



UNIVERSITY OF CYPRUS  
ECONOMICS RESEARCH CENTRE



## Economic Analysis Papers

### **Tax-Free Income vs. In-Work Tax Credits: Effects on Labour Market Participation**

*Panos Pashardes*

*Economics Research Centre and  
Department of Economics,  
University of Cyprus*

*Alexandros Polycarpou*

*Economics Research Centre,  
University of Cyprus*

**No. 01-08  
March 2008**

Publication Editors: Costas Hadjiyiannis, Theodoros Zachariadis

**ERC Sponsors (in alphabetical order)**

Association of Cyprus Commercial Banks

Central Bank of Cyprus

Cyprus Tourism Organisation

Department of Economics, University of Cyprus

Ministry of Finance

Ministry of Labour and Social Security

Planning Bureau

University of Cyprus

**Disclaimer: Views expressed in the Economic Policy Papers and Economic Analysis Papers are of the authors and do not necessarily represent ERC and its sponsors.**

# Tax-free income vs. In-work tax credits: Effects on Labour Market Participation

Panos Pashardes\*  
*University of Cyprus*

Alexandros Polycarpou  
*University of Cyprus*

March 2008

## Abstract

The purpose of this paper is to investigate the effect of two alternative tax policies, high tax-free income and in-work tax credits, on labour market participation rate. In particular, we study the extent to which a generous tax-free labour income can be more effective for raising employment than in-work benefits. For this, we use Cyprus data to estimate the labour market participation decisions of individuals and a tax-benefit model to simulate two revenue equivalent tax regimes: a system with in-work tax credits and low tax-free income; and a system without in-work tax credits but a high tax-free income. We also compute and compare the labour market participation rates among groups with policy interest, such as older workers and women, under the two regimes.

*JEL:* J2, H3

*Keywords:* Tax free income, in-work tax credits, labour market participation.

## 1 Introduction

The objective of this paper is to investigate the relationship between the tax-benefit system and the labour force participation. In particular, we compare the impact on labour force participation from in-work benefits, linked to family composition, and tax-free labour income, with emphasis on the labour force participation among older workers.

---

\*Corresponding author: University of Cyprus, POBox 20537, 1678 Nicosia, Cyprus. Email addresses: Pashardes, p.pashardes@ucy.ac.cy; Polycarpou, polycarpou@ucy.ac.cy.

The investigation of the relationship between the tax-benefit system and the labour force participation goes back to the 1950s (Break, 1957) but it was in the 1970s when research on empirically measuring the effect of taxes on labour supply started. This coincided with development of statistical tools for dealing with the nonconvexities in the budget set caused by taxation (Burtless et al. 1978, Hausman 1979, Heckman 1979). In this context, the impact of tax-benefit reforms on labour market participation and labour supply is extensively investigated in the literature, in view of the importance of full employment in realising the growth potential of the economy and of high labour market participation in reinforcing social cohesion. These targets are particularly emphasised, for instance, in European Union (EU) with country members expected to raise their overall employment rate to 70 percent for the working age population, 60 percent for women and 50 percent for older workers by 2010.

Empirical investigation, in the literature, on the link between the tax-benefit system and employment largely focuses on in-work benefits. This type of benefits give strong incentives to individuals to take up gainful employment by lowering the net replacement rates of persons at minimum wage (Blundell et al 2000, Imervoll et al 2007, Brewer et al 2006). Brewer et al. (2006) studied the replacement of the Family Credit (FC) system with the Working Families Tax Credit (WFTC) system in UK. The main difference of the two systems is the increased generosity of the WFTC and the fact that the WFTC is a payable tax credit rather than an income-related cash benefit. According to Brewer et al. (2006) the introduction of WFTC has increased the employment rate by 5 percentage points for lone mothers and by almost 1 percentage point for men with children. In contrast, the employment rate of married women with children decreases (Elissa et al, 2005). Blundell et al (2004) compare the impact of in-work benefits in the US and the UK in 1990s and find a much higher impact in the US. This is attributed to the fact that, in contrast to the UK, the US in-work benefits do not count as income, while out-of work benefits are limited. Furthermore, Blundell and Hoynes (2004) find that while the replacement of FC by WFTC has a positive effect on the employment of target groups like single parents, the effect on the employment rate of couples with children and with both spouses working is negative. Blundell (2006) attributes the low impact of the introduction of the WFTC system in the UK to interactions of this system with other taxes and benefits and the rise in family allowance which is not conditional on working.

