

# Research Memorandum

**No 140**

**Analyzing Fiscal Policy in the Netherlands:**  
Simulations with a revised MIMIC

**Johan J. Graafland and Ruud A. de Mooij**

CPB Netherlands Bureau for Economic Policy Analysis, The Hague,  
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CPB Netherlands Bureau for Economic Policy Analysis  
Van Stolkgweg 14  
P.O. Box 80510  
2508 GM The Hague, The Netherlands

Telephone +31 70 33 83 380  
Telefax +31 70 33 83 350

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the author(s)

<b>Contents</b>	<b>Page</b>
1 Introduction	1
1.1 History of MIMIC	1
1.2 Recent innovations	2
2 The structure of MIMIC	4
2.1 Firm behavior	4
2.2 Household behavior	6
2.3 Wage formation and the matching process	12
2.4 Labor market institutions and government policy	16
3 Tax simulations with MIMIC	17
3.1 Reducing income taxes and VAT	17
3.2 Targeted versus across-the-board tax reductions for employers	23
3.3 Replacing the basic tax deduction by a tax credit	28
3.4 Alternative tax allowances for workers	31
4 Concluding remarks	36
Appendix Comparison with previous version of MIMIC	38
References	39
Abstract	44

## **1 Introduction**

Recently, the so-called 'Dutch miracle' has received a lot of attention from other countries. In particular, the relatively good performance of the Dutch economy in terms of economic growth and job creation has made the Netherlands an example for other economies in Europe. One explanation for the Dutch miracle is related to the recent reforms of various labor-market institutions. Indeed, during the last decade the tax and social security system have been reformed in order to improve the functioning of the labor market. Although the Dutch economy has performed rather well during the last few years, the labor market still suffers from a number of serious problems, such as low participation rates and high structural unemployment levels, especially among the low skilled. Consequently, reforms of the tax system and labor-market institutions aimed at addressing these problems are still being debated. CPB contributes to these debates by analyzing the economic consequences of policy proposals. Thereby, it often uses its applied general equilibrium model, MIMIC. The model provides both qualitative and quantitative insights into the effects of many, sometimes detailed, tax proposals and reforms of labor-market institutions.

This paper presents the structure of a new version of MIMIC. In particular, compared to its predecessor as described by Gelauff and Graafland (1994a), the model contains a number of new elements including some extensions, a better empirical foundation and a broader mix of policy instruments. After elaborating on the new structure, the paper discusses a number of tax experiments such as reductions in income taxes and VAT, various reductions in the labor costs for employers and tax allowances for workers. Before outlining the structure of the new model, we start with a brief history of MIMIC and discuss the recent innovations in the model's structure.

### **1.1 History of MIMIC**

Work on MIMIC started in 1987. At that time, one of the most pressing policy issues in the Netherlands was the high rate of inactivity. In particular, every 100 people earning a wage had to carry the burden of financing the benefits of 86 people, of which 15 were unemployed, 17 disabled and 46 elderly people. This created a high tax wedge which distorted the labor market and contributed to a high unemployment rate in the Netherlands. Apart from the size of the tax wedge, also the structure of the tax system was thought to be relevant for the performance of the Dutch labor market. Indeed, several policy questions arose, such as:

- What is the impact of several welfare schemes on the labor market?
- What is the impact of a reduction of the minimum wage?
- Does a tax shift from high to low income groups improve the functioning of the labor market?
- What do we expect from the introduction of a negative income tax or a tax credit?
- How does the transferable tax-free allowance between spouses affect labor-market participation of women?

CPB's macro-econometric model contains only one income-tax variable. Hence, the model is unable to give a proper answer to questions posed above. Indeed, these questions require a model with a detailed description of the tax system and various labor-market institutions. Other CPB instruments are also unable to analyze policies targeted at specific groups, such as low-skilled workers. Because unemployment among the low-skilled is one of the main problems of the Dutch labor market, this is considered as an important omission. With the development of MIMIC, CPB aimed to tackle those issues more properly and more systematically than before.

Another push-factor for the development of MIMIC was the fall-down in the belief among economists in macro-econometric models. Indeed, it had become clear during the eighties that macro-econometric models suffer from several limitations, including the well-known Lucas critique. As a response to this, AGE models gained popularity, both in economic science and in a number of international model-building institutions. In the Netherlands, this resulted in the building of the MESEM model at the Ministry of Economic Affairs (see Van Sinderen, 1993) and the MIMIC project at CPB.

## 1.2 Recent innovations

Since 1992, MIMIC has been successfully used for policy analysis.<sup>1</sup> The strength of the model is its rich theoretical framework and its empirical foundation that is largely based on micro data. With the model, we can investigate several, sometimes detailed policy proposals. Furthermore, the theoretical foundation of MIMIC makes it a model that can be interpreted rather easily. Some economists also did suggestions for further

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<sup>1</sup>Most policy simulations are described in Gelauff and Graafland (1994a). Some were published in economic journals (Gelauff (1993), Gelauff and Graafland (1994b), Manders (1994), Graafland (1995) and De Jager et al (1996)) or reported in CPB documents (CPB 1992, 1994). Furthermore, MIMIC has been used for analyzing policy proposals by Dutch Ministries, unions and employers' organizations, the Social Economic Council in the Netherlands (SER) and political parties.

improvement of the model. The new version of MIMIC captures part of these suggestions. For those readers familiar with the previous version of MIMIC, we start with a brief discussion on the main differences between the old and new version. The structure of the new model is described in section 2 of this paper.

### *Extensions*

One suggestion for further improvement is to incorporate the effects of high marginal tax rates on the quality of labor and the informal economy (Bovenberg et al., 1994). For this purpose, the household model in MIMIC has been extended in several ways. First, the model includes endogenous formation of human capital by modelling the impact of taxes on training efforts. Second, in addition to the formal economy, an informal economy has been included which comprises black labor and household production. Furthermore, labor supply by breadwinners and single persons has been endogenized. In the previous version of MIMIC only labor supply of partners (married women) was modelled. Although empirical evidence suggests that the labor-supply elasticities of breadwinners and single persons are rather low, endogenous labor supply is important because these groups are by far the largest in total working population. Hence, changes in their marginal tax rate may have a substantial effect on aggregate labor supply, especially if large policy shocks are analyzed.

### *Empirical foundation*

The empirical foundation of MIMIC has been improved in four ways. First, the old model bases the nesting structure of the CES production function and the corresponding substitution elasticities on several empirical studies for the United States (see e.g. Hamermesh, 1993). In contrast, the new model contains estimated parameters in the production function (Draper and Manders, 1996). Second, the parameters of the wage model of old MIMIC are calibrated on the basis of estimation results of a linearized macro-wage equation. For small policy changes, this procedure suffices. However, in case of policy shocks causing large changes in unemployment, strong non-linearities in the wage bargaining model give rise to large differences between the calibrated wage outcome and the linearized estimated wage equation. For this reason, Graafland and Huizinga (1996) estimated a non-linear wage equation in structural form which is incorporated in the new model. Third, the previous MIMIC model assumes indexation between social benefits and *wage costs*. In practice, however, social benefits are linked to *gross wages*. The new MIMIC model incorporates this more realistic link. Finally, the previous model is calibrated on the basis of a data set for 1985 whereas the new version of MIMIC is based on a more recent data set for 1993.

### *Policy analysis*

The final improvement of MIMIC relates to the scope of policy instruments in the model. First, apart from high-skilled and low-skilled labor, the new model distinguishes also unskilled labor. This allows us to better explore the consequences of policies targeted at this latter group. A second example is the set of policy measures targeted at the long-term unemployed. To illustrate, Snower (1994) has argued that long-term unemployment may drop substantially if governments provide subsidies (so-called vouchers) to employers when they hire long-term unemployed. By distinguishing between short and long-term unemployment, the new version of MIMIC is able to explore the implications of those targeted policy measures. Other policies that can be analyzed with the new version of MIMIC (in addition to what could be analyzed also with the previous version) are child care policies and consumption taxes on labor-intensive services.

## **2 The structure of MIMIC**

MIMIC is an applied general equilibrium model designed for the Dutch economy. It is a typical model for a small open economy in the sense that Dutch policies do not affect foreign markets. Broadly speaking, MIMIC distinguishes three submodels. These describe, respectively, firm behavior, household behavior and the functioning of the labor market. The public sector is largely exogenous in MIMIC. This holds also for the foreign sector. Below, we discuss the main features of the three submodels and the relevant government institutions.

### **2.1 Firm behavior**

The business sector is subdivided into six sectors of which the sheltered sector and the exposed sector are the two largest ones. The sheltered sector consists of labor-intensive services facing little competition from abroad. The exposed sector mainly consists of capital-intensive industries subject to fierce competition from other countries. The output-market environment for all firms is characterized by monopolistic competition. In particular, firms set their output prices as a mark-up over marginal cost. Commodities supplied by foreign firms are assumed to be imperfect substitutes for domestic commodities. This leaves room for a positive mark-up, also in the exposed sector. MIMIC takes foreign prices to be the numeraire. The terms of trade may change if domestic suppliers adjust their output prices.

Domestic firms maximize profits subject to a neo-classical CES production function that exhibits constant returns to scale<sup>2</sup> with respect to five factor inputs: intermediaries, capital, unskilled labor, low-skilled labor and high-skilled labor. From the optimizing behavior of firms, we derive the factor demand equations as a function of input prices, domestic and foreign output prices and production. The demand elasticities for firms are calibrated on the basis of recent estimates by Draper and Manders (1996). In particular, the elasticity of substitution between labor and capital equals 0.15 for the exposed sector and 0 for the other sectors. The elasticity of substitution between different skill-types of labor is 1.1 for the exposed sector, 2.0 for the sheltered sector and construction sector and 1.5 for the non-market service sector.

For each skill type, firms can also hire labor from the black market, the so-called semi-autonomous informal labor. This black labor is modeled as an additional nest in the structure of the CES-production function. The elasticity of substitution between semi-autonomous informal labor and formal labor is assumed to be 2 (see Baartmans et al., 1986). Furthermore, firms may pay their formally employed workers partly informal, i.e. without reporting it to the tax authority. This so-called coupled informal labor ( $L_c$ ) is derived from an additional step in the optimization strategy of firms (i.e. after labor demand has been determined). On the one hand, coupled informal labor is attractive for employers compared to formal labor because they avoid tax payments and social security premiums. On the other hand, there is a potential penalty for the firm if the government finds out about the informal wage. From the maximization process, we derive the following expression for  $L_c$ :

$$L_c = \bar{L}_c \frac{\tau^\varepsilon}{B} \quad (1)$$

where  $\tau$  denotes the marginal tax burden on employers,  $B$  stands for the penalty, is a scaling parameter and  $\varepsilon$  denotes the elasticity of  $L_c$  with respect to the marginal tax. According to (1), a higher marginal tax burden on employers raises coupled informal labor as it induces substitution from formal wage payments towards informal wage payments. Empirical evidence on the elasticity  $\varepsilon$  is lacking. As best-guess estimates, we take a value of 1.0 for unskilled workers, 0.5 for low-skilled workers and 0.3 for high-skilled workers.

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<sup>2</sup>Except the exposed sector, which exhibit increasing returns.

The marginal tax burden on employers affects also the on-the-job training activities that firms undertake to raise the productivity of their employees. In particular, if the firm invests in the human capital of its workers, employees may claim part of the return to these investments in terms of a higher wage rate.<sup>3</sup> A high marginal tax burden for the employer makes such wage increases expensive. Accordingly, the incentives for firms to invest in the human capital of their workers decline. In the absence of empirical evidence on the elasticity of on-the-job training with respect to the marginal social premium rate of the employer, we assume a value of 0.2, which is approximately the same as the elasticity of training activities by households (see below).

