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The Redistributive Impact of Alternative Income Maintenance Schemes: A Microsimulation Study using Swiss Data*

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Abstract

Taking a benchmark scenario, the current situation in Switzerland, and using a microsimulation technique, we compare the effectiveness of various income maintenance schemes for reducing inequality and poverty. A full negative income tax allowance designed to eliminate poverty, is shown to reduce income inequality most drastically. An integrated federal linear tax rate of 62% is required to make it viable. Aggregate work hours are reduced by approximately 10% and average disposable income falls by 9.3% under such circumstances. A participation income restricted to adults in employment and covering 50% of subsistence costs is however shown to result in an unambiguous social welfare improvement over the current situation in Switzerland.

Keywords: Income maintenance, negative income tax, microsimulation, income redistribution.


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1 Introduction

Undoubtedly, one of the principal goals of the welfare state is to provide a social safety net for families whose incomes are likely to fall below a critical threshold, and more generally to redistribute resources in an equitable manner. Because social insurance schemes are often funded from income taxation, the government must always trade off these justice objectives against the distortions caused by taxation, especially when these result in significant reductions of work hours of individuals with a capacity to generate high earnings.

Alternative income maintenance schemes generate different budget constraints for households, and, in theory at least, different labour supply responses. For this reason, they will not be equally effective at reducing poverty and inequality; likewise they will not be equally costly in terms of tax revenue requirements. Hence, alternative income maintenance schemes may be taken to imply qualitatively different trade-offs between equality and efficiency. The purpose of this study is precisely to study the effect of various income maintenance schemes on poverty, inequality and social welfare. Summary statistics for the underlying level of poverty and inequality are computed. However, because the question we ask is essentially a qualitative one, we also undertake an ordinal analysis of the income distributions pertaining to the various policy scenarios, examining the underlying Lorenz and poverty deficit curves. The social welfare criterion embodies a preference for higher incomes, and accordingly provides a means of comparing alternative policy scenarios which generate different levels of aggregate income. Thus, income distributions pertaining to key scenarios of interest are also compared in the light of the generalized Lorenz criterion.

Taking a benchmark scenario, the current distribution of household disposable income in Switzerland for individuals in paid employment, or seeking employment and available for work, we are also interested in examining if any of the policy scenarios we examine can result in a social welfare improvement over the reference situation.\footnote{The self-employed are excluded from our analysis primarily because of poor data quality. See the data appendix for further details.} The various schemes examined here include a full negative income tax allowance, a partial negative income tax allowance, a participation income covering 50\% of the subsistence cost of living, an income support scheme which tops up household resources to the level of subsistence expenditure, and a simplified form of an earned income tax credit.

As stated above, alternative income support schemes result in different budget...
constraints for household. In this sense, it would be somewhat arbitrary to assume that household labour supply remains fixed across policy scenarios. For this reason, our chosen method of investigation was to undertake a microsimulation study of family labour supply responses, comprising an estimated econometric model coupled with an integrated tax-benefit module that models the budget constraint of every household under different policy scenarios. The microsimulation method has been used to investigate the incentive effects of welfare reform packages such as the Earned Income Tax Credit in the US, and the Working Families Tax Credit in the United Kingdom (see Blundell and MaCurdy, 1999 as well as Blundell, 2001 for discussions). A similar study in the Swiss context is that of Gerfin and Leu (2003), where the authors propose to examine also by means of a microsimulation technique the likely effects on poverty and labour force participation of the introduction of an earned income tax credit.

It is important to note however that studies of this type (e.g. Duncan and Giles 1996 and 1998) pay cursory attention to the overall distributional impact of tax credit reforms, choosing to focus instead on labour supply responses (because such schemes are primarily intended to stimulate participation). Our paper thus departs from this literature by placing the emphasis of the analysis on changes in income distribution.

Social security reform has been high on the agenda of most developed countries. The American Earned Income Tax Credit [EITC], and the British Working Families Tax Credit [WFTC], have been the subject of various evaluation studies (see Blundell and MaCurdy, 1999 for a survey). The rationale underlying these programmes is to induce increased participation of low income workers in the labour force. The Negative Income Tax [NIT] and Basic Income [BI], two related income support schemes, are more predominantly intended to redistribute resources to the poor population, independently of their work decisions.