A basic feature of in-work benefits is their linked to family composition, with the main beneficiaries being individuals with children. In contrast, the tax free labour income confers a benefit on all workers. This means that in a revenue neutral reform, away from in-work benefits towards a system with a higher tax free income, is equivalent to a transfer of net income from individuals with to individuals without children. In this paper we investigate the extent to which such a reform can result in a higher overall labour market participation. The rationale behind our analysis is that a reform can result in higher labour market participation when the labour market supply responses among gainers are higher than the same responses among losers. As shown by Saez (2002) using numerical simulations, the optimal programs (in terms of maximising labour market participation) can be sensitive to the size of the participation elasticities. In particular, when participation elasticities are substantial (like in the case of elderly, single mothers or secondary earners) the optimal program should exempt incomes below a threshold from taxation, the guarantee income should be low and the income support to individuals with low income from employment should be taxed away with a fairly high rate as their income increase.

The focus of our analysis here is the labour force participation rate of older people, which has been declining. In 1970, the average effective age of retirement for males in the OECD was around 69 with limited variation across countries. Recently, the average effective age of retirement for men has declined to 63.3 and in several countries (e.g. Austria Hungary, France) is below 60. The retirement age of women, historically lower than men, followed a similar trend. The incentives driving individuals to early retirement are often blamed on the increasing generosity of the social security systems to older people and people with disabilities: many OECD countries have relaxed the entitlement conditions for the recipients of unemployment or disability benefits to older workers, thereby turning these benefits into retirement benefits (Böndal et al. 1999, Burtless et al. 2001, Blundell et al. 2002). Miniaci et al. (1998) show that the participants in occupational pension schemes have higher probability of retirement when the benefit becomes available. There is also an increasing trend towards using poor health as an excuse for early retirement (Miniaci et al. 1998). Many countries respond to these trends by reforms on their tax-benefit system to reduce the disincentive to work. Such reforms include the increase in pensionable age and the pension accrual rates (so that continued work is rewarded in higher pensions) and the tightening of eligibility for early retirement and the unemployment and disability benefits.

The positive relationship between the generosity of the pension system and early retirement suggests that older workers have a relatively high labour market participation elasticity. Evidence also suggests that this elasticity is lower among individuals who have dependent children (Miniaci et al 1998, Quinn et al 1998). Therefore, reforms raising universal in-work benefits at the expense of in-work benefits linked to family composition can increase the overall labour market participation because the gainers are likely to be older individuals without dependants who tend to have a higher labour market participation elasticity than the losers. Here we investigate this hypothesis using data for Cyprus drawn from the European Union Statistics on Income and Living Conditions (EU-SILC) database for 2005.

The structure of the paper is as follows: the next section outlines the empirical model of labour market participation and the results obtained from its estimation; section 3 presents the results from simulating the effects of alternative tax-benefit reforms on the labour market participation; section 4 concludes the paper.

## 2 Empirical model and estimation

The labour market participation decision of individuals is modelled using the structural form participation equation:

$$L_i = 1 \Leftrightarrow \gamma_1 \log (DI_i^1 (y_i, \alpha_i; \theta)) + \gamma_2 \log (DI_i^0 (\alpha_i; \theta)) + \beta X_{i1} + \varepsilon_{i1} \geq 0 \quad (1)$$

where  $L_i = 1$  if the individual  $i$  works,  $L_i = 0$  if  $i$  she/he does not work;  $DI_i^1 (y_i, \alpha_i; \theta)$  and  $DI_i^0 (\alpha_i; \theta)$  are the disposable income in case of employment and non employment, respectively;  $\beta X_{i1}$  captures the observed heterogeneity in preferences for leisure or in reservation income, where  $X_{i1}$  is a vector of demographic characteristics (age, gender, education, experience, marital and health status etc); while  $\varepsilon_{i1}$  captures random errors and the unobserved heterogeneity in the preferences for leisure or in reservation income. Disposable income in case of employment has a positive effect on participation decision thus  $\gamma_1$  is positive and disposable income in case of non employment has a negative effect on participation decision thus  $\gamma_2$  is negative.

The disposable income for the two-activity statuses are given by

$$DI_i^0 (\alpha_i; \theta) = \alpha_i + T_i^0 (\alpha_i; \theta) \text{ in case of non-employment, and} \quad (2)$$

$$DI_i^1(y_i, \alpha_i; \theta) = y_i + \alpha_i + T_i^1(\alpha_i; \theta) \text{ in case of employment,} \quad (3)$$

where  $\theta$  represents all the characteristics of the public transfers system,  $\alpha_i$  represents other than labour or transfer income,  $y_i$  represents labour income (observed in the data only for employed individuals) and  $T_i^0, T_i^1$  are respectively the amount of net public transfers in the case of non-employed and employed individual.

