THE STRENGTHS AND FAILURES OF INCENTIVE MECHANISMS IN NOTIONAL DEFINED CONTRIBUTION PENSION SYSTEMS

Author(s): Angelo Marano, Carlo Mazzaferro and Marcello Morciano

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Angelo Marano[§]
Italian Ministry of Labor and Social Affairs
amarano@welfare.gov.it

Carlo Mazzaferro[§]
Department of Economics, Bologna University and CAPP,
carlo.mazzaferro@unibo.it

Marcello Morciano[§]
University of East Anglia (UK), Institute for Social
and Economic Research (UK) and CAPP
m.morciano@uea.ac.uk.

Public pension systems based on the Notional Defined Contribution (NDC) principle were introduced during the '90s in Italy, Sweden and Poland. They should realize actuarial equity and incentive neutrality. However, when one considers the presence of NDC pensions together with minimum and social assistance pensions, this is no longer true and a regressive feature of NDC systems emerges. We examine the extent of such incentive problem in all three countries mentioned and discuss how it could be addressed by changing the cumulation rules for social assistance and NDC pensions. In the Italian case, the use dynamic micro-simulation model, allows us to examine the incentive issue also in its distributive and financial aspects. The same model allows us to also assess some major effects of the December 2011 pension reform, which, however, being very prescriptive, could show some side-effects on the incentive and distributional aspects we focus on.

1. Introduction

Pension systems based on the Notional Defined Contribution principle (henceforth **NDC**) were firstly introduced in Italy (1995), Sweden (1994-

1998), Latvia (1995-1996) and Poland (1999) as major, structural, reforms of their respective public pension systems. After more than fifteen years in operation, the NDC mechanism has been more clearly understood at the international level and has become almost "fashionable", in that several other countries are moving in such direction[1].

However, some misunderstandings about the characteristics of NDC systems still remain. On one side, many analyses can be found which highlight NDC features like the flexibility of the design and the presence of mechanisms of automatic adjustment of expenditure and contribution revenues, or which discuss the best way of making adjustments for the increase of longevity and of guaranteeing pension adequacy in an NDC framework (Holzmann and Palmer 2006, Queisser and Whitehouse 2006, Whitehouse 2010). On the other side, issues such as the effectiveness of the incentive structure to contribute in a NDC system and its actuarial fairness have received little attention; these are considered to be embedded in the Defined-Contribution (**DC**) formula and, at best, analyses have been limited to the comparison of NDC systems with private pension funds.

In such framework, we are unaware of any contribution examining the issue covered in this paper: the failure of NDC systems to guarantee actuarial equity and incentive neutrality when the interaction of NDC and social assistance pensions is considered. In fact, in presence of social assistance, low-wage workers, or those who experience intermittent employment histories, could find that is not worthwhile for them to contribute to the pension system, as their NDC pension entitlement will be lower, or not much larger, than the social assistance minimum they would be entitled to anyway. An incentive failure similar to the one that characterizes poverty and unemployment traps arises, with a distinctive feature that no activation policies can be implemented in this case. Seen from another point of view, a regressive feature of NDC systems emerges, in that workers get the less from their pension contributions the poorest they are, when social assistance is considered in the analysis.

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[1] NDC systems are also sometime referred to as "non-financial" defined contribution. The Kyrgyz Republic, Mongolia, Russia and Egypt, among others, have introduced NDC elements in their pension systems, while Spain, China and Belarus have been examining the possibility to do so. Also, the comparison of traditional pension systems with NDCs stimulated the introduction in the former of mechanisms that replicate some of the NDC features (Whitehouse 2010).

This incentive problem seems relevant in all the three countries we consider, Italy, Sweden and Poland. In Italy it could become even stronger as side-effect of the end of 2011 Monti-Fornero (**MF**) pension reform. Accordingly we suggest some possible solutions. One, which would completely eliminate the distortions, would be giving individuals the possibility to fully cumulate social assistance and NDC pension benefits. However this option would be costly for the public budget and it would require a structural reform of the pension system financing mechanism. For this reason, we rather focus on solutions that contemplate only a partial cumulation of the two types of pensions. In particular, with reference to Italy, where the possibility of cumulation already exists, but to a very limited extent, we examine the effects of increasing it. We develop our analysis considering the institutional details and, for Italy, also using CAPP_DYN, one of the most advanced dynamic population-based micro-simulation model in the EU (TARKI 2008), which allows us to also study the distributional and financial aspects of the incentive problem we focus on.

The paper is organized as follows. Section 2 briefly reviews some of the main features and strengths of NDC systems; section 3 considers the interaction of NDC pensions with social assistance and minimum pensions in Italy, Sweden and Poland. In section 4 we study the relevance of the incentive neutrality and actuarial equity problems in Italy in the coming decades using CAPP_DYN and evaluate the effects of a parametric reform that increases the possibility to accumulate social assistance and the NDC pension. In section 5 we analyze how the MF pension reform affects the incentive mechanisms we deal with and discuss two other policy options which could affect both the NDC pension incentive structure and adequacy: the first allows full accumulation of social assistance and NDC pensions, whereas the other introduces a social security minimum pension, which is length-of-service dependent. Section 6 concludes.

2. THE NDC PRINCIPLE, ACTUARIAL EQUITY, INCENTIVE NEUTRALITY AND AUTOMATIC BALANCE OF EXPENDITURE AND REVENUES

NDCs are public pension systems that, operating on a pay-as-you-go (**PAYG**) basis, adopt a DC pension formula, built around actuarial principles which mimic private savings. In other words, although workers' social contributions are not put aside, notional (i.e. virtual) individual accounts are built, where each worker's contributions are credited till retirement, getting a return which is in line with the growth rate of total contributions in the economy. Upon retirement, the accumulated (notional) capital is converted

into a pension multiplying the accredited capital by age-specific annuity co-efficients, which are computed on the same actuarial principle as of private pensions' ones.

Formally, pensions in a NDC system are calculated as: $P^{NDC} = \varepsilon K$, where ε is the retirement age-specific coefficient (inversely related to the expected life-expectancy at retirement), and K the (notional) pension savings, being:

$$K = \sum_{i=1}^{L} \eta w_i (1+\vartheta)^{L-i+1} \; ,$$

with w_i = wage in the ith year of work, η = contribution rate, L = length of service and θ = return rate on pension contributions, which is typically set at the growth rate of total wages or GDP.

The advantages of NDC, with respect to the public Defined-Benefit (**DB**) systems they are typically going to replace, concern both the micro and macro aspects of pension policies (Holzmann and Palmer 2006).

As far as the microeconomic aspects are concerned, the NDC building principle should imply, on the one hand, a certain (actuarial) equity among individuals and, on the other, incentive neutrality with respect to the retirement age, the age of exit from the labor market and the work – leisure (or working in the formal – informal sectors of the economy) individual's choice.

As for actuarial equity, each year all workers get the same rate of return on their contributions, although the return rate may vary year by year. Thus, NDC systems do not redistribute resources among retirees, nor they prize more particular categories of workers or types of careers, as DB systems generally do[2].

Moreover, as NDC systems aim at giving back to individuals just what they put in the system (plus returns, net of administrative costs), provided the annuity coefficients (ε) are computed accordingly to sound actuarial techniques, they attain incentive neutrality[3]. Firstly, neutrality with respect to the retirement age is granted. That is because a later retirement implies that the notional pension saving will be multiplied by an higher annuity co-

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[2] We define actuarial equity as a situation where people have equal internal rates of returns on their contributions, which (under some additional assumptions on the time horizon and the type of career considered) is guaranteed in NDCs through the provision that each year an equal rate of return applies to every contributions and to all pension savings accrued in the virtual individual accounts. While actuarial equity compares individuals, incentive neutrality deals with how social contributions affects individual's behavior, typically comparing the internal rate of return on contributions with an outside return.

[3] It is important to notice that actuarial equity and incentive neutrality only holds at the aggregate level as, in particular, annuity coefficients do not generally take into account gen-

efficient, which takes into account a lower life-expectancy, while new contributions will be credited to one's account, together with further returns on past contributions, which will be given back as future pension. Secondly, NDC systems are also neutral with respect to the choice of exit from the labor market, providing positive effects in labor market flexibility. In fact, an individual could claim her/his pension while still remaining at work, without this implying a redistribution in favor or against her/him. Finally, as contributions are given back to individuals once retired, they enter in the individual's life-time optimization problem as compulsory saving, not as taxes. Thus, they do not distort individual's choice about labor and leisure, or about working in the formal sector or in the shadow economy, at least as long as compulsory social contributions do not exceed her/his saving needs and the analysis takes into account the different return rates recognized on private savings (the market rate) and on NDC contributions (the rate of growth of total wages or GDP)[4].

As far as the macroeconomic aspects are concerned, NDCs embed automatic adjustment mechanisms which guarantee the equilibrium among pension expenditure, contribution revenues and the respective rates of growth. Such mechanisms rely, on one side, upon the link between the return rate offered on contributions and the growth rate of total earnings[5] and, on the other, on the update of annuity coefficients to changes in longevity. This, however, does not imply that in a NDC system the entire pension expenditure should be financed through social contributions only: general fiscal revenues could still be required, in particular (and with relevance for our discussion) in order to finance social assistance programs, as well as to guarantee the accumulation of pension rights in case of spells of unemployment or training, sickness and maternity leaves.

It is remarkable that all of the positive features mentioned above would be attained without the need to change the way of financing pension expenditure, i.e. avoiding the extra-burden that any shift from a PAYG to a fully funded system would entail in terms of greater taxation during the entire

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der differences in life-expectancy, as well as differential mortality risks according to individual socio-economic and health statuses (Mazzaferro et al. 2012).

[4] Indeed, on this basis one could question the inclusion in the tax wedge of compulsory social contributions to a NDC system, which would have strong implications for international comparisons.

[5] This implicitly assumes either equal contribution rates for all workers or a constant composition of the work force among different categories of workers. Furthermore, when, as in the Italian case, the NDC return rate is based on the GDP growth rate, underlying there is an assumption that real wages evolve in line with labor productivity.

transition phase (first generation problem). Aside all these nice features, however, there is also some costs.

Firstly, generally NDCs appear less generous than the previous DB systems, which rises concern about future pensions' adequacy. This derives, on the one hand, from the specific parameters used in the old and in the reformed systems and, on the other, from the fact that, while in the old systems typically only wages in years close to the end of the working career or "best wages" were considered in the pension formula, NDCs give equal weigh to all wages the individual received in her/his working-life, so that lower wages at the beginning of the career, or occasional drops of income, directly affect the amount of benefits.

Secondly, the automatic adjustment of expenditure to social contribution revenues in NDCs is pursued through a risk shift of both demographic and economic risks upon individuals, which was not present in the previous DB systems[6]; indeed, in NDCs only longevity risks *after* retirement remain collectivized, all other risks being individualized (Marano 2006)[7].

