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Taxation and employability in MIMIC

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Abstract
CPB's applied general equilibrium model for the Dutch economy, MIMIC, has recently been extended to include the effects of taxation on training incentives. This paper elaborates on the training model. Furthermore, it illustrates how the extension with a training model affects the simulation results of MIMIC. I find that the incorporation of a training model has important implications for the quality of the labour supply, especially in tax experiments that substantially affect the marginal tax burden.

Introduction

CPB usually adopts its applied general equilibrium model MIMIC to explore the labour-market implications of tax reforms. The model focuses on adequately describing wage formation, labour supply and demand, and the process of job matching between vacancies and unemployed persons looking for a job. By including elements of wage bargaining and costly job matching, MIMIC describes equilibrium unemployment in terms of the structure of the tax system and the features of social insurance. MIMIC is designed to help Dutch policymakers investigate the structural labour-market implications of changes in the tax system.

Although the previous version of MIMIC (described in Gelauff and Graafland (1994)) yields a number of important insights into the labour-market effects of tax reforms, it does not capture the impact of high marginal tax rates on motivation and on-the-job training. These qualitative aspects, however, are receiving increasing attention from policymakers and economists in knowledge-based economies. The new version of MIMIC therefore incorporates training decisions. This article discusses how this is done and what the implications of the training model are for various tax experiments.

Structure of the model

The model adopts a concept developed by Boone (1998). In this framework, employed individuals can move between states that differ with respect to their employability levels. By investing time and effort in training, workers raise the probability of moving into a state with a higher employability level and a correspondingly higher wage rate.[2]

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Figure 1 MIMIC's training model in a nutshell

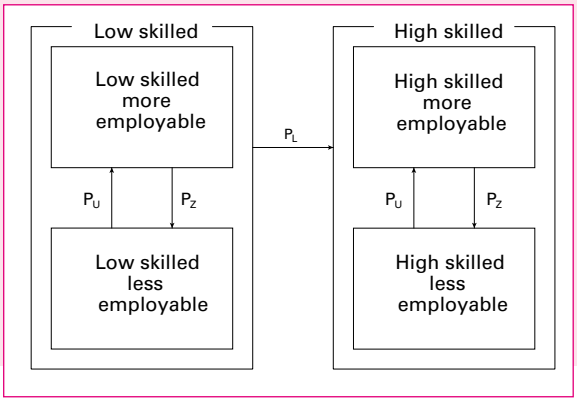

Figure 1 illustrates the stocks and flows in the training model. We use the term 'skill' for the initial skill level of a worker (i.e. someone is low skilled *(L)* or high skilled *(H)*). This skill depends on the initial educational level of a worker, i.e. the level before he/she started to work. At both skill levels, workers are subdivided into less employable *(U)* and more employable workers *(Z)*.

Workers in each state in figure 1 maximise utility by choosing between enrolment in a training programme or not. In making this choice, households trade off the effort cost and benefits of training. The effort cost is heterogenous, as some workers need to spend more effort (or leisure time) than others to successfully finish the programme. For less employable workers, the benefits of training take the form of a higher probability of moving towards the high-employability state in which they earn a higher wage (captured by P_u in figure 1). For more-employable workers, the benefits of training amount to a lower probability of moving from the high employability state towards the low employability state (captured by P_z in figure 1). Indeed, compared to more-employable workers that undergo training, workers that do not participate in training have a greater probability of losing their skills, e.g. due to depreciation of human capital or because new technologies make current skills worthless.[3]

Apart from training, low-skilled workers may participate in formal education. In this way, they may exchange their low-skilled status for a high-skilled status. High-skilled workers have little incentive to enrol in formal education because they are unable to further improve their skill level. The choice for low-skilled workers to enrol in education is determined by trading off the cost of education, which is determined by an (heterogenous) effort cost, and the benefits of education. These benefits are determined by the increase in the probability that the worker will become skilled, in which case he will earn a higher after-tax wage.