Equation (1) cannot be estimated directly since  $DI_i^1$  cannot be calculated for individuals who are observed in the sample to be non labour market participants since their labour income is unknown. To solve this problem, we use the maximum likelihood missing data procedure proposed by Griliches-Hall-Hausman (1978) to estimate their labour income and use it in the model of labour force participation. Based on this procedure there is a joint specification of the labour income and the participation decision to eliminate potentially biased estimates of the labour income.<sup>1</sup>

Here the labour income equation is defined as

$$\log(y_i) = \delta_1 X_{i2} + u_{i1}, \quad (4)$$

where  $X_{i2}$  is a list of explanatory variables that effect labour income (gender, experience, marital status, etc) and  $u_{i1}$  reflects the unexplained part of labour income (error term); and the selection bias is corrected using the reduced-form participation equation

$$L_i = 1 \Leftrightarrow \lambda_0 \log(DI_i^0(\alpha_i; \theta)) + \lambda_1 X_{i1} + \xi_{i1} \geq 0. \quad (5)$$

The fitted values of  $y_i$  are computed using equation (4), including the potential labour income for the individuals who do not work. Then, the disposable income  $DI_i^1$  is calculated for both working and not working individuals. The effect of  $DI_i^1$  and  $DI_i^0$  on employment is estimated using the structural form participation equation (1), in which demographic and other policy interest characteristics are also included among the explanatory variables.

The dataset used for the regression analysis is the 2005 EU-SILC microdata prepared by the Statistical Service of the Member States on behalf of Eurostat. The dataset contains information on income (level and sources), demographic

---

<sup>1</sup>An upward bias can arise, for example, when the relationship between the participation decision and labour income is ignored because individuals with potentially higher labour income may be more likely to work giving rise to correlation between the disturbance terms of the labour income and participation equations.

characteristics, employment status and other variables for the EU25 plus Norway and Iceland at household and personal level. For the estimations data for Cypriot individuals between the age of 16 and 64 were used. In the dataset there were 7585 individuals satisfying the above criteria for whom information on all variables included in the analysis was available.<sup>2</sup>

Table 1 presents the estimation results of the structural form participation equation together with the results of the reduced form participation equation used in the first step of the Griliches-Hall-Hausman procedure. On the basis of the results from the structural equation, it appears that the probability of employment increases in the ages between 25 and 54. In particular women between the ages 25 and 54 have higher employment probability than younger or older women. Men between 41 and 54 also have higher employment probability than men in other age groups. The family composition has a significant negative effect on the employment mainly among female individuals. More specifically, the labour market participation of women decreases with the number of dependent children and increase with the age of the youngest child. The labour market participation of men does not appear to be affected by the number of the dependent children or the age of the youngest child.

Education has different effect on the employment probability of men and women. Female college or university graduates have a significantly lower probability of employment than lower educated females, with a higher negative effect on employment among university graduates. Among men, individuals with low level of education (elementary, gymnasium, lyceum) have higher probability of employment than higher educated men or illiterate. The health condition of individuals has also a significant effect on employment. Individuals in fair or bad health have lower probability to participate in the labour force. In particular, women in fair health have lower employment probability compared to women in good or very good health, while the employment probability of women in bad health is even lower. Unlike women, fair health does not have a significant effect on the employment probability of men. Bad health, however, decreases the employment probability of men, as it does for women. Experience in the labour market (the number of years individuals have spent working) has a positive but decreasing effect on the probability of employment, especially among women.

---

<sup>2</sup>Twenty one individuals were dropped from the sample because of lack of observations. This was due to their refusal to co-operate or their temporary absence.