Finally, as NDC systems give equal weight to all wages earned by an individual, a crucial incentive mechanism embedded in traditional DB systems, which prizes individual effort and dynamic career, disappears. Although this eliminates a regressive redistribution mechanism, it produces, however, clear disadvantages in term of promotion of workers' effort (Marano et al. 2012).

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[6] It is often argued (OECD 2007) that NDCs are just a particular case of traditional DB systems, where wages during the entire career are considered in the calculation of pensionable earnings. However, while traditional DB systems insure most of the risks and do not embed automatic adjustment mechanisms, NDCs attain the result of automatic adjustment of expenditure to contribution revenues mostly shifting risks from the public to the individual. It follows that any equivalence between the two systems in terms of benefits delivered can only be verified *ex-post* (given the actual course of the economy and the demography), not *ex-ante*.

[7] Notice that while this is hardly the most efficient risk allocation from an insurance theory point of view, it also calls for an increased individuals' responsibility to protect themselves from these risks, which poses important challenges when some population sub-groups are subject to myopia, or do not have enough market power to protect themselves, or do not have enough financial literacy (Lusardi and Mitchell 2006; Banks and Oldfield 2007; Fornero and Monticone 2011). Indeed, this, together with the above mentioned adequacy problem, could end up generating a time-inconsistent pension policy, in that the NDC rule could become suboptimal once applied to a large and increasing elderly population, both from a social welfare function perspective and from a political economy one.

3. SOCIAL ASSISTANCE MINIMUM PENSIONS IN CURRENT NDC SYSTEMS

3.1 How things change in presence of social assistance pensions

The above mentioned literature analyzing the pros and cons of NDC systems generally implicitly assumes NDC pensions rich enough to not interfere with social assistance provisions. However, this should not be taken for granted and hides what we believe is a critical problem in NDC systems: the failure to deliver actuarial equity and incentive neutrality in presence of non-contributory social assistance pensions which cannot be fully cumulated with the contributory ones.

Indeed, depending on the institutional setting, it is possible that low earners, or those who experience intermittent employment histories, will end up with a contributory NDC pension which is not greater that the social assistance minimum they would get anyway, in absence of other sources of income. If that is the case, the payment of social contributions would originate no returns when the amount of social assistance benefits is taken into account in running inter-temporal analyses. Similarly, people that will be entitled to a NDC pension of value greater than social assistance endowments, could nevertheless find themselves only marginally better-off than those who receive social assistance benefits or, at least, not so much as the contributions they paid would justify. An incentive failure similar to the one that characterizes poverty and unemployment traps arises (Employment Committee 2003, Carone et al. 2004), with a distinctive feature, in this case, that activation policies cannot be implemented: social assistance pensions, in fact, are aimed at setting a minimum standard of living for all the elderly and, as such, the only possible tagging criteria is the means-test.

In this section we analyze this problem with reference to the institutional settings and the pension system parameters of three main EU countries that adopted the NDC system in the '90s: Italy, Sweden and Poland. The situation is represented in Figures 1, 2 and 3 for each country respectively, with reference to an individual without spouse and other sources of income. In Panels *a)* of these three figures we show the amount of social assistance benefits (broken line) and the total amount of income (solid line) the individual gets, as a function of the NDC pension matured (all variable are expressed as a fraction of countries' average wage[8]). When the ratios between individual NDC pension and average wage is greater than 27% in Italy, 39% in Sweden and 15% (or 21%, see below) in Poland, total income and the NDC

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[8] We considered the OECD average annual wages in 2009: 27,533 euro for Italy, 36,809 euro for Sweden and 9325 euro for Poland.

pension coincide, since individuals are not entitled to social assistance benefits. Conversely, the NDC pension is supplemented by a social assistance integration if the ratios fall below such thresholds. In Panels *b)* and *c)* we draw two indicators of the incentive problem. Panels *b)* show the implicit (marginal) tax rate, defined as the ratio of the increase of total income to the increase of NDC pension: when individuals' NDC pension increases, but total income increases less, or not at all, because social assistance benefits decrease, the implicit tax rate is positive, whereas equal to zero otherwise. In Panels *c)* we calculate the Net Present Value Ratio (**NPVR**) of the NDC pension payments flow, net of the full potential social assistance benefits payments, in order to measure the difference between the present value of contributions an individual pays and the present value of the flow of benefits she/he will be entitled because of such contributions, not being granted otherwise[9].

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[9] The NPVR is a commonly used financial measure defined as the ratio of the present value of benefits received, to the present value of contributions paid during an individual's lifetime. If we assume a NDC pension formula that fully captures the actuarial principle, i.e. that the NPVR is equal to 1 when social assistance benefits do not exist, it is relatively simple to correct the indicator for the presence of social assistance benefits. Namely, if a proportion of the NDC pension (P^{NDC}) can be deducted from the means-test for the social assistance pension (granted to a maximum value of SA^{max}), being *Cont* the contribution paid during a working life of length L, V the life expectancy at retirement and the discount rate, one can write:

$$NPVR = \frac{\sum_{j=1}^{V}\left(SA_j^{max} + \beta \cdot P_j^{NDC}\right)\cdot\left(1+\delta\right)^j - \sum_{j=1}^{V} SA_j^{max}\cdot\left(1+\delta\right)^j}{\sum_{i=1}^{L} Cont_i \cdot\left(1+\delta\right)^{L-i+1}} = \frac{\sum_{j=1}^{V}\beta \cdot P_j^{NDC}\cdot\left(1+\delta\right)^j}{\sum_{j=1}^{V} P_j^{NDC}\cdot\left(1+\delta\right)^j} = \beta,$$

so that the NPVR reduces to the parameter that sets the accumulation rules of NDC and social assistance pensions. The assumption of an NDC pension formula that fully captures the actuarial principle is justified because our goal is to show the extent of departure from this principle when one takes into account social assistance. As a matter of fact CAPP_DYN, the micro-simulation model we use below in the analysis, calculates the NPVR for each individual and shows departures from the actuarial principle due to gender and socio-economic differences in longevity (Mazzaferro et al. 2012). More generally, it is often claimed that NDC pensions would not be fair from the actuarial point of view because they would be lower than those private pension funds would pay with the same contributions (Queisser and Whitehouse 2006, Holzmann and Palmer 2006). However, such claim derives from two specific assumptions: 1) that the return rate in a NDC system is lower than the risk free, net of managing cost, market interest rate, which is not necessarily true; 2) that annuities are sold in the private market at their true value, which contrasts with many evidences (Estelle and Song 2001, Cannon and Tonks 2003, Mackenzie and Schrager 2004, Guazzarotti and Tommasino 2008).

3.2 Social assistance minimum pensions in Italy, Sweden and Poland

Italy

Currently, in Italy there is the co-presence of three different public pension calculation rules: people that have entered the labor market since 1996 are subject to a NDC rule; people with more than 18 years of work seniority in 1995 have their pension computed mostly according to a traditional DB formula; whereas people in between have their benefits calculated by a mix of the two systems, in proportion to the working-life spent under each one[10]. A NDC pension is granted with as little as 5 years of seniority, while 20 years are needed when the other two rules are used; starting in 2012, however, such lower vesting period will only applies upon reaching 70 years of age, as stated in the MF pension reform, the higher seniority requirement applying otherwise. As for minimum benefits, while pensions computed according to the DB or mixed regimes benefit from a (means-tested) minimum-pension supplement (*integrazione al minimo*), bringing the pension up to 500-600 euro per month (6500-7800 per year, depending on age), a lower, social-assistance, non-contributory, minimum (*assegno sociale*) applies to people whose pension is calculated exclusively through the NDC formula. The latter, granted to individuals older than 65 years (66 since 2018), is worth 430 euro per month (5600 euro per year), reaching 600 euro per month only for those aged 70 plus[11].

The NDC pension is only partially cumulable with the social assistance one. In practice, the NDC pension is considered in the means-test for social assistance, but with a deduction of 1/3, within the limit of 1/3 of the social assistance pension itself. Formally, for an individual single:

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[10] To people that reached 18 years of work seniority in 1995 the NDC formula only applies for the years of work since 2012; to people already in the labor market in 1995, but with less than 18 years of seniority at the end of that year, the NDC formula applies for the years of work since 1996.

[11] All monetary figures in use are those in force in 2011. In detail, upon reaching 70 years of age a supplement applies, bringing the minimum up to 600 euro per month. Such age threshold is anticipated by 1 year every 5 years of contribution and is subject to a means-test procedure which differs from the one used for the standard social assistance pension. We do not consider such provision in our implicit tax rate and NPVR calculation formulas, which would only complicate the discussion, however we take it into account in the micro-simulation. Notice that, while this is justified in the pre-MF reform scenario, where typical retirement age is well below 65, things change when a large share of workers is forced to remain at work till 70 years of age, as in the MF reform framework (see below).

$$SA = \max\left\{0; 5592.8 - [y - \min(\beta \cdot P^{NDC}; \alpha \cdot 5592.8)]\right\},$$

where:

SA = social assistance benefits;

P^{NDC} = NDC pension;

$y = P^{NDC}$ + other sources of income;

$\alpha = 1/3$ = maximum deduction from the means-test in terms of social assistance pension;

$\beta = 1/3$ = proportion of P_{NDC} not entering the means-test.

Thus, focusing only on people fully subject to the NDC regime, as shown in Figure 1.a, social assistance offers a minimum income to each individual. People that also benefit from a small NDC pension may reach a total income greater than the minimum by 1/3 of the NDC pension itself. However, for NDC pensions between 20% and 27% of average income (between 5600 and 7457 euro per year), total income remains fixed at 27% of the average income itself. For NDC pensions above such threshold, social assistance benefits fall to 0 and the individual only gets her/his contributory pension. In other words, people without other sources of income will experience an implicit tax rate of 2/3 of their NDC pension at low income levels, which rises to 100% in the interval 20-27% of average income (when the limit of 1/3 of the social assistance pension is reached), and falls to zero thereafter (Figure 1.b). The NPVR of the NDC pension flow, computed net of social assistance benefits (Figure 1.c), drops to 33% for wages lower than 20% of average income and then further, till a minimum of 25%; above 27% of the average income the indicator starts rising, going back to the benchmark value of 1 only asymptotically.

Sweden

The situation in Sweden is not too different than the Italian one. There exists a flat rate social assistance benefit, *guarantipension*, which is paid to residents independently of previous labor market experience. It amounts to 9958 euro per year in 2011, which correspond to 2.13 times a "price-base amount" (42,800 SEK in 2011); the full amount is paid only to those with at least 40 years of residence in the country, whereas it is correspondently reduced otherwise. The *guarantipension* is subject to a means-test: NDC pensions lower than 16% of average income (5891 euro, 1.26 times the price base) are absorbed by the *guarantipension*; for those above such limit but with a NDC pension lower than 39% of average wage (14,352 euro, 3.07 times the price base), total income is given by 6895 euro plus 52% of the NDC pension; NDC pensions above 39% of average wage are not entitled to

the *guarantipension* (Figure 2.a)[12]. Figure 2.b shows that the implicit tax rate is equal to 1 till the NDC pension reaches 16% of average wage (as in this interval everybody are brought up to the same amount of 27% of average wage), then drops to 48% till the NDC pension reaches 39% of average wage, going to 0 thereafter. Finally, the high value of Swedish minimum pension translates in a corresponding lower NPVR for contributors (Figure 2.c).

