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Abstract

In Italy, poverty and disability are two strictly related issues (Parodi, 2004, 2006, 2007; Parodi and Sciulli, 2008; Davila Quintana and Malo, 2012). Moreover, public transfers are not sufficient to exlude households with at least one disabled member from the poverty risk. We simulate a simple Real Business Cycle model to investigate the macroeconomic effects of a permanent increase in civilian disability pensions. In particular, we stress whether such a policy action is effective to stimulate private consumption. The exercise is implemented through both temporary and permanent reduction of public spending. Results show that in the long run a minimum increase in civilian disability pensions allows households with one disabled member to consume more and, importantly, to exit from poverty condition. In the short run we observe a policy trade-off. If public spending reduction is temporary and fast, private consumptions immediately increase but output deeply falls. On the contrary, if public spending permanently and slowly reduces, the recessionary effect softens but private consumptions only gradually increase.

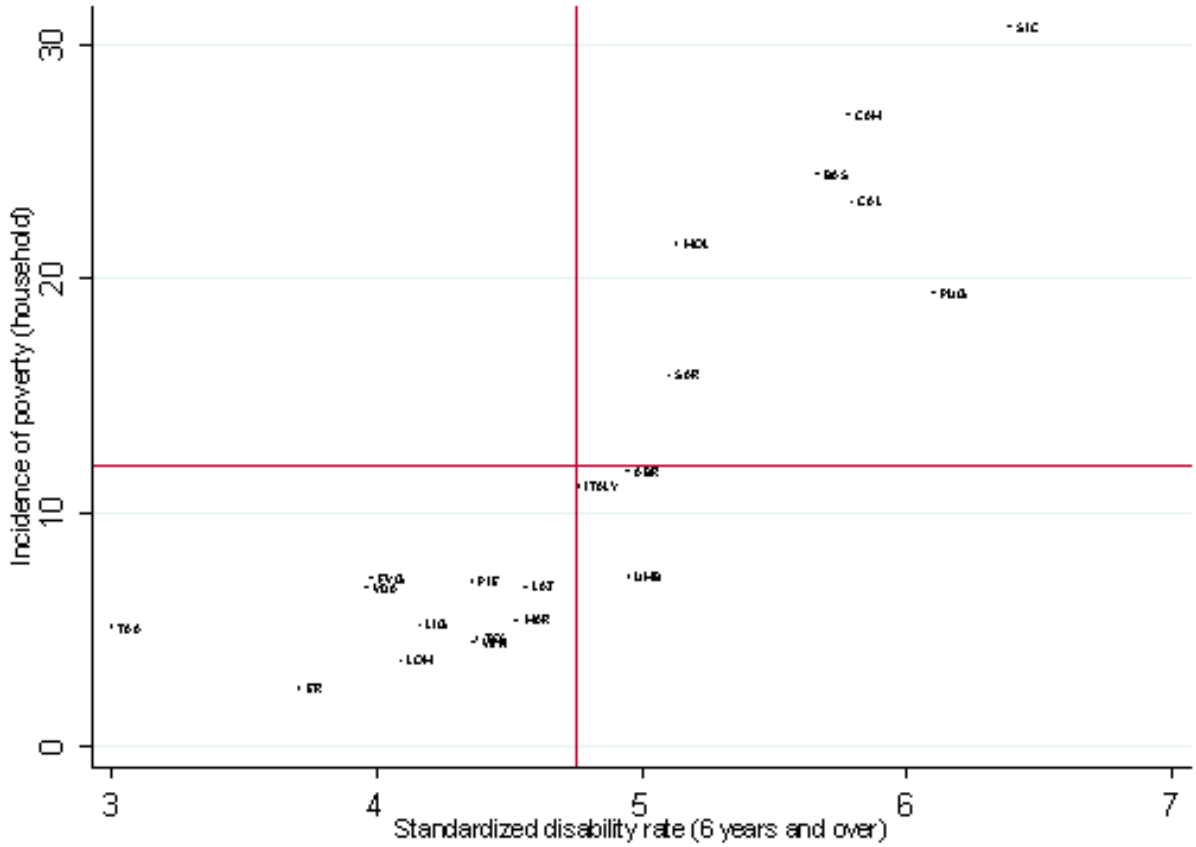
Keywords: *Disability, Poverty, Fiscal policy*
JEL Classification: *J14, I14, E62*

1. Introduction

Among the European countries, in Italy the poverty risk is one of the highest (EUROSTAT, 2012). As a matter of fact, the 19,4% of individuals holds a disposable income which is lower than the poverty threshold, against the 17% in UE28. The empirical literature on disability argues that households with one or more disabled members are mainly exposed to the poverty risk (Parodi, 2004, 2006, 2007; Parodi and Sciulli, 2008; Davila Quintana and Malo, 2012).

Figure 1 shows the strong relationship between the disability rate and the incidence of poverty in Italy (the correlation coefficient is equal to 0.88 and significant at 1%). It is clear that when the disability rate grows up the incidence of poverty increases. In particular, the South regions of Italy feature poverty and disability rates higher with to respect to the national average (crossroads between the vertical and horizontal line). The opposite holds for the North regions of Italy.

Figure 1 - Relationship between poverty incidence (household) and standardized disability rate (6 years and over), 2005



Source: our data processing ISTAT (2014b).
Legend: North regions of Italy: Lombardia (LOM), Liguria (LIG), Piemonte (PIE), Valle d'Aosta (VDA), Friuli-Venezia Giulia (FVG), Emilia-Romagna (ER), Trentino-Alto Adige (TAA) and Veneto (VEN); Central regions of Italy: Lazio (LAZ), Marche (MAR), Toscana (TOS), Umbria (UMB) e Abruzzo (ABR); South regions of Italy: Abruzzo (ABR), Basilicata (BAS), Calabria (CAL), Campania (CAM), Molise (MOL), Puglia (PUG), Sicilia (SIC) and Sardegna (SAR):.

The literature on disability argues that a disabled member reduces the household' sources of income. In fact, the spouse leaves the job to devote her time to the disabled people's needs.