*Table 1: Labour market participation equation*

Variables	Structural form			Reduced Form		
	Male	Female	All	Male	Female	All
Male			.018 (.064)			.659*** (.042)
Age 25-40	1.99 (2.13)	4.99*** (1.76)	3.27** (1.37)	-.043*** (.137)	.132*** (.088)	.122** (.069)
Age 41-54	5.02** (2.43)	4.60*** (1.76)	3.99*** (1.39)	-2.00*** (.430)	-.802*** (.123)	-.900*** (.116)
Age 55-64	2.44 (2.34)	1.47 (1.88)	1.56 (1.44)	-3.53*** (.491)	-1.68*** (.154)	-1.92*** (.147)
Number of dependent children	-1.31 (.946)	-2.33*** (.373)	-2.04*** (.319)	.132 (.086)	-.081* (.042)	-.015 (.035)
Age of youngest child less than 5	.150 (.264)	.264* (.164)	.298** (.135)	.396* (.236)	.030 (.119)	.193* (.100)
Age of youngest child between 5-12	.255 (.228)	.372** (.168)	.373*** (.135)	.170 (.219)	.168 (.120)	.246** (.103)
Age of youngest child between 12-18	.266 (.244)	.450*** (.146)	.442*** (.126)	.355 (.260)	.367*** (.120)	.438*** (.109)
Married	.214 (.183)	.015 (.093)	-.031 (.082)	.459*** (.143)	.069 (.071)	.120* (.064)
Elementary	.737*** (.285)	-.054 (.181)	.167 (.157)	.444* (.239)	.099 (.157)	.146 (.127)
Gymnasium	.726** (.324)	-.051 (.198)	.124 (.172)	-.348 (.255)	-.110 (.167)	-.337** (.134)
Lyceum	.675** (.306)	-.178 (.187)	-.007 (.164)	.327 (.252)	.180 (.159)	.110 (.130)
College	.371 (.441)	-.462* (.257)	-.255 (.227)	.021 (.350)	.156 (.408)	.010 (.177)
University	.251 (.324)	-.468** (.201)	-.367** (.173)	.721*** (.266)	.725*** (.164)	.530*** (.134)
Health condition: Fair	-.213 (.139)	-.195* (.102)	-.213*** (.083)	-.167*** (.131)	-.325*** (.086)	-.264*** (.071)
Health condition: Bad	-.612*** (.155)	-.411*** (.135)	-.512*** (.099)	-.937*** (.144)	-.414*** (.194)	-.749*** (.095)
Experience	-.028 (.022)	.076*** (.011)	.042*** (.009)	.243*** (.025)	.203*** (.009)	.199*** (.008)
Experience squared	-.001*** (.0003)	-.001*** (.0002)	-.0005** (.0002)	-.003*** (.0004)	-.003*** (.0002)	-.003*** (.0002)
$\log(DI^I)$	-.664*** (.092)	-.463*** (.095)	-.610*** (.069)	-.196*** (.013)	-.050*** (.009)	-.106*** (.007)
$\log(DI^I)$ x Dummy: age 25-40	.493*** (.097)	.306*** (.100)	.444*** (.072)			
$\log(DI^I)$ x Dummy: age 41-54	.447*** (.110)	.388*** (.098)	.502*** (.072)			
$\log(DI^I)$ x Dummy: age 55-64	.195 (.249)	.191* (.100)	.081*** (.077)			
$\log(DI^I)$ x number of dependent children	-.025 (.058)	-.008 (.024)	-.016 (.023)			
$\log(DI^I)$	1.88*** (.310)	1.66*** (.260)	1.73*** (.220)			
$\log(DI^I)$ x Dummy: age 25-40	-.659* (.348)	-.874*** (.269)	-.785*** (.230)			
$\log(DI^I)$ x Dummy: age 41-54	-.999*** (.374)	-.937*** (.269)	-.953*** (.231)			
$\log(DI^I)$ x Dummy: age 55-64	-.643* (.380)	-.523* (.282)	-.610*** (.238)			
$\log(DI^I)$ x number of dependent children	.167* (.092)	.248*** (.043)	.227*** (.033)			
Constant	-11.55*** (1.86)	-10.48*** (1.67)	-10.08*** (1.29)	-.069 (.249)	-.873*** (.163)	-.634*** (.130)

Number of Obs

7585

Notes: 1. standard errors in brackets

2. \*, \*\*, \*\*\* significant at 10%, 5%, 1% significance level, respectively.

As expected, the employment probability is negatively related to disposable non-employment income and positively related to disposable employment income. In addition, in absolute terms, the magnitude of the effect of disposable employment or non-employment income on the employment probability is larger for men than women, i.e. an increase in the disposable (non-)employment income of men (decrease) increases the employment probability more than a similar increase (decrease) in the disposable (non-)employment income of women.

In the structural form employment equation also included are interaction terms between disposable income (from employment and non-employment) with age and with children. These interaction terms show in the two employment states how the sensitivity of labour market participation to disposable income changes with the age and the number of dependent children of individuals.

- As disposable income from non-employment increases, the labour market participation probability of individuals in all age groups decreases; but, the probability decreases less among individuals in the 25-40 and 41-54 age groups. This means that a higher non-employment income makes younger (16-24) and older (55-64) individuals more reluctant to participate in the labour market than it does individuals between 25 and 54 years old.
- Individuals in the younger (16-24) age group also appear to be more responsive to changes in their income from employment, in the sense that as this income increases their participation increases more than the participation of individuals in other age groups. The lowest response of labour market participation to changes in disposable income from employment occurs among individuals between 25 and 40.
- How disposable income from non-employment affects the labour market participation probability of men and women does not appear to be significantly influenced by the number of dependent children. In contrast, the (positive) effect of disposable employment income on labour market participation increases significantly with the number of dependent children, especially among women.