Poland

The situation in Poland is partly different from the other two countries. The Poland system has two minimums, one which is a true social assistance minimum, set at 477 PLN per month in 2011 (about 1435 euro per year, 15% of average income) and a minimum pension for those who contributed for at least 20 (females) or 25 (males) years to the social security system. This second minimum, which in the Polish NDC system is also classified as social assistance and financed through general fiscal revenues, is set at 706 PLN per month in 2011 (2123 euro per year, about 23% of average wage)[13]. Apparently there is no possibility to cumulate either of the two minimums with a NDC pension, so that, as shown in Figure 3.a, there are two flat intervals for total benefits, at 15% and 23% of average income; above the latter, the individual only gets her/his NDC pension[14]. Implicit tax rates (Figure 3.b) are at 1 till individual's NDC pension becomes greater than the social assistance minimum, then fall and become negative upon reaching the work seniority which allows to benefit from the minimum NDC pension (here assumed to be reached with a NDC pension of 19% of average income), to finally end up at 0 for NDC pensions above 23% of average in-

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[12] For a couple, amounts and income limits are proportionally lower. Notice that a different benefit (maintenance support for the elderly persons) applies to individuals that do not have enough residence seniority to be entitled to a decent *guarantipension*. Furthermore, many elderly persons benefit from housing allowances.

[13] Again, thresholds and amounts are proportionally higher for single people than for those partnered.

[14] In the case of Poland, differently than for Italy and Sweden, we also had to assume a certain number of years of contribution for each NDC pension, as, as said, the minimum social security pension is attributed upon reaching 20 or 25 years of work seniority. The situation shown in Figure 3 is broadly coherent with that of a male working at 50% of average income for less than 18 years (social assistance minimum), between 18 and 24 years (NDC pension above social assistance minimum but no right to minimum social security pension), between 25 and 30 years (NDC pension brought to the minimum), and above 31 years (individual receives only the NDC pension).

come. The NPVR tends to be 0 when one benefits from one of the minimums (with a hike in between the two), then increases, asymptotically tending to 1 (Figure 3.c).

FIGURE 1 - FIGURE 2 - FIGURE 3

Figure 1 - Italy: Current situation | Figure 2 - Sweden: Current situation | Figure 3 - Poland: Current situation

Fig. 1a - Italy: NDC pension, social assistance integration and totale income as % of average wage

Fig. 2.a - Sweden: NDC pension, social assistance integration and total income as % of average wage

Fig. 3.a - Poland: NDC pension, social assistance integration and total income as % of average wage

Fig. 1b - Italy: implicit tax rate on the NDC pension considering social assistance

Fig. 2.b - Sweden: Implicit tax rate on the NDC pension considering social assistance

Fig. 3.b - Poland: Implicit tax rate on the NDC pension considering social assistance and minimum pension

Fig. 1c - Italy: net present value ratio (NPVR) of the NDC pension considering and not considering social assistance

Fig. 2.c - Sweden: net present value ratio (NPVR) of the NDC pension considering and not considering social assistance

Fig. 3.c - Poland: net present value ratio (NPVR) of the NDC pension considering and not considering social assistance and minimum pension

3.3 An underestimated problem

The previous analysis seems to confirm that NDC pension systems fail to deliver actuarial equity and incentive neutrality at low income levels, when social assistance minimums (and the social security minimum, in the case of Poland) are taken into account. This would also originate a regressive feature within the NDC systems, as NPVRs reach the value of 1 only asymptotically as income increases, being significantly lower the lower the pension and the poorer the pensioner. How important is this issue? Are we dealing with something which is affecting a significant share of workers and pensioners, or just a few, unlucky, individuals?

In Italy, currently 5 millions of pensions, out of 24 millions, benefit from the social security or social assistance minimums (of with 2.2 millions are old-age pensions, 0.8 millions social-assistance pensions and the rest invalidity and survivors pensions, Ministero del lavoro e delle politiche sociali 2011). The median pension is around 1000 euro per month (45% of average income, ISTAT 2011). As we show later, pension benefits are expected to drop in the future, which implies that data based on current benefit levels could even underestimate the relevance of such programs.

The problem in Poland seems less pronounced, but this is mostly due to the lower levels of the two minimums with respect to the other two countries, even when calculated as a fraction of national average wage. Furthermore, it is expected that minimums will play an increasing role in the future and a change "of the role of minimum pension from one of the tools supporting redistributive policy to the main tool of social policy preventing poverty among elderly persons" is expected (Chlon-Dominczak and Strzelecki 2010); indeed, while Poland experienced sustained employment and wage growth during the past decade, its pension system will have to cope with a labor market where people are not anymore invariably registered as formally employed, as it was in the old era.

Finally, the strength itself of Sweden, which is able to grant to residents a high living standard, with a social assistance minimum standing just below 10,000 euro per year, triggers the weakness of the incentive structure of its NDC system, which does not perform well both in terms of implicit tax rate and NPVR.

As a further element to evaluate the relevance of the issue we are dealing with, Table 1 shows the number of contribution years a worker at different levels of income (from 50% to 150% of the national average) would need to reach a NDC pension equal to the social-assistance minimum (Italy and Sweden) and to the two distinct social assistance and social security minimums existing in Poland. Calculations are rough, but give powerful

hints. Based on official theoretical replacement rates in 2006, in Italy an average worker has to contribute for 10 years to mature a NDC pension just equal to the social assistance pension, which rise to 20 years for a worker at 50% of average income. In Poland an average worker needs 11 and 16 years to reach the two minimums respectively, which become 21.5 and 32 years for workers paid 50% of the average. The Swedish situation, as seen above, appears worse than the others, because the social assistance pension is proportionally higher: an average worker will need more than 20 years of contribution just to mature a pension equal to the *guarantipension*, while a worker at 50% of the average income will probably not reach such minimum with the contributions of her/his entire career. Performing similar calculations using the replacement rates expected in 2046 (which would be more correct, as we are dealing with pensions in the reformed NDC systems), would only make things worse, even when the private pension component is taken into account.

Given this evidence, the possibility that low earners could end up with a NDC pension lower, or not much greater, than social assistance minimums appears as a realistic one and some individuals could actually be better-off hiding in the shadow economy than surfacing, which challenges the standard assumption that NDC pensions replicate private savings. Indeed, while this may be a problem of minor importance in countries where the informal economy only plays a marginal role, as in the case of Sweden, this is certainly not the case in Italy, as well as in many developing countries that could adopt the NDC system. From this point of view, and in sharp contrast of the statement of Gora and Palmer (2004) and Holzmann (2000), NDC systems could perform even worse than traditional DB systems, as these last rewarded length of contributions and were generally more generous, so that workers had some incentive to pay enough contribution to at least get recognition for each year of work, this giving a concrete perspective of getting a pension significantly higher than social assistance minimums.

Table 1 - Number of years of contribution needed to mature a NDC pension equal to the social assistance minimum (Italy and Sweden) and to the social security minimums (Poland)*

worker's income as % of average income**	Italy			Poland*** — years to social assistance minimum		Poland*** — years to social security minimum		Sweden			Italy (2011 pension reform) — Years to reach a certain value of the NDC pension based on replacement ratios in 2046 (NDC pension only)		
	based on replacement ratios in 2006	based on replacement ratios in 2046 (NDC pension only)	based on replacement ratios in 2046 (NDC+private DC pensions)	based on replacement ratios in 2006	based on replacement ratios in 2046	based on replacement ratios in 2006	based on replacement ratios in 2046	based on replacement ratios in 2006	based on replacement ratios in 2046 (NDC pension only)	based on replacement ratios in 2046 (NDC+private DC pensions)	To reach the social assistance level	To reach 1.5 the social assistance level	To reach 2.8 the social assistance level
50	22.2	28.2	23.1	21.5	28.6	31.8	42.4	44.9	56.9	43.5	28.2	42.3	79.0
75	14.8	18.8	15.4	14.3	19.1	21.2	28.2	30.0	37.9	29.0	18.8	28.2	52.6
100	11.1	14.1	11.5	10.8	14.3	15.9	21.2	22.5	28.4	21.8	14.1	21.2	39.5
125	8.9	11.3	9.2	8.6	11.4	12.7	16.9	18.0	22.8	17.4	11.3	16.9	31.6
150	7.4	9.4	7.7	7.2	9.5	10.6	14.1	15.0	19.0	14.5	9.4	14.1	26.3

Note: * Based on theoretical replacement rates at 65 years of age with 40 years of seniority as calculated by the EU countries in an harmonized way. ** For % different from 1 we just increased or reduced proportionally the number of years. *** In Poland the requirement to be entitled to social security minimum pension is 20-25 years of contribution (for females and males respectively). Poland did not calculated replacement rates including private provision for 2046.

Source: our calculations based on data from Social Protection Committee (2009): Updates of current and prospective theoretical replacement rates - 2006-2046. Report of the Indicator Subgroup. Annex: Country Fiches - Bruxelles, European Union.

4. A MICRO-SIMULATION ANALYSIS OF THE BASE SCENARIO AND OF A PARAMETRIC REFORM

Focusing from now on Italy, the issues of actuarial equity and incentive neutrality in a NDC pension system when social assistance benefits are taken into account are empirically assessed using the latest version of CAPP_DYN, a dynamic micro-simulation model of the Italian population and pension system (Mazzaferro and Morciano 2012a). Below in this section, we briefly describe the main features of CAPP_DYN, then we show projections obtained using the pre-MF reform as base scenario and finally we assess the effects of a parametric reform which increases the possibility to cumulate social assistance and NDC pensions. In section 5 we discuss the 2011 MF pension reform and how it affects the incentive problems we focus on, also examining two alternative policy interventions.

4.1 The CAPP_DYN micro-simulation model

The use of dynamic simulation at the micro level to study the institutes of the welfare state allows to follow people through their life and work, retirement and death. It also allows to take into account the complexity of eligibility criteria for retirement and of rules for computing pension earnings, as well as the non-linearity induced by means testing social security benefit programs, together with the interactions between demographic and economic developments of a population. Moreover, in contrast with traditional macro-economic models, a dynamic micro-simulation model provides, under certain assumptions, disaggregated information, such as the whole distribution of the variable of interest, as well as sample means, which are critical ingredients for making distributive analysis. Overall, such type of model can be a powerful tool in evaluating the long-run distributional effects of public policies, and using such technique it is possible to better assess issues like pension adequacy, incentive neutrality and "fairness" (from both the inter-generational and intra-generational points of view), which are intimately related with the topic of this paper (O'Donoghue 2001; Zaidi and Rake 2002)[15].