Moreover, public transfers are not sufficient to compensate the income loss of the spouse caring of the disabled member. Furthermore, most of the pension is used to provide medical cares for the disabled people (Parodi and Sciulli, 2008)[3]. On the other hand, public transfers produce positive but not sufficient effects.

The main tools adopted to reduce the poverty risk for households with disabled members are disability pensions and social expenditures (expenditures for social interventions and services). Pensions are determined at national level while social expenditures are fixed at regional and municipal level. That's why it's very difficult to empirically treat this tool.

Figure 2 shows the key role of transfers in reducing the poverty risk of disabled people. After public transfers the risk is reduced by more than 100%, reaching 140% in 2009 (see the rate of growth in Figure 2).

Although the positive effect of transfers, the poverty risk is still high (it's about 30%). Therefore, massive interventions are necessary, especially in South of Italy (see Agovino and Parodi, 2012).

Figure 2 – Percentage of disabled members before and after public transfers, 2005-2012

Source: our data processing EUROSTAT.

Therefore, under the assumption of severe disability, this paper asks the following questions:

— How much do civilian disability pensions (CDP, henceforth) need to increase in order to flush out households with disabled member from the poverty status?

— Which are the effects on the key macroeconomic variables after an increase in CDP?

[3] Households provide for the deficiencies of Italian welfare system supporting sizable social costs. ISTAT (2014 a) reports that the 55% of households with one disabled member receives backing from other households, the 7.8% from paid staff and only the 0.8% from social operators.

To answer to the questions above we simulate a *Dynamic Stochastic General Equilibrium Model, DSGE*. These models imply that each equation has an economic interpretation which allows a clear identification of policy actions and their transmission mechanisms (Peiris and Saxegaard, 2007).
As far as we know, this is the first contribution in the literature analysing, in a general equilibrium framework, the macroeconomic effects of a fiscal policy devoted to unburden the economic conditions of households with a disabled member.
Results show that an increase of 0.1% of CDP importantly guarantees the exit from poverty status for households with a disabled member and entails an increase of their consumption. Moreover, in the short run we observe a policy trade-off. If public spending reduction is temporary and fast, private consumptions immediately increase but output deeply falls. On the contrary, if public spending permanently and slowly reduces, the recessionary effect softens but private consumptions only gradually increase.
The paper is organized as follows. The next section reports a processing data exercise about the poverty risk of households with disabled member. Section 3 describes the model, the fiscal policy exercise implementation and parameters' calibration. Section 4 shows the results and, finally, section 5 concludes.

2. The poverty risk of households with a disabled member. An exercise using Italian data.

In this section we compute the fraction of income that household have to spend for the disabled people's care. We also compute the target value of CDP which is necessary to cover these costs and to exclude the poverty risk for households with a disabled member.
We will make very simple assumptions helping us to overcome problem of the lack of data.

2.1 Share of income needed to cover disability costs

2.1.1 Computational issues on income of households with and without disabled member

A precise measure of fraction of income devolved to cover disability cost is not actually available. Therefore, we proceed to its computation making the following hypothesis on households.
In our model we consider two groups of households:

— *ND* household composed by three adult and non disabled persons. Two out of three persons work and thus have a labour income. Both have a full-time job (8 hours per day and six days per week or, equally, 220 days per year). We assume that the two workers are a male and a female. The third individual could be an adult son/daughter that never worked. The last assumption makes easier the analysis because it excludes the unemployment benefits from household's income computation.

— *D* household composed by three individuals, including one disabled member. Only the male works full time, while the female doesn't work devoting her time to disabled people's cares. The household's income will be the male's labour income plus public transfer in favour of the disabled people.

We assume that the disabled member is affected by a severe disability. If this is the case the nation-state provides the CDP and also the attendance allowance. Moreover we have also to consider the expenditure for social services in favour of disabled members.

We take into account different data sources. In particular, the labour income by gender is from INPS[4] data, the CDP plus the attendance allowance and expenditure for social services are from ISTAT (2014)[5].

Table 1 reports the income computation of *D* and *ND* household. The income inequality between the two types is clear. In particular, we observe that *D* household's income is the 85% of the *ND* household's income. Public transfers in favour of *D* households are not sufficient to make incomes equal. This result is in line with the empirical literature arguing that *D* households are mainly exposed to the poverty risk (Davila Quintana and Malo, 2012; Parodi, 2007; Parodi and Sciulli, 2008; Parodi and Sciulli, 2012a; Parodi and Sciulli, 2012b).

The major poverty risk for *D* households is evident computing the equivalized income and its comparison with the poverty line. Following Davila Quintana and Malo (2012), we compute the modified OECD scale. Such a scale assigns a different weight to each household's member. In particular, it appoints weight 1 to the first adult, 0.5 to other adult individuals and 0.3 to children below 14 years. The modified OCED scale reads as follows: $E = 1 + 0.5 * (N_A - 1) + 0.3 * N_{CH}$, where N_A is the adults' number and N_{CH} is the childrens' number. From the equivalized income computation, allowing a comparison between the two households' incomes, we observe that both incomes are above the poverty line. However, *D* household's income is much lower than the *ND* household's income. In particular, we observe that *D* household's income is 1.53 times the poverty line, while *ND* household's income is 1.80 times the poverty line. This way to build the poverty line has been strongly criticized because it doesn't take into account disability (Davila Quintana and Malo, 2012; Kuklys, 2005). Kuklys (2005) considers an equivalence scale assigning a weight of 1.56 to disabled members; the same has been done by Davila Quintana and Malo (2012) for European data processing. Therefore now the modified OCED scale reads as follows: $[1 + 0.5 * (N_D - 1)] + 0.5 * (N_A - N_D) + 0.3 * N_{CH}$, where N_A is the adults' number, N_D is the disabled

[4] http://www.inps.it/webidentity/banchedatistatistiche/menu/dipendenti/main.html (last access april 29, 2015).
The household income is equal to the sum of the labor income out of personal taxes and social contributions from household members.