Using a probability density function of the effort cost of training (education), we can determine, for each effort cost, the fraction of workers that participate in training (education). These fractions determine the aggregate transition rates between the different states of figure 1, which are indicated by P_i for $i = U, Z, L$. Fractions and transition rates are affected by the tax system. In particular, if the after-tax wage in a more-employable state increases relative to a less-employable state, then the value of the effort cost at which a household is indifferent between training and no training increases. Accordingly, more households will find it attractive to enrol in training.[4] From the macro transition rates, we can derive the steady-state stock of workers in each of the states of figure 1. In the steady state, the share of high-skilled workers is fixed, due to an exogenous inflow of new, young and low-educated workers, and an exogenous outflow of old, high-educated workers.

Calibration

In MIMIC, 33% of the workers are low skilled and 67% high skilled. Low-skilled workers are subdivided into 36% less-employable workers (defined as those with an income below 120% of the minimum wage) and 64% more-employable workers. The group of high-skilled workers is equally split between 50% of the lowest incomes, who will be called less-employable workers, and 50% with the highest incomes, who will be called more-employable workers.

With regard to the incentives for training in MIMIC, note that the after-tax wage of the more-employable, low-skilled worker is around 50% higher than the average wage of a less employable, low-skilled worker. For high-skilled workers, this after-tax wage differential is somewhat larger, namely 57%. The average after-tax wage differential between high-skilled and low-skilled workers is almost 40%.

The transition rate from less-employable, low-skilled labour towards more-employable, low-skilled labour is 12%. For the high skilled, this transition rate is 8%. The transition rate from low-skilled into high-skilled labour is slightly less than 3% per year (see de Mooij, 1999, for a foundation of these figures).

The individual transition rate of workers who train differs from those who do not. The difference between transition rates determines the rate of return to training for which we use estimates from the literature. In particular, we set the rate of return on training at 21% (Groot and Maassen van den Brink, 1998). The rate of return to schooling is set at 8%. In 1996, 34% of the workers enrolled in an on-the-job training programme, while 13% participated in an educational programme.

A final important parameter in the calibration of the model is the effect of after-tax wage differentials on the incentives to train. Groot and Oosterbeek (1995) find that the effect of after-tax wage differentials on the share of households that participates in training is significantly positive, but small. For the US, Dupor et al. (1996) find a larger effect: a 10% rise in the marginal tax will lead to approximately a 15% decline in human capital investment.

Table 1 Labour-market effects of four simulations according to MIMIC[a]

	(1)	(2)	(3)	(4)
		percentage changes		
Labour supply (hours)	0.31	0.46	0.24	– 1.06
Employment	0.76	0.79	1.80	– 0.01
Unemployment rate	– 0.27	– 0.18	– 1.00	– 0.78
Production	0.72	0.74	1.04	– 0.02

a Cumulated differences between simulation and base projection.

(1) Reduction in the first tax bracket
(2) Reduction in the third tax bracket
(3) EITC based on hourly wages, phased out between 100 - 130% minimum wage
(5) EITC based on annual incomes, phased out between 100 - 130% minimum wage

We use a value that is an average of these two studies: a 1% rise in the replacement ratio between high-employable and low-employable workers in our model raises the fraction of households that enrol in training by 0.008.

Simulations with MIMIC

Table 1 reveals the labour-market implications of four tax experiments in a version of MIMIC without a training model (i.e. where we set training elasticities equal to zero). Table 2 shows how the training model modifies these simulation results. In particular, it contains the difference between a version of MIMIC with training and the one without training.