The proposal for a NIT first appeared in Milton Friedman’s *Capitalism and Freedom*. Though it was never implemented, it has also shaped a great deal of recent US welfare policy as argued for instance by Moffitt (2003). Friedman (1962) intended to substitute the NIT for the ‘rag bag’ of multiple welfare programmes. This was argued to save administrative costs, and was also argued to be beneficial on the grounds that the NIT would ‘integrate’ the tax system. The NIT would not intrude into people’s privacy since other than a means test, welfare officers were not required to evaluate individual’s capacity to work, how hard they have tried to find work etc. Because of the universal nature of this policy package, the NIT was also
argued to reduce welfare stigma (an analysis of which is presented in Moffitt, 1983) and not to interfere with marriage decisions and family composition.

The Basic Income and accompanying flat tax proposal is extensively discussed in Atkinson (1995). The basic income proposal shares many features with the NIT. Under the BI proposal the tax rate on all income sources is intended to be identical, obviating the need to define a tax unit. Thus, unlike in the NIT, the benefit recipient in the case of the BI is the individual and not the family. The tax rate on income is intended to be flat, in order to save on the administrative costs of operating a graduated tax schedule. The linear income tax rate envisaged is perhaps in the order of 0.4 to 0.5.

We devote a large part of our study to the examination of the effect on income distribution of the introduction of a combined negative income tax allowance and flat tax. The related basic income and flat tax proposal has been the focus of the study of Atkinson (1995). Our study is similar in emphasis to that of Creedy and Dawkins (2002), which addresses several issues raised in Atkinson (1995) by comparing the working of a means tested benefit versus a universal coverage. Creedy and Dawkins use a simulation method to address their concerns, whereas this study is based on a micro-simulation technique with reference to Swiss household data. As is most often the case, the particularities and level of realism underlying a microsimulation model \([MSM]\) are chosen to reflect the nature of the question one wishes to address. At one end, one finds arithmetic \(MSM\)s designed primarily to study the impact of marginal reforms on household welfare (see Bourguignon and Spadaro, 2005 for a discussion) which abstract from behavioral responses in the aftermath of policy reforms. At the other end we find the level of generality proposed by Fredriksen and Stolen (2007) and Merz (1996), where events such as changes in family composition, the decision to migrate, or mortality risk\(^2\) are taken into account.

We are primarily interested in labour supply reactions of households in face of alternative tax and benefit schemes. Thus, we follow Orsini (2006) and Steiner and Wrolich (2006) in adopting the discrete choice hours of work framework initially proposed by van Soest (1995) for modelling behavioral responses. It is to be noted that labour demand is assumed infinitely elastic in this approach. Because the tax reforms we study have to be judged in relation to their distributional impact but also in relation to their feasibility, it is important that the various policy reforms we examine be comparable in terms of the costs they entail. For this reason we have chosen to implement the various programmes under the requirement of fiscal

\(^2\)See in particular the description of the Mosart \(MSM\) the authors of the study provide.
neutrality, as in Aaberge, Colombino and Strom (2004).

It is plausible in practice that given two households with identical characteristics and occupational choices, they respond differently to a change in the tax/benefit system which concerns them equally. This is the problem of unobserved heterogeneity in relation to labour supply responses (see Bourguignon and Spadaro, 2005). To accommodate this source of unobserved heterogeneity, we simulate (as in Gerfin and Leu 2003) a pseudo-residual for each household, chosen so as to make the predicted occupational choice of the household conform with its utility maximizing choice under the benchmark scenario.

Perhaps one feature of our study which sets it apart from the papers mentioned above, is our emphasis on the ordinal analysis of the effect of policy reform on income distribution. Again, our interest in poverty and inequality reduction and not in changes in work hours per se, has geared our analysis towards these normative aspects of policy reform.

In this sense, it is hoped that the present study presents a step in the direction of adding realism to the evaluation of the redistributive impact of various income maintenance schemes.

Section 2 of the paper presents the policy scenarios which form the basis of our study. Results are presented in section 3 and 4. Section 5 contains a detailed examination of the unique policy scenario which entails a general welfare improvement over the current situation in Switzerland. Section 6 concludes the paper. A technical appendix contains the details of our policy evaluation methods and a data appendix presents the sample used in the study.