[5] http://dati.istat.it/Index.aspx?DataSetCode=DCIS_SPESESERSOC&Lang= (last access april 29, 2015).

members' number e N_{CH} is the children's number. As for *ND* households the modified OECD scale is exactly the one previously considered. With respect to the previous formula, we observe that the equivalence coefficient increases for a *D* household. Moreover, also the equivalized income of disabled members reduces by 4000 euro. This result highlights how much it's important to consider disability to study the poverty issue and that the poverty risk is underrated when disability is excluded from the poverty line computation. This calls for much massive interventions of the policy maker.

Table 1- Income per household type, year 2013(*)

AVERAGE ANNUAL VALUES	YEAR 2013	
APPROXIMATION HOUSEHOLD INCOME	*D* HOUSEHOLD	*ND* HOUSEHOLD
Average annual salary (male) (+)	24376,15322€	24376,15322€
Average annual salary (female) (+)	.	16728,36482€
Civilian disability pension with attendance allowance (+)	7756,72€	.
Expenditure for social interventions and services (+)	2886€	.
HOUSEHOLD INCOME	**35018,87322€**	**41104,51803€**
Computation of the equivalized income		
modified OECD scale: $E = 1 + 0.5 * (N_A - 1) + 0.3 * N_{CH}$	2	2
equivalized income without revision for disability	17509,43661€	20552,25902€
Poverty line (60% of median equivalent income)	11418,50869€	
equivalence scale including disability: $E = 1.56 * [1 + 0.5 * (N_D - 1)] + 0.5 * (N_A - N_D) + 0.3 * N_{CH}$	2,56	2
equivalized income with revision for disability	13679,24735€	20552,25902€
Poverty line (60% of median equivalent income)	10269,45191€	

Source: our data processing on INPS and ISTAT.

2.1.2 Social costs computation

In the costs of diseases analysis, evaluations of costs associated to illness are defined as social cost studies (Montanelli and Gerzeli, 2001; Amato et al., 2002; Patti et al., 2011; Leardini et al., 2002; Casado et al., 2006; Kobelt et al., 2004; Kobelt, 2006; Kobelt et al., 2006a; Kobelt et al., 2006b; Russo et al., 2004; Naci et al., 2010)[6].

Social costs are classified as: direct, indirect and intangible.

Direct costs denote the value of health and not health resources spent for diagnosis, treatment and illness therapy[7].

Indirect costs refer to the missing production because of illness or of time devoted to the care of disabled people.

[6] For further details on disability extra costs see Tibble (2005).

[7] Clinical examinations, specialist examinations, pharmacological terapy.

Intangible costs include all the negative effects produced by illness and that worsen the quality of life of the disabled individual and of its family[8].

So far, social costs have been estimated using micro data with reference to specific illnesses (Amato et al., 2002; Patti et al., 2011; Leardini et al., 2002; Casado et al., 2006; Kobelt, 2006; Kobelt et al., 2006a; Kobelt et al., 2006b; Russo et al., 2004; Naci et al., 2010). As far as we know, macro data allowing a quantification of disability costs are not available. In this study we are exclusively interested to the effects of disability on household's income. Therefore we need to compute the costs burdening the family income.

From ISTAT data, it emerges that spending for the care of disabled people is 29.5% of family income. This implies that 48% of households reduces consumption to pay dedicated staff, 20% corrodes saving and 2.8% has to borrow. In order to have a measure of direct costs, we consider the 29.5 income family with at least one disabled person as a portion of direct costs. We exclude from the calculation the intangible costs, as it is impossible to get information on their amount.

As for the computation of indirect costs we assume that the family member deciding to not work and to care about the disabled member is the spouse. In fact, according to ISTAT (2014, a b) the care job is mainly carried out by females.

To compute indirect costs we use the human capital approach. This allows to estimate the productivity loss due to disability. The labour incomes are used to assess the productivity loss due to the morbidity, assuming that labour income reflect productivity (Tarricone et al., 2000). Following Tarricone et al. (2000) we apply (for both disabled member and who takes care of him) the following formula:

$$PLNE = NUDP * ALFR * (100 - UR) * AAW$$

where PLNE is the production losses by not employed; NUDP is the number of unemployed disabled people; ALFR is the active labour force rate; where (100-UR) is the percentage of the not employed disabled people. The product $NEP * (100 - \mathrm{UR}) * ER$ is the participation rate to the labour market of disabled members. AAW is the average annual wage of an employee (Netten and Beecham, 1993). Unfortunately, data on disabled persons in working age (15-64) are not available. As a matter of fact, ISTAT provides the overall number of disabled persons. Therefore the PLNE computation is misrepresented. This actually allows us to compensate, only partially, other disability costs that otherwise we cannot compute.

We apply the same formula for the spouse that devolves her time to the disabled people's care:

$$PLNE = NUW * AFLFR * (100 - FUR) * FAAW$$

[8] Deterioration of social relationship, isolation, anguish, all affect the quality of life of the patient (Montanelli and Tarricone, 1997).

where NUW is the number of unemployed women; AFLFR is the active female labour force rate; and (100-FUR) is the percentage of unemployed women who gives her time to take care the disabled person. FAAW is the female average annual wage of an employed women.
From ISTAT (2014 b) NUW is equal to 15,5% computed for the number of women in working age (15-64).

2.1.3 Direct and indirect costs

Tables 2 and **3** report the indirect costs associated to the disabled person which doesn't work and to the spouse which substitutes job with the disabled people's care. Moreover, **Table 4** reports total costs (direct plus indirect) for disability.
In particular, the total cost supported by a *D* household for the disabled member is 16250,22468€ per year. It's worth stressing to highlight that this cost is distorted because it doesn't include other disability costs that cannot be quantified.