An interesting result in the context of our investigation is that the magnitude of the effect of a change in income from employment ( $DI_i^1$ ) is greater in absolute

terms than the effect of an equal size change in non-employment income ( $DI_i^0$ ). This suggests that an increase in disposable income from employment (as in the case of an increase in tax-free income examined later in this paper) can be a more effective measure for increasing employment than a measure adding the same amount to non-employment income (e.g. a decrease of unemployment benefit).

Comparing the results obtained from the structural and reduced form equations, one can see that the change in magnitude and sign of variables that are highly correlated with labour income, like education and experience, conforms to expectation based on the fact that the first equation reflects the direct whereas the second can also reflect the indirect effect on employment, the latter operating through labour income. For example, while the structural form equation suggests that university graduates have a lower probability of employment the opposite is true in the reduced form equation. Also in the reduced form equation experience has a significant positive effect on employment for men while in the structural equation experience is insignificant. For women, although the effect of experience is significant in both equations, the magnitude of the effect in the structural equation is about 3 times lower than that in the reduced form equation.

Table 2 presents the results obtained from the labour income equation which are used for the estimation of the unobserved (reservation) labour income of individuals not participating in the labour market. In predicting this income gender, age, education and the experience in the labour market are used as explanatory variables.

Individuals between the ages of 25 to 40 have, on average, 53.7 percent higher labour income compared to younger individuals (aged between 16 and 24). This difference decrease to 33.6 percent for individuals between 41 and 54 and to 37.4 percent for individuals aged between 55 and 64. The effect of age on the wage rate is much higher among men than women. Also other things being equal, men obtain their maximum labour income between the ages 25 to 40 while women obtain their maximum labour income between the ages 55 to 64. It is also interesting that for both men and women labour income decreases between the ages 41 to 54 compared to the labour income of younger individuals; and increases afterwards.

As one would expect, labour income also increases with education. For men this increase is not significant for education below the university level. In the case of women, however, education adds to labour income at all levels. More precisely, women with elementary education have by 29.6 percent higher labour income than

women without education. Also women with gymnasium, lyceum, college and university education have, respectively, 38.4, 68.0, 81.7 and 115 percent higher labour income than the women with no education. As expected, years of experience add to labour income, albeit at a declining rate.<sup>3</sup> Finally, the constant term, suggest that men in the reference group (aged 16-25, without education and work experience) have higher labour income than women with the same characteristics.

*Table 2: Labour income prediction equation*

Variables	Male	Female	All
Male			.353*** (.020)
Age 25-40	.706*** (.066)	.161*** (.057)	.537*** (.046)
Age 41-54	.497*** (.088)	.122*** (.074)	.336*** (.057)
Age 55-64	.584*** (.102)	.336*** (.088)	.374*** (.065)
Elementary	-.124 (.089)	.296*** (.094)	.142** (.071)
Gymnasium	-.070 (.096)	.384*** (.101)	.207* (.075)
Lyceum	-.097 (.094)	.680*** (.095)	.296*** (.073)
College	.044 (.119)	.817*** (.172)	.554*** (.094)
University	.432*** (.096)	1.15*** (.097)	.869*** (.074)
Experience	.103*** (.005)	.036*** (.007)	.086*** (.004)
Experience squared	-.002*** (.0001)	-.0004*** (.0001)	-.001*** (.0001)
Constant	8.03*** (.104)	8.01*** (.111)	7.54*** (.086)
Number of Obs		7585	

Notes: 1. standard errors in brackets

2. \*, \*\*, \*\*\* significant at 10%, 5%, 1% significance level, respectively.

### 3 Simulation results

In this section we use the tax-benefit model for the Cyprus economy, (Andreou et al, 2007) and the estimated structural employment equation, to simulate effects of two revenue neutral tax scenarios on the labour force participation, with emphasis on particular target groups like youngsters, older persons and women. The two tax scenarios are:

<sup>3</sup>The average years of experience are 15.07, for men are 17.98 and for women are 12.25.

- the ‘tax-free income’ where there are no tax-credit allowances and the following income bands and tax rates: for income up to 15380EUR (9000CYP) is tax-free (zero tax rate), income over 15380EUR and up to 20500EUR (12000CYP) is taxed with a rate of 30% and income over 20500EUR is taxed with a rate of 40%; and
- the ‘tax-deductions’ where tax deductions exists for the spouse, the dependent children under 16 years old and the dependent children over 16 who are going in education or military service, but, unlike the tax-free-income scenario, income up to 15380EUR is taxed at 20%.

Under each of the two scenarios above we compute the net disposable income for the 7585 individuals in employment and non employment in our sample. We also compute the same under a system with neither tax-free income or tax-deductions to serve as benchmark for comparison of the labour market participation results from the two tax scenarios. The probability of labour market participation for each individual in the sample is estimated using the structural employment equation described in the previous section.