## 2.2 Household behavior

To give an adequate description of labor supply per skill, MIMIC distinguishes 40 types of households. These households add up to the total population. Households are divided into couples, single persons, single parents, pensioners and students. People aged between 55 and 65 years are distinguished as a separate group. Couples consist of a so-called breadwinner (i.e. the individual with the highest personal income) and a partner (with the lowest personal income). Couples are subdivided into families with children and without children. Individuals within each household may differ with respect to their skill level and their job status, i.e. having a job or receiving some kind of social benefit. Per type of household we use class-frequency income distributions based on micro data to describe the gross incomes of individuals. By applying the corresponding statutory tax and premium rates to these gross incomes, we can determine net incomes and the average and marginal tax rates determining labor-supply decisions.

Household behavior in each household type can be derived from maximization of a utility function, subject to a time constraint and a budget constraint. We divide the optimization procedure for each household into three steps.

### *Step 1: Consumption and saving*

In the first step, households determine how to optimally allocate their income over saving and consumption, while taking their time spent on leisure ( $V$ ) and the distribution of labor time ( $L$ ) over formal ( $L_f$ ) and black labor ( $L_z$ ) as given. The

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<sup>3</sup>Macleod and Malcomson (1993) and Gelauff and Den Broeder (1996).

optimal choice is derived from maximization of an intertemporal utility function  $\sum_t U_t(C_t)$ , where  $t$  denotes time and  $C$  is consumption. For particular specifications of  $U(\cdot)$ , utility can be written as a CES utility function  $Y = y(C_0, A_0; r, \theta)$  where  $C_0$  denotes current consumption,  $A_0$  is the stock of financial capital at the end of the period and  $r$  and  $\theta$  stand for, respectively, the real interest rate and the pure rate of time preference.<sup>4</sup> Consumption ( $C$ ) consists of three categories: labor-intensive services from the formal market ( $C_f$ ), labor-intensive services from the black market ( $C_b$ ), and other consumption ( $C_k$ ). In the CES utility structure,  $C_f$  and  $C_b$  first combine into aggregate consumption of labor-intensive services ( $C_l$ ). This aggregate then combines with  $C_k$  to yield total consumption ( $C$ ). From the first-order conditions of the household optimization problem, we derive the following demand functions:

$$A = \alpha Y (pa/py)^{\sigma_y} \quad (2a)$$

$$C = (1 - \alpha) Y (pc/py)^{\sigma_y} \quad (2b)$$

$$C_i = \alpha_i C (pc_i/pc)^{\sigma_c} \quad i = l, k \quad (2c)$$

$$C_j = \alpha_j C_l (pc_j/pc_l)^{\sigma_l} \quad i = f, b \quad (2d)$$

Expressions (2a) and (2b) reveal that full household income ( $Y$ ) is allocated between consumption today ( $C$ ) and the financial capital stock ( $A$ ). The valuation of financial capital ( $pa$ ) is linked to the world interest rate and the pure rate of time preference.  $py$  is a weighted average of the consumer price index ( $pc$ ) and the valuation of financial capital. The intertemporal elasticity of substitution ( $\sigma_y$ ) is based on Draper (1992) and set at 0.85. According to (2c) and (2d), relative consumer prices determine the allocation of consumption among the various categories. The elasticity of

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<sup>4</sup>For a derivation, see Boone (1998).

substitution between labor-intensive consumption ( $C_l$ ) and other consumption ( $C_k$ ) equals 1.1 (see e.g. Eijgenraam and Verkade, 1988). The elasticity between labor-intensive services from the formal market ( $C_f$ ) and the black market ( $C_b$ ) is set at 2 (see e.g. Baartmans et al., 1986).

*Step 2: Labor supply*

In the second step of the optimization procedure, labor supply is selected from a limited set of

discrete options on the labor market.<sup>5</sup> To illustrate, single persons have to choose between four options: a full-time job, a part-time job of 40% or 80%, or a job that amounts to 120% of a full-time equivalent. Breadwinners can choose between 80%, 100% and 120% of a full-time equivalent. Partners of breadwinners have to choose between non-participation and a part-time job of 30%, 50% or 80%. For each of the discrete choices an individual faces, utility is determined by:<sup>6</sup>

$$G = U(Y/py, V) - \beta(L - \bar{L}) \quad (3)$$

Leisure ( $V$ ) can be derived from the time constraint:

$$V = 1 - L - T \quad (4)$$

where time endowment is normalized to unity and  $T$  denotes the time spent on training activities (which is exogenous at this stage of the optimization process, see below). According to (3), the optimal labor-supply choice depends on two elements.

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<sup>5</sup>The main reason to assume discrete options for labor supply is that empirical evidence for both the Netherlands and other countries suggests that jobs do not exhibit smooth continuous patterns, but rather are concentrated on certain points, see Woittiez (1990); Van Soest et al. (1990); Tummers and Woittiez (1991).

<sup>6</sup>We assume that individuals within couples select their own labor time to maximize household utility in (3), for given actions of the partner. Furthermore, a 'keeping-up-with-the-Jones' effect is included by partly scaling full household income by the average full household income of all households. This effect reflects the social impact on preferences.

For each choice of  $L$ , the first element on the right-hand side of (3) is determined in the first step of the optimization procedure, which is rather standard in the theory on labor supply. Whereas the first term is homogeneous across households, the second term on the right-hand side of (3) introduces heterogeneity. In particular,  $G(\cdot)$  contains a disutility associated with differences between actual labor supply ( $L$ ) and some autonomous preference for labor supply ( $\bar{L}$ ). This autonomous term does not depend on financial motives, but is related to the desired lifestyle of households, i.e. socio-cultural aspects and the status people assign to a job. The exogenous preference for labor ( $\bar{L}$ ) is heterogeneous among households. In contrast to actual labor supply, it amounts to a continuous variable that follows from a probability density function. The loss in utility associated with deviations between the discrete option for actual labor supply and the continuous autonomous preference for labor is measured by parameter  $\beta$ .

The labor-supply choice of a particular household ( $L$ ), as derived from (3), will strike a balance between, on the one hand, minimizing the loss associated with deviations from the autonomous preference ( $\bar{L}$ ) and, on the other hand, the highest possible utility from  $U(\cdot)$ . The probability density function of  $\bar{L}$  is calibrated such that the model reproduces Dutch labor-market data in our base year 1993. The parameter  $\beta$  and the substitution elasticity between leisure and consumption are calibrated so that the model reproduces labor-supply elasticities estimated in the empirical literature for the Netherlands. In particular, the uncompensated wage elasticity of labor supply by partners is set at 1.0, single persons feature an elasticity of 0.25 and breadwinners have an elasticity of around 0.1. Older breadwinners have an elasticity of 0.15, because the possibilities for early retirement imply a higher degree of freedom for them to flexibly adjust their working time. The income elasticities of labor supply are much smaller than the wage elasticities and set at 0.2 for partners, 0.05 for single persons and almost zero for breadwinners.<sup>7</sup>

### *Step 3: Black versus formal labor supply*

In the third step of the optimization procedure, total labor supply ( $L$ ) is to be allocated across the formal labor market ( $L_f$ ) and the black labor market ( $L_z$ ). In particular, households have to choose between two discrete options. First, they may supply their labor only to the formal market (so that  $L_z = 0$  and  $L_f = L$ ). Alternatively, a certain

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<sup>7</sup>These elasticities are based on Theeuwes (1988), Kapteyn et al. (1989), Woittiez (1990), Van Soest et al. (1990), Theeuwes and Woittiez (1992) and Van Soest (1995). It should be noted that the calibrated elasticities in MIMIC incorporate also the shift between formal and black labor supply. For this reason the wage elasticities are set a bit higher than found in these articles.

proportion of their labor may be supplied to the black market. Maximization of the following extended utility function determines the choice between these two discrete options:

$$Z = G(.) - \delta(Lz - \bar{Lz}) \quad (5)$$

where  $0 < \bar{Lz} < Lz$ . The specification of (5) is similar to (4), but the interpretation is a bit different. According to (5), the optimal choice between formal and black labor supply is determined by two terms. First, it depends on subutility  $G(.)$ . This subutility is typically higher for the option with black labor because black wages exceed after-tax formal wages. Hence, according to the first term at the right-hand side of (5), the black option is more attractive than the formal option. The second term at the right-hand side of (5) indicates a moral cost associated with the supply of black labor. This makes the black option less attractive compared to the formal option. The moral cost of black labor is adversely related to the parameter  $\bar{Lz}$ . This parameter is heterogeneous among households and is taken from a continuous probability density function. Households with a value of  $\bar{Lz}$  close to zero feature a high moral cost of black labor. Indeed, expression (5) reveals that black labor supply yields a substantial disutility for those households, measured by parameter  $\delta$ . Households with a value for  $\bar{Lz}$  close to  $Lz$  face a low moral cost. The specification in (5) implies that black labor is attractive only for households featuring a relatively low moral cost of black labor (as indicated by a high value of  $\bar{Lz}$ ). Through the calibration of  $\bar{Lz}$ , MIMIC reproduces rough data that are available on the size of the black economy in the Netherlands (which is about 3% of GDP).<sup>8</sup> The parameter  $\delta$  is calibrated so as to reproduce the supply elasticity of black labor. Based on Koopmans (1994), the uncompensated wage elasticity of black labor supply is set at 0.75 for all individuals.

#### *The black labor market*

The black labor market in MIMIC contains three types of demand. First, households exert demand for black labor-intensive services. This implicitly determines the demand for so-called autonomous black labor. Also informal childcare belongs to this category. Second, firms demand so-called semi-autonomous black labor. Finally, a separate category of black labor by firms involves coupled informal labor. The first two

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<sup>8</sup>Although the estimates show a wide range from 1% to almost 10% of GDP, see Graafland (1990), Koopmans (1994), Koning et al. (1994).

categories of black labor are confronted with the supply of black labor by households, derived from optimizing behavior (see (5)). Similar to Graafland (1990), we assume that the black labor market is perfectly competitive. Hence, an equilibrium condition determines the price of black labor. Coupled informal labor does not influence this black price as it is determined by a separate agreement between the employer and the employee.

### *Housekeeping*

Apart from a black market, MIMIC distinguishes a second type of informal activity, namely housekeeping activities. These activities are modelled as a constant fraction of the time spent on leisure. The fractions are based on a time allocation survey for the Netherlands in 1993 (SCP, 1995). This survey reveals that women (in MIMIC-terms, mostly partners) spent more time on housekeeping activities than men (mostly breadwinners) do. Housekeeping activities yield household production that is a perfect substitute for the consumption of marketable labor-intensive services (the aggregate of black and formal services). The implication of this is that an increase in leisure (especially of women) raises household production, thereby crowding out the consumption of marketable labor-intensive services, including black services.

### *The quality of labor supply*

In MIMIC, individuals start as either unskilled, low skilled or high skilled. This skill characterization is determined by the primary and secondary education. After secondary education, workers are able to further enhance their skills by allocating time to activities such as training, extra efforts on the job, etc. Through acquiring more skills, households can either raise their productivity within their own skill category or jump to a higher skill level.

MIMIC endogenizes the time spent on training activities (denoted by  $T$  in expression (3)) in a rather simple manner. In particular, we have developed a separate, intertemporal time-allocation model where training activities contribute to human capital accumulation (see De Mooij, 1997). More human capital yields higher wage incomes in the future. The return to training, in terms of higher future wages, is to be weighed against the opportunity cost of training, measured by current wage income. From the time-allocation model, we can derive the following steady-state relationship between training activities and formal labor:

$$T = \eta Lf \tag{6}$$

According to (6), training activities are directly related to formal labor supply, with a fraction  $\eta$ . Intuitively, if labor supply becomes more attractive compared to leisure, this indicates that also other activities intended to increase (current or future) labor incomes are encouraged.<sup>9</sup>

The parameter  $\eta$  is calibrated on the basis of Dutch data on the time spent on training. In particular, the time allocation survey of SCP (1995) suggests that men spent more time on training than women, also as a ratio of their labor time. Consequently, breadwinners in MIMIC feature a larger  $\eta$  than partners do.