Table 2- PLNE associated to the disabled person not working, 2013

PLNE associated to the disabled person not working		
VARIABLES	DATA	DATA SOURCES
Total of disabled people (A)	4100000 (6,7% of population)	ISTAT
% of disabled people unemployed individuals (B)	40%	ISTAT
NUDP (C = (A * B)/100)	1640000	
ALFR (D)	0,634	ISTAT
(100-UR) (E)	0,879	ISTAT
(*)TALFRDP (F=C*D*E)	913949,04	
AAW (G)	21137,83297€	INPS
Total PLNE (H)	19318902155€	
Annual average PLNE per disabled member (per household)	4711,927355€	

*Theoretical active labour force of disabled people

Table 3 - PLNE associated to the spouse not working and taking care of the disabled member, 2013

PLNE associated to the spouse not working and taking care of the disabled member		
VARIABLES	DATA	DATA SOURCES
Female population in age working (A)	19478721	ISTAT
% of unemployed women because of disabled people's care (B)	15,50%	ISTAT
NUW (C =(A * B)/100)	3019201,755	
AFLFR (D)	0,536	ISTAT
(100-FUR) (E)	0,869	ISTAT
(*) TAFLFR (F=C*D*E)	1406295,87	
FAAW (G)	16728,36482€	INPS
Total PLNE (H)	23525030357€	
Annual average PLNE for disabled people's care (per household)	1207,729725€	

Table 4 - Total costs supported by *D* households (yearly average), 2013

	COSTS
Total indirect costs	5919,65708€
Total direct costs (29,5% of family income)	10330,5676€
TOTAL COSTS (yearly average)	16250,22468€

The rest of the section concerns the computation of the share of income of *D* households devolved to the disabled people's care. Moreover we assess how much do CDP need to increase in order to cover disability costs. Public transfers actually include not only CDP but also expenditures for social interventions in favour of disabled persons. However, in our exercise we consider such an expenditure as a fixed cost which is not adjustable by the fiscal authority. In particular, we are exclusively interested to investigate the effects of a permanent variation of CDP.

The share of income devolved to the disabled people's care is given by the ratio between the total costs (16250,22468€) and the *D* household income (35018,87322€). It is equal to 0.46; therefore the 46% of the household income is devoted to the care of disabled people[9].

To compute the target value of CDP we proceed as follows:

$$\frac{social\ costs\ (direct+indirect)}{civilian\ disability\ pension\ with\ \ attendance\ allownace+expenditure\ for\ social\ interventions\ and\ \ services}=1$$

We assume that social costs are entirely covered by public transfers. Therefore in order to totally repay the total costs, the CDP should be increased by 5607€ per year (it's about the 72% of the current amount of CDP). Once we have taken into account the social costs, it's interesting to stress the effects on the *D* households income (**Table 5**). From the equivalized income's computation, when the equivalence coefficient does not consider disability, it emerges that *D* households are never below the poverty threshold. By the opposite, when we consider disability results notably change. First of all, the incomes of the two groups of households become much different and *D* households are now below the poverty threshold by about 1033,6254€ (8365,128705€-7331,503335€). Therefore, the intervention by the policy maker becomes necessary. Thus we ask: what does happen, in terms of poverty risk, once the CDP increase by 0.1% at the aggregate level (or, equivalently, by 72% per household)? (see **Table 6**). When we compute the equivalized income without considering disability, we observe that *D* households face a bigger poverty risk but they are actually far from the poverty line. When we correct the equivalence coefficient taking into account disability we verify that the difference in incomes of the two groups of households is very

[9] Studies for United kingdom show that the extra-costs associated to disability vary between 30-40% of family income (Zaidi and Burchardt, 2005; Morciano et al., 2012).

pronounced. Moreover, although *D* households are not below the poverty threshold (9019,601955€), the poverty risk is very high. As a matter of fact, the difference between the *D* household income and the poverty line is only of 500€(9513,080835€-9019,601955€).

The increase of 72% of CDP allows to *D* households to exit from the poverty status but the brink is very small.

We can suppose that the probability that *D* households are below the poverty threshold is very high. In fact, because of data lack we have excludes a lot of other costs from the social costs' computation. This implies that, if we considered all the social costs, the increase of CDP should be much higher than 72%.

Table 5 – Family income per household type out of social costs, year 2013

ANNUAL AVERAGE VALUES	YEAR 2013	
APPROXIMATION HOUSEHOLD INCOME	***D*** **HOUSEHOLD**	***ND*** **HOUSEHOLD**
Average annual salary (male) (+)	24376,15322€	24376,15322€
Average annual salary (female) (+)	.	16728,36482€
Civilian disability pension with attendance allowance (+)	7756,72€	.
Expenditure for social interventions and services (+)	2886€	.
DIRECT COSTS (-)	10330,5676€	.
INDIRECT COSTS (-)	5919,65708€	.
HOUSEHOLD INCOME	18768,64854€	41104,51803€
Computation of the equivalized income		
modified OECD scale: $E = 1 + 0.5 * (N_A - 1) + 0.3 * N_{CH}$	2	2
equivalized income without revision for disability	9384,324268 €	20552,25902€
poverty line (60% of median equivalent income)	8980,974985€	
equivalence scale including disability: $E = 1.56 * [1 + 0.5 * (N_D - 1)] + 0.5 * (N_A - N_D) + 0.3 * N_{CH}$	2,56	2
equivalized income with revision for disability	7331,503335 €	20552,25902€
Poverty line (60% of median equivalent income)	8365,128705€	

Table 6 - Family income per household type out of social costs including the increase of CDP with attendance allowance, year 2013.

ANNUAL AVERAGE VALUES	YEAR 2013	
APPROXIMATION HOUSEHOLD INCOME	***D*** **HOUSEHOLD**	***ND*** **HOUSEHOLD**
Average annual salary (male) (+)	24376,15322€	24376,15322€
Average annual salary (female) (+)	.	16728,36482€
Civilian disability pension with attendance allowance (+)	7756,72€	.
Increase of 72% of CDP (+)	5584,8384€	
Expenditure for social interventions and services (+)	2886€	.
DIRECT COSTS (-)	10330,5676€	.
INDIRECT COSTS (-)	5919,65708€	.
HOUSEHOLD INCOME	24353,48694€	41104,51803€
Computation of the equivalized income		

modified OECD scale: $E = 1 + 0.5 * (N_A - 1) + 0.3 * N_{CH}$	2	2
equivalized income without revision for disability	12176,7434€	20552,25902€
Poverty line (60% of median equivalent income)	9818,700745€	
equivalence scale including disability: : $E = 1.56 * [1 + 0.5 * (N_D - 1)] + 0.5 * (N_A - N_D) + 0.3 * N_{CH}$	2,56	2
Equivalized income with revision for disability	9513,08083€	20552,25902€
Poverty line (60% of median equivalent income)	9019,601955€	

3 . The Model

This section describes the model equations. Then, it focuses on the fiscal policy exercise implementation and finally reports the parameters'calibration.