In each of the four experiments, the government reduces the tax burden by 0.5% of GDP and reduces government consumption by an equivalent amount (ex-ante). The government budget is maintained ex-post through adjustments in government consumption. Hence, taxes and social premiums remain constant over time after the policy is imposed. The experiments presented in Tables 1 and 2 are (1) a reduction in the first tax bracket; (2) a reduction in the third tax bracket; (3) an Earned Income Tax Credit of DFL 5800 based on hourly wages that is phased out between the minimum wage and 130% of the minimum wage rate; (4) an EITC of DFL 2200 that is phased out on the basis of annual income between the minimum wage and 130% of the minimum wage. The effects of these policies on labour supply, unemployment and employment have been discussed in detail by Bovenberg, Graafland and de Mooij (1999) and Graafland and de Mooij (1999). Table 1 summarises the main results. It reveals that reductions in marginal tax rates are most effective in stimulating aggregate labour supply in hours (first two columns). Targeted reductions in the average tax burden on the low-skilled are most effective in cutting unemployment (last two columns)

This paper concentrates on the implications of adding the training model for the allocation of labour supply across skills and for production. Table 2 contains these effects. It includes the impact on the fractions of employable workers in total low-skilled and high-skilled labour, the impact of schooling on the fraction of high-skilled workers in total labour, and the effect on production. Note that the household model of MIMIC distinguishes between two types of low-skilled workers (more and less employable), but only one type of high-skilled labour. The higher fraction of employable high-skilled workers therefore does not affect production through a different composition of high-skilled labour supply in the household model, but rather through an increase in a training index. This index directly affects the productivity of high-skilled workers in the model of the firm.

Table 2 Consequences of adding the training model to MIMIC in the four simulations[a]

	(1)	(2)	(3)	(4)
		percentage changes		
Training effects				
– fraction employable low-skilled	0.08	0.06	– 2.44	– 0.72
– fraction employable high-skilled	– 0.17	1.68	– 0.46	– 0.18
– fraction high skilled	0.00	0.17	– 0.36	– 0.12
Labour supply (hours)	0.00	– 0.04	0.01	0.00
• low skilled				
– less employable	– 0.10	– 0.34	3.36	0.90
– more employable	0.05	– 0.22	– 1.02	– 0.34
• high skilled	0.01	0.05	– 0.16	– 0.04
Production	– 0.02	0.19	– 0.16	– 0.06

[a] Differences between simulations with MIMIC – with and without the training model

(1) Reduction in the first tax bracket
(2) Reduction in the third tax bracket
(3) EITC based on hourly wages, phased out between 100 - 130% minimum wage
(5) EITC based on annual incomes, phased out between 100 - 130% minimum wage

Lower marginal taxes

A lower tax rate in the first bracket is relatively attractive for low-skilled, more-employable workers and for high-skilled, less-employable workers. The high basic tax deduction implies only a small benefit for the

low-skilled, less employable, while the high-skilled workers with higher incomes are largely taxed in the higher tax brackets (which are not reduced). Accordingly, low-skilled workers are encouraged to enrol in training efforts so that the composition of low-skilled labour supply changes in favour of more employable workers, at the expense of less-employable workers. In contrast, the lower first tax bracket reduces the incentives for training by the high-skilled. The effect on schooling is negligible, so that the fraction of high-skilled labour remains more or less unchanged.

Reductions in the third tax bracket increase the relative wage differentials between less- and more-employable, high-skilled workers. Therefore, this policy is more effective in stimulating the training of high-skilled workers than are reductions in the first bracket. This boosts production through an increase in the training index for high-skilled labour. Furthermore, by raising the relative wage differential between low- and high-skilled workers, a lower third bracket stimulates the incentives for schooling by the low skilled. Accordingly, high-skilled labour supply expands at the expense of low-skilled labour supply. Since the third tax bracket is not relevant for most low-skilled workers, it exerts only a small effect on their incentives for training. The improvement in the quality of the labour force through training and schooling raises the production effect of a lower third tax bracket by 0.19%, compared to the model without training.

