once through training levies as the only source of funding.[16] This is different from the analysis of an ILA that is only funded by training subsidies (section 5.1) or only training levies (section 5.2), where differences in resources also imply different time investments as a result of the set-up (section 3).

When considering only training subsidies (Table 9), both tax

[13] Note, however, that the training subsidies for high-educated workers alone are not enough to double their training investments in the widening-gap scenario (only by 50 percent).

[14] The reason why the increase in tax revenues (*TR*) is less in the closing-gap scenario despite an almost similar increase in annual gross earnings (*Y*) is because the increase in earnings is mainly attributable to low- and medium-educated workers ($Y_l > Y_m > Y_h$) who have on average a lower marginal tax rate.

[15] Note, however, that the training levies alone are not enough to double training investments in the widening-gap scenario (only by about 80 percent).

[16] In this case, higher educated workers should receive more training subsidies (+40 to +100 percent) in order to make the same time investment in training. Similarly, the compulsory training levies should be higher (+12 to 221 percent) for all workers (but especially low and medium educated workers) in order to make the same time investment in training.

Table 7
Costs and benefits of an ILA funded by training subsidies and levies (x €1000).

	Δ TR	Δ UB	Δ C	NB	Δ Y	Δ INQ	Δ Y_l	Δ Y_m	Δ Y_h
Widening-gap scenario	642	−274	783	133	0.5%	0.5%	0.2%	0.4%	0.7%
Closing-gap scenario	589	−393	1267	−285	0.6%	−1.1%	1.4%	0.8%	0.3%

Note: TR = Tax revenues; UB = Unemployment benefits; C = Costs for the government; NB = Net balance (TR – UB–C); Y = Gross earnings; INQ = Income inequality (Y_h – Y_l).

Table 8
Share of accumulated training levies invested per scenario (x €1000).

	Accumulated training levies	Invested training levies		Non-invested training levies	
Widening-gap scenario	1318	783	59%	535	41%
Closing-gap scenario	1250	625	50%	625	50%

revenues (*TR*) and direct costs (*C*) increase in both scenarios. The increase in tax revenues is the net effect of no tax deductions and lower additional investments because of a higher deadweight loss. The direct costs increase proportionally to the increase in subsidies. Since the increase in costs outweigh the increase in tax revenues, the net benefits (*NB*) worsen and become negative in both scenarios. However, income inequality (*INQ*) increases by less (widening-gap scenario) or decreases by more (closing-gap scenario) because of differences in the assumed deadweight loss across education levels.

When considering only training levies (Table 10), tax revenues (*TR*) are only marginally affected in both scenarios. This means that the indirect costs of higher tax deductions and the lower deadweight loss almost cancel each other out. Since there are no longer direct costs for the government of training subsidies, the net benefits (*NB*) increase and become positive in both scenarios. However, income inequality (*INQ*) increases by more (widening-gap scenario) or does almost not decrease (closing-gap scenario) because of training levies are much more of a burden for lower and medium educated workers than for higher educated workers compared to their assumed return to training.

In sum, these results show how the costs and benefits of an ILA depends on the interplay between take-up rates, returns to training and the deadweight loss. First, the two alternative scenarios show that a higher uptake of training subsidies by low- and medium-educated workers (i.e., closing-gap scenario) results in higher costs for the government relative to the benefits because of a relatively modest return to training, but, at the same time, it reduces income inequality. The opposite effect holds true for a higher uptake by high-educated workers (i.e., widening-gap scenario), even after taking into account a higher deadweight loss. This result suggests that there is a trade-off between maximizing (minimizing) government benefits (costs) and reducing income inequality when targeting training subsidies. Second, the two ways of funding (training subsidies and training levies) show that private co-funding could reduce the deadweight loss (mainly for high-educated workers), but also heavily weighs on gross earnings (especially for low- and medium-educated workers) and tax revenues (due to the tax deductibility of training levies) when a large part is not invested in training and yield a return.

6. Sensitivity analysis

We explore the sensitivity of our results with regard to the model parameters that are considered important from both a methodological and a policy perspective. These model parameters include the return to training, including the employment probability, the deadweight loss and the depreciation rate of human capital. From a methodological perspective, these parameters are important because their specification is decisive for the simulation results. From a policy perspective, these parameters reflect the outcomes of an ILA that can be influenced by effective policies. As a result, the sensitivity analysis provides insight in both the methodological robustness and policy issues, from which we derive our policy implications.