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[15] Some words of caution should however be spent. Indeed, reliability of micro-simulation predictions depends on the accuracy of simulation algorithms and on the quality of the data in use (Pudney and Sutherland 1994). In addition, dynamic micro-simulation models rely on reduced form relations that are not invariant to changes in the economic, demographic and institutional environment (Klevmarken 2005). Finally, the forward looking perspective, which is typical of these model, requires to assume some scenarios of development of the economy, the demography and the society (in our case on a half century horizon) which could be extremely arbitrary and make the results potentially manipulable. We address this

CAPP_DYN, is a population-based dynamic micro-simulation model firstly built by the Center for the Analysis of Public Policies (CAPP) in 2004 for the Italian Ministry of labor and social affairs and further developed and updated ever since. It is specifically designed to analyze the long-term economic well-being of a relatively large and representative sample of the Italian population, over the period 2010-2050. The model takes the initial population from the 2007 wave of the IT-SILC, the Italian version of the European Union Statistics on Income and Living Conditions survey, and projects individuals forward through time[16].

All individuals in the sample are involved in a considerable number of demographic and socio-economic events, such as birth, education, (re)marriage and divorce, work, retirement, disability and death, dealt with in different modules, as described in Figure 4. Events are modeled by means of finite and discrete Markovian processes and using the Monte Carlo technique. Transition probabilities of the socio-economic circumstances depend on individual characteristics and are estimated using a wide set of data sources. Certain behavioral functions have been introduced, the main one being that governing retirement choices.

Each annual cycle starts running a set of demographic modules (mortality, fertility, net migration) which, in line with the demographic projections of the Italian National Statistics Institute (ISTAT), determines the size and structure of the population in each year of the simulation horizon. Household formation/dissolution modules (parental house living decision, (re)marriage and divorce) allow the definition of the family structure in which each sample member is allocated.

The second set of modules allows the simulation of individuals' educational choices, job decisions and earnings. In each of the simulated year, individuals incur in the probability of changing occupational status (full-time, part-time, out of the labor market, unemployed). For employed people, gender and sector-specific earning equations are used to compute cross-sectional age-earning profiles, making some assumptions regarding the treatment of the unobservable individual effect and expected earnings growth rate over the simulated period.

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latter problem sticking as much as possible to the official scenarios that are now routinely produced by the EU and national governments and statistical institutes, which allows us to add to such aggregate scenarios – on which policies are build – a micro dimension.
[16] For a detailed description of the model see Mazzaferro and Morciano (2012a). Currently, the base year population consists of about 52,560 sample members. While the unit of simulation is the individual, CAPP_DYN also keeps information on family structure and any changes this may be subjected to over the course of time.

Once the population structure has been defined, and labor incomes have been generated, the model simulates the main social security benefits in considerable institutional detail, according to the pension scheme provisions in force. Individuals' retirement choice and the computation of old-age, seniority and survivors pension benefits, as well as of social assistance benefits, social assistance increases (*maggiorazioni sociali*) and social security supplements *(integrazioni al minimo)* are simulated in this module.

FIGURE 4 - *The modules of CAPP_DYN*
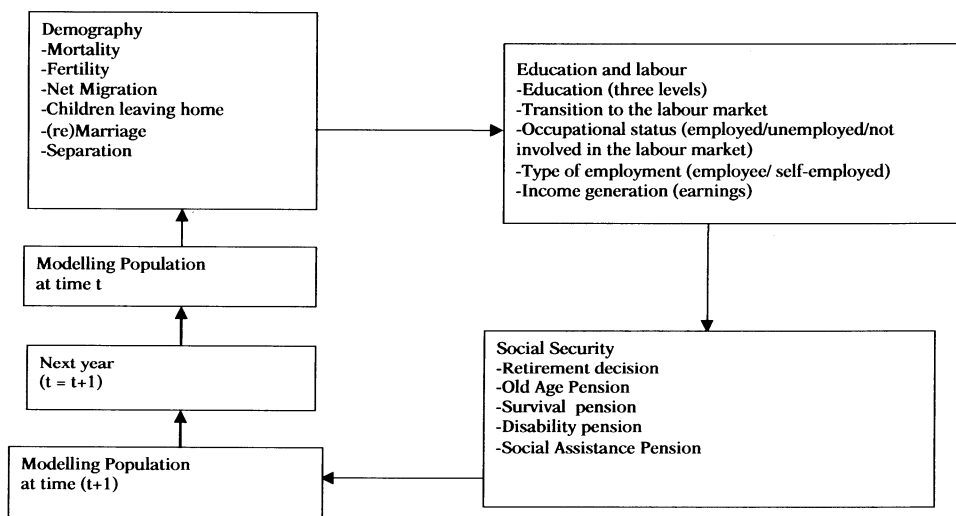
4.2 Adequacy and social assistance pensions before the MF reform

For the purpose of the present study we present some indicators of the adequacy of the pension system, and we then move to analyze the part of the population of pensioners directly interested by the coexistence of NDC pensions and social allowance benefits before the pension reform which took place in December 2011[17]. We specifically attempt to address the questions raised in section 3, namely quantifying the relevance of the problem there discussed and providing information on the socio-economic characteristics

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[17] The 2011 MF pension reform has been the first act of the government chaired by Mario Monti. While we will present below a series of projections on some of the distributive properties of the Italian social security system after such reform, we have decided not to use it as the reference scenario for two reasons. On one side, because it emerges from our perspective, as will appear clear below, an unfinished trait of the MF reform, in that some of

of those who are likely to receive social assistance benefits as supplement to their own pension income.

Figure 5 shows the evolution of the replacement rate of new retirees (computed as the mean between individuals' ratio of accrued pension in the first year of retirement and their last earning, both gross of income taxes and social security contributions). The figure highlights a significant reduction of the indicator, especially in the second part of the period, when the NDC system will be completely phased-in. The average replacement rate, slightly above 70% at the beginning of the estimated period, decreases to about 50-55% at the end of it. It seems possible to identify three different time-intervals which witness the phasing-in of the NDC system. From 2010 to 2025 we project a slow reduction in the average replacement ratios of new pensioners, as many workers will still retire with the old, DB, formula. The reduction is faster from 2025 to 2035, when all workers will retire with a large and increasing part of their pension calculated through the NDC formula, with those who the full NDC system applies not benefiting anymore from the so-

FIGURE 5 - *Gross replacement rate for new old-age pensioners. 2010 - 2050*
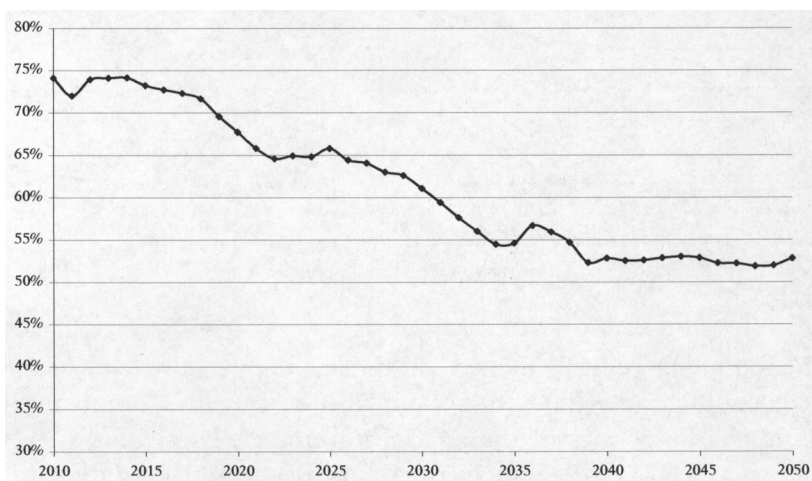
its features are not well established and tailored yet, which is due to both its very ambitious nature and the hurry of the approval process, which took place in an emergency situation. In particular, the aim of substantially increase the retirement age brought to some misalignment of social assistance and NDC pension age limits, which could originate some, probably unintended, strategic behaviors, calling for technical adjustments in the years to come. On the other side, which goes deep into the nature and limitations of microsimulation models, while they are extremely powerful in enriching the base macro scenario with individual data and in order to perform robustness checks and parametric analyses, they are less suitable when a large and structural change takes place.

cial security supplement, but only from the social assistance minimum. Afterwards average replacement ratios are constant at around 50-55%, as all new pensioners are of the NDC type.

Figure 6 gives a broad description of the weight of social assistance pensions in the Italian social security system for the next decades. As a percentage of old-age pensions they are slightly above 8% in 2010, but over the considered period, the share is expected to continually grow up to nearly 16% in 2030. Afterwards the share of social assistance pensions over old-age pensions will remain around this level till the end of the simulation. The proportion of individuals receiving both a social assistance pension and an NDC pension will grow continuously, from nil at the beginning of the simulation to nearly 6% of the whole old-age pensioners at the end of it.

FIGURE 6 - *Share of social assistance pensions*
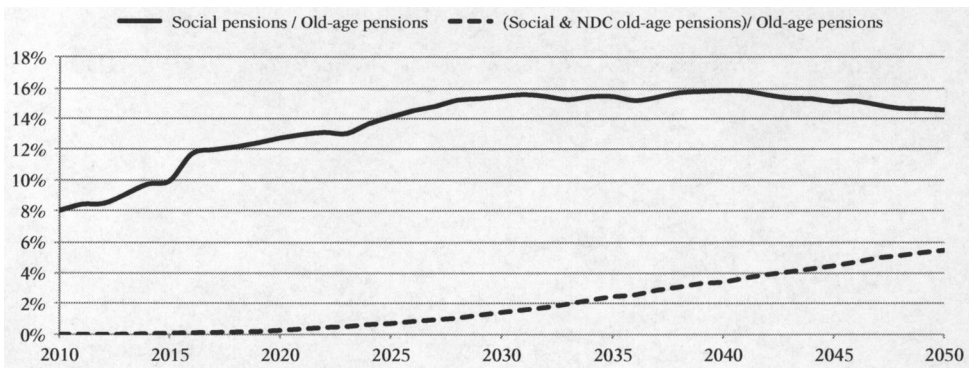
The following analysis focuses on those who are in receipt of social assistance benefits under the NDC system. Table 2 contrasts demographic and economic characteristics of the population under observation with the remaining part of NDC old-age pensioners. As for the gender composition it is immediately clear that women are overrepresented among those NDC pensioners who receive a social assistance pension. With respect to the civil status there are less partnered individuals, in favor of divorced and widowed people. Seniority at retirement appears sensibly lower for those in receipt of a social assistance pension in absolute values (23.9 years versus 35.1 years) and as percentage of those with less than 30 years of contributions. Besides, the group under observation reaches a considerably lower replacement rate, computed as the ratio between old-age pension and last year wage (35% versus 55%) even if retirement age is higher (67.4 years versus 66.2 years). Fi-