### 2 Policy scenarios

The tax reform scenarios we have chosen to simulate are intended to capture some features of the different schemes discussed above, and of the current situation in Switzerland. However because of the federal structure of fiscality in Switzerland, they are considerably simplified in order to be easily implemented in the context of our study. All in all we have considered eight scenarios, a benchmark scenario, which we have termed base in Table 1, together with six other schemes. We begin with a summary of the general structure of the Swiss tax and benefit system.

Income taxes are levied at three different levels in Switzerland: federal, cantonal and municipal. There are different tax schedules that operate for each Canton and there is also a distinct federal income tax schedule. In general, each Canton chooses
to operate a separate schedule for each of the main two demographic groups: singles and married couples. This is also the case with regards to the federal income tax. Municipal taxes are set as a proportion of cantonal taxes. Note that the cantonal tax schedules vary a great deal in terms of progressivity. Every Canton will also allow for some tax deductions, in relation to the number of dependent children and also in relation to social insurance and pension funds contributions. Again these tax deduction rules are fairly heterogeneous across Cantons.

Social insurance contributions operate at both the federal and cantonal level. Two major federal level payroll deductions are unemployment insurance (approximately 1% of gross earnings) and old age insurance (AVS)—the first tier of pension contributions amounting to about 5.25% of gross earnings. The second tier of the retirement pension scheme is operated by private pension funds subject to a legal minimum levying rate. Similarly, social benefits are administered by both federal and cantonal authorities. Unemployment benefits are determined at the federal level. Individuals who have contributed for a six months period are entitled to 70% to 80% of their gross earnings over a 24 months period. The take-up of a basic health insurance scheme is compulsory. Government regulated private insurance providers insure individuals. The actual insurance premiums are not determined by the individual’s income or wealth, but rather according to their age group. Cantons however provide rebates to households with limited means. Health insurance rebates as well as housing and child benefits are administered by the Cantons. The rules as to who qualifies for these cantonal benefits, the means test, and the level of the transfer are all subject to the Canton’s discretion.

However, the guidelines of the Swiss Conference on Social Support (CSIAS) regarding the minimum subsistence income are generally followed by the relevant cantonal authorities. For this same reason, in applied work on Switzerland, the equivalence scale and related income thresholds used to define the poverty line are those of the CSIAS. The CSIAS sets the critical income threshold at CHF 23690 per equivalent adult. This stands in contrast with other commonly used thresholds in the European Union, determined as a given fraction of median disposable income. We note however that this threshold corresponds to 57% of the median equivalent household disposable income in 1998, when needs are calculated using the modified OECD scale.

It is important to note that our benchmark scenario differs from the current situation in Switzerland in one important respect. All cantons operate different types of social assistance schemes subject to means tests. Amongst the population
entitled for social assistance, the take up of these allowances is however far from the rule. Leu et al. (1997) in fact suggest that the non-take up rate varies considerably according to the type of benefit considered, and is somewhere in the range of 45% to 86%.

Ideally we would have wanted to model the probability of benefit take-up. However, because of data limitations, we were unable to estimate such a decision. For this reason, we assume in our base scenario however that no one receives social benefits from the government. The current situation in Switzerland with regards to social assistance is therefore somewhere between our base scenario and another limiting case where the take-up rate is universal, a scenario which we have modelled below under the label inc supp. The different scenarios are summarized with the help of Table 1, and Figures 1 and 2 according to the participation condition they entail (essentially a restriction on work hours) and the underlying budget constraint (summarized by the column headings income subsidy and flat tax region). The scenarios are all constructed to be revenue neutral, meaning that they generate the same level of tax receipts at the federal level as in the benchmark scenario, plus the revenues required to sustain the alternative income support programmes.

Participation in a scenario located in the north half of Figure 1 is subject to an income means test. Participation in a scenario located in the east half is subject to a minimum number of hours restriction. Thus, eitc100, located in the North-East quadrant operates subject to both an hours of work requirement and an income restriction. In the South-West quadrant, we have the other polar case defining policy scenarios which have a universal character (that do not require labour force participation, and which are not restricted to individuals on low income.) There are two policy reforms of this nature which we shall examine below: nit50f and nit100f which are two variants of the negative income tax. The scenario inc supp (an income support scheme) located in the North-West quadrant grants assistance to families on low income, regardless of their employment status. Conversely, pi50f in the South-East quadrant, is a participation income which is granted to all families that meet an hours of work requirement, irrespective of their income levels. The pros and cons of each of the scenarios from the point of view of the equity and efficiency effects they entail will be discussed later, with the results at hand.