Targeted tax reductions to the low-skilled

The third column of Table 2 presents the effects of an EITC of DFL 5800 for hourly wages at the minimum wage. The EITC is phased out linearly between the minimum wage and 130% of the minimum wage. This policy is attractive for reducing the unemployment rate, especially among the low skilled (Bovenberg et al., 1999). However, the EITC typically reduces income differentials between less- and more-employable low-skilled workers. Accordingly, this policy diminishes the incentives for training of low-skilled workers. Table 2 reveals that this reduces the fraction of employable low-skilled workers by 2.44%. The EITC also reduces the after-tax wage differential between low-skilled and high-skilled jobs, thereby reducing the incentives for schooling. This reinforces the increase in the less-employable low-skilled labour supply. The effect on more-employable low-skilled labour supply depends on the relative importance of the negative effects through training (causing substitution from more-employable towards less-employable low-skilled labour supply) and the positive effect through schooling (which induces substitution from high-skilled towards low-skilled labour). On balance, we find that the training effect dominates the schooling effect. Hence, more-employable low-skilled labour contracts. Some less-employable high-skilled workers also benefit from the EITC, so that high-skilled workers are discouraged in acquiring more skills through training. This effect is substantially smaller than for low-skilled workers, however. These results suggest that an EITC based on hourly wages tends to hamper the upgrading of skills, especially at the bottom of the labour market. This adversely affects overall labour productivity in the economy. Indeed, adverse effects on the quality of labour supply due to an EITC are responsible for a decline in production of 0.16%, as compared to the model without training.

If the phase-out of the EITC is based on annual income, rather than hourly wages, the fourth column of Table 2 shows that the adverse training and schooling effects are substantially smaller than in the previous experiment. This is because the EITC is less well targeted at the less-employable low-skilled. Indeed, by making the EITC dependent on annual income, high-skilled workers with small part-time jobs also benefit. Hence, after-tax wage differentials between low-skilled and high-skilled workers and less- and more-employable workers decline less sharply than in the previous experiment. This renders the adverse effect on training and schooling also smaller.

Conclusions

This paper shows how the extension of MIMIC with a training model affects the simulation results of tax policies. It shows that reductions in marginal tax rates favour training and schooling incentives. Targeted tax reductions for the low skilled – which typically raise the marginal tax burden – cause adverse effects on training and schooling, especially for the low skilled. The training model thus has important implications for the effect of taxation on the quality of labour supply and, therefore, production. To illustrate, without a training model, an EITC is the most effective instrument to cut unemployment and to boost production. By including the training model, the increase in production is smaller than in case of a reduction in the marginal tax rate in the third bracket. The training model thus adds a new trade-off to MIMIC, namely, between tax policies that are effective in cutting unemployment and those that raise productivity.

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Notes

[1] The author thanks André Nibbelink for research assistance and Johan Graafland and Maarten Cornet for useful comments.

[2] This approach contrasts with most of the literature on taxation and human capital, which typically adopts a life-cycle approach (see De Mooij (1997) for a survey). The advantage of our approach is that it allows for a better calibration of the model, since empirical evidence on the factors affecting training enrolment is available from the literature.

[3] Although we ignore investment decisions of firms, this does not mean that MIMIC deals solely with off-the-job training. Theory and evidence suggest that workers tend to have an important impact on on-the-job training decisions as well, even if they do not bear the financial costs of training (see e.g. Groot and Oosterbeek, 1995). Indeed, if workers have no incentive to train, it is difficult for employers to affect the human capital of their employees. We therefore interpret training as both on-the-job training and off-the-job training.

[4] The literature suggests that proportional taxes on labour income can be neutral with respect to human capital formation. This occurs if all cost of training is tax deductible, e.g. in case of foregone working time. In our model, the effort costs of training are untaxed. Proportional taxes are nevertheless neutral with respect to training, since we adopt a logarithmic utility function. Indeed, using this specification implies that only relative wage differentials between different employability states (e.g. due to changes in tax progression) affect the incentives for training.