Table 2- A comparison between NDC old-age pensioners who receive (right) and not receive (left) a social assistance pension

	NDC old-age pensioners not receiving social pensions		NDC old-age pensioners receiving social pensions		Test on the difference		
	mean	sd	mean	sd			
Female	0.39	0.49	0.74	0.44	female	-0.297***	(-72.21)
Couples	0.46	0.5	0.23	0.42	st1	0.183***	-37.74
Single	0.21	0.41	0.22	0.41	st2	-0.0330***	(-8.44)
Divorced	0.09	0.28	0.2	0.4	st3	-0.0894***	(-25.44)
Widow	0.24	0.43	0.34	0.48	st4	-0.0605***	(-13.84)
Seniority at retirement	35.14	7.28	23.94	8.83	acontrib	9.926***	-110.16
Less than 10 years	0.01	0.12	0.09	0.28	acontr10	-0.104***	(-29.89)
Between 11 and 20 yrs	0.04	0.19	0.27	0.45	acontr20	-0.249***	(-54.29)
Between 21 and 30 yrs	0.15	0.36	0.39	0.49	acontr30	-0.0746***	(-16.44)
More than 30 yrs	0.8	0.4	0.25	0.44	acontr30plus	0.428***	-111.84
Previously priv. dep	0.77	0.42	0.63	0.48	setpen1	0.0575***	-12.13
Previously pub. Dep.	0.15	0.36	0.06	0.24	setpen2	0.104***	-35.69
Previously self empl.	0.09	0.28	0.3	0.46	setpen3	-0.162***	(-38.03)
Replacement rate	0.55	0.13	0.35	0.15	ts_ass	0.198***	-25.95
					_ts_ass	0.200***	(-94.73)
Retirement age	66.2	1.82	67.43	0.75	eta	-2.374***	(-41.29)
					etapen	-0.714***	(-78.82)
					grage1	0.154***	-33.27
					grage2	-0.0765***	(-15.38)
					grage3	-0.0775***	(-21.88)
Observations	*4336*		*423*		N	58238	

t statistics in parentheses

* *p* <0.05, ** *p* <0.01, *** *p* <0.001

nally, it is noticeable the higher proportion of previous self-employed individuals among those in receipt of both an NDC pension and a social assistance pension.

With respect to the adequacy problem, the normative scenario in force before the MF reform did not seem to be able to cope with the problem, at least entirely. Considering old age pensioners that will receive also social assistance benefits, our simulation indicates that the latter will amount in average to just around 17%-18% of the average old age pension for the entire population during the entire period 2030 - 2050. Over the same time span, old age pensioners also receiving social assistance, summing the two, will reach a total income equal, on average, to just 22%-24% of average earnings.

Moving now to the NDC incentive structure indicators, the graphs in Figure 7 assess the capacity of CAPP_DYN to validate at the micro level the incentive structure depicted with the representative individual analysis in Figure 1 above. Therefore we computed both the implicit tax rate and the NPVR in the sub-sample of un-partnered NDC pensioners. For computational reason, the implicit tax rate is computed among individuals who are receiving both an NDC pension and a social assistance pension in a certain year (2050 in the graph). It is immediate to notice that the left part of the graph reproduces exactly the dynamic seen in Figure 1.b[18]. As for the right panel of the graph, NPVRs increase as the level of old-age pension benefit increases, in line with Figure 1.c (note that such graph is drawn on a interval on the x-axis larger than in Figure 1.c). It is however important to notice that simulated NPVRs reproduce a certain heterogeneity, as consequence of the heterogeneity in sample members' working careers. Besides, the value of the NPVR would not reach the value of one even if social assistance benefits would be excluded from the analysis, as a consequence of differences in life-expectancy according gender and cohort of birth observed in the sample[19].

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[18] More precisely, it reproduces the first two segments shown in Figure 1.b.

[19] See Mazzaferro et al. 2012a on this point. Note that gender differences in life expectancy also explain the evidence in the right panel of Figure 7 of two distinct curves, the higher one applying to females.

FIGURE 7 - *Implicit tax rate (left) and NPVR (right) in the pre-2011 reform scenario*
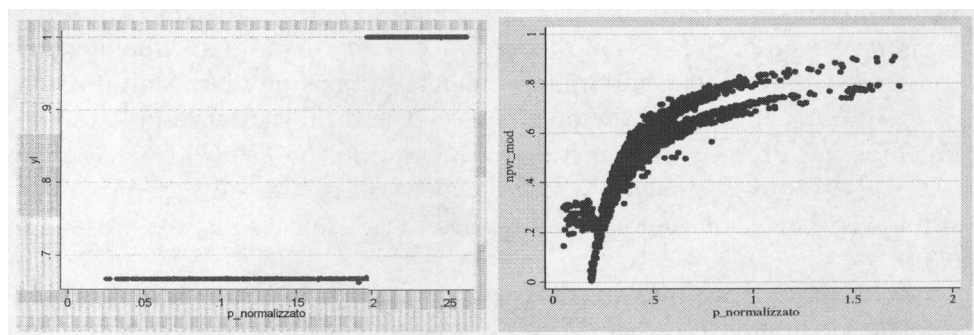
4.3 Increasing cumulability of social assistance and NDC pensions

We now explore some of the effects expected from increasing the possibility of cumulation of social assistance and NDC pension benefits within the Italian NDC system. As stated in section 3 above, only a proportion $\beta=1/3$ of the NDC pension does not enter the means-test for claiming the social assistance pension, within a further limit $\alpha=1/3$ of the social assistance pension itself. While α is responsible for the implicit tax rate reaching 1 in Figure 1.b and Figure 7 (left panel), it can easily be dropped from the analysis, working only on β, the extent of the deduction of the NDC pension from the means-test. Accordingly, we assume a policy scenario where rises to 1/2 and the limit is lifted[20]. Clearly, while dropping allows to avoid the implicit tax rate reaching 1, the parametric intervention on β does not eliminate completely the incentive problem, only making it less pronounced in the interval where social assistance benefits are positive (which also increases). Moreover, while such intervention certainly costs to the public purse, maintaining in place the means-test requirement to benefit from social assistance allows us to confine the improvement of the incentive structure and of pension adequacy only to those that are actually hurt in their incentives and do not have other sources of income apart from their pension. Besides, the selective nature of this program allows to contain its cost.

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[20] For any given , results are unaffected when $\alpha \geq \beta/(1-\beta)$. Thus, in the status quo with $\beta = 1/3$, the limit of "within α of the social assistance pension" would be redundant when $\alpha \geq 1/2$. In the policy scenario where β rises to 1/2, dropping α from the analysis is equivalent to assume it is brought to any value ≥ 1.

The situation is described in Figure 8, which is also shown aside with Figure 1 (the status quo) and Figure 9 (which will be discussed in Section 5) for comparison purposes[21]. In the reformed scenario, an individual benefits from a social assistance add-up to her/his NDC pension till the latter reaches 11,400 euro, instead of the previous 7600, and till such threshold the implicit tax rate drops to 50%, instead of the previous 66%-100% (Panels *a* and *b*). The NPVR in the interval where social assistance benefits are positive is still lower than 1, but not as much as before (it drops to just 0.5, instead of 0.33).

With these more theoretical results in mind, we ran the micro-simulation model. Figure 10 shows CAPP_DYN estimates under the same assumptions used in drawing Figure 8 (β = 1/2 and α dropped from the analysis). The left panel shows how easing the rules on cumulation of social assistance and NDC pension dramatically reduce the implicit tax rates (as expected, from 66.6% in the base case, to 50%). Furthermore, the interval where the left panel of Figure 7 shows and implicit tax rate equal to 1 disappears, due to the dropping of α. However, one has to notice that, due to the increasing interval where social assistance benefits are positive, the implicit tax rate remains positive for the entire interval considered in the x-axis. As for NPVRs, the right panel in Figure 10 confirms an improvement with respect to the base case depicted above in Figures 1.c and in the right panel of Figure 7. What matters for our purposes is that the NPVR values increase in the area on the left side of the curve (i.e. for values of the pension to average earning ratio, on the x-axis, lower than 0.4) from 1/3 in the base case to 1/2.

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[21] NDC pension, social assistance benefits and total income are now expressed in euro (at 2011 value) instead than as ratios to average earnings.
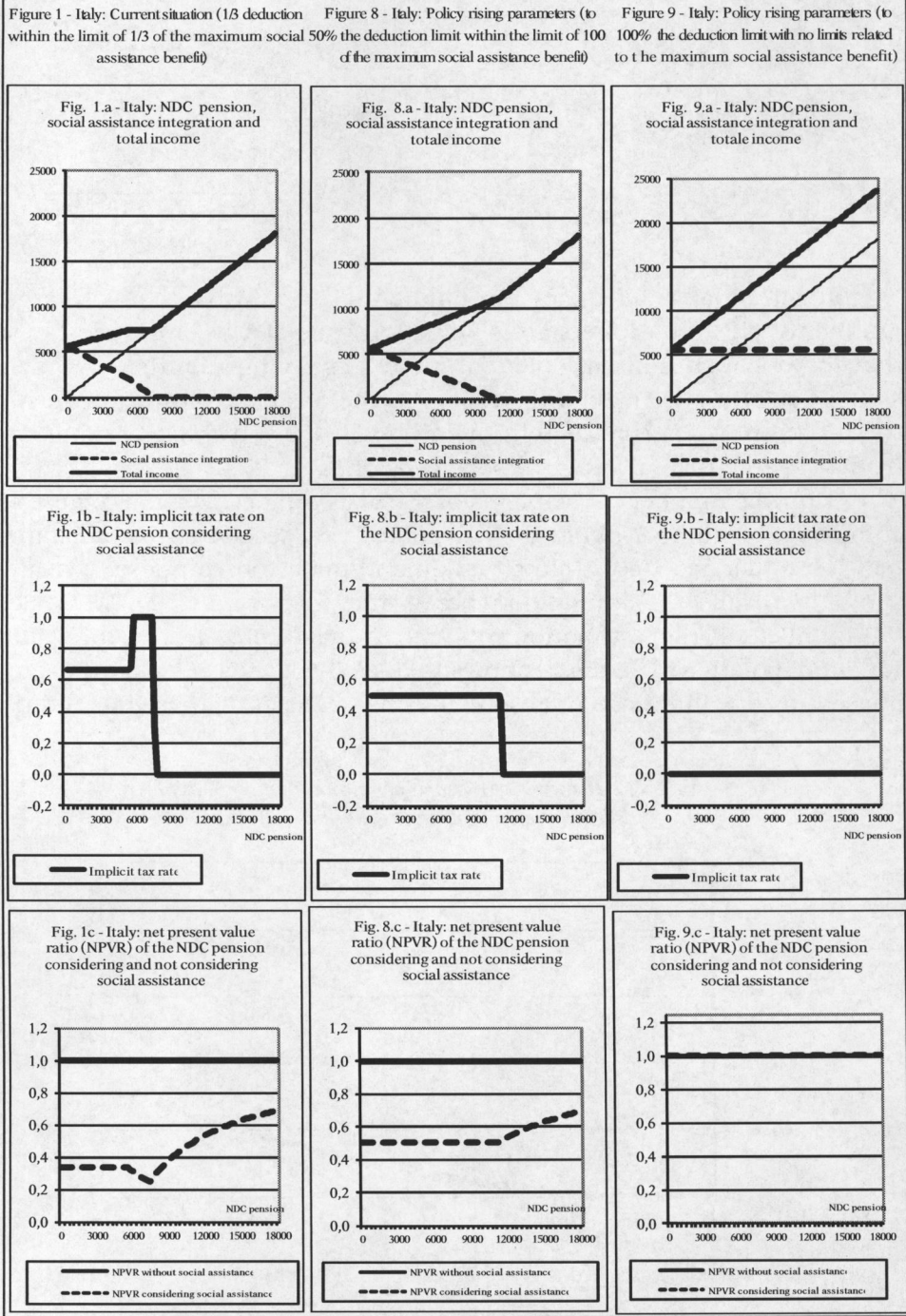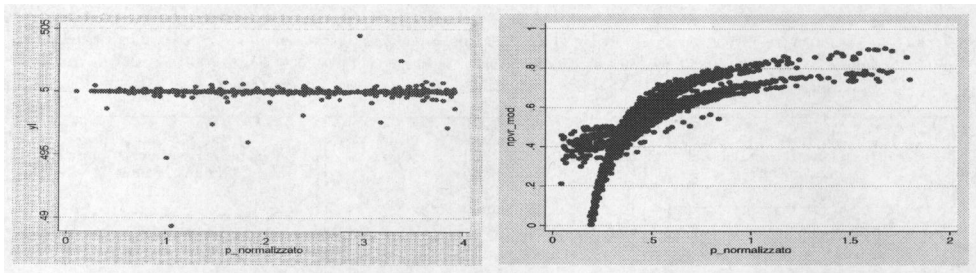
FIGURE 1 - FIGURE 8 - FIGURE 9