Human capital affects labor productivity in the model of the firm. The rate of return to investments in human capital is calibrated on the basis of some empirical evidence and set at a rather modest value of 8%. Hence, offering one guilder of wage income today by spending time on training rather than working, yields a permanent increase in the future wage rate by 0.08 guilders. This rate of return is in line with estimates by Teeuwes et al. (1985), a bit smaller than found by Mincer (1974) and Rosen (1982) for the US, and also smaller than the rates of return found by Groot and Mekkelholt (1995) for the Netherlands.

#### *Childcare*

MIMIC incorporates a market for childcare. In particular, the consumption of childcare services is related to labor supply of families with children and single parents. Indeed, a family exerts demand for childcare if it supplies more labor than one full-time equivalent. In demanding childcare, each household faces an ideal price index of childcare that amounts to a weighted average of the prices of two types of childcare supply, namely formal and informal childcare (consisting of black childcare and childcare provided by relatives). Both the supply and the price of formal childcare are exogenously determined by the government. We assume that this formal supply is insufficient to meet the total demand for childcare. Hence, informal childcare is necessary to ensure that the supply of childcare meets demand. The price of black childcare is related to the price of black labor.

### **2.3 Wage formation and the matching process**

#### *Wage formation*

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<sup>9</sup> Implicitly it is assumed that the marginal tax rate relevant for labor supply is the same as the one relevant for training. The theoretical model in De Mooij (1997) implies that, if these marginal tax rates divert (like in the EITC simulation in Table 7),  $\eta$  changes with the ratio between the complement of the marginal tax rate on training and that on total labor income.

Wage formation in MIMIC is described by the so-called right-to-manage model (see e.g. Nickell and Andrews, 1983; Binmore and Dasgupta, 1987). In this framework, a bargaining process between employers and employees determines the wage outcome while employers determine employment. The wage equation that follows from the bargaining model implies that gross wages are positively related to the consumer price and the average tax and premium burden. Furthermore, a higher replacement rate raises gross wages.<sup>10</sup> This is because a high replacement rate improves the bargaining power of employees by raising the income of their threat point. Wages decrease with the unemployment rate as this weakens the bargaining power of employees. The marginal tax rate exerts a negative influence on wages. In particular, a higher marginal tax rate implies that increases in the wage rate only generate a small increase in after-tax wage incomes. Indeed, as the government collects a large part of the wage increase, the marginal value for the employee is only small (Hersoug, 1984; Hersoug et al., 1986).

Graafland and Huizinga (1996) have estimated the wage equation for MIMIC in its structural non-linear form. They find that the positive elasticity of the average tax is six times (0.6) as large in absolute value than the negative elasticity of the marginal tax rate (-0.1).<sup>11</sup> Hence, simultaneously reducing average and marginal tax rates moderates gross wages. The unemployment rate and the replacement rate interact in the wage equation. In particular, at low unemployment rates, the replacement rate does not generate much wage pressure because the threat of becoming unemployed is less serious. At an unemployment rate of 7%, the elasticity of the replacement ratio equals 0.3. Finally, the elasticity of the consumer price equals the sum of the elasticities of the marginal and average tax rates (0.5), whereas the elasticity of the producer price is equal to its complement and, therefore, equals also 0.5.

The wage equation in MIMIC is specified both on the macro level and for the three skill types: high skilled, low skilled and unskilled. In the macro wage equation, we adopt macro-aggregates for the average tax burden, the marginal tax burden, the replacement rate and unemployment. Skill-specific aggregates are used in the three

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<sup>10</sup>The replacement rate is defined as  $bn/(wn(1+(1-\tau)g))$ , where  $bn$  denotes the net unemployment benefit,  $wn$  the net wage,  $\tau$  the marginal tax wedge and  $g$  an autonomous incidental wage growth component. Incorporating a positive value for parameter  $g$  implies that unemployed people believe that their wage income will grow once they have accepted a job, e.g. due to work experience. Based on Van Opstal et al. (1997),  $g$  is set at 0.05.

<sup>11</sup>A negative impact of the marginal tax rate is supported by empirical studies for other countries, like the United Kingdom (Lockwood and Manning, 1993), Italy (Malcomson and Sartor, 1987) and the Scandinavian countries (Hansen et al., 1995; Lockwood et al., 1995).

skill-specific wage equations. The contractual wage rate for a particular skill is determined for one half by the macro-wage outcome and for one half by the skill-specific wage rate.<sup>12</sup> The wage structure among skills is further modified by a skill-specific incidental wage component, which is related to the labor-market situation for a particular skill (Gelauff and Graafland, 1994a). To illustrate, in the presence of many vacancies for a particular skill, firms may offer a higher incidental wage in order to attract sufficient applicants. In this way, firms reduce their search costs to find an appropriate employee. The rise in incidental wages thus reflects the scarcity on the labor market for a particular skill.

#### *The process of job matches*

More generally, the scarcity on the labor market for certain skills is related to the mismatch between vacancies and unemployment. Indeed, in the tradition of Pissarides (1990), MIMIC incorporates a market for jobs per type of skill. On this market, unemployed people meet firms that search for appropriate employees to fill their vacancies. The search strategy of the unemployed is described by two variables: the search intensity and the reservation wage. Both of these variables are endogenous and depend on, among others things, the replacement rate. In particular, a higher replacement rate reduces the number of job matches because it lowers search intensity and raises the reservation wage. Accordingly, the mismatch on the labor market exacerbates, causing higher incidental wages and higher unemployment.

The search strategy of employers is influenced by the minimum wage. In particular, we use a distribution function per type of labor for the (match-specific) productivity per worker. This function is based on micro panels for wages. Minimum wages constitute a restriction for the acceptance of unskilled or low-skilled workers as it determines a minimum productivity level that employers require from potential employees. A higher minimum wage reduces the number of candidates whose productivity meets this minimum required level. Hence, vacancy duration will increase, thereby raising search costs for employers and reducing labor demand.

The effective minimum wage may differ from the official minimum wage. This is because the lowest wage scales in the Netherlands, agreed upon in collective wage agreements, generally exceed the official minimum wage. Indeed, research by the Dutch Ministry of Social Affairs and Employment (1990) suggests that the official minimum wage affects the lowest wage scales (i.e. the effective minimum wage for employers) for only 30 percent. For the other part, the effective minimum wage is

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<sup>12</sup>This assumption is based on Graafland and Lever (1996). They find that sector-specific variables account for 50 % of the total impact on wages. Since sectors differ in their skill profile, we use this as a measure for the impact of skill-specific factors on wage formation.

determined endogenously as the outcome of the collective wage bargain for unskilled workers.

*A flow model for short and long-term unemployment*<sup>13</sup>

Long-term unemployed typically differ from short-term unemployed in their search behavior, reservation wage and productivity. MIMIC therefore distinguishes short- and long-term unemployment by using a steady-state flow model for job matches in the tradition of Holmlund and Linden (1993) and Pissarides (1990). In particular, the long-term unemployed are less productive than short-term unemployed because of a loss in skills during the prolonged unemployment period. If they find a job, long-term unemployed have some (exogenous) probability to restore their human capital.

The model describes three types of transitions. From short-term unemployment into long-term unemployment or into employment and from long-term unemployment into employment. The transition rate from short-term into long-term unemployment is the complement of the transition rate of short-term unemployment into employment. The transition rates into employment depend on the search strategy of the unemployed and the selection strategy of firms. The long-term unemployed expect the wage level to increase with tenure because their human capital may be restored during the period of employment. They take this aspect into account when deciding about accepting or rejecting a job offer. Hence, they have a relatively low reservation wage. This is in accordance with empirical findings by Van den Berg (1990) and Devine and Kiefer (1991). Accordingly, the possibility to find a job for the long-term unemployed is not so much restricted by the reservation wage, but much more by the lowest wage scale, i.e. the effective minimum wage for the employer. For the short-term unemployed and high skilled workers, the opposite holds. In particular, the reservation wage is relatively high and hence is a more important restriction in the number of successful job matches than is the effective minimum wage.

The search intensity declines over the unemployment spell. This is because the probability of finding a job decreases with unemployment duration. Hence, the long-term unemployed search less intensively for a job than the short-term unemployed do. This is consistent with findings of Layard et al. (1991) and Van Aalst and Hermsen (1994). Hence, although long-term unemployed people feature a rather low reservation wage, their employment perspectives are worse than those of the short-term unemployed due to their relatively low productivity and low search intensity. Hence, transition rates into employment are lower for long-term unemployed than for short-

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<sup>13</sup>For a more detailed description of this part of the model, see Jongen and Graafland (1998).

term unemployed. This assumption is consistent with so-called hazard function studies (see e.g. Gorter et al. (1993); Van den Berg and van Ours (1994)). These studies generally find that most of the decline in the macro transition rate from unemployment into employment is due to heterogeneity in the composition of the unemployed. In MIMIC part of the heterogeneity-effect is captured by the distinction between skill types. Some studies report a true duration dependence effect (see Kerckhoffs et al. (1994), Van Opstal and Van de Pol (1991), Groot (1990)). In MIMIC this is associated with the duration effect caused by the loss in skills during the unemployment period.

#### *Disability*

Another aspect of the matching process concerns so-called hidden unemployment, i.e. people who do not actively search for work, but nevertheless receive a social benefit. In case of the Netherlands, especially disability schemes are partly occupied by people who are actually able to work. A number of studies suggest that the size of hidden unemployment in disability schemes is positively related to the disability benefit level (see e.g. Aarts and De Jong, 1990). The previous MIMIC model recognized this and incorporated an ad-hoc positive relationship between the number of disability claimants and the benefit level. To replace this ad-hoc model, we developed a separate model that explains the phenomenon of hidden unemployment (see Westerhout (1996)). The structure is based on a principal-agent model in which an imperfect control agency (the agent) decides whether jobless people will be classified as either disabled or unemployed. In addition to the interest of the government (the principal), the control agency takes also the interest of the workers into account. These latter interests are related to the relative replacement ratios for unemployment benefits and disability benefits and the duration of the benefit. In the Netherlands, the replacement rate of disability benefits exceeds that of unemployment benefits. Moreover, disability benefits are permanent, while unemployment benefits are only temporary. This explains why unemployed people prefer to collect disability over unemployment benefits. We have implemented this model in MIMIC. Hence, if disability schemes become less attractive compared to unemployment schemes, less jobless people will flow into disability schemes and more into unemployment schemes. This is important for the labor market because, in contrast to the unemployed, people with a disability benefit do not have to search for work and thus do not affect wage formation and the number of job matches.

## **2.4 Labor market institutions and government policy**

Government behavior is largely exogenous in MIMIC. The model contains several exogenous public institutions, including the statutory income tax system in the Netherlands in 1998. This consists of a general tax-free allowance of about 8.600 guilders and three tax brackets. The tax rate in the first bracket in 1998 is about 36%. Besides an exogenous tax part, this first tax bracket contains also the national social insurance premiums. In MIMIC, these premiums are endogenously determined in order to ensure equilibrium on the budget of the social insurance funds. The rate in the second tax bracket is 50% and has to be paid on incomes above 50.000 guilders. The marginal rate in the third tax bracket is 60% and is paid on incomes above 100.000 guilders. For workers, a special earned-income tax deduction exists that amounts to 12% of current labor income with a maximum of around 3.100 guilders. VAT in the Netherlands consists of a low rate on necessary goods (6% rate) and a high rate for other goods (17½%). Other public institutions in MIMIC are the employers and employees social security contributions, the official minimum wage, several social benefit schemes and a number of policy instruments targeted at specific groups such as the long-term unemployed or the unskilled.