We first consider the scenario flat taxf, intended to examine the redistributive effect of replacing the current federal, cantonal and municipal income tax structure by a single flat tax, operating as of the level of subsistence expenditure. The “f” of the acronym “flat taxf” denotes the fact that a single tax would be levied at the

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two reasons which motivate this exercise. First, as argued by Atkinson (1995, p. 2) in the context of Britain, the tax rate required to sustain variants of the Negative Income Tax is likely to be higher than the current highest tax rates operating in Europe, so that the scope for a non-linear graduated tax schedule is indeed limited. Second, the feasibility of the envisaged tax reforms can be summarized by examining the marginal tax rate necessary to sustain the reforms under a balanced budget requirement. We also consider a variant of the above scenario, flat tax, where we only replace the current federal income tax structure by a single flat tax, operating as of the level of subsistence expenditure. This latter scenario will prove useful for assessing the desirability of reforms more limited in nature than the negative income tax, i.e. inc supp and eitec100.

Consider then the scenario nit50f in Table 2. This scenario grants households 50% of subsistence expenditure, but only begins to tax income as of the level of subsistence expenditure. As there are no participation conditions operating here, the scenario is intended to capture the distributive effects of what may be considered to be a negative income tax allowance covering 50% of household subsistence costs (as opposed to a full negative income tax scheme granting an allowance equal to 100% of subsistence expenditure). As is the case in flat tax, under the scenario nit50f households are assumed to pay all their taxes at the federal level. Therefore, the graduated cantonal and federal income tax schemes are replaced by a unique linear income tax schedule, which is sketched in Figure 2. We also examine the impact of a full negative income tax scheme which we have called nit100f. The scheme therefore grants an income allowance covering subsistence expenditure. The nit100f scheme is the full negative income tax analogue of nit50f, which is also sketched in Figure 2.\footnote{We use this notation for other scenarios which include such a wide-ranging fiscal reform.}

Another variant of the negative income tax package is one where a participation requirement is introduced. The participation income scheme considered here introduces a work requirement on behalf of each adult in the household. For example, under pi50f the participation income is not paid to a two-parent family in case the wife decides to stay home to take care of the children, even when the family’s resources fall short of a specified poverty line. Likewise, for single parent households such as lone mothers, the scheme only covers those in paid employment. The scheme pi50f therefore mimics all features of nit50f with the participation condition added.\footnote{For the two variants of the negative income tax, namely nit100f and nit50f, we take it that basic health insurance is financed through income taxation.}

federal level, replacing the three-level structure of the current Swiss income tax system.
Finally, we have considered simulating two further social assistance packages which involve a federal tax only, keeping cantonal and municipal taxation unchanged. We have defined an income support package, *inc supp*, which tops up the income of every household to bring them to the level of subsistence expenditure. Until this threshold is reached, there is a one for one withdrawal of assistance for each additional franc earned, implying a marginal tax rate of 100%; a scheme in many respects identical to the way social assistance operates currently in a majority of Swiss cantons. Once the subsistence threshold is crossed, we assume that federal taxation takes the form of the linear flat tax scheme *flat taxf* discussed earlier. Our final policy package operates as *inc supp* with the additional participation requirement of positive work hours for each household member. Because this last package is in several ways similar to the American and British tax credit schemes discussed in the Introduction, we have chosen to label this last scenario *eitc100*.

3 Results: an overview

In order to evaluate the economic effects of the scenarios outlined in the preceding section, we use a microsimulation model which combines a tax-benefit module and an econometrically estimated model of labour supply. The tax-benefit module contains detailed tax and benefit schedules for Swiss residents both at the federal and cantonal level. These schedules are used, on the one hand, to generate budget constraints for each household in the econometric estimations and, on the other hand, as a baseline for the simulation of alternative policy scenarios. In the econometric model, labour supply is modelled as a discrete choice between non participation and different employment states (part-time,...,full-time). The labour supply model is specified separately for two-adult and single-adult households, using the Swiss expenditure and income survey of 1998 as data base. Our sample includes 5434 family units.