Figure 1 - Italy: Current situation (1/3 deduction within the limit of 1/3 of the maximum social assistance benefit)

Figure 8 - Italy: Policy rising parameters (to 50% the deduction limit within the limit of 100 of the maximum social assistance benefit)

Figure 9 - Italy: Policy rising parameters (to 100% the deduction limit with no limits related to the maximum social assistance benefit)

Fig. 1.a - Italy: NDC pension, social assistance integration and total income

Fig. 8.a - Italy: NDC pension, social assistance integration and totale income

Fig. 9.a - Italy: NDC pension, social assistance integration and totale income

Fig. 1b - Italy: implicit tax rate on the NDC pension considering social assistance

Fig. 8.b - Italy: implicit tax rate on the NDC pension considering social assistance

Fig. 9.b - Italy: implicit tax rate on the NDC pension considering social assistance

Fig. 1c - Italy: net present value ratio (NPVR) of the NDC pension considering and not considering social assistance

Fig. 8.c - Italy: net present value ratio (NPVR) of the NDC pension considering and not considering social assistance

Fig. 9.c - Italy: net present value ratio (NPVR) of the NDC pension considering and not considering social assistance

FIGURE 10 - *Implicit tax rate (left) and NPVR (right) with β = 1/2*

Moving now to adequacy our simulation shows that a much larger number of NDC pensioners are eligible for a social assistance add-up, so that there is a substantial potential increase of total benefits (NDC pension + social assistance): with respect to the baseline shown previously, these rise on average in 2050 from 24% to 30.4% of average earning and from 47% to 60% of average old-age pension.

As for the number of recipients of social assistance pension, Figure 11 compares the number of old age pensioners who receive social assistance pension under the status quo situation and under our proposal (we also show the result of a simulation where β further rises, to 2/3). We scaled the numbers of our estimation in order to make inference to the whole Italian population. The figure shows that, as the NDC system starts being phased in, the difference in absolute terms between the baseline and the

FIGURE 11 - *Number of old age pensioners who receive a social allowance benefit with different values of* β
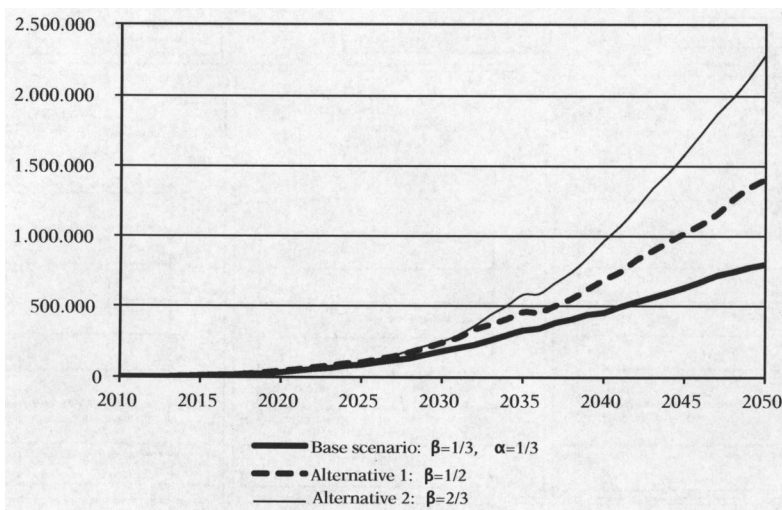
alternative scenario keeps growing, reaching roughly 1 million at the end of the simulation period in the case of β=1/2. All these nice features, however, come with a cost. Increasing the number of recipient of social assistance benefits clearly increases expenditure. As shown in Figure 12, the expenditure rises from 1.2% of the total wage mass (here expressed as the sum of dependent and self employed labor gross incomes) to 2% when β rises to 1/2. Indeed, while the expenditure increase is gathered on a period where the pension expenditure forecasts shown a sharp drop (Department of General Accounts 2011) it should be noticed that the more β rises, the more the social assistance pension tends to become a universalistic (although means-tested) zero-pillar program, which would require, as will be argued in section 5, a re-thinking of the overall pension system organization.

FIGURE 12 - *Expenditure on social pension benefits as a share of total wage mass with different values of β*
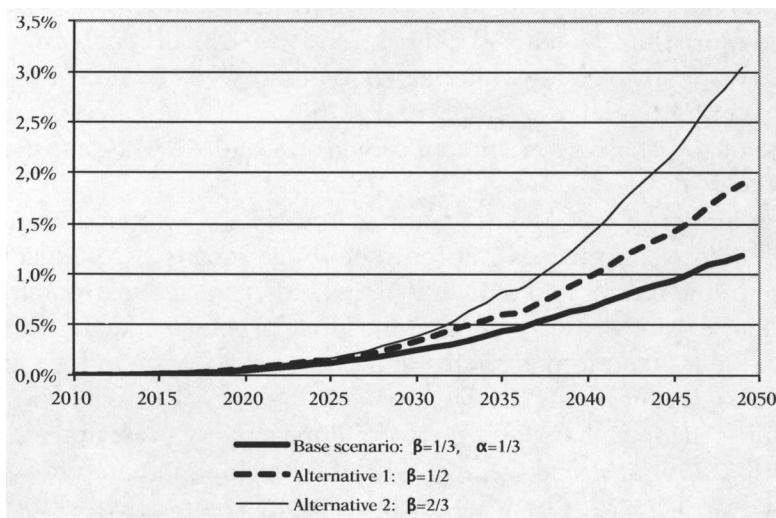
5. ADEQUACY AND INCENTIVES IN ALTERNATIVE SCENARIOS: THE MONTI-FORNERO PENSION REFORM AND TWO OTHER POLICY OPTIONS

5.1 The MF pension reform

While the incentive issues we are discussing here have a general validity for all NDC systems, and although an overall assessment of the effects of the 2011 MF pension reform is beyond the scope of this article, we found

important to assess the reform from our perspective. In order to do so, we firstly review the changes which are most relevant for our analysis and then apply our tools of analysis and run CAPP_DYN under the reformed policy scenario.

The MF reform rises the normal retirement age to 66 years, allowing early retirement only either upon reaching a work seniority of 42 years and three months (one year less for females) or in case one can claim a NDC pension worth at least 2.8 times the social assistance pension, upon reaching 63 years of age and 20 years of work seniority. Even at age 66, however, not all workers will be able to claim a pension: in fact, they will need 20 years of seniority (as against the previous 5 years) and being able to claim a NDC pension worth at least 1.5 times the social assistance pension. Otherwise they will need to wait till 70 years of age, when the work seniority requirement reduces to 5 years and the minimum accrued pension requirement drops. The minimum age to claim social assistance pension also rises, to 66 years, and all above mentioned retirement ages (as well as the seniority requirement of 42 years and three months above) are increased every two years in line with life expectancy. Finally, the NDC formula will apply also to people that had more than 18 years of contribution in 1995, although only for their years of work since 2012, while the NDC annuity coefficients are extended till 70 years of age, and even beyond as life expectancy increases, this allowing not to penalize, on an actuarial ground, those workers that remain at work.

As a matter of fact, the MF reform attains its two main goals of reducing expenditure and increasing retirement age mostly by drastically tightening retirement rules and reducing individuals' choice sets. In such a framework it comes not as a surprise that incentive problems like the ones we unveiled are not taken into accounts and even made worse. Indeed, three elements are relevant in our framework.

Firstly, the fact that the MF reform appears very prescriptive brings in several discontinuities, associated with the reaching of each threshold. On one side, workers with high labor disutility have an incentive to reach 20 years of seniority and a pension entitlement of 2.8 or 1.5 times the value of social assistance pension, to be allowed to retire earlier than 66 or 70 years of age (plus increases of life expectancy), respectively. On the other side, upon reaching 70 years of age individuals reach the last threshold, which makes irrelevant the accrued pension amount threshold and much weaker the seniority threshold (which, as said, drops to five years). However, now incentives become even more problematic than before, because at 70 years also the social assistance minimum rises, from 430 to 600 euro per month, such increase being subject to a different means test, which does not allow for ac-

cumulation with the NDC pension. It follows, therefore, that until reaching such threshold (about 7750 euro per year) tax rate rises to 1 and the NPVR net of social assistance drops to 0.

Secondly, while people with 20 years of seniority could retire at 66 years of age (or earlier), and while 66 years is also the age to claim a social assistance pension, the additional requirement of having an accrued pension worth at least 1.5 times the social assistance pension makes it impossible any accumulation of social assistance and NDC pensions before 70 years of age. Indeed, what we believe is an unintended feature of the reform emerges, which could induce people (or suggest firms to force workers) into opportunistic behaviors, claiming at 66 years of age a social assistance pension and only four years later the NDC pension[22].