The economy is populated by firms, households and government.

Firms maximize their profits by taking into account their technological constraint.

Households maximize their utility function defined on consumption and labor, both subject to distortionary taxation. In particular, there are two groups of households: households without any disabled member (*ND*) and households with one disabled member (*D*). The former optimally make their choices in a forward-looking perspective. The latter, as it's shown in disability literature (see Parodi and Sciulli, 2008; Davila Quintano and Malo, 2012), have a lower disposable income because of disability expenditures. For that matter, the meager Italian welfare system doesn't support them. Therefore, we assume that these households are *rule of thumb* (see Campbell and Mankiw, 1989; Fuhrer, 2000; Galí, Lopez-Salido, Vallés, 2004, 2007; Bilbiie, 2008; Cowell, Karagiannaki and McKnight, 2012; Anderson, Inoue and Rossi, 2013; Iacoviello and Pavan, 2013), since they cannot save neither allocate intertemporally their consumption. Therefore, in each period t, they entirely consume their disposable income.

The fiscal authority finances current expenditures by raising labour income and consumption taxes[10].

3.1 Households

There exists a continuum of households i, with $i \in [0,1]$ infinitively living. *D* and *ND* households are respectively defined on the intervals $[0, \Omega]$ and $(\Omega,1]$. All the households share the same utility function[11]:

$$\mathbf{U_t^i = E_t \sum_{t=0}^{\infty} \beta^t \left\{ \frac{c_t^{i(1-\sigma)}}{(1-\sigma)} - \frac{h_t^{i(1+\varphi)}}{(1+\varphi)} \right\}} \qquad [1]$$

[10] For simplicity, we assume constant public debt. Therefore the fiscal authority doesn't issue new public debt.

[11] The function u is incresing in consumption, decreasing in labor and strictly concave.

c_t^i and h_t^i represent individual consumption and labour at time t, β is a subjective discount factor $(0 < \beta < 1)$, E_t denotes the mathematical expectation operator conditional on information available at time t. The parameters σ and φ are the inverse of the intertemporal elasticity of consumption and labor supply, respectively.

3.1.1 ND households

ND households maximize the utility function by taking into account the following budget constraint:

$$c_t^{nd}(1+\tau_t^c) + D_t = R_{t-1}D_{t-1} + w_t h_t^{nd}\left(1-\tau_t^h\right) \qquad [2]$$

where τ_t^c e τ_t^h respectively denote consumption and labour income tax rates, R_t is the nominal interest rate on bank deposits and w_t is the real wage.

These households optimally decide how much to consume, work and save. Therefore the first order conditions with respect to consumption c_t^{nd}, hours h_t^{nd} and bank deposits D_t, are:

$$\lambda_t^{nd} = \frac{c_t^{nd(-\sigma)}}{(1+\tau_t^c)} \qquad [3]$$

$$\lambda_t^{nd} = \frac{h_t^{nd(\varphi)}}{w(1-\tau_t^h)} \qquad [4]$$

$$\lambda_t^{nd} = \beta\lambda_{t+1}^{nd}R_t \qquad [5]$$

where (3) is the marginal utility of consumption and (4) denotes the labour supply. The Euler equation (5) describes the consumption intertemporal allocation by *ND* households.

3.1.2 D households

D households entirely consume their current after-tax labour income plus the civilian disability pensions P_t^d and the disability benefits, out of the disability expenditures H_t. Therefore their budget constraint is the following:

$$c_t^d = \frac{w_t h_t^d(1-\tau_t^h) - H_t + B^d + P_t^d}{(1+\tau_t^c)} \qquad [6]$$

where $H_t = \xi\left[w_t h_t^d\left(1-\tau_t^h\right) + B^d + P_t^d\right]$. The parameter $\xi < 1$ denotes the disposable income'share destined for disability spending. We assume that *D* households supply only a fraction $\alpha<1$ of hours that they would work if they were *ND* type. This assumption follows the disability literature. Parodi and Sciulli, 2008) argue that *D* households work less than *ND* households. Hence:

$$h_t^d = \alpha h_t^{nd} \qquad [7]$$

The marginal utility of *D* households is:

$$\lambda_t^d = \frac{c_t^{d(-\sigma)}}{(1+\tau_t^c)} \qquad [8]$$

3.2 Firms

A generic firm[12] maximizes its profits by taking into account the following technological constraint:

$$y_t = h_t^{(1-\vartheta)} \qquad [9]$$

where y_t is the output of the single final good produced in the economy at time t, h_t is the labor input solely used in production. From profits maximization it follows:

$$w_t = h_t^{-\vartheta}(1-\vartheta) \qquad [10]$$

3.3 Aggregation and market clearing

The goods market clearing condition is:

$$y_t = c_t + G_t \qquad [11]$$

where the aggregate consumption is defined as:

$$c_t = \Omega c_t^d + (1-\Omega) c_t^{nd} \qquad [12]$$

Moreover, aggregate hours and aggregate marginal utilities of consumption are:

$$h_t = \Omega h_t^d + (1-\Omega) h_t^{nd} \qquad [13]$$

$$\lambda_t = \Omega \lambda_t^d + (1-\Omega) \lambda_t^{nd} \qquad [14]$$

From the ratio CDP to the households *D* share, we obtain the amount of CDP per household *D*:

$$P_t^d = \frac{P_t}{\Omega} \qquad [15]$$

[12] In this model there is a symmetric equilibrium because all the firms are equal: they maximize the same objective function subject to the same technological constraint.

3.4 The fiscal sector and the exercise of a permanent increase in CDP

In this subsection, we describe the fiscal sector and explain the implementation of the fiscal policy exercise. At this regard, we use DYNARE software[13] in MATLAB.

The exercise entails a transition from one initial steady state where CDP is set at 0.97% of GDP (ISTAT, 2013) to a new steady state corresponding to the target value of 1.07% of GDP[14].