The effects on income distribution, output and employment entailed by the eight scenarios discussed above are summarized in Table 2. There are two sets of results: Panel A results refer to reforms involving an integrated tax system replacing the existing three levels of taxation. Panel B results pertain to reforms involving a

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5 A 100% marginal tax rate describes quite precisely the social assistance system in 1998 when the ERC survey was carried out. More recently, several cantons have introduced a small incentive to take up work by exonerating the first several hundred francs earned per month. However, these modest reforms have worsened the situation of those who plan to leave the social assistance system altogether; in this situation marginal tax rates well above 100% can be observed in several cantons. These more complicated schemes could not be taken into account in our simulations since data limitations prevented us from modelling the take-up decision, as mentioned above.

6 See the Appendix for a detailed description of the microsimulation framework.
change in federal taxation only. For each scenario we report inequality statistics (Atkinson and Gini indices) and poverty statistics (head-count and Foster et al. \(P_\alpha\) indices). We also report for the various scenarios the relative variation in average disposable income and in total hours of work. We also present the value for the flat tax rate \(t\) required to sustain the various social insurance schemes under the assumption of revenue neutrality discussed above. Before we turn to the results, we give brief remarks pertaining to the choice of indices of income distribution.

3.1 A note on the choice of inequality and poverty indices

The Gini coefficient is presented here due to its wide appeal amongst practitioners and government statistical bureaus. While the Gini index satisfies the Pigou-Dalton principle of social aversion to inequality, this index presents a drawback in the sense that the underlying social welfare function is quasi-concave, but not strictly so. For this reason the social marginal utility of income to a household underlying the Gini index depends only on its rank, rather than the level of its resources. In practice, the Gini index will be more sensitive to income changes in the middle of the distribution rather than in the tails. The Atkinson index (Atkinson, 1970) does not present this drawback of the Gini. Furthermore, in case sub-group decomposable measures of inequality are required, the Atkinson index can be used, whereas the Gini index is not decomposable.

The poverty headcount is a useful summary statistic indicating the population share living below the poverty line. However it conveys no information about the depth of the problem, and it is insensitive to the distribution of resources among the poor. For this reason, we supplement the head-count with the Foster et al. (1984) measure \(P_\alpha\), which offers a remedy for both problems for values of \(\alpha > 1\).

3.2 Policy effects: summary statistics

Our summary statistics here pertain to the resulting distributions of household disposable income. The income concept used is the equivalized household income; needs being calculated according to the CSIAS equivalence scale discussed above.\(^7\) Our benchmark scenario base entails a level of inequality of 0.15 when using the

\(^7\)In the calculation of summary statistics, the household data are weighed according to sample weights provided by the ERC survey.
Atkinson index and 0.21 using the Gini coefficient. The poverty headcount $H$ takes on a value of 0.033 while the $P_\alpha$ index takes on a value of 0.002. To examine the effect of replacing all taxation with a flat tax rate, other things held constant, we examine the flat taxf scenario. The results (first line of Panel A) indicate that the introduction of an integrated flat tax would result in a marginal tax rate of 28.69%. There is a marginal increase in inequality, with a 1% decline in the poverty headcount. There is a 0.14% increase in average disposable income, and virtually no change in total hours worked.

Next, we turn to nit50f, the partial negative income tax allowance. In comparison to the introduction of a flat tax scheme alone, the combined partial negative income tax allowance and flat tax has a pronounced effect on income inequality and poverty. Taking nit50f, we may note a 44% drop in the level of the $I_A$ index, in comparison to the benchmark scenario base. There is also a 24% drop associated with the Gini (a decline from 0.21 to 0.16). The resulting poverty head-count drops from 3.3% to 1.1%. Likewise, for the $P_\alpha$ index there is also a substantial 50% drop from 0.002 to 0.001. The envisaged scenario is shown however to entail a heavy tax burden: in comparison to the 28.7% marginal tax rate of flat taxf, households above the subsistence resource level would face a federal marginal tax rate of 51% under nit50f. The welfare gains from increased equality have therefore to be weighted against the efficiency effects they entail: our microsimulation results indicate a resulting 5.9% reduction in disposable income and a 6.4% decline in total hours worked in comparison to the base scenario.