Finally, the MF reform, through the two minimum accrued pension requirements to retire before 66 and 70 years of age (as said, respectively 2.8 and 1.5 times the social assistance pension), introduces a formal regressive feature in the pension system. The last panel in Table 1 above, which shows the number of years of contribution workers at different income levels need to reach a NDC pension worth 1, 1.5 and 2.8 times the social assistance pension, gives some hint of this: while an average worker will likely be able to retire at 66 with 20 years of contributions, and even before with 40 years of seniority, workers at 150% of the mean will be able to retire at 63 with as little as 26-30 years of seniority. On the other hand, workers at 50% of the average will be forced to stay at work till 70 years[23], as they will need more than 40 years of contribution to reach the 1.5 threshold. As a matter of fact, while workers with low wages tend anyhow to remain more at work because the lower amount of accrued pension does not allow them to maintain an adequate living standard, we do not know of other cases where such a regressive feature is embedded in the formal rules of the pension system.

Table 3 synthesizes some of the most relevant effects of the MF reform on both the social security system and the labor market. Results are reported in terms of differences with respect to the base scenario presented in section 4. Firstly, it is worthwhile to notice the dramatic effect on the size of the labor force due to the tightening (mainly in the short and medium term) of the eligibility rules for the retirement, with the substantial abolition of sen-

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[22] In this way individuals would also benefit from the higher annuity coefficients associated with a later retirement age. *De facto*, the social assistance pension would play as a social cushion during the last years of activity (in alternative to unemployment benefits) which could constitute an interesting new feature, if intended.

[23] As said, plus increases of life expectancy. In our demographic framework this implies such threshold increases to about 73 years in 2050.

iority pensions: the labor force is projected to increase by roughly 5% in 2020 and 2030, and by about 2% afterwards. Assuming that future gains in productivity are distributed pro-quota amongst workers, the model determines an almost specular change in pro-capita earnings of future workers. With respect to the old age pensioners, the MF reform will produce a significant shrinkage of their number and a substantial increase of their average pension levels, particularly in the medium-long run[24].

Amongst others[25], main features of the MF reform are the factual abolition of seniority pensions and the introduction of the NDC formula also for those who had at least 18 years of contribution in 1995. Retirement age increases substantially in the coming decades: in 2020 it will be already greater than 65, increasing up to 68.7 at the end of the simulation period. By tightening the eligibility conditions of retirement, the MF reform has an important effects on increasing the number of years individuals spend in the labor market[26]. Consequently, replacement rates are higher in the MF scenario than the ones projected with the base scenario, in particular in the first half part of the simulated period[27].

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[24] The magnitude of the increase of the pension amounts is the effect of two opposed tendencies. From one side, a reduced growth rate of life-time earnings due to the increases in labor force size will reduce K, the notional pension savings, and P^{NDC}, consequently. From the other side, the increases in retirement age would increase the lengh of service L, which would increase P^{NDC}, ceteris paribus.

[25] See Mazzaferro and Morciano 2012b for the analysis of the main normative changes and the financial effects of the MF reform.

[26] The MF reform, through the two minimum accrued pension requirements, has an important effect in lengthening the length of service (L) for those at the bottom of the L distribution.

[27] It is clear how such results strongly depend upon the model assumption on the endogeneity of total labor and productivity, for given assumptions on the GDP growth. In particular, the increase in replacement rates under the MF reform scenario, with respect to the ones presented in Figure 6 above, crucially rely upon a substantial lengthening of working life (L) and a reduction in life-cycle earning growth. L increases because, in line with many other models, we are assuming that employment decisions are fully determined by features of the supply side of the labor market, and are thus independent of demand-side factors (Flisi and Morciano 2011). Life-cycle earning growth is lower in the MF scenario because, while keeping GDP growth rate set at 1.5% in the long-run, total labor force is increasing over time (Ciani and Morciano 2011). Therefore, according our assumption, we do not take into account any possible behavioral response from the demand side. For example it could be possible that a higher employment among the elderly crowds out younger workers employment or changes the relative price of their earnings, which would have important effects in unemployment spells, earnings and ultimately in the level of future pension benefits.

The last two rows of the table shows how the MF reform is likely to change the situation of those who were willing to cumulate an NDC pension with the social allowance (SA+NDC). Abrupt reductions in the absolute numbers of those in receipt of SA+NDC are projected according the reformed scenario. Many factors contribute to the explanation of this result. Firstly, as noted above, the age condition for being eligible to the social allowance benefit will increase substantially according the MF reform, rising up to 69.7 years at the end of the simulated period. Secondly, by tightening eligibility rules, the MF reform increases old age pension amounts, reducing the scope of cumulation between NDC pension and social allowance benefits. Finally, the minimum accrued pension requirement of 1.5 times the social assistance benefit makes *"de facto"* not possible any cumulation of SA and NDC before reaching 70 years of age.

Besides, a substantial risk of polarization will emerge after the reform, being the oldest old age pensioners the poorest. This can be seen in the last row of the table where the average age of new pensioners who belong to the first decile of the pension benefits distribution is sensibly higher than the one observed in the whole sample of new pensioners.

Table 4 yields a better inside into the distributive implication of the MF reform by contrasting the subsample of those in receipt of NDC+SA before and after the reform. The sample mean of recipient in the MF scenario shrinks dramatically with respect the pre-reform scenario. The representative NDC pensioner in receipt of a social assistance benefit will have – in the reformed system- a significantly higher seniority at retirement (23.9 years versus 28.6). In the reformed scenario, there is no SA recipient with less than 10 years of contributions and even the share of those with 10 to 20 years is reduced considerably. The timing in which individuals become eligible for a social assistance benefit increases of about 3 years. Being more time in the

Table 3: The effect of the Monti-Fornero reform on the main outcomes of interest				
	2020	2030	2040	2050
Labor Force	5,00%	4,60%	2,10%	2,40%
Earnings	-4,70%	-4,50%	-2,10%	-2,60%
Old-age pensioners	-13,40%	-14,60%	-10,70%	-12,40%
Old-age pensions	0,60%	7,70%	18,60%	16,80%
Retirement age	65,4	67,2	67,8	68,7
Retirement Age	1,4	1,7	0,6	1,5
Contributions at retirement	5,7	2,8	3,1	1,3
Replacement Rates	12,1	12,7	9	4,1
(SA + NDC) recipients	.	-83,20%	-67,60%	-55,00%
Average age in the first decile	67,8	69,1	69,4	69,8

Notes: Percentage/absolute differences between the main and the MF scenarios.
Source: CAPP_DYN

labor market has an effect in increasing expected replacement ratios from about 35% up to 48%.

Table 4: Characteristics of those in receipt of SA+NDC in the base scenario and in the MF scenario				
	Base scenario (N=870)		Monti-Fornero Reform (N=386)	
	mean	Sd	mean	Sd
Female	0,74	0,44	0,69	0,46
Partnered	0,23	0,42	0,22	0,41
Seniority at retirement	23,94	8,83	28,6	7,31
Less than 10 years	*0,09*	*0,28*	*0,0*	*0,0*
Between 11 and 20 yrs	*0,27*	*0,45*	*0,1*	*0,31*
Between 21 and 30 yrs	*0,39*	*0,49*	*0,56*	*0,49*
More than 30 years	*0,25*	*0,44*	*0,33*	*0,46*
Previously in the private sector	0,63	0,48	0,51	0,5
Previously in the public sector	0,06	0,24	0,08	0,27
Previously self-employed	0,3	0,46	0,4	0,49
Retirement age	67,43	0,75	70,0	0,0
Replacement rate	0,35	0,15	0,48	0,13

Notes: Mean and Standard Deviation (sd) computed only among NDC pensioners who are receiving a social assistance benefit in the pre and post MF reform scenarios. Source: CAPP DYN

5.2 Two other alternatives

It is interesting to briefly contrast our proposal of increasing cumulability of social assistance and NDC pension benefits with two other policies which could also affect incentive effectiveness and pension adequacy.

Firstly, one could design a situation where the NDC system incentive problems disappear completely and adequacy substantially increases: it is when full cumulation of social assistance and NDC pensions is allowed, i.e. $\beta=1$. In such case, represented in Figure 9, shown aside with previous Figure 8, the social assistance pension, while remaining means-tested, would become a pension base, on top of which the NDC pension would add. Thus, implicit tax rates would stay at 0 and NPVRs at 1, regardless of the size of the NDC pension (Figures 9.b and 9.c).

Clearly, allowing full cumulation of the two types of pension would imply a substantial increase of public expenditure[28]. However, this rather extreme option should be explored together with a reduction of social contributions and an increase of fiscal revenues to finance it. Indeed, it could and should bring-in a reassessment of the current equilibrium between the different instruments of financing the welfare. This option could even originate

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[28] An explorative simulation shows that expenditure would rise to 8% of the wage bill in 2045 and to 12% in 2050, when more than 5 millions of individuals would be receiving a social assistance add-up.

a reduction of labor cost and/or an increase of wages, if social assistance would end up being financed through revenues from a larger tax base than labor. While this is certainly a scenario which is worth studying more in detail, it should be noted from the beginning that a different financing arrangement would not undermine the financial equilibrium of the NDC system, which allows for the presence of non-contributory components financed through general tax revenues.

A different perspective with respect to our proposal is the one developed by Raitano and Pizzuti (Raitano 2011, Pizzuti and Raitano 2011). Wishing to address the expected fall of pension replacement rates in Italy, the authors examine a scenario where a minimum NDC pension is introduced, higher than the social assistance minimum and linked to work seniority and retirement age. The level of the minimum NDC pension would reach a maximum of 900 euro per month (2011 prices) for an individual retiring at 65 with 40 years of seniority, dropping to 710 euro per month in case of retirement at age 62 with 35 years of seniority. The amount needed to bring each NDC pension to the minimum would be financed through general fiscal revenues.

While such measure has clear positive effects on pension adequacy, which are directly proportional to its cost and depend on the exact parametric specification chosen, it is worth noting the differences with our proposal as for what is concerned with the effects on the NDC incentive structure. Indeed, while the Pizzuti - Raitano's proposal increases incentives to contribute to get an higher seniority to be considered in the calculation of the minimum, it also reduces incentives to contribute above the minimum needed to get recognition for each year of work. In practice, the returns on contributions increase above that recognized in the NDC system until the yearly minimum contribution is reached, then the implicit tax rate on all additional contributions during the year becomes 1. In other words, for those workers and pensioners that will end up benefiting from the minimum NDC pension, the DC mechanism would drop, the game becoming how large a fraction of a flat rate pension an individual will be entitled to, given her/his seniority and retirement age. Indeed, Pizzuti and Raitano do not consider such failure of the DC principle a problem, as they claim that one needs to reintroduce redistributive features within the pension system[29]. We believe, however, that the reintroduction of redistributive aspects within the pension system could be done without necessarily jeopardizing the DC principle, following an approach more alike the one developed in this paper.