### **3. Tax simulations with MIMIC**

#### **3.1 Reducing income taxes and VAT**

The first set of simulations with MIMIC involves a reduction in income taxes and VAT. In particular, we analyze reductions in the rates of the three tax brackets, an increase in the basic tax-free allowance, an increase in the tax deduction for workers, and a reduction in the VAT rate.<sup>14</sup> In all experiments, the ex-ante reduction in tax revenues is equal to 0.5% of GDP. The government budget is balanced through an equivalent reduction in government consumption. All experiments are revenue neutral ex-post. In particular, if tax revenues change due to behavioral responses of economic agents, public consumption is adjusted in order to meet the government budget

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<sup>14</sup> An increase in the basic allowance or the tax deduction for workers erodes the national social premium base (which is equal to the base of the first tax bracket). The resulting ex-ante fall in the budget of the national social insurance funds is compensated by a transfer from the government. Hence, the premium rate remains constant ex-ante. However, endogenous changes in economic behavior may change the national social premium rate ex-post.

**Table 1** Long-run effects according to MIMIC of six types of tax reduction by 0.5% GDP, financed by a reduction in government expenditure<sup>a</sup>

	-----income tax rates-----			----allowance----		VAT rate
	1	2	3	basic	wage	
level in 1998	8.9	50.0	60.0	8600 <sup>b</sup>	3100 <sup>b</sup>	17.5
change	-1.2	-6.9	-24.6	650 <sup>b</sup>	925 <sup>b</sup>	-1.7
<i>Prices</i>						
	<i>percentage changes</i>					
Wage rate	-0.4	-0.3	-0.2	-0.1	-0.5	-0.1
Production price	-0.4	-0.4	-0.3	-0.1	-0.6	-0.5
Consumption price	-0.3	-0.3	-0.2	-0.1	-0.4	-0.9
Black price	0.7	1.2	1.7	0.5	0.7	-0.1
<i>Volumes</i>						
Private consumption	1.3	1.3	1.3	0.9	1.4	1.2
of which: child care	1.0	0.6	0.5	0.0	1.4	0.6
Exports	0.6	0.6	0.5	0.2	0.9	0.5
Imports	0.5	0.6	0.5	0.2	0.7	0.5
Production	0.8	0.8	0.7	0.2	1.1	0.6
Black production	-0.2	-1.1	-2.0	0.2	-0.1	-0.3
Household production	-0.1	0.0	0.0	0.1	0.0	0.0
Employment	0.6	0.6	0.5	0.1	0.9	0.4
-unskilled	0.8	0.5	0.3	0.1	1.5	0.6
-low skilled	0.7	0.5	0.1	0.0	1.0	0.5
-high skilled	0.6	0.7	0.6	0.1	0.8	0.4
Labour supply (pers.)	0.1	0.1	0.0	-0.2	0.3	0.0
Labour supply (hours)	0.2	0.2	0.3	-0.1	0.1	0.1
-breadwinners	0.0	0.2	0.4	0.0	0.0	0.0
-partners	0.7	0.0	-0.3	-0.4	0.8	0.2
-single persons	0.2	0.4	0.2	-0.1	0.0	0.1
-55+	0.1	0.4	0.8	0.0	0.0	0.0
Black labour(hours)	-0.2	-1.1	-1.9	0.3	0.0	-0.2
Human capital (index)	0.1	0.1	0.1	0.0	0.1	0.1
<i>Ratios</i>						
	<i>absolute changes</i>					
Unemployment rate	-0.3	-0.2	-0.1	-0.1	-0.5	-0.2
-unskilled	-0.4	-0.3	-0.2	-0.2	-0.8	-0.4
-low skilled	-0.3	-0.2	-0.1	-0.2	-0.6	-0.3
-high skilled	-0.2	-0.2	-0.1	-0.1	-0.5	-0.2
Share long term unemployment	-1.4	-1.3	-0.7	-0.8	-2.9	-1.3
Number unemploy. benefits <sup>c</sup>	-18	-17	-9	-11	-36	-17
Replacement ratio	-0.1	-0.4	-0.1	0.3	-0.7	0.0
Average burden <sup>d</sup>	-0.7	-0.7	-0.6	-0.4	-1.0	-0.1
Marginal burden <sup>d</sup>	-0.7	-1.9	-2.1	-0.1	-0.6	-0.1
Government consumption <sup>e</sup>	-0.3	-0.3	-0.3	-0.5	-0.2	-0.3

<sup>a</sup> Cumulated differences between simulation and base projection

<sup>b</sup> In guilders

<sup>c</sup> In thousands of persons

<sup>d</sup> Weighted average of the micro burdens of individuals

<sup>e</sup> Closure rule, in percentage of GDP

**Table 2** Average real disposable official household income<sup>a</sup>

	-----income tax rates-----			-----allowance-----		VAT rate
	1	2	3	basic	wage	
	percentage changes					
Breadwinners in families						
– Employed with children	0.8	1.2	1.4	0.6	1.1	1.0
– Employed without children	1.0	1.3	2.0	0.5	1.3	1.0
– With benefit	0.7	0.1	0.1	0.9	0.0	0.9
Partners in families						
– Employed with children	2.2	0.3	–0.3	0.4	3.5	1.3
– Employed without children	1.6	0.1	–0.1	0.7	2.0	1.1
– With benefit	1.0	–0.4	–0.3	1.5	–0.5	0.8
Single persons < 55						
– Employed	1.2	1.2	0.3	0.6	1.6	1.1
– With benefit	0.8	0.0	–0.2	1.3	0.0	1.1
Elderly persons						
– Employed	0.9	2.3	3.2	0.8	1.2	1.0
– With benefit	0.8	0.3	0.4	1.3	0.1	1.0
Pensioned persons	0.7	0.9	0.8	1.0	0.1	0.9

<sup>a</sup> Cumulated differences between simulation and base projection

constraint.<sup>15</sup> Table 1 presents the simulation results which should be interpreted as the long-run effects of the policy proposals. Table 2 contains the effects on individual incomes of various types of households.

#### *Labor supply (in hours)*

A lower marginal tax rate raises after-tax wages, thereby stimulating labor supply (in hours) through the substitution effect, i.e. in MIMIC substitution towards options with more labor supply. A reduction in the average tax burden reduces labor supply through the income effect. The first three columns of Table 1 reveal that the substitution effect dominates the income effect in case of a reduction in the rates of the three tax brackets. In particular, if the tax rate in the first bracket declines, single persons and especially partners increase labor supply. This is because a number of them have part-time jobs with relatively low wage incomes. At the margin, these incomes are subject to the tax rate of the first bracket. A lower marginal rate induces them to substitute away from leisure. Due to a large uncompensated wage elasticity of labor supply for especially partners, the rise in labor supply is quite strong. Many breadwinners and older workers face a marginal tax rate in the second or third bracket. Hence, a lower

<sup>15</sup>This methodology differs from Gelauff and Graafland (1994; see Table 8.1, page 168). In particular, in their simulations, endogenous changes in tax revenues caused by behavioral responses are attended by further changes in the tax burden. See the appendix.

tax rate in the first bracket reduces their average tax burden, but leaves their marginal tax rate unchanged. Through the income effect, this discourages the labor supply of many breadwinners and elderly workers. Because these groups feature a low income elasticity of labor-supply, the effect is quantitatively less important than the effect on partner labor supply.

By comparing the first three columns of Table 1, we find that reductions in the tax rates of the third bracket are somewhat more effective in stimulating aggregate labor supply in hours than reducing the tax rate in the first bracket and second bracket. This is due to the rise in labor supply of breadwinners, a number of single persons and older workers. Despite the low labor-supply elasticity of these groups, the implications for aggregate labor supply are strong for two reasons. First, breadwinners, single persons and elderly account for a relatively large part of the working population.<sup>16</sup> Second, the marginal tax rate for these groups drops substantially. Indeed, the rate in the third bracket can be reduced even below the rate in the second bracket. Table 1 reveals that partners reduce their labor supply if the rate in the third bracket is reduced because only a small number of them earn high incomes. Hence, the substitution effect is relatively unimportant for partners. In contrast, the income effect is important because the lower tax rate in the third bracket raises the income of the breadwinners which is important also for partner behavior.

The fourth column of Table 1 reveals that a higher basic tax deduction reduces labor supply. The reason is that the tax deduction reduces the average tax burden, but leaves the marginal tax burden for most workers unchanged. Hence, the substitution effect is zero while the income effect exerts a negative impact on labor supply.

The earned-income tax deduction in the Netherlands is 12% of the gross income for people with an income below a certain threshold. In 1998, this threshold is around 26.000 guilders. Higher incomes feature a maximum tax deduction of approximately 3.100 guilders. The fifth column of Table 1 shows the effects of an increase in the percentage of the existing earned-income tax deduction, while leaving the threshold income of 26.000 guilders unchanged. We find that the percentage tax deduction encourages partner labor supply because it reduces the marginal tax rate on part-time jobs. People with a full-time job, however, typically deduct the maximum earned-income tax deduction. Hence, whereas their average tax burden declines, the marginal tax burden remains unchanged.

A lower VAT rate directly reduces consumer prices, thereby raising real after-tax labor incomes. This stimulates labor supply through the substitution effect. However,

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<sup>16</sup>At the end of the simulation period, total labor supply in hours consists for 38% of breadwinners, 27% of single persons and 13% of 55+ aged people.

since all household types and income groups benefit equally from the fall in the consumer price, the labor supply effect is tempered by the keeping-up-with-the Jones effect.

### *Black labor supply*

A lower tax burden affects the black labor market through three channels. First, lower income taxes make the option with black labor supply less attractive for households compared to the formal option. Second, the reduction in the average tax burden stimulates private consumption, thereby raising also the demand for black labor-intensive services. Finally, the reduction in the average tax reduces the formal wage rate. Accordingly, firms find it more attractive to hire formal labor, rather than black labor. On balance, Table 1 reveals that, in most experiments, the black economy shrinks while the price of black labor rises. Only in case of a higher basic tax-free allowance (the fourth column of Table 1), we find that the black market expands.

The black labor market may be affected through two additional channels as well, but these channels operate only in specific experiments. First, in case of a reduction in the VAT rate, the reduction of the black economy operates through a different channel than in the other experiments. In particular, the share of black production declines due to substitution between black and formal labor-intensive services. Although the positive income effect mitigates this reduction in black production, total demand for black services falls. As a result, black prices and black wages fall. This causes substitution from black labor supply to formal labor supply. Quantitatively, the impact on black prices and black employment are similar to those found by Graafland (1990).<sup>17</sup>

A second channel through which tax reductions may affect the black economy operates through household production. If leisure decreases, especially of partners, household production falls. As household production substitutes with labor-intensive services, the decline in household production boosts the demand for black labor-intensive services. The rise in labor supply also raises the demand for childcare. For a given supply of formal childcare, this increases the demand for informal childcare.

### *The quality of labor supply*

Table 1 reveals that the time spent on training activities rises with labor supply. The additional human capital associated with this training raises labor productivity. Hence, the expansion of production exceeds that of employment in most experiments.