Next consider the full negative income tax allowance, nit100f. Of the eight schemes considered here nit100f allows for the largest drop in inequality. The Atkinson index takes a value of 0.06, and the Gini 0.14. In its current form, the proposed scheme is excessively costly to operate: the federal tax rate required to sustain nit100f is equal to 0.62. Again, the equality gains resulting from the above social insurance scheme have to be weighed against their efficiency costs: nit100f entails a 9.3% reduction in disposable income and 10% reduction in work hours. It is also instructive to compare the full negative income tax scheme with its partial negative income tax allowance counterpart: nit100f entails an integrated marginal tax rate of

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8The calculations pertaining to poverty and inequality have been undertaken using the software DAD 4.4 (see Duclos et al., 2005).
9The calculations for the Atkinson index here set the inequality aversion parameter $\varepsilon$ at 2; for the calculations of the Foster et al. index we set $\alpha$ at 2.
10This decline in poverty results from the fact that in the base scenario the poor are not exempted from taxation in all cantons. Under the present scenario all incomes below the poverty line are exempt from taxation.
0.62 whereas nit50f was sustainable at $t = 0.51$. While nit50f does not eliminate all poverty, it results in a limited 5.9% sacrifice in terms of average disposable income, whereas, as stated earlier, nit100f entails a 9.3% loss of average income.

The next scenario we examine operates under a participation requirement for all working age adults. This participation income scheme is not intended to reduce social exclusion — it typically excludes non-participants in the labour market. Instead, its purpose is to induce participation. The pi50f scheme is the analogue of nit50f, with the participation condition added. It is therefore instructive to compare the performances of pi50f and nit50f in equity and efficiency terms. While nit50f entails a 6.4% reduction of work hours, there is a 0.6% increase of hours under the latter scheme. Our microsimulation results suggest that pi50f is sustainable at an integrated flat tax rate of 0.42, whereas $t$ was found to equal 0.51 under nit50f. The variant with a participation requirement however entails degrees of inequality not far from those of the benchmark scenario base. The Gini for instance equals 0.19 under pi50f, 0.21 under base, but is considerably lower, 0.16, under nit50f. It is to be noted also that pi50f does not reduce the poverty headcount to the level achieved by the nit50f reform.

Under Panel B we examine more limited reforms involving a change in federal taxation only. The analogue of flat taxf is a scenario flat tax which replaces the existing federal income tax schedule (a tax schedule involving a large interval of exemption followed by a steeply rising average tax rate) with a flat tax levied as of subsistence expenditure. The existing cantonal and municipal taxes however remain unchanged. The resulting marginal tax rate of 4.9% (first line of Panel B) highlights the limited nature of the reform involved. There inequality rises because with a marginal tax rate of 4.9% the resulting tax schedule is less progressive than the federal tax schedule of the base scenario. The level of poverty is virtually unchanged. There is a 0.16% increase in average disposable income, and a 0.4% increase in hours worked.

Our inc supp scenario is designed with the specific purpose of eliminating poverty by targeting resources exclusively to those below the subsistence poverty line, and by granting poor families only the top up required to reach the subsistence level. It comes therefore with little surprise that such a finely targeted scheme achieve the 0% poverty level at a federal tax rate of only 9.1%. We devote a sub-section below to a critical examination of the relative merits of operating such a scheme.

The final scheme we considered is a variant of the above scheme designed to correct for the disincentive effects related to inc supp. The earlier scheme is thus
kept in all respects unchanged, except now that every working age adult is required to supply a positive amount of hours in order for the household to benefit from social assistance. The resulting scheme eitec100, is operational with a linear tax rate of 6.7%, and results in a minor (0.03%) decline in hours worked. Again, the incentive effects induced by such a scheme have to be judged in the light of its less successful performance in terms of income redistribution. Our summary measures indicate that the eitec100 scheme results in an increase of inequality over the benchmark scenario, and entails higher levels of poverty than all other reform scenarios. Again, the main reason for this finding is due to the fact that the resulting federal income tax scheme, with a marginal tax rate of 6.7% is considerably less progressive than that of the base scenario.

3.3 Policy effects: a word of caution

It is to be noted that many of the critiques voiced against the targeting approach (for instance Sen, 1995) apply in the context of the operation of the inc supp scheme: namely it is assumed that household resources are observed accurately, that there is no stigma to applying for assistance, no administrative costs to evaluating household resources and finally that targeting type I and II errors are inexistent (see Goodin, 1985 for a discussion).