In order to finance such an increase of CDP, we assume to reduce public spending. This study doesn't consider revenues tools because, as the macroeconomic literature argues (see Nickel, Rother and Zimmermann, 2010; Alesina, Favero and Giavazzi, 2012), they are strongly recessive.

In particular, we use two alternative strategies. The first one is a temporary reduction of public consumption. In that case, once public spending has been reduced such that CDP achieves the target value, it comes back to the initial steady state level. This implies a worsening in the fiscal authority's budgetary position in the long run, needing an increase of taxation. Differently, the second strategy is a permanent reduction of public spending that doesn't modify the government budget position and so doesn't require any other policy tactic.

The government budget constraint reads as:

$$G_t + DB + P_t + B = \tau_t^c c_t + \tau_t^h w_t h_t + \frac{DB}{R_t} \qquad [16]$$

where G_t is the final consumption expenditure including the value of goods and services purchased or produced by general government and directly supplied to private households for consumption purposes. *DB* is the public debt. For simplicity, we assume it is constant over time. We rewrite, in terms of GDP:

$$g_t + db + p_t + b = \tau_t^c \frac{c_t}{y} + \tau_t^h \frac{w_t h_t}{y} + \frac{db}{R_t} \qquad [17]$$

where $g_t \stackrel{\text{def}}{=} \frac{G_t}{y*}$, $db \stackrel{\text{def}}{=} \frac{DB}{y*}$, $p_t \stackrel{\text{def}}{=} \frac{P_t}{y*}$ respectively denote public spending, public debt and civilian disability pensions in terms of the target value of GDP. During the transition, we assume the following fiscal rule, where the public expenditure path depends upon the CDP dynamics:

$$\left(\frac{g_t}{g^{**}}\right) = \left(\frac{p_t}{p^{**}}\right)^{-\phi_g} \qquad [18]$$

[13] For further details see the web page http://www.cepremap.cnrs.fr/dynare/

[14] As it is explained in Section 2, this is the target value allowing households with a disabled member to exit from poverty status.

where $g^{**} = \frac{G}{y^{**}}$ is the public consumption to GDP ratio.

Following Ferrara and Tirelli (2014), since we are not interested in policy-induced long-run changes in consumption-labour ratios, we posit that the relative tax rates are constant both during the transition and in the long-run:

$\frac{\tau_t^c}{\tau_t^h} = \frac{\tau^{c*}}{\tau^{h*}} = \frac{\tau^{c**}}{\tau^{h**}}$.

In other words consumption and labour tax rates have the same path during the transition. Then for the sake of brevity, from now on we only refer to consumption tax rate.

In the long run, if public consumption only temporarily reduces, we assume that there is a gradual increase of the tax rates according to the following[15]:

$$\tau_t^c = (1-\phi_c)\tau_{t-1}^c + \phi_c \tau_t^{c**} \qquad [19]$$

As results are going to show, temporary and permanent reduction of public spending differentiate each other not only for the process duration but mostly for the different impact on consumption behaviour of the two groups of households.

3.5 Calibration

This section describes the parameters' calibration.[16]

Structural Parameters

Following Galí (2001), we assume a log utility for consumption, which corresponds to $\sigma = 1$, and set the inverse of the intertemporal elasticity of substitution of labour supply φ equal to 1.

According to a conservative parameterization in the macroeconomic literature, the subjective discount factor β is set to 0.99.

The labour share parameter in the production function $(1 - \vartheta)$ is calibrated following OECD data for Italy,[17] namely 0.6.

Disability Parameters

Calibration of parameters describing *D* households' behaviour is extensively justified in Section 2. In particular, we set the size of the group of households with a disabled member equal to 10% of Italian population.

[15] The same fiscal rule applies to the labor income tax rate.
[16] In Appendix A, Table A1 summerizes the parameters'calibration.
[17] http://stats.oecd.org/Index.aspx?queryname=345&querytype=view, last access 05/24/2015.

Italian data show that hours worked by *D* households are the 50% of hours worked by *ND* households, hence the parameter $\alpha = 0.5$. Moreover, the share of the disposable income intended for disabled people's care is 46%; therefore $\xi = 0.46$.

Fiscal sector parameters

As for fiscal sector, we follow ISTAT 2012 (last available data)[18] to set the initial value of CDP p^* at 0.97% of GDP. Moreover, in order that *D* households exit from poverty[19] status, it's necessary that CDP increase of 0.1%. Therefore, the target value of CDP p^{**} is 1.07% of GDP.

The parameter governing the CDP path ϕ_g in the government spending rule is set equal to 1. This guarantees that public consumption closely tracks the CDP dynamics. Moreover, such a calibration is often used for fiscal rules (see Coenen, Mohr and Straub, 2008; Ferrara and Tirelli, 2014). We set the parameter ϕ_c in (19) equal to 0.03, such that tax increase is only gradual. The initial value of the tax rate ratio $\frac{\tau^c}{\tau^h}$ is calibrated according to ISTAT data 2013, where the consumption tax rate is equal to 21% and the labour tax is computed through the mean value of the several batches of income considered by the Italian system[20]. Thereafter, while the steady state value of consumption tax rate is calibrated such that the fiscal authority's budget is balanced, the initial value of labour tax rate is anchored to the consumption-labour tax rate ratio.

Finally, the debt to GDP ratio *db* is set at 129%, following EUROSTAT 2013.

4. Results

Results show that an increase of 0.1% of CDP does allow *D* households to exit from poverty condition. As a matter of fact, the target value of CDP is the one minimum necessary so that the poverty threshold is overcome.

However, the implementation of temporary or permanent reduction of public consumption does matter to understand the impact of fiscal policy on the macroeconomic variables.

4.1 Long-run results: percentage variations after CDP increase

Long-run results (**Table 7**) show that an increase in CDP, through both temporary and permanent decline of public spending, reduces income inequality between the two groups of households. The effect is stronger in case of temporary decrease. In fact, the relative consumption of *D* households (c^d/c) raises by about 5%. The relative consumption of *ND* households (c^{nd}/c) reduces by 0.22%

[18] http://www.istat.it/it/archivio/117355, last access 05/24/2015.
[19] For further details see Section 2.
[20] In Italy labor tax is progressive.

if public spending's decline is permanent. Differently, if public spending's contraction is temporary and requires tax increase, (c^{nd}/c) reduces by 0.35%.