### *Replacement rate*

Reductions in the first tax bracket and the VAT rate are more or less neutral with respect to the replacement rate. Hence, workers and transfer recipients enjoy a similar

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<sup>17</sup> For reductions in income taxes, Graafland (1990) reports a smaller impact on tax evasion, because his model does not include direct substitution between formal and black labor supply.

increase in real after-tax incomes. In contrast, workers benefit relatively more from a reduction in the tax rate of the second bracket. The tax rate in the third bracket has a smaller effect on the replacement rate, because this income range is irrelevant for most unemployed persons. The rise in the replacement rate in the fourth column of Table 1 demonstrates that transfer recipients benefit more from a higher basic tax-free allowance than workers do. The most effective instrument to reduce the replacement rate is the earned-income tax deduction, as only workers benefit from it (see the fifth column of Table 1).

#### *Wages, employment and unemployment*

The rise in aggregate labor supply in most experiments strengthens the bargaining power of employers. Accordingly, wages fall. This drop in wages is reinforced by the lower average tax burden and, in some cases, a reduction in the replacement rate. In contrast, a lower marginal tax burden exerts some upward pressure on wages. On balance, Table 1 reveals that gross wages drop in all experiments.

A reduction in wage costs enables a fall in output prices. Accordingly, Dutch firms improve their competitive position relative to foreign competitors. Indeed, exports rise. Furthermore, private consumption increases because the reduction in the average tax burden raises private incomes. Accordingly, output and employment increase as well.

The biggest expansion in employment in the experiments in Table 1 occurs when the earned-income tax deduction increases. Indeed, the substantial reduction in the replacement rate is responsible for a large decline in wages and a correspondingly large boost in job creation. Lower tax rates in the first or second brackets are also effective ways to increase the number of jobs. The employment impact from a reduction in the tax rate of the third bracket is somewhat smaller because of a relatively large reduction in the marginal tax burden, which exerts upward wages pressure.

The effect on the unemployment rate is determined by the difference between the effect on labor supply and employment. Table 1 reveals that a lower tax rate in the first bracket is somewhat more effective in fighting unemployment than reducing rates in the second or third bracket. The earned-income tax deduction is the most effective instrument to reduce the unemployment rate. This is because the large decline in the replacement rate in this experiment improves the efficiency of the matchings process by raising the search intensity of the unemployed and reducing their reservation wage.

#### *Public consumption*

In most cases, the behavioral responses have a favorable impact on the budget deficit. Hence, the reduction in public consumption that is necessary to meet the government budget constraint ex-post is smaller than the ex-ante reduction in public consumption

of 0.5% GDP. Indeed, in all experiments, except for the increase in the basic tax deduction, we find that the reduction in public consumption is smaller than 0.5% GDP. In case of a higher earned-income tax deduction the ex-post reduction in public consumption is only 0.2% of GDP.

### **3.2 Targeted versus across-the-board tax reductions for employers**

This section explores three types of reductions in the tax burden on employers. In particular, employers in the Netherlands pay a substantial part of the social security contributions (SSC) for employee insurances. We analyze two ways in which the government may reduce this tax burden, namely an across-the-board reduction in the rate of SSC and a targeted reduction of SSC of unskilled workers. A third experiment involves a two-year subsidy for firms if they hire a long-term unemployed person. The effects are presented in Table 3. In order to maintain equilibrium on the budget of the social security funds, we assume that the government transfers 0.5% GDP to the social security funds. The government budget is balanced through an equivalent ex-ante reduction in public consumption. Ex-post, the government budget is balanced through adjustments in public consumption.

#### *Across-the-board reductions of employers' SSC*

The first column of Table 3 shows the effects of an across-the-board reduction in the SSC premium paid by employers. The lower tax burden on employers directly reduces the labor costs for workers of all skills. Accordingly, employment in all categories expands. However, workers succeed in collecting part of this tax reduction through two channels. First, employees raise their wage claims in contractual wage formation as the higher profit margin improves the relative bargaining position of employees. Second, lower labor costs raise the number of vacancies. This pushes incidental wages upward as firms try to attract more applicants to fill these vacancies. The rise in the number of jobs reduces unemployment. The magnitude of this effect is similar to a reduction in VAT rate (see the last column of Table 1).

#### *Targeted reductions of the labor costs of the unskilled*

The Dutch government provides a tax-free allowance for the employer's SSC for each worker that earns an hourly wage rate at the minimum level (the so-called SPAK). This allowance gradually falls with the hourly wage rate of a worker. After a certain threshold wage, the tax allowance is zero. The maximum allowance at the minimum wage level is 3.660 guilders per year. The threshold wage where the allowance is zero

**Table 3** Simulation results of reduction in the tax burden on employers by 0.5% GDP, financed by a reduction in government expenditure<sup>a</sup>

	general SSC reduction	targeted SSC reduction	subsidy long-term unemployed
<i>Prices</i>		<i>percentage changes</i>	
Wage rate	-0.2	-1.0	0.1
Production price	-0.4	-0.4	-0.6
Consumption price	-0.2	-0.3	-0.4
Black price	0.6	0.6	0.9
<i>Volumes</i>			
Private consumption	1.1	0.8	1.2
of which: child care	0.6	1.6	1.6
Exports	0.5	0.5	0.7
Imports	0.4	0.3	0.5
Production	0.6	0.6	0.9
Black production	-0.1	4.7	-0.5
Household production	0.1	-0.4	-0.6
Employment	0.4	0.9	1.2
-unskilled	0.6	5.4	6.2
-low skilled	0.4	0.0	0.8
-high skilled	0.4	0.4	0.5
Labour supply (pers.)	0.1	0.2	0.1
Labour supply (hours)	0.1	-0.1	0.1
-breadwinners	0.0	-0.2	0.0
-partners	0.2	0.3	0.5
-single persons	0.1	-0.2	0.1
-55+	0.0	-0.3	0.0
Black labour(hours)	-0.1	6.3	-0.1
Human capital (index)	0.1	-0.2	0.1
<i>Ratios</i>		<i>absolute changes</i>	
Unemployment rate	-0.2	-0.7	-0.7
-unskilled	-0.4	-3.6	-4.2
-low skilled	-0.2	-0.4	-0.5
-high skilled	-0.2	-0.3	-0.2
Share long term unemployment	-1.2	-3.8	-6.9
Number of unemployment benefits <sup>b</sup>	-16	-37	-58
Replacement ratio	0.0	-0.5	-0.5
Average burden <sup>c</sup>	-0.5	-0.7	-1.1
Marginal burden <sup>c</sup>	-0.2	2.6	-0.4
Government consumption <sup>d</sup>	-0.3	-0.2	-0.2

<sup>a</sup> Cumulated differences between simulation and base projection

<sup>b</sup> in thousand of persons

<sup>c</sup> Weighted average of micro burdens of individuals

<sup>d</sup> Closure rule, in percentage of GDP

**Table 4** Average real disposable official household income<sup>a</sup>

	general SSC reduction	targeted SSC reduction	subsidy long-term unemployed
	percentage changes		
Breadwinners in families			
– Employed with children	0.8	0.1	0.8
– Employed without children	0.8	0.1	0.9
– With benefit	0.7	0.5	1.1
Partners in families			
– Employed with children	1.2	0.4	1.4
– Employed without children	1.0	0.3	1.2
– With benefit	0.8	0.9	1.9
Single persons < 55			
– Employed	0.9	0.5	0.9
– With benefit	0.8	0.6	1.3
Elderly persons			
– Employed	0.8	-0.2	0.2
– With benefit	0.8	0.7	1.7
Pensioned persons	0.8	0.1	0.5

<sup>a</sup> Cumulated differences between simulation and base projection

is 115% of the gross minimum wage at a working time of 36 hours a week. For a person with a full-time job (i.e. 38 hours per week) the threshold is 121% of the minimum wage. The second column of Table 3 reports the effects of an increase in the SPAK. In particular, we raise the maximum allowance by 6.000 guilders, while the threshold where this additional allowance is zero is 130% of the minimum wage.

Before commenting on the simulation results, we note that some of these experiments are surrounded by more uncertainty than other experiments. In particular, the targeted reduction in SSC substantially raises the marginal tax burden on employers. This exerts a negative impact on on-the-job training activities by firms, induces substitution towards coupled informal labor and has an impact on collective wage formation (see below). The modelling of the first two channels typically suffer from a weak empirical basis.<sup>18</sup>

Comparing the first and second columns of Table 3, we find that an SSC reduction targeted at unskilled workers is more effective in raising employment than a general reduction in SSC, especially for the unskilled. In particular, the labor costs for employees with an income between the minimum wage and 130% of the minimum

<sup>18</sup> In order to specify these uncertainties, we will do some sensitivity analysis in the near future.

wage fall substantially. This raises the demand for unskilled workers through two channels. First, there is substitution from high-skilled labor towards low-skilled labor. Second, the reduction in SSC-premiums enhances the job matching process because the labor costs at the minimum wage level fall. Indeed, the lower minimum wage costs reduce the minimum required productivity standard set by employers. Accordingly, a number of unemployed people with a low productivity -- especially long-term unemployed -- become acceptable for firms. The efficiency of the matching process is improved further by a reduction in the replacement rate for unskilled workers, which stems from an increase in the wage rate for the unskilled. Indeed, the lower replacement rate reduces the reservation wage and raises the search intensity of the unemployed, thereby raising the number of job matches.

The targeted SSC reduction has some drawbacks as well. First, by gradually reducing the tax allowance, the marginal tax rate for employers increases. Accordingly, wage increases just above the minimum wage are extremely expensive for the employer because it reduces the SSC allowance. This high marginal tax burden harms the incentives for employers to invest in the human capital of their unskilled employees. Accordingly, the productivity level of unskilled workers drops. Indeed, Table 3 reveals that production rises less than employment, which reflects the loss in human capital of the unskilled. Moreover, private consumption rises less than in the first column. Furthermore, the reduction in on-the-job training hampers the upgrading of unskilled workers into low-skilled labor. Since unskilled people face a higher replacement ratio than low skilled people do, this tends to increase the average replacement ratio. This effect on the replacement rate is reinforced by the lower expected net wage growth for unskilled workers (see footnote 10).

Another drawback of a high marginal tax burden for employers is that it stimulates substitution between formal labor and coupled informal labor (see equation (1)). In particular, a high marginal tax burden makes it attractive for firms to pay unskilled and low-skilled workers the formal minimum wage, while paying the rest of the labor income informally. Accordingly, the employer and the employee benefits from the tax allowance while the employee may benefit from a higher income. The substitution into coupled informal labor erodes the tax base and thus leaves less room for reducing taxes.

Through these adverse effects associated with a higher marginal tax burden, the favorable effects of a targeted reduction in employers SSC are mitigated. Furthermore, the group of unskilled workers in the Netherlands is concentrated among married women and young single persons. These people generally do not receive a social benefit. Hence, the reduction in the unemployment rate does not correspond to a reduction in the number of unemployment benefits. Despite these drawbacks, our

simulations reveal that the effects on employment and unemployment are more favorable than in the case of an across-the-board reduction in employers' SSC.

*Subsidies for hiring long-term unemployed*<sup>19</sup>

The third column of Table 3 presents the effects of a subsidy for the first two years of a labor contract with an applicant who is currently long-term unemployed. This subsidy is similar to the proposal of Snower (1994) who calls the subsidy a voucher for the long-term unemployed.

The simulation results suggest that the subsidy for long-term unemployed is more effective in fighting unemployment than the previous two experiments, especially of the long-term unemployed. The subsidy amounts to 100% of net unemployment assistance each year. Hence, the reduction in labor costs for long term unemployed during the first two years is substantial. As a result, the minimum required productivity for long term unemployed falls, improving their employability. The efficiency of the matching process between vacancies and (long-term) unemployment is raised. Long-term unemployed who find a job are able to restore their capabilities increasing their human capital. Besides, the subsidy does not raise the marginal tax burden as it does not depend on the hourly wage rate but on the unemployment status of a potential worker. Accordingly, the experiment does not harm the incentives for human capital accumulation or stimulate substitution into the black economy. The voucher thus does not reduce labor productivity.