Table 3 shows the average participation changes by age under the tax-free income and the tax-deductions scenario, relative to the reference system and the difference in these changes between the two scenarios. Among both men and women in all age categories the labour market participation is higher under the tax-free income compared to the tax-deductions scenario, though the two scenarios differ vis-à-vis gender and age. The highest difference between the two scenarios concerns males in the 16-24 age group for which the labour market participation is by 1.8 percentage points higher in the tax-free income than the tax-deductions scenario; whereas this difference is 0.77 for males in the 55-64 age group and only 0.56 for those in the 25-54 age group. As regards females, the highest participation difference between the two scenarios occurs among the 55-64 age group, where the participation rate is by 2 percentage points higher under the tax-free income than under the tax-deductions scenario. For females in the 25-54 age group this difference is 1.4 and for those in the 16-24 age group 0.76 percentage points. Overall, having a high tax-free income rather than tax deductions system increases the participation rate by 1.32 percentage points among the 16-24, by 1 percentage point among the 25-54 and by 1.4 percentage points among the 55-64 age group. Notably, under both scenarios the increase in the labour market participation of

women in higher than men’s (1.4 vs. 0.89) vis-à-vis the reference (neither tax-free income nor tax-deductions) system.

*Table 3: Participation changes under the tax-deductions and tax-free income scenarios*

Age	Men			Women			All		
	Tax deductions	Tax free income	Difference	Tax deductions	Tax free income	Difference	Tax deductions	Tax free income	Difference
16-24	.017 (.008)	1.80 (.101)	1.78 (.101)	.199 (.042)	.958 (.082)	.760 (.069)	.099 (.020)	1.42 (.067)	1.32 (.065)
25-54	2.18 (.057)	2.73 (.065)	.555 (.058)	2.99 (.075)	4.43 (.086)	1.44 (.060)	2.60 (.048)	3.62 (.056)	1.02 (.042)
55-64	3.49 (.164)	4.26 (.164)	.769 (.130)	1.02 (.101)	3.01 (.156)	1.98 (.122)	2.21 (.101)	3.61 (.114)	1.40 (.090)
All	1.87 (.032)	2.75 (.054)	.887 (.048)	2.11 (.055)	3.51 (.039)	1.40 (.046)	1.99 (.036)	3.14 (.043)	1.15 (.033)

Note: standard errors in brackets

The main reason behind the labour market participation advantage of offering individuals a high tax free income rather than tax-deductions is that under the former regime persons without dependent children benefit as much as those with children. Although having children in the family, particularly young ones, is well known to affect the income elasticity of demand for leisure (non-participation in the labour market), especially among spouses, the same elasticity seems to be also affected by age. Indeed, in the context of our analysis, the income elasticity of demand for leisure appears to be more associated with age rather than children: as shown in Table 1, individuals in the 16-24 and 55-64 age groups, who tend to have no dependent children, are more likely to participate in the labour market when their disposable income from employment increases than individuals in the 25-54 age group. Therefore, tax-deductions linked to dependent children and, thereby, biased against individuals in the 16-24 and 55-64 age groups are associated with a lower labour market participation rate compared to a not so biased (revenue equivalent) increase in tax-free income.

To illustrate the argument in the previous paragraph, Table 4 presents the labour market participation differences between the two tax scenarios by age and number of dependent children. As expected, the positive differences in the table occur among individuals without dependent children in all age groups because these individuals benefit under the high tax-free income but not under the tax-deductions regime. Negative differences, indicating an advantage for the

tax-deductions over the high tax-free income scenario, occur among individuals with dependent children. Yet, the labour market participation advantage of the high-tax income scenario observed among all individuals without and some individuals with dependent children (women with up to two children) is generally more pronounced than the corresponding advantage of the tax-deductions scenario observed only among individuals with dependent children. This results in a net overall labour market participation advantage for the high-tax income scenario.

*Table 4: Participation differences between the tax-free and tax-deduction scenarios by age and number of children*