Table 11 reports the results from the sensitivity analysis. For each of the model parameters, we assess a 50 percent higher and a 50 percent lower value relative to the baseline specification. Additionally, we assume all parameters to be homogeneous across workers' education level, taking the value for medium-educated workers as a reference. On the one hand, the net benefits of an ILA increase (decrease) with a higher (lower) assumed return to training and employment probability resulting from training. This is because a higher return increases gross earnings and tax revenues, while a higher employment probability both increases gross earnings and tax revenues and reduces the costs of unemployment benefits. On the other hand, the net benefits of an ILA decrease (increase) with a higher (lower) assumed deadweight loss and depreciation rate of human capital. This is because a higher deadweight loss means that fewer costs for the government are compensated for by tax revenues, while a higher depreciation rate mitigates the increase in gross earnings and tax revenues. Finally, when assuming a homogeneous rate of return, deadweight loss or depreciation rate, changes in the results only reflect differences in take-up rates and other parameters and not differences in the corresponding parameter.

The overall result as displayed in Table 11 is that the net benefits of

Table 9
Policy trade-off: Costs and benefits of an ILA funded by training subsidies (x €1000).

	Δ TR	Δ UB	Δ C	NB	Δ Y	Δ INQ	Δ Y_l	Δ Y_m	Δ Y_h
Widening-gap scenario	1136	−251	1567	−180	0.9%	0.4%	0.7%	0.8%	1.1%
Closing-gap scenario	721	−289	1892	−883	0.7%	−1.3%	1.7%	0.9%	0.4%

Note: TR = Tax revenues; UB = Unemployment benefits; C = Costs for the government; NB = Net balance (TR – UB.

Table 10
Policy trade-off: Costs and benefits of an ILA funded by training levies (x €1000).

	Δ TR	Δ UB	Δ C	NB	Δ Y	Δ INQ	Δ Y_l	Δ Y_m	Δ Y_h
Widening-gap scenario	673	−297	0	970	0.6%	0.6%	0.2%	0.3%	0.8%
Closing-gap scenario	465	−437	0	902	0.4%	−0.1%	0.5%	0.4%	0.4%

Note: TR = Tax revenues; UB = Unemployment benefits; C = Costs for the government; NB = Net balance (TR – UB.

Table 11
Results sensitivity analysis.

	Baseline			+50% w.r.t. baseline			−50% w.r.t. baseline			Homogeneous		
Rate of return	Δ TR-Δ UB	NB	Δ INQ	Δ TR-Δ UB	NB	Δ INQ	Δ TR-Δ UB	NB	Δ INQ	Δ TR-Δ UB	NB	Δ INQ
Widening-gap scenario	916	133	0.5%	1607	824	0.8%	238	−308	0.2%	770	−14	0.1%
Closing-gap scenario	982	−285	−1.1%	1368	100	−1.4%	260	−748	−0.9%	458	−352	−1.6%
	Baseline			**+50% w.r.t. baseline**			**−50% w.r.t. baseline**			**Homogeneous**		
Employment probability	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**
Widening-gap scenario	916	133	0.5%	1131	348	0.4%	701	−82	0.5%	882	99	0.4%
Closing-gap scenario	982	−285	−1.1%	1285	18	−1.5%	678	−589	−0.8%	981	−286	−1.4%
	Baseline			**+50% w.r.t. baseline**			**−50% w.r.t. baseline**			**Homogeneous**		
Deadweight loss	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**
Widening-gap scenario	916	133	0.5%	842	59	0.4%	990	207	0.5%	943	160	0.6%
Closing-gap scenario	982	−285	−1.1%	898	−269	−1.1%	1066	−201	−1.2%	984	−283	−1.0%
	Baseline			**+50% w.r.t. baseline**			**−50% w.r.t. baseline**			**Homogeneous**		
Depreciation rate	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**	**Δ TR-Δ UB**	**NB**	**Δ INQ**
Widening-gap scenario	916	133	0.5%	562	−222	0.4%	1191	408	0.5%	705	−78	0.4%
Closing-gap scenario	982	−285	−1.1%	523	−744	−1.1%	1519	252	−1.1%	866	−402	−1.2%

Note: TR = Tax revenue; UB = Unemployment benefits; NB = Net balance (TR – UB–C), INQ = Income inequality ($Y_h - Y_l$).

an ILA are affected by higher or lower rates of return but not so much when homogeneity is assumed. When suppliers of education are able to increase returns the net balance in het closing the gap scenario becomes positive. The same goes for the employment probability, which suggests that education that stimulates labour participation directly is cost effective. Reducing deadweight losses seems less effective, although letting the losses increase is very costly. Finally, a lower rate of depreciation by investing in long-term training and education programmes is cost effective.

7. Conclusion

We analyse the *ex-ante* costs and benefits of a public-private funded ILA for workers and job seekers in the Netherlands, using a lifecycle model of human capital investments. In particular, we consider an ILA that is funded by training subsidies that are targeted at low- and medium-educated workers and compulsory training levies that are imposed on the wage bill. Although an ILA can potentially be an effective instrument to stimulate participation in lifelong learning and increase workers' gross earnings and employment probabilities, we show how the extent to which the costs of training subsidies and levies will be recouped through increased tax revenues and unemployment benefit savings depends on the interplay between take-up rates, returns to training and the deadweight loss. These factors have several implications for policy makers when considering implementing an ILA.