In case of temporary reduction of public expenditure, aggregate consumption variation is exactly equal to the negative variation of GDP (see equation 11)), namely 0.13%. If public consumption permanently reduces, not only it dampens the recessionary effect but also produces an increase of aggregate consumption. This also reflects the restrained reduction of hours worked.

Finally, disability expenditures *H* increase more when taxation is constant. In fact, if this is the case, disposable income of *D* households increases.

Table 7- Steady state percentage variations

Variable	Temporary Reduction g	Permanent Reduction g
Δc^d	5.7	6.2
Δc^{nd}	-0.35	0.14
Δc	-0.13	0.36
$\Delta(c^d/c)$	5.8	5.8
$\Delta(c^{nd}/c)$	-0.35	-0.22
Δy	-0.13	-0.06
Δh	-0.21	-0.09
ΔH	5.9	6.2
$\Delta \tau^c$	1.42[21]	0
$\Delta \tau^h$	1.42	0

Summarizing, if the temporary reduction of public consumption entails a bigger decline of income inequality between the two groups of households, the permanent reduction dampens the unavoidable recessionary effect.

4.2 Short-run results

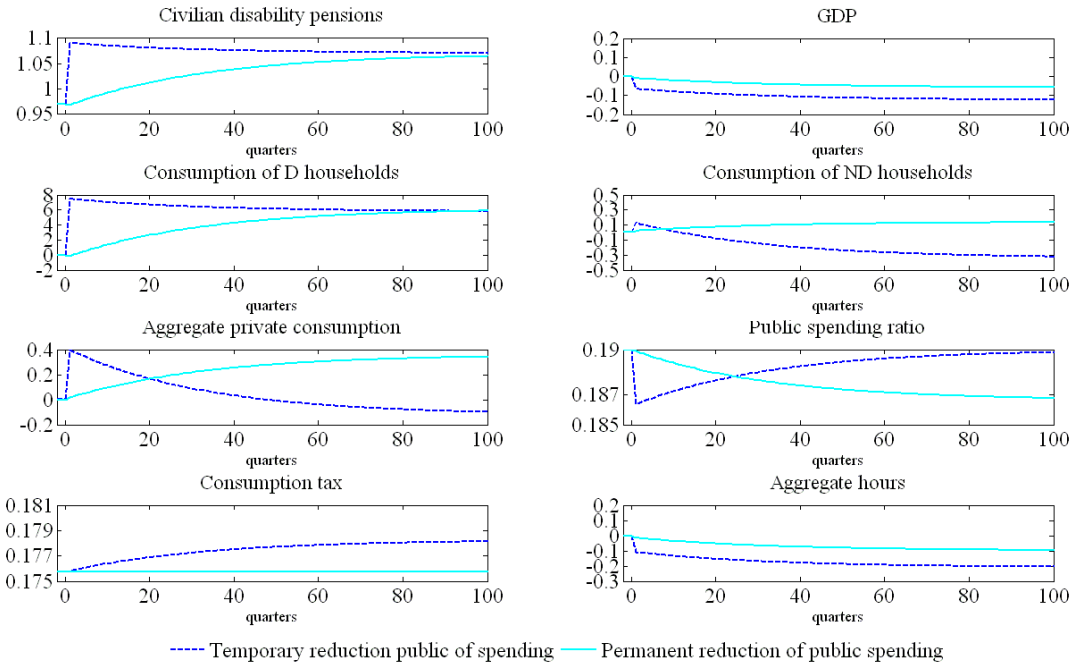
In this section we show the short-run effects of a permanent increase of CDP.

Figure 3 reports transitions (expressed in percentage variations from the first steady state) of the key macroeconomic variables after an increase of 0.1% of CDP.

The dashed line denotes the case of temporary reduction of public spending and consequent increase of taxation. The solid line represents the case of permanent decline of public consumption and taxation remain constant at the initial steady state level.

[21] Le aliquote di imposta presentano la stessa variazione per quanto assunto nel modello.

Figure 3 - Short-run effects of a permanent increase of CDP



Consider first the temporary reduction case. Under this assumption, results report an immediate surge of CDP even overshooting the target value before reaching it. This produces a direct positive impact on consumption behaviour of *D* households via their budget constraint. At least during the first two quarters, also *ND* households' consumption increases. As a matter of fact, they expect future tax cuts after the public consumption decline (wealth effect). However, as soon as they know that reduction is only temporary they reduce their consumption because they know that instead there will be a tax rate increase. It follows that aggregate consumption raises in the first phase of transition and then declines in the last ones.

If public spending reduction is permanent, CDP dynamics is very inertial to achieve the target value. In fact it takes about 20 years. Although the process' inertia, *D* households' consumption increases as well. Also *ND* households' consumption raises because of the "pure" wealth effect.

It follows that a gradual increase of consumption of the two groups and so of aggregate consumption, together with an inertial decline of public consumption, implies a lither recessionary effect.

Therefore, once the exit from the poverty condition for *D* households is warranted by the policy action, during the transition the policy maker alternatively may:

— to prefer an immediate surge of CDP. This would produce a strong increase of *D* households' consumption but would entail a deep recession;
— to prefer an inertial increase of CDP. This strategy would only slightly stimulate *D* households' consumption but it would be able to restrain the negative real effect.

5. Conclusions

In this paper we show the effects of an increase of civilian disability pensions, mainly focusing on consumption of households with one disabled member. The analysis is performed simulating a Real Business Cycle model. This simplification is an advantage because it allows to identify the transmission mechanisms of fiscal policy at work. This become even important because, as far as we know, this is the first contribution analyzing the economic consequences of disability issue in a general equilibrium framework.

The fiscal policy exercise is implemented through a reduction, both temporary and permanent, of public consumption.