Number of Children	Men			Women			All		
	16-24	25-54	55-64	16-24	25-54	55-64	16-24	25-54	55-64
0	<b>1.81</b> (.103)	<b>2.28</b> (.123)	<b>1.40</b> (.133)	<b>.816</b> (.075)	<b>3.36</b> (.137)	<b>2.11</b> (.127)	<b>1.37</b> (.068)	<b>2.84</b> (.093)	<b>1.79</b> (.093)
1	.0001 (.0001)	<b>-.360</b> (.133)	<b>-1.87</b> (.380)	<b>.177</b> (.055)	<b>1.05</b> (.092)	<b>.868</b> (.419)	<b>.135</b> (.043)	<b>.403</b> (.082)	<b>-.904</b> (.309)
2	.0000 (.0000)	<b>-.427</b> (.031)	<b>-1.65</b> (.353)	.0001 (.0001)	<b>.295</b> (.055)	.102 (.887)	.0000 (.0000)	-.048 (.034)	<b>-1.18</b> (.366)
3		<b>-.368</b> (.032)	<b>-1.70</b> (.626)	.015 (.015)	.008 (.042)	<b>-1.48</b> (.731)	.015 (.015)	<b>-1.71</b> (.028)	<b>-1.65</b> (.494)
4 or more		<b>-.211</b> (.025)	-1.63 (1.62)		-.003 (.049)			<b>-1.05</b> (.029)	-1.63 (1.62)
All	<b>1.78</b> (.101)	<b>.555</b> (.058)	<b>.769</b> (.130)	<b>.760</b> (.069)	<b>1.44</b> (.060)	<b>1.98</b> (.122)	<b>1.32</b> (.065)	<b>1.02</b> (.042)	<b>1.40</b> (.091)

Note: 1. standard errors in brackets.

2. Figures in bold are significant at 5% significance level.

## 4 Conclusions

Countries throughout the world often resort to in-work benefits to encourage higher labour market participation. Empirical investigations, in general, find these measures to have a positive effect on labour market participation, however, this effect varies between groups of individuals and between countries.

This paper investigates the labour market participation effect from linking in-work benefits to the number of dependent persons (spouse and children). According to our empirical findings (based on Cyprus data) such a linkage can result in a smaller increase in labour market participation than a revenue equivalent universal tax-free income from employment. This result is obtained from modelling

and estimating the labour market participation decision assuming that individuals base this decision on their personal and family characteristics as well as their disposable income from employment and non-employment. The parameter estimates are then used in a tax-benefit model to simulate the tax liability of the individuals under two alternative revenue equivalent tax scenarios: one with a high tax-free income and no tax-deductions for spouse and children; and one with tax tax-deductions for children and spouse but no tax free income.

Underlining differences in the impact of in-work benefits on labour market participation corresponding to alternative tax policies is the elasticity of demand for leisure of the beneficiaries of such policies. In the context of our analysis the labour market participation advantage of a high tax-free income, rather than tax-deductions for dependents, arises from differences in the distribution of benefits between the two scenarios: the tax-deductions linked to dependents do not benefit individuals in the 16 to 24 and 55 to 64 age groups, whereas a high tax free income is uniformly distributed across all individuals. According to our empirical findings, based on Cyprus data, the exclusion of younger and older workers from in-work benefits does not help increase the overall labour market participation because these are the individuals with the highest income elasticity of demand for leisure.

In interpreting the results above, one has to consider that the focus of the analysis in the paper is labour market participation, so that the effects of alternative tax policies on the supply of hours are ignored. This may or may not be a serious limitation depending on how far one is prepared to accept that encouraging non-participants to enter the labour market is often a higher priority than increasing the labour supply of those already in employment. Nevertheless, excluding the effects on hours supplied means that the difference between the overall employment effects between the two tax policies considered in the paper is not known.

Another limitation of our analysis is that no attention is paid to distributional effects associated with alternative tax policies. For instance, while tax-deductions linked to dependents may not be as effective as a high tax-free income in terms of labour market participation, one may favour such tax-deductions because they are more likely to reduce income inequality. Thus, the analysis needs to be extended to incorporate welfare considerations before one can conclude that one tax policy is socially more preferable to another.