Although the results in Table 3 seem quite favorable, they are less promising than Snower suggests. There are several reasons for this difference. First, there is a deadweight loss of the subsidy since a number of unemployed persons would have found a job also without a subsidy. Second, the higher transition rate of long-term unemployment into employment crowds out the opportunities of short-term unemployed to find a job. Third, employers anticipate that the subsidy holds for only two years. Accordingly, the present value of the subsidy is lower than a permanent subsidy. The fourth reason for the difference in the results is that long-term unemployed are less productive than short-term unemployed. Since the subsidy applies only to the long-term unemployed, the reduction in wage costs per efficiency unit of labor is smaller than the reduction in wage costs per worker. Since Snower applies the wage elasticity of labor demand to the reduction in wage costs per worker, he overestimates the employment effect. Finally, the productivity of the long-term unemployed is rather heterogeneous. Accordingly, the subsidy makes only a small part of the long-term unemployed employable. Especially if long-term unemployment

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<sup>19</sup>For a more detailed discussion of these results, see Jongen and Graafland (1998).

coheres with other unfavorable characteristics of the unemployed persons, employers may be reluctant to employ them, even if the labor cost are subsidized. As Van Beek et al (1997) note, employers may stigmatize unemployed people who are not young, healthy, native and male. However, they also find that if subsidies are very large, these stigmatization effects may be overcome.

### **3.3 Replacing the basic tax deduction by a tax credit**

This subsection analyzes the replacement of the basic tax deduction by a tax credit. In particular, we explore two experiments. In the first experiment, we abolish the general tax deduction and use all ex-ante revenues to introduce a general tax credit.<sup>20</sup> The second experiment also abolishes the general tax deduction but combines the introduction of a tax credit with an increase in the border of the first tax bracket.

#### *Replacing the basic tax deduction by a tax credit*

The first column of Table 5 shows the effect of abolishing the general tax deduction and using the revenues to introduce a tax credit.<sup>21</sup> This policy has three effects on the labor market. The first effect is related to a more progressive tax system. In particular, whereas the value of the tax deduction depends on the marginal tax rate of an individual, the value of the tax credit is equivalent for all households. Hence, replacing the tax deduction by a tax credit redistributes the average tax burden from low incomes (i.e. people facing a marginal tax rate in the first bracket) towards households facing a high marginal tax rate (i.e. in the second or third bracket). Furthermore, the abolishment of the tax deduction implies that a number of breadwinners, single persons and elderly who previously faced a marginal tax rate in the first (second) bracket become marginally taxed by the second (third) bracket. Accordingly, the higher marginal tax burden for those people discourages their labor

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<sup>20</sup> Since aged households do not pay all national social insurance premiums, their marginal tax rate is (on average) lower than for other groups. Hence, they do not suffer as much from an abolishment of the basic tax allowance. For this reason, the tax credit for this group is set lower than for other groups.

<sup>21</sup>Note that the abolishment of the basic tax deduction would broaden the base of social premiums, thereby allowing for a substantial decline in social premium rates. In this subsection, we assume that premium rates are fixed, however. The tax credit is set in such a way that the ex-ante tax revenues do not change.

**Table 5** Simulation results of a revenue-neutral replacement of the basic tax deduction by a tax credit<sup>a</sup>

		with increase in the border of the first bracket
<i>Prices</i>		<i>percentage changes</i>
Wage rate	0.2	-0.1
Production price	0.3	-0.1
Consumption price	0.2	0.0
Black price	-0.7	0.1
<i>Volumes</i>		
Private consumption	-0.5	0.1
of which: child care	-0.4	0.5
Exports	-0.5	0.1
Imports	-0.4	0.1
Production	-0.6	0.1
Black production	1.4	0.0
Household production	0.0	-0.1
Employment	-0.6	0.2
-unskilled	-0.3	0.2
-low skilled	-0.4	0.2
-high skilled	-0.6	0.1
Labour supply (pers.)	0.5	0.5
Labour supply (hours)	-0.3	0.2
-breadwinners	-0.2	0.0
-partners	0.4	0.9
-single persons	-0.7	0.0
-55+	-0.5	-0.1
Black labour(hours)	1.6	-0.1
Human capital (index)	-0.1	0.0
<i>Ratios</i>		<i>absolute changes</i>
Unemployment rate	0.2	0.0
-unskilled	0.3	0.0
-low skilled	0.2	0.0
-high skilled	0.1	0.0
Share long term unemployment	0.8	0.1
Number of unemployment benefits <sup>b</sup>	14	4
Replacement ratio	1.2	0.1
Average burden <sup>c</sup>	0.3	-0.1
Marginal burden <sup>c</sup>	2.0	-0.2
Government Consumption <sup>d</sup>	-0.1	0.0

<sup>a</sup> Cumulated differences between simulation and base projection

<sup>b</sup> In thousands of persons

<sup>c</sup> Weighted average of the micro burdens of individuals

<sup>d</sup> Closure rule, in percentage of GDP

**Table 6** Average real disposable official household income<sup>a</sup>

	with an increase in the border of the first tax bracket	
	<i>percentage changes</i>	
Breadwinners in families		
– Employed with children	–0.9	–0.2
– Employed without children	–0.8	0.1
– With benefit	1.0	0.0
Partners in families		
– Employed with children	2.5	1.9
– Employed without children	0.3	0.0
– With benefit	1.1	–0.8
Single persons < 55		
– Employed	–0.8	0.2
– With benefit	1.5	0.0
Elderly persons		
– Employed	–1.9	–0.6
– With benefit	0.8	–0.2
Pensioned persons	–0.2	0.2

<sup>a</sup> Cumulated differences between simulation and base projection

supply. Moreover, it induces substitution from formal labor towards informal labor so that the underground economy expands.

The second effect of replacing the basic tax deduction by a tax credit is that partners are encouraged to participate in the formal labor market. The reason is that, in the current tax system, partners are allowed to transfer their tax deduction to the breadwinner if their own income is less than the tax deduction. Accordingly, the value of their transferable tax deduction depends on the marginal tax rate of the breadwinner. As soon as the partner earns more than the tax deduction, transferability is no longer allowed. In that case, the value of the tax deduction is determined by the marginal tax rate of the partner instead of the breadwinner. Because for a number of families the marginal tax rate of partners is lower than that of breadwinners, the transferability of the tax deduction discourages labor supply of partners. The tax credit does not exert this adverse effect on partner labor supply because its value is independent of the marginal tax rate. Hence, replacing the tax deduction by a tax credit boosts labor supply of partners (see the effect on labor supply in persons in the first column of Table 5).

The more progressive tax system is associated also with a higher replacement rate. As a result, the reservation wage of the unemployed rises thereby harming the efficiency of the matching process. Also the bargaining position of employees improves. Hence, wages rise. However, more progressivity is associated also with a higher marginal tax burden, which induces a negative effect on the wage outcome. On

balance, the higher replacement ratio and marginal tax rate and the fall in labor supply exert a rise in wages. This harms the competitive position of Dutch industries, reduces exports and production, and induces a fall in employment. Because of these unfavorable effects, the ex-post tax revenues decline. Accordingly, a reduction in government consumption is required to balance the government budget.

#### *Increasing the border value of the first tax bracket*

In the second column in Table 5 the revenues from an abolishment of the basic tax deduction are used for two purposes. First, we introduce a tax credit that is equal to the tax deduction multiplied by the marginal rate of the first tax bracket. The second part of the revenues is used to increase the border value of the first tax bracket. Accordingly, the tax credit compensates most incomes for the abolishment of the basic tax deduction. Furthermore, people with an income close to the border of the first or second tax bracket are no longer confronted with a higher marginal tax rate. Indeed, the potential increase in the marginal tax rate due to the abolishment of the tax deduction is compensated by the increase in the border of the first tax bracket. The only group that is not fully compensated by the increase in the border value of the first tax bracket are families in which the partner transfers the basic tax deduction to the breadwinner. Hence, this policy redistributes the marginal tax burden from partners with small part-time jobs towards breadwinners with high incomes. This makes it attractive for partners to enter the labor market.

By combining the tax credit with an increase in the border value of the first tax bracket, the government thus alleviates the progressivity effect mentioned above while the positive impact on partner labor supply maintains. Indeed, Table 5 reveals that the replacement rate remains more or less unchanged while labor supply in persons and hours increases.

### **3.4 Alternative tax allowances for workers**

This section discusses five alternative ways to introduce a tax allowance for workers. These instruments receive much attention in current Dutch policy debates as a way to fight unemployment by reducing the replacement rate. In all experiments, we assume that the government budget is balanced through a corresponding ex-ante reduction in public consumption by 0.5% GDP. Premium rates are assumed to be constant, ex-ante. Hence, changes in the budget of national social insurance funds are compensated by a transfer from the government. The government budget remains balanced ex-post by adjusting public consumption. The long-run effects of the experiments are presented in Table 7.

**Table 7** Simulation results of alternative tax allowances for workers that reduce public revenues by 0.5% GDP, financed through an equivalent ex-ante reduction in public consumption.<sup>a</sup>

	Maximum EITD	Fixed EITD	Fixed EITC	Targeted EITC	Moderately Targeted EITC
Prices					
Wage rate	-0.6	-0.5	-0.5	-1.1	-1.2
Production price	-0.7	-0.6	-0.6	-0.7	-0.7
Consumption price	-0.5	-0.4	-0.4	-0.4	-0.4
Black price	0.8	0.7	0.6	0.1	0.1
Volumes					
Private consumption	1.6	1.4	1.4	1.1	1.1
of which: child care	1.6	1.3	1.3	1.2	1.2
Exports	1.0	0.9	0.9	0.9	1.0
Imports	0.8	0.7	0.7	0.6	0.6
Production	1.3	1.1	1.1	1.0	1.1
Black production	-0.3	-0.1	0.0	2.4	2.2
Household production	-0.1	0.0	0.0	-0.3	-0.4
Employment	1.1	0.9	0.9	1.3	1.4
-unskilled	1.3	1.5	1.5	5.4	5.0
-low skilled	1.2	1.0	1.0	0.5	0.8
-high skilled	1.0	0.8	0.7	0.9	1.0
Labour supply (pers.)	0.0	0.5	0.5	0.4	0.3
Labour supply (hours)	0.3	0.1	0.1	0.1	0.1
-breadwinners	0.0	0.0	-0.1	-0.3	-0.2
-partners	0.8	0.8	0.8	1.4	1.3
-single persons	0.4	-0.1	-0.2	0.0	-0.1
-55+	0.1	0.0	-0.1	-0.3	-0.2
Black labour(hours)	-0.2	0.0	0.1	3.2	2.9
Human capital (index)	0.2	0.1	0.1	-0.2	-0.2
Ratios					
Unemployment rate	-0.5	-0.5	-0.5	-0.8	-0.9
-unskilled	-0.8	-0.8	-0.8	-2.3	-2.2
-low skilled	-0.6	-0.6	-0.6	-0.8	-0.9
-high skilled	-0.4	-0.5	-0.5	-0.6	-0.7
Share long term unemployment	-2.8	-2.9	-3.0	-4.6	-5.0
Number of unemployment benefits <sup>b</sup>	-37	-35	-36	-61	-67
Replacement ratio	-0.8	-0.7	-0.7	-1.3	-1.5
Average burden <sup>c</sup>	-1.0	-1.0	-1.0	-1.1	-1.1
Marginal burden <sup>c</sup>	-0.8	-0.5	-0.3	1.5	1.5
Government consumption <sup>d</sup>	-0.2	-0.2	-0.2	-0.1	-0.0