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[29] In particular, they argue, to take care of the fact that many workers with unconventional labor contracts have been subject for too many years to too little contribution rates (in order to reduce labor costs) and should not be penalized for this.

6. CONCLUSIONS AND FUTURE WORK

NDC pension systems are built on principles of actuarial fairness and incentive neutrality. However, the joint consideration of NDC pensions and means-tested social assistance benefits brings to question their ability to respond to these same principles. Retirees entitled to a NDC pension, even in absence of other sources of income, either will not benefit, or not benefit in full, of social assistance, or they will get social assistance losing a part of their contributory pension. This means that, when the situation of a NDC retiree is compared to the one of somebody that never entered the public pension system, actual returns on contributions granted by NDC are lower than generally though: net present value ratios are well below 1 and, within certain intervals of the pension amount, implicit marginal tax rates may reach 100%. As these problems are more pronounced at low income levels, such incentive failure brings a regressive feature in the NDC system, which could disincentivate contribution, suggesting people to remain, or shift, into the informal sector of the economy.

The analysis of the current institutional framework in Italy, Sweden and Poland suggests that this issue is relevant. Thus, problems of actuarial unfairness and incentive failure in NDC systems emerge aside with the traditional concerns on pension adequacy, in particular for those at the bottom of the income distribution.

To address such problems, the paper explored the effects of increasing the possibility of cumulating social assistance and NDC pension benefits in Italy, above the current value of 1/3 and to 1/2. The empirical analysis is done using CAPP_DYN, a dynamic micro-simulation model of the Italian pension system, using as benchmark the situation prior the 2011 Monti Fornero reform. Results suggest that with the proposed intervention the incentive structure and actuarial fairness would improve, as would do adequacy. According to our simulations, by rising to 1/2 the parameter of cumulation of NDC and social assistance pensions would: *i)* reduce the implicit tax rate from 0.67 to 0.5; *ii)* increase the NPVR from 0.33 to 0.5; and *iii)* allow one million more pensioners than previously expected to benefit from a social assistance add-up on top of their NDC pension, without this endangering the public balance.

Against this framework, the 2011 Monti Fornero reform appears as mainly driven by the aims of increasing retirement ages and reducing expenditure in an emergency situation. As such, it privileges compulsory measures rather than individuals' rational calculation and tries to contrast opportunistic behaviors, or choices that are not considered socially desirable, more by tightening retirement rules than by strengthening the incentive structure. In doing so, some inconsistencies emerge, as well as some re-

gressive features and a possible role of the social assistance pension as a social cushion tool in the years immediately before retirement, which we are not sure are fully intended.

Results presented in this paper show robustness with respect to several changes of parameters and scenario. Further developments are envisaged in two main directions. On the one hand, it would be interesting to combine the analysis presented here with one that explicitly considers differences in life-expectancy among people with different socio-economic status. Such topic has already, although separately, been considered using CAPP_DYN, unveiling another regressive dimension of NDC systems (Mazzaferro et al. 2012). On the other hand, our parametric reform should be applied to a Monti-Fornero reform framework more complete and coherent, which will require to wait for some further corrections of the pension system rules. Against such a baseline, also the two alternatives considered in section 5, namely *i)* allowing full cumulation of social assistance and NDC pensions and *ii)* reintroducing, within the NDC system, a minimum (contributory) pension should be examined. To this aim, however, one will have to make comparable the effects on incentives, adequacy and expenditure of all the options considered, building an appropriate metric. Also, the extreme scenario of full cumulation of the two types of pension should be examined in more details, considering it in the framework of a more general rethinking of the financing of welfare expenditure.

REFERENCES

BANKS, J. and OLDFIELD Z. (2007). "Understanding Pensions: Cognitive Function, Numerical Ability and Retirement Saving", *Fiscal Studies* 28(2), pp. 143-170.

CANNON E. and TONKS I. (2003), "UK Annuity Rates and Pension Replacement Ratios 1957-2002", *UBS Pension Research Program Discussion Paper* No. 8, London School of Economics, London.

CARONE G., IMMERVOLL H., PATUROT D. and SALOMÄKI A. (2004), "Indicators of Unemployment and Low-Wage Traps (Marginal Effective Tax Rates on Employment Incomes)", *Social, Employment and Migration Working Papers*, No. 18. OECD, Paris.

CHLON-DOMINCZAK A. and STRZELECKI P. (2010), "The Minimum Pension as an Instrument of Poverty Protection in the Defined Contribution Pension System – An Example of Poland", *MPRA Paper* No. 25262. http://mpra.ub.uni-muenchen.de/25262/.

CIANI E. and MORCIANO M. (2011), "Estimation and Simulation of Earnings in IT-SILC", *CAPP Working Paper* No. 90, University of Modena and Reggio Emilia.

DEPARTMENT OF GENERAL ACCOUNTS (2011), "Mid-Long Term Trends for the Pension, Health and Long Term Care Systems", Ministry of economy and finance, Rome.

EMPLOYMENT COMMITTEE (2003), "Making Work Pay", European Union, Bruxelles.

ESTELLE J. and SONG S. (2001), "Annuities Markets Around the World: Money's Worth and Risk Intermediation" *CeRP Working Paper* No. 16-2001, Turin.

FLISI S. and MORCIANO M. (2011), "Trends and Dynamics in the Italian Labour Market. An Empirical Evaluation Using RFL Data, 1993-2007," *CAPP Working Paper* No. 91, University of Modena and Reggio Emilia.

FORNERO E. and MONTICONE C. (2011), "Financial Literacy and Pension Plan Participation in Italy", *Journal of Pension Economics and Finance*, 10(4), pp. 547-564.

GUAZZAROTTI G. and TOMMASINO P. (2008), "The Annuity Market in an Evolving Pension System: Lessons from Italy", *CeRP Working Paper* No. 77, Turin.

GÒRA, M. and PALMER, E. (2004), "Shifting Perspectives in Pensions", *IZA Discussion Paper Series*, No. 1369.

HOLZMANN, R. (2000), "The World Bank Approach to Pension Reform", *International Social Security Review*, 53(1), pp.11-34.

HOLZMANN R. and PALMER E. (eds.) (2006), *Pension Reform. Issues and Prospects for Non-Financial Defined Contribution (NDC) Schemes*, World Bank, Washington DC. http://siteresources.worldbank.org/INTPEN-SIONS/Resources/NDC_English.pdf.

ISTAT (ISTITUTO NAZIONALE DI STATISTICA) (2011), *I Beneficiari delle Prestazioni Pensionistiche*, Rome. http://www.istat.it/sanita/assistenza/.

KLEVMARKEN, A., (2005) "Dynamic Microsimulation for Policy Analysis - Problems and Solutions", *Paper presented at the 2005 Australian Conference of Economists*.

LUSARDI, A. and MITCHELL, O.S., (2007) "Baby Boomer Retirement Security: The roles of Planning, Financial Literacy, and Housing Wealth", *Journal of Monetary Economics*, 54(1), pp. 205-224.

MACKENZIE G. and SCHRAGER A. (2004), "Can the Private Equity Market Provide Secure Retirement Income?", *IMF Working Paper* 04/230, Washington D.C.

MARANO A. (2006), "Pension Reforms in Italy: Principles and Consequences". *Revue Française des Affaires Sociales*, No. 1/2006, Paris.

MARANO A., PROFETA P. and SOMMACAL A. (2012), "Il Sistema Pensionistico: dall'Assicurazione Sociale all'Individualizzazione". In: AA.VV.: *Economia Pubblica e Istituzioni. Scritti di e per Roberto Artoni*. Il Mulino, Bologna.

MAZZAFERRO C. and MORCIANO M. (2011), "Measuring Intra-Generational And Inter-Generational Redistribution In The Italian Old Age Pension System", *MEF Working Paper* No.11, Department of the Treasury, Ministry of Economy and Finance, Rome.

MAZZAFERRO C., MORCIANO M. and SAVEGNAGO M. (2012), "Differential Mortality and Redistribution in the Italian Notional Defined Contribution System". *Journal of Pension Economics and Finance*, Vol 11, Issue4, October, pp. 500-30.

MAZZAFERRO, C. and MORCIANO, M. (2012a), "A Dynamic Micro-simulation Model for the Long-Term Analysis of the Italian Social Security System", Capp Working Paper n. 48, disposable at http://www.capp.uni-more.it/pubbl/cappapers/Capp_p48.pdf.

MAZZAFERRO, C. and MORCIANO, M. (2012b), "Pensioni Pubbliche: l'Ultima Riforma?". in A. Zanardi, ed. *La finanza pubblica italiana. Rapporto 2012*, Il Mulino, Bologna.

O'DONOGHUE C., (2001), "Dynamic Microsimulation: A Methodological Survey", *Brazilian Electronic Journal of Economics*, Universidade Federal de Pernambuco, vol. 4(2).

OECD (2007), *Pension at a glance 2007*. OECD, Paris.

PIZZUTI R. and RAITANO M. (2011), "Le Prospettive del Sistema Previdenziale: Problemi e Proposte", in R. Pizzuti, ed. *Rapporto sullo stato sociale 2011*, Esselibri, Naples, pp. 388-398.

PUDNEY, S. and SUTHERLAND, H. (1994), "How Reliable are Microsimulation Results?", *Journal of Public Economics*, 53(3), pp.327-365.

QUEISSER M. and WHITEHOUSE E. R. (2006), "Neutral or Fair? Actuarial Concepts and Pension-System Design" *OECD Social, Employment and Migration Working Papers*, No. 40, OECD, Paris._www.oecd.org/els/workingpapers.

RAITANO M. (2011), "Carriere Fragili e Pensioni Attese: i Possibili Correttivi al Sistema Contributivo e la Proposta di una Pensione di Garanzia", *Rivista delle politiche sociali*, No. 3/2011. Ediesse, Rome.

SOCIAL PROTECTION COMMITTEE (2009), "Updates of Current and Prospective Theoretical Replacement Rates - 2006-2046, Report of the Indicator Subgroup. Annex: Country Fiches", European Union, Bruxelles. http://ec.europa.eu/social/main.jsp?langId=en&catId=752&newsId=551&furtherNews=yes.

TARKI SOCIAL RESEARCH INSTITUTE (2009), "PENMICRO - Monitoring Pension Developments through Micro Socioeconomic Instruments based on Individual Data Sources: Feasibility Study". *Final Report for The European Commission*, European Union, Bruxelles. http://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=490&furtherNews=yes.

WHITEHOUSE E. R. (2010), "Decomposing National Defined-Contribution Pensions: Experience of OECD Countries' Reforms", *OECD Social, Employment and Migration Working Papers*, No. 109, OECD, Paris. www.oecd.org/els/workingpapers.

ZAIDI A. and RAKE K., (2002), "Dynamic microsimulation models: a review and some lessons for SAGE", *Sage discussion paper* No. 2, London.