First, and most importantly, an ILA should actually increase investments in training and stimulate participation in lifelong learning in order to be effective. This might be especially difficult to realize for low- and medium-educated workers, whose training participation is currently lagging behind those of high-educated workers. Therefore, an ILA should be accompanied by additional measures in order to maximise take-up rates and stimulate a learning culture among the labour force. These measures may include interventions that address several behavioural factors (e.g., self-control and inertia), provision of information, advice and guidance (e.g., a one-stop shop) and/or paid training leave.

Second, the returns to training in terms of workers' gross earnings and employment probabilities should be substantial in order to translate into higher tax revenues and unemployment benefit savings for the government. This could be achieved by the certification of training providers, putting restrictions on the type of training that can be undertaken and requiring the training to be professionally relevant for the labour market.

Third, the deadweight loss should be minimized in order to realize maximum effectiveness and efficiency of an ILA. This would suggest targeting training subsidies at low-skilled and low-educated workers and/or mobilizing private co-funding of an ILA in order to co-finance the training costs.

Finally, the benefits of an ILA should be weighed against the costs of potential government failures, administrative burdens and its sensitivity to fraud as well as against other alternatives to finance lifelong learning, which are not taken into account in this analysis.

Contribution

Both authors have contributed equally to the research.
We use alphabetical order of authors

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A

Table A.1
Training participation by education level (2017)

	Training participation rate	Average number of training courses	Median instruction hours	Net training participation (hours)
Low-educated	39%	1,45	21,0	11,9
Medium-educated	53%	1,45	21,0	16,1
High-educated	63%	1,45	24,0	21,9

Source: Fouarge et al. (2018).

Table A.2
Gross earnings by age and education level (€ 2019)

	25–30 year	30–35 year	35–40 year	40–45 year	45–50 year	50–55 year	55–60 year	60–65 year	65–70 year	Average
Low-educated	€ 24,170	€ 28.834	€ 30.318	€ 31.908	€ 32.650	€ 33.180	€ 32.968	€ 33.180	€ 32.862	€ 31.119
Medium-educated	€ 27,562	€ 32.862	€ 36.043	€ 37.845	€ 39.541	€ 41.131	€ 41.873	€ 42.297	€ 40.707	€ 37.762
High-educated	€ 36,785	€ 47.385	€ 55.230	€ 63.180	€ 68.269	€ 68.269	€ 66.679	€ 64.983	€ 63.498	€ 59.364
Average	€ 29.505	€ 36.361	€ 40.530	€ 44.311	€ 46.820	€ 47.527	€ 47.173	€ 46.820	€ 45.689	€ 42.748

Source: Statistics Netherlands (2018)

Table A.3
Full-time employed labour force (2019)

	25–30 year	30–35 year	35–40 year	40–45 year	45–50 year	50–55 year	55–60 year	60–65 year	65–70 year	Total
Low-educated	52.985	53.654	67.697	75.093	110.531	119.675	122.618	86.543	16.212	705.006
Medium-educated	182.424	174.799	164.641	174.775	220.392	236.479	193.520	117.511	19.617	1.484.158
High-educated	266.654	287.175	237.381	217.433	229.591	232.804	193.310	115.051	16.531	1.795.931
Total	502.063	515.628	469.719	467.301	560.513	588.959	509.447	319.105	52.360	3.985.095

Source: Labour Force Survey (2019)

Table A.4
Part-time employed labour force (2019)

	25–30 year	30–35 year	35–40 year	40–45 year	45–50 year	50–55 year	55–60 year	60–65 year	65–70 year	Total
Low-educated	28.312	38.825	43.676	45.457	70.553	88.002	107.285	99.565	43.307	564.982
Medium-educated	121.214	116.287	123.832	140.745	179.261	198.226	173.932	129.900	48.642	1.232.040
High-educated	110.760	156.897	177.376	153.637	150.871	136.391	125.088	106.455	42.258	1.159.734
Total	260.286	312.009	344.884	339.840	400.686	422.620	406.305	335.921	134.207	2.956.756

Source: Labour Force Survey (2019)

Table A.5
Unemployed labour force (2019)

	25–30 year	30–35 year	35–40 year	40–45 year	45–50 year	50–55 year	55–60 year	60–65 year	65–70 year	Total
Low-educated	5.636	6.131	4.723	6.961	7.241	4.896	8.441	7.499	1.975	53.500
Medium-educated	10.734	9.035	6.756	8.689	9.043	8.832	11.083	10.135	3.743	78.050
High-educated	8.690	9.183	7.413	5.922	6.038	7.906	7.884	7.559	3.401	63.996
Total	25.060	24.349	18.891	21.572	22.321	21.633	27.408	25.193	9.118	195.546

Source: Labour Force Survey (2019)

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