<sup>a</sup> Cumulated differences between simulation and base projection

<sup>b</sup> In thousands of persons

<sup>c</sup> Weighted average of the micro burdens of individuals

<sup>d</sup> Closure rule, in percentage of GDP

**Table 8** Average real disposable official household income<sup>a</sup>

	Percentage EITD	Fixed EITD	Fixed EITC	Targeted EITC	Moderately Targeted EITC
	percentage changes				
Breadwinners in families					
– Employed with children	1.4	1.0	0.9	0.3	0.3
– Employed without children	1.5	1.2	1.2	0.3	0.3
– With benefit	0.1	0.0	–0.1	–0.2	–0.2
Partners in families					
– Employed with children	2.3	3.8	4.1	0.8	0.6
– Employed without children	2.3	2.0	2.1	0.5	0.4
– With benefit	0.7	–0.8	–0.9	–0.3	–0.3
Single persons < 55					
– Employed	1.9	1.5	1.4	0.9	0.8
– With benefit	0.2	0.0	–0.1	–0.1	–0.1
Elderly persons					
– Employed	1.4	1.1	1.0	0.3	0.3
– With benefit	0.2	0.1	0.1	–0.1	0.0
Pensioned persons	0.1	0.1	0.1	–0.2	–0.1

<sup>a</sup> Cumulated differences between simulation and base projection

#### *Raising earned-income tax deduction (EITD)*

The earned-income tax deduction in the Netherlands is 12% of the gross income with a maximum of 3100 guilders at a threshold income of around 26.000 guilders. The first column of Table 7 shows the simulation results of an increase in the maximum tax deduction, thereby leaving the percentage tax deduction unchanged. The effect of a higher percentage deduction are analyzed in the fifth column of Table 1. We find that raising the maximum EITD substantially raises labor supply in hours. In particular, a number of partners and single persons who previously deducted the maximum amount of 3.100 guilders, now deduct 12% of their gross income. Accordingly, their marginal tax burden declines, thereby generating positive substitution effects on labor supply. In contrast, partners with small part-time jobs do not benefit from the increase in the maximum tax deduction. Hence, labor supply in persons does not expand.

Table 7 reveals also that the earned-income tax deduction substantially reduces the replacement rate and the average tax burden on workers. This exerts a negative impact on wages so that employment expands. Comparing this experiment with the higher percentage tax deduction for workers in the fifth column of Table 1, we find that the

percentage tax deduction is more favorable for labor supply in persons. However, the higher maximum tax deduction is more attractive if the government aims at raising labor supply in hours. This latter effect renders the effect on employment also larger in case of a higher maximum tax deduction. The impact on unemployment is similar.

#### *Fixed EITD*

The second column of Table 7 shows the effects of the introduction of a fixed earned-income tax deduction. The main difference with the percentage tax deduction (see the fifth column in Table 1) is that this fixed deduction holds also for partners with a part-time job. Hence, the average tax burden on low incomes falls shows a larger decline. Accordingly, labor supply of partners in small part-time jobs increases more substantially. Apart from this effect on labor supply, the fixed earned-income tax deduction yields rather similar effects on the labor market as a percentage tax deduction.

#### *Fixed earned-income tax credit (EITC)*

An alternative way to reduce the replacement rate is to introduce a fixed tax credit for workers. In contrast to the tax deduction for workers, the value of this fixed earned-income tax credit (EITC) does not depend on the marginal tax rate. Hence, compared to the tax deduction, the government is able to more substantially reduce the replacement rate for low-income groups. Accordingly, the unemployment rate among the unskilled drops slightly more (although this is not illustrated by the figures as they are rounded).

#### *Targeted EITC*

The fourth column of Table 7 shows the effects of a targeted earned-income tax credit for workers. Similar to the targeted reduction in SSC-premiums discussed in section 3.2, the targeted EITC depends on the hourly wage rate of an employee. In particular, the full credit is available for workers who receive an hourly wage at the minimum wage level. The credit gradually drops with the wage rate and is zero for people with an hourly wage of 130% of the minimum wage. The credit in our experiment differs from the EITC in the US tax system which is related to the total wage income per household per year, rather than the hourly wage rate of an individual worker.

From Table 7, we find that the EITC raises labor supply in persons. Indeed, low-skilled partners are stimulated to supply labor as the average tax burden on part-time jobs with low hourly wages drops. However, high-skilled partners are not encouraged to participate on the formal labor market. Hence, compared to the previous experiments, the increase in labor supply in persons is smaller. For most other

individuals, the marginal tax burden on hours worked remains unchanged so that labor supply in hours is hardly affected.

Given the same budget of 0.5% GDP, the targeted EITC reduces the replacement rate and the average tax burden for unskilled workers more substantially than the fixed EITC does. Through the process of skill-specific wage formation, this causes a relatively strong decline in the wage rate for the unskilled. Furthermore, the lower replacement rate for unskilled workers stimulates their search intensity and lowers their reservation wage. This improves the efficiency of the matching process for unskilled labor. Accordingly, the unemployment rate among the unskilled drops more substantially than in case of a fixed EITC.

A drawback of the targeted EITC is that the gradual decline between the minimum wage and 130% of the minimum wage raises the marginal tax burden on employees. Although this does not discourage labor supply (as the allowance depends on hourly wages rather than yearly labor incomes), the higher marginal tax burden has adverse effects on labor productivity. Indeed, unskilled workers become less motivated to raise their future wage rate through the accumulation of human capital or through raising their efforts. Accordingly, compared to the fixed tax credit for workers, we find that the targeted EITC exerts smaller effects on production and consumption. Furthermore, the high marginal tax burden stimulates substitution from formal into coupled informal labor. Accordingly, tax revenues fall and less money can be used for the EITC.

By comparing the targeted EITC with the targeted reduction in SSC paid by employers, we find that the EITC is more effective in fighting total unemployment but less effective in fighting unemployment among the unskilled. The reason for this is the following. The reduction in the SSC for employers enhances the efficiency of the matching process through a reduction of the effective minimum wage costs. This strongly reduces unemployment among the unskilled because the effective minimum wage is the most important distortion in the matching process for the unskilled (see Table 9 in Jongen and Graafland, 1998). The EITC improves the matching process through a reduction of the replacement rate of the unskilled. Although this seems less important for the matching process than a reduction in the effective minimum wage, the lower replacement rate also moderates wages of low skilled and high skilled workers through the collective wage negotiations. This makes the EITC even more effective in reducing total unemployment than the targeted reduction in employers' SSC. Note, however, that the large effect on the unemployment rate is associated with a drop in the incomes of social benefit recipients (see Table 8). Indeed, social benefits are indexed to gross wages which decline endogenously. In case of a targeted SSC reduction, benefit recipients are better off because gross wages increase, rather than decline (see Table 4).

#### *Moderately targeted EITC*

The fifth row of Table 7 shows the effects of an EITC that is phased out more gradually than the previous experiment, namely, between the minimum wage and 150% of the minimum wage. Hence, this version of the EITC is more moderately targeted at the unskilled. Given the same budget of 0.5% GDP, this implies that the maximum credit for people who earn the minimum wage rate is smaller. However, the marginal tax burden for people with an income between the minimum wage and 130% of the minimum wage rises less. Table 7 reveals that this moderately targeted version of the EITC is slightly more effective in reducing the unemployment rate than the targeted EITC. Furthermore, human capital of the unskilled drops less so that the effect on production is somewhat larger than in the previous experiment. Also compared to the fixed EITC in the third column of Table 7, the moderately targeted EITC is more effective in reducing the unemployment rate. This suggests that there are decreasing returns with respect to targeting. Indeed, there exists some sort of inverse U-shape that describes the effectiveness of the EITC in terms of unemployment reduction as a function of the degree of targeting.<sup>22</sup> Hence, moderately targeting the EITC seems the most effective way to reduce the unemployment rate. Furthermore, targeting on a small income range causes larger adverse effects on human capital and the underground economy, because it is associated with an extremely high marginal tax burden.

#### **4 Concluding remarks**

This paper analyses the impact of several tax policies on the labor market by using a revised version of the applied general equilibrium model MIMIC. Compared to its predecessor, MIMIC incorporates a number of new elements such as the impact of marginal taxes on labor supply of breadwinners and single persons, human capital formation and the underground economy. This makes MIMIC more appropriate to analyze the impact of targeted tax reductions that are receiving much attention in current policy debates in the Netherlands.

The simulation experiments show that a reduction in the tax rates of the three tax brackets yield similar effects on labor supply. A notable difference is that a lower first bracket encourages labor supply of partners, while a lower rate in the second or third bracket stimulates labor supply of single persons, breadwinners and the elderly.

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<sup>22</sup> Note that, because of the weak empirical base of the elasticities of training and the black economy, the exact position of this curve is highly uncertain.

Compared to the second and third tax bracket, reductions in the tax rate in the first tax bracket are more effective to reduce the unemployment rate, but less favorable in improving the quality of labor supply.

A higher basic tax deduction reduces labor supply through income effects. Moreover, it raises the replacement rate. Through both channels, the impact on wages and employment is relatively small compared to the other tax simulations. Replacing the basic tax deduction by a tax credit also reduces labor supply as it makes the tax system more progressive. However, if the introduction of a tax credit is accompanied by an increase in the border of the first tax bracket, this progressivity effect is alleviated. In that case, abolishing the basic tax deduction raises labor supply of partners because it shifts the marginal tax burden from partners with low incomes towards breadwinners with high incomes. Accordingly, labor supply expands.

The most effective way to fight unemployment and raise employment are tax reductions that are targeted at the employed. The reason is that these instruments produce the largest decline in the replacement rate. This paper explores different types of such earned-income tax allowances. We find that targeting the tax allowance for workers at the unskilled is the most attractive way to reduce the unemployment rate. However, targeting implies that the marginal tax burden increases. Accordingly, compared to a general earned-income tax allowance, targeting low-income groups reduces the incentive to invest in human capital and induces substitution towards the informal economy. This causes a negative impact on production and consumption. MIMIC simulations thus suggest that targeting low-income groups features decreasing returns, i.e. the allowance should not fall too steeply with the wage rate. Indeed, the optimal strategy seems to phase out the earned-income tax allowance over a rather broad income range. Note that benefit recipients may be worse off due to tax reductions for workers. This is because their income is indexed to the gross wage rate. As earned-income tax allowances reduce the gross wage rate, this may cause a decline in the real disposable income of social benefit recipients.

Reductions in the tax burden on employers are also more effective in reducing unemployment if they are targeted at specific groups. Indeed, a reduction in employer's social security contributions for unskilled workers exerts a larger decline in the unemployment rate than do across-the-board reductions in employer's social security contributions. However, also here targeting causes negative incentives for on-the-job training so that the effect on labor productivity is less favorable. An alternative way to target the tax reductions is to introduce subsidies for firms that hire long-term unemployed people. In that case, we find that unemployment drops in a similar proportion as in case of an SSC reduction that is targeted at the unskilled. However, the marginal tax rate does not rise so that the subsidy has no adverse effects on labor productivity and the underground economy.

## Appendix      Comparison with simulation results of previous version of MIMIC

Table 9 compares the results of income tax simulations of the current version of MIMIC with those of the previous version as described by Gelauff and Graafland (1994, Table 8.1). For this purpose, we used the methodology of Gelauff and Graafland and simulated a tax reduction financed by an ex-ante reduction in government consumption by 0.2% of net national income. Endogenous increases in tax revenues caused by the behavioral responses, are used to further reduce taxes (instead of lowering the reduction in government consumption, as in Table 1). Furthermore, in contrast to the simulations in Table 1, the premium rate of national social insurance is (fully) endogenous.