## References

- Andreou M., N. Nikolaidou, A. Polykarpou and S. Hadjispyrou, 2007, "Tax-benefit microsimulation model for the Cyprus economy", *Economic Policy Paper*, 12-07, Economics Research Centre, University of Cyprus.
- Blöndal, S., and S. Scarpetta, 1999, "The Retirement Decision in OECD Countries", *OECD Economics Department Working Papers*, 202, OECD Publishing.
- Blundell, R., A. Duncan, J. McCrae, and C. Meghir, 2000, "The Labour Market Impact of the Working Families Tax Credit", *Fiscal Studies*, 21, 65-74.
- Blundell, R., C. Meghir, and S. Smith, 2002, "Pension Incentives and the Pattern of Early Retirement", *Economic Journal*, 112, 153-170.
- Blundell, R., and H.W. Hoynes, 2004, "Has 'In-Work' Benefit Reform Helped the Labour Market?", *Seeking a Premier League Economy*, ed. by R. Blundell, D. Card and R. Freeman, University of Chicago Press: Chicago.
- Blundell, R., 2006, "Earned Income Tax Credit Policies: Impact and Optimality, The Adam Smith Lecture 2005", *Labour Economics*, 13, 423-443
- Break, G.F., 1957, "Income Taxes and Incentives to Work: An Empirical Study", *American Economic Review*, XLVII, 529-49.
- Brewer, M., A. Duncan, A. Shephard, and M.J. Suárez, 2006, "Did working families' tax credit work? The impact of in-work support on labour supply in Great Britain", *Labour Economics*, 13, 699-720.
- Burtless, G., and J. Hausman, 1978, "The Effect of Taxation on Labor Supply: Evaluating the Gary Negative Income Tax Experiment", *Journal of Political Economy*, 86, 1103-1130.
- Burtless, G., and J. F. Quinn, 2001, "Retirement Trends and Policies to Encourage Work Among Older Americans", *Boston College Working Papers in Economics*, 436.
- Eissa, N.O., and H.W. Hoynes, 2005, "Behavioural Responses to Taxes: Lessons from the EITC and Labor Supply", *NBER Working Paper*, No. W11729.
- Griliches, Z., B. H. Hall, and J. A. Hausman, 1978, "Missing Data And Self-Selection in Large Panels", *Annales de L'INSEE*, 30-31, 137-176.
- Hausman, J.A., 1979, "The econometrics of labour supply on convex budget sets", *Economic Letters*, 3, 171-174.
- Hausman, J. A., 1985, "Taxes and Labour Supply", *Handbook of Public Economics*, 1, ed. by A. Auerbach and M. Feldstein, North-Holland Publishers, 213-263.
- Heckman, J., 1979, "Sample bias as a specification error", *Econometrica*, 47, 153-161.
- Immervoll, H., H.J. Kleven, C.T. Kreiner, and E. Saez, 2007, "Welfare reform in

- European countries: a microsimulation analysis”, *Economic Journal*, 117, 1–44.
- Miniaci, R., and E. Stancanelli, 1998, "Microeconomic Analysis of the Retirement Decision: United Kingdom", *OECD Economics Department Working Papers*, 206, OECD Publishing.
- Pencavel, J., 1986, “Labor supply of men”, *Handbook of Labor Economics*, 1, ed. by O. Ashenfelter and R. Layard, North-Holland Publishers, 3–102.
- Quinn, J., R. Burkhauser, K. Cahill, and R. Weathers, 1998, "Microeconomic Analysis of the Retirement Decision:n United States", *OECD Economics Department Working Papers*, 203, OECD Publishing.
- Saez, E., 2002, “Optimal Income Transfer Programs: Intensive Versus Extensive Labour Supply Responses,” *Quarterly Journal of Economics*, 117, 1039-1073.

### Recent Economic Policy/Analysis Papers

- 13-07 Hasapis C., "Financial and economic convergence in the European Union", December 2007 – in Greek.
- 12-07 Andreou M., N. Nikolaidou, A. Polykarpou and S. Hadjispyrou, "Tax-benefit microsimulation model for the Cyprus economy", December 2007 – in Greek.
- 11-07 Pashardes P., "Tackling child poverty and promoting the social inclusion of children", December 2007.
- 10-07 Christofides L. and K. Vrachimis, "The Gender Wage Gap in Cyprus", December 2007.
- 09-07 Eliophotou–Menon M., N. Pashourtidou, A. Polykarpou and M. Socratous, "Students' employment and earnings expectations in Cyprus", December 2007 – in Greek.
- 08-07 Mamuneas T. and C.S. Savva, "Public expenditure in infrastructure and the productivity of the private sector", November 2007 – in Greek.
- 07-07 Athanasiadou M., T. Mamuneas and C.S. Savva, "R&D in Cyprus and the EU", October 2007 – in Greek.
- 06-07 Kontolemis Z., S. Nicolaou, N. Pashourtidou and C.S. Savva, "Business and consumer surveys in the European Union: What do they tell us?", July 2007.
- 05-07 Christofides L., A. Kourtellos and K. Vrachimis, "New unemployment indices for Cyprus and their performance in established economic relationships", July 2007.
- 04-07 Mamuneas T. and C.S. Savva, "The efficiency of Cypriot commercial banks: Comparison with Greece and the UK", June 2007.
- 03-07 Hassapis C., "Inflation, Long Term Interest Rate Convergence and the Maastricht Criteria", April 2007 – in Greek.
- 02-07 Pashardes P., S. Hajispyrou and N. Nicolaidou, "Poverty in Cyprus: 1991-2003", March 2007 – in Greek.
- 01-07 Christofides L., A. Kourtellos and K. Vrachimis, "Unemployment indices for Cyprus: A comparative study", March 2007.
- 13-06 Christofides L., A. Kourtellos and I. Stylianou, "Approaches towards the development of a model of the Cyprus economy", December 2006 – in Greek.