Results seem to be very appealing. In particular, they show that a minimum increase of 0.1% of civilian disability pensions warrants the exit from the poverty condition for *D* households. Moreover it stimulates their consumption entailing a reduction in income inequality between the two groups of households. Moreover, the transmission mechanisms are importantly different according to a permanent or temporary reduction of public spending.

Future research agenda will include the implementation of the same fiscal policy exercise in a New Keynesian DSGE model. Moreover the analysis will be focused on Italian regions to capture the heterogeneity of fiscal policy impact among regional economies.

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APPENDIX A: Calibration

Table A1 – Parameters Calibration

Parameters	Values	Description
		Structural Parameters
$\boldsymbol{\sigma}$	1	Inverse of the elasticity of intertemporal substitution of consumption
$\boldsymbol{\varphi}$	1	Inverse of the elasticity of intertemporal substitution of labor supply
$\boldsymbol{\beta}$	0.99	Subjective discount factor
$(\mathbf{1}-\boldsymbol{\vartheta})$	0.6	Labor share in production function
		Disability Parameters
Ω	0.1	Fraction of *D* households
$\boldsymbol{\alpha}$	0.5	Hours worked by *D* households as a share of hours worked by *ND* households
$\boldsymbol{\xi}$	0.46	D household's share of disposable income allocated to the care of the disabled person.
		Fiscal Sector Parameters
p^*	0.97%	Initial value of the civilian disability pensions to GDP ratio
p^{**}	1.07%	Target value of the civilian disability pensions to GDP ratio
$\boldsymbol{\phi_g}$	1	Fiscal rule public spending
$\boldsymbol{\phi_c}$	0.03	Fiscal rule taxation
$\frac{\boldsymbol{\tau^c}}{\overline{\boldsymbol{t^h}}}$	0.75	Tax rate ratio consumption/labour
d	129%	Debt to GDP ratio

APPENDIX B: Steady states given parameters' calibration

This appendix reports the computation of the steady state values of endogenous variables, given the equilibrium conditions and the parameters' calibration.

From the Euler equation (5) we obtain the nominal interest rate. In steady state the following holds:

$$\lambda^{nd} = \beta\lambda^{nd}R \qquad [B1]$$

Hence:

$$R = \frac{1}{\beta} \qquad [B2]$$

Moreover from the equations (3) e (4), it holds:

$$\frac{c^{nd(-\sigma)}}{(1+\tau^c)} = \frac{h^{nd(\varphi)}}{w(1-\tau^h)} \qquad [B3]$$

From [B3] we can write c^{nd} as a function of h^{nd}. Moreover, given that σ and φ are equal to 1, we obtain:

$$c^{nd} = \frac{w(1-\tau^h)}{h^{nd}(1+\tau^c)} \qquad [B4]$$

From (6), the budget constraint of households *D* in steady state is:

$$c^d = \frac{wh^d(1-\tau^h)-H+B^d+P^d}{(1+\tau^c)} \qquad [B5]$$

Then we substitute the disability expenditure H in (B5) and rewrite disability benefits B^d and CDP P^d in terms of GDP, where $B^d = b^d y$, $P^d = p^d y$ e $y = h^{(1-\vartheta)}$. Therefore we obtain:

$$c^d = \frac{(1-\xi)[wh^d(1-\tau^h)+(b^d+p^d)h^{(1-\vartheta)}]}{(1+\tau^c)} \qquad [B6]$$

From the aggregate resource constraint, we take into account the aggregate consumption equation (12) and rewrite public spending as $G = \frac{G}{y}y = gy = gh^{(1-\vartheta)}$ and finally get the following expression:

$$h^{(1-\vartheta)} = \Omega\left[\frac{(1-\xi)[wh^d(1-\tau^h)+(b^d+p^d)h^{(1-\vartheta)}]}{(1+\tau^c)}\right] + (1-\Omega)\frac{w(1-\tau^h)}{h^{nd}(1+\tau^c)} + gh^{(1-\vartheta)} \qquad [B7]$$

From the real wage equation (10), in steady state it holds:

$$w = h^{-\vartheta}(1-\vartheta) \qquad [B8]$$

Substituting (B8) in (B7), we rewrite:

$$h^{(1-\vartheta)} = \Omega\left[\frac{(1-\xi)h^{-\vartheta}(1-\vartheta)h^d(1-\tau^h)+(b^d+p^d)h^{(1-\vartheta)}}{(1+\tau^c)}\right] + (1-\Omega)\left[\frac{h^{-\vartheta}(1-\vartheta)(1-\tau^h)}{h^{nd}(1+\tau^c)}\right] + gh^{(1-\vartheta)} \quad [B9]$$

Solving the system of equations [B9] and (13), and rewriting (13) as $h^{nd} = \frac{h}{[\Omega\alpha+(1-\Omega)]}$ and finally solving for aggregate hours:

$$h = \left\{\frac{\left[\frac{(1-\Omega)(1-\vartheta)(1-\tau^h)}{(1+\tau^c)}[\Omega\alpha+(1-\Omega)]\right]}{\left[1-\frac{\Omega(1-\xi)}{(1+\tau^c)}\left(\frac{(1-\vartheta)\alpha(1-\tau^h)}{[\Omega\alpha+(1-\Omega)]}+(b^d+p^d)\right)-g\right]}\right\}^{\left(\frac{1}{2}\right)} \qquad [B10]$$

Solving for hours worked of households *ND*, we obtain:

$$h^{nd} = \frac{h}{[\Omega\alpha+(1-\Omega)]} \qquad [B11]$$

We can now compute [B4] and [B6] and the following steady state expressions:

- Aggregate consumption:

  $$c = \Omega c^d + (1-\Omega)c^{nd} \qquad [B12]$$

- Marginal utility of consumption of households *D*:

  $$\lambda^d = \frac{c^{d(-\sigma)}}{(1+\tau^c)} \qquad [B13]$$

- Marginal utility of consumption of households *ND*:

  $$\lambda^{nd} = \frac{h^{nd(\varphi)}}{w(1-\tau^h)} \qquad [B14]$$

- Average marginal utility:

  $$\lambda = \Omega\lambda^d + (1-\Omega)\lambda^{nd} \qquad [B15]$$