**Table 9**      Comparison of tax simulations

	-----income tax rates-----			----allowance-----		VAT rate
	1	2	3	basic	wage	
<i>Previous version</i>						
Employment <sup>a</sup>	0.36	0.13	0.02	-0.18	0.65	0.11
Labor supply (hours) <sup>a</sup>	0.13	0.01	-0.07	-0.15	-0.31	0.01
Unemployment rate <sup>b</sup>	-0.16	-0.09	-0.08	0.00	-0.81	-0.08
<i>Current version</i>						
Employment <sup>a</sup>	0.28	0.29	0.24	-0.19	1.18	0.18
Labour supply (hours) <sup>a</sup>	0.09	0.11	0.13	-0.15	0.02	0.03
Unemployment rate <sup>b</sup>	-0.11	-0.11	-0.06	0.02	-0.79	-0.10

<sup>a</sup> Percentage changes

<sup>b</sup> Absolute changes

The simulated unemployment effects are more or less similar in both models. Only a reduction in the rate of the first tax bracket shows a relative large change in unemployment effect. More notable changes occur in labor supply responses. First, because of endogenous labor supply of single persons and breadwinners, the revised version of MIMIC shows larger labor supply effects when the tax rate of the second or third bracket are lowered. Second, due to an improvement in the way the tax allowance of wage earners is incorporated in the labor supply model, an increase in the tax allowance for workers has no unfavorable impact on labor supply anymore. As a result of these changes, the relative order in employment effects is modified. Particularly, in contrast to the previous version, reductions in the first, second or third tax bracket rate are now more or less equally effective in boosting employment. Furthermore, the relative effectiveness of the tax allowance for workers has increased because of the change in labor supply effect.

## References

Aalst, M. van de and H. Hermsen, 1994, Weer werk na lang zoeken: Actief arbeidsmarktgedrag van (zeer) langdurig werklozen en de kans op werk, Ministry of Social Affairs and Employment, Research Memorandum 333, The Hague.

Aarts, L.J.M. and Ph.R. de Jong, 1990, *Economic Aspects of Disability Behavior*, Rotterdam.

Baartmans, K., F. Meyer and A. van Schaik, 1986, *Woningonderhoud en informele sector*, Volkshuisvesting in theorie en praktijk 11, University of Delft

Beek, K.W.H., C.C. Koopman and B.M.S. van Praag, 1997, Shopping at the labor market: A real tale of fiction, *European Economic Review*, 41, pp. 295-318

Berg, G.J. van den, 1990, Search behavior, transitions to non-participation and the duration of unemployment, *The Economic Journal*, 100, pp. 842-865

Berg, G.J. van den and J.C. van Ours, 1994, Unemployment dynamics and duration dependence in France, the Netherlands and the United Kingdom, *The Economic Journal*, 104, pp. 432-43

Binmore, K. and P. Dasgupta, 1987, *The economics of Bargaining*, Oxford: Basil Blackwell.

Boone, J., 1998, A simple dynamic optimization model to determine household's saving, mimeo, CPB

Bovenberg, A.L., R.A. de Mooij and F. van der Ploeg, 1994, Does a Robin-Hood policy work (in Dutch), *Economisch Statistische Berichten*, pp. 332-36.

CPB, 1992b, *Nederland in drievoud*, SDU, The Hague

CPB, 1994a, *Vijf verkiezingsprogramma's*, The Hague

Devine, T.J. and N.M. Kiever, 1991, *Empirical labor economics*, Oxford University Press, Oxford

Draper, D.A.G., 1994, Savings, pension rights and taxation, *De Economist*, Vol. 142, no.2, pp. 171-92

Draper, D.A.G. and A.J.G. Manders, 1996, Structural changes in the demand for labor, Research Memorandum, no. 128, CPB

Eijgenraam, C.J.J. and E.M. Verkade, 1988, *Beta, een bedrijftakkenmodel van de Nederlandse economie*, Occasional Paper 44, Central Planning Bureau

Gelauff, G.M.M., 1993, Taxation and employment, *Public Finance/Finances Publiques*, pp. 387-405.

Gelauff, G.M.M. and J.J. Graafland, 1994a, *Modelling Welfare State Reform*, North Holland

Gelauff, G.M.M. and J.J. Graafland, 1994b, Individualizing the income tax and unemployment assistance system, *Journal of Policy Modeling*, Vol. 16, pp. 417-25

Gelauff, G.M.M. and C. Den Broeder, 1996, Governance of stakeholder relationships, CPB Research Memorandum no 127.

Gorter, D. and C. Gorter, 1993, The relation between unemployment benefits, the reservation wage and search duration, *Oxford Bulletin of Economics and Statistics*, 55, 2, pp. 199-214

Graafland, J.J., 1990, Tax policies and interaction between hidden and official economy, *Public Finance* 45, pp. 70-89

Graafland, J.J., 1995, The positive effects of a partial basic income, *Economisch Statistische Berichten*, pp. 737-740 (in Dutch)

Graafland, J.J. and F.H. Huizinga, 1996, Taxes and benefits in a non-linear wage equation, Research Memorandum, no. 125, CPB

Graafland, J.J. and M.H.C. Lever, 1996, Internal and external forces in sectoral wage formation: Evidence from the Netherlands, *Oxford Bulletin of Economics and Statistics* 58, pp. 241-52

Groot, W., 1990, The effects of benefits and duration dependence on re-employment probabilities, *Economics Letters* 32, pp. 371-76

Groot, W. and E. Meckelholt, 1995, The rate of return to investments in on-the-job training, *Applied Economics* 27, pp. 173-181.

Hamermesh, D., 1993, *Labor demand*, Princeton University Press, Princeton.

Hansen, C.T., L.H. Pedersen and T. Sløk, 1995, Progressive taxation, wages and activity in a small open economy, Working Paper 1995-21, EPRU

Hersoug, T., 1984, Union wage responses to tax changes, *Oxford Economic Papers* 36, pp. 37-51

Hersoug, T., K.N. Kjaer and A. Rødseth, 1986, Wages, taxes and the utility-maximizing trade union: a confrontation on Norwegian data, *Oxford Economic Papers* 38, pp. 37-51

Holmlund, B., Linden, J., 1993, Job Matching, Temporary Public Employment, and Equilibrium Unemployment, *Journal of Public Economics*, 51, pp.329-343, North-Holland.

Jager, N.E.M., J.J. Graafland and G.M.M. Gelauff, 1996, A negative income tax in a mini-welfare state: A simulation exercise with MIMIC, *Journal of Policy Modelling*, pp. 223-31

Jongen, E.L.W and J.J. Graafland, 1998, Vouchers for the long-term unemployed: a simulation analysis with MIMIC, Research Memorandum 139, CPB, The Hague

Kapteyn, A., I. Woittiez and P. ten Hacken, 1989, Household labor supply in the Netherlands in the eighties and the nineties, OSA working paper W61, The Hague

Kerckhoffs, C., C. de Neuburg and F. Palm, 1994, The determinants of unemployment and jobsearch duration in the Netherlands, *De Economist*, 142, pp. 21-42

Koning, J. de, A. Gelderblom and M.A. Spierings, 1994, *Toekomstverkenningen gebaseerd op mogelijke configuraties van inkomen, arbeid en scholing*, NEI.

- Koopmans, C.C., 1994, Direct measurement of hidden labor, *Applied Economics* 26, pp. 575-581.
- Layard, R., S. Nickell and R. Jackman, *Unemployment*, Oxford University Press, Oxford
- Lockwood, B. and A. Manning, 1993, Wage setting and the tax system, theory and evidence for the United Kingdom, *Journal of Public Economics*, Vol. 52, pp. 1-29
- Lockwood, B., T. Sløk and T. Tranaes, 1995, Progressive taxation and wage setting: Some evidence for Denmark, Working Paper 1995-20, EPRU
- Macleod, W.B., and J.M. Malcomson, 1993, Investment, holdup, and the form of market contracts, *American Economic Review*, pp. 811-837.
- Malcomson, J.M. and N. Sartor, 1987, Tax push inflation in a unionized labor market, *European Economic Review*, Vol. 31, pp. 1581-96
- Manders, A.J.G., 1994, Reduction of working time: a long term perspective, *Economisch Statistische Berichten* (in Dutch), pp. 534-37
- Ministry of Social Affairs and Employment, 1990, *De ontwikkeling van de laagste CAO-lonen in de periode 1983-1988*, The Hague
- Mooij, R.A. de, 1997, Taxation and human capital accumulation (in Dutch), *Maandschrift Economie*, no. 61, pp. 224-240.
- Nickell, S.J. and M. Andrews, 1983, Unions, real wages and employment in Britain 1951-79, *Oxford Economic Papers* 35, pp. 183-206
- Opstal, R. van, J. Theeuwes, 1986, Duration of unemployment in the Dutch youth labor market, *De Economist*, 134, pp. 351-67
- Opstal, R. van, R. Waaijers and G. Wiggers, 1997, Wage growth of low- and high-skilled workers, *CPB Report*, 1997/2, pp. 38-42
- Pissarides, C.A., 1990, *Equilibrium Unemployment Theory*, Basil Blackwell, Oxford.

Rosen, H.S., 1982, Taxation and on-the-job training decisions, *Review of Economic Studies*, pp. 442-449.

Sinderen, J. van, 1993, Taxation and economic growth, *Economic Modelling* 13, pp. 285-300.

Snower, D.J., 1994, Converting unemployment benefits into employment subsidies, *AEA Papers and Proceedings*, Vol. 84, pp. 65-70

Soest, A. van, 1995, Structural models of family labor supply, a discrete choice approach, *Journal of Human Resources*, Vol. 30, pp. 63-88

Soest, A. van, I. Woittiez and A. Kapteyn, 1990, Labor supply, income taxes and hours restrictions in the Netherlands, *Journal of Human Resources*, Vol. 25, pp. 517-88

Sørensen, P.B., N.K. Frederiksen, P.R. Hansen and H. Jacobsen, 1995, Subsidising consumer services - Effects on employment, welfare and the informal economy, *Fiscal Studies*

Theeuwes, J.J.M., 1988, Arbeid en belastingen, in: *Belastingheffing en belastinghervorming*, Preadviezen van de Koninklijke Vereniging voor de Staathuishoudkunde, Stenfert Kroese, pp. 65-110

Theeuwes, J, C.C. Koopmans, R. van Opstal and H. van Reijn, 1985, Estimation of optimal human capital accumulation parameters for the Netherlands, *European Economic Review*, pp. 233-257.

Theeuwes, J.J.M. and I. Woittiez, 1992, Advising the minister on the elasticity of labor supply, Research Memorandum 92.06, Leiden University

Tummers, J., and I. Woittiez, 1991, A simultaneous wage and labor supply model with hours restrictions, *Journal of Human Resources*, Vol. 26, pp. 393-423

Westerhout, E.W.M.T., 1996, Hidden unemployment in Dutch disability schemes, *CPB-report*, no. 2, pp. 24-29.

Woittiez, I., 1990, *Modelling and empirical evaluation of labor supply behavior*, dissertation

## **Abstract\***

This research memorandum analyzes fiscal policy in the Netherlands by using a revised version of CPB's applied general equilibrium model, called MIMIC. Compared to its predecessor as described by Gelauff and Graafland (1994a), the new MIMIC model contains several new elements, such as endogenous labor supply of breadwinners and single persons, an underground economy, endogenous formation of human capital and a distinction between short- and long-term unemployment. The MIMIC model thus better incorporates the economic impacts of high marginal tax rates and is able to analyze a broader set of policy proposals. In particular, we explore the economic effects of changes in the tax system that currently receive much attention in the Dutch policy debate including lower marginal tax rates, across-the-board reductions in social premiums paid by employers, reductions in these premiums targeted at the unskilled, vouchers for long-term unemployed, and earned income tax credits.

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