The results of Table 2 may easily lead the policy maker to conclude that the income support scheme is most preferable given that it eliminates poverty with a moderate 9% flat tax scheme, and a 2.4% loss in average disposable income. However, bearing in mind that at the chosen level of the poverty line very few people with very uncommon circumstances are in poverty, a word of caution is required here. In Figure 3, we plot the poverty headcount against the poverty line for various policy scenarios. One pattern clearly emerges when comparing the overall performances of the four scenarios examined there: the inc supp scheme clearly eliminates poverty up to the retained level of subsistence expenditure. However, the poverty headcount immediately jumps to well over 5% (a higher level than in all other scenarios) for poverty lines above the pre-specified income threshold. The reason for this finding is the well documented poverty trap induced by an income support scheme operating a 100% marginal tax rate on all income earned below the subsistence poverty line.

\[11\] Although the participation condition of the eitec100 scheme encourages individuals outside the labour force to take up work, this reform provides also an incentive for working individuals (especially secondary earners) to reduce the number of hours worked. Here the latter effect obviously prevails over the former.
leading many households to stop working altogether.\textsuperscript{12}

This somewhat undesirable feature of \textit{inc supp} occurs to a lesser extent in the context of \textit{eitc100}. The latter scheme does not eliminate poverty entirely at the level of subsistence expenditure; however the jump in the poverty headcount which occurs above the specified poverty threshold is smaller in size than is the case in the context of the earlier scheme. The negative income tax scheme \textit{nit50f} while costly to administer however entails a lower level of head-count poverty than the base scenario, \textit{eitc100}, and \textit{inc supp} once we consider poverty lines above the retained subsistence expenditure level. It is in this sense necessary to examine the overall distributive impact of the various policy scenarios, not just around a pre-specified poverty line. We turn to such considerations in the section below.

The analysis of inequality also yields intriguing results. Moving from the benchmark scenario to \textit{inc supp}, the Atkinson inequality index of Table 2 indicates a decline, whereas the Gini index records a rise, in the level of inequality. This result is best apprehended by recalling that, on the one hand, \textit{inc supp} redistributes resources to those at the bottom end of the distribution and, on the other hand, a substantial share of households in the middle of the distribution see their income decrease because they cease to work. The Atkinson index is more sensitive to the former effect and the Gini index to the latter. These results demonstrate the importance of a more general approach to income inequality comparisons. This is the issue of the next section.

4 Changes in income distribution: an ordinal analysis

The various scenarios analyzed above were shown to redistribute income and to alleviate poverty to differing extents. They were also shown to have different impacts on hours worked and average income.\textsuperscript{13}

It is necessary however to complement the results of Table 2 by taking a further look at the data. Questions such as what happens to income inequality if we choose to use an alternative inequality index to the Gini and Atkinson measure need to be addressed. Similarly, depending on the budget constraints they entail, the various

\textsuperscript{12}The participation rate of single adult households drops from 90.6\% in the base scenario to 83.1\% in \textit{inc supp}. Moreover, the share of couples who work zero hours increases from 0.7\% in the base scenario to 1.7\% in the \textit{inc supp} scenario.

\textsuperscript{13}Clearly, the welfare loss resulting from a reduction in average income and in hours worked under certain scenarios may be partly offset from the welfare gains arising from additional consumption of leisure. Our primary interest here being on the changes in poverty and inequality, we do not take up this issue further. Regarding this point see Aaberge et al. (2004) and Kornstad and Thoresen (2006) for further details.
policies may redistribute resources differently at the bottom, middle and top of the income ladder. In this respect, the use of graphical devices involving transformations of the cumulative distribution function will usually provide richer information on the extent of redistribution, than an examination of poverty and inequality summary measures.

To address these issues, in this section we examine the distributional impact of the set of policy scenarios from an ordinal perspective.\(^{14}\) That is, taking one pair of distributions at a time, we examine the usual dominance conditions on the respective Lorenz curves pertaining to these scenarios which guarantee a change in inequality of the same sign for all inequality indices that satisfy the Pigou-Dalton transfer principle (subsection 4.1). Likewise for the class of poverty indices which obey the Pigou-Dalton transfer principle, we examine related dominance conditions on the pattern of specific pairs of poverty deficit curves which guarantee that all poverty measures rank two specific scenarios in a similar fashion (subsection 4.2). The final subsection addresses the question as to which of the five envisaged reform scenarios may be seen to entail a level of social welfare superior to the current status quo scenario in Switzerland. Following Shorrocks (1983), the social welfare concept may be seen here as an approach unifying considerations of equity and efficiency.

### 4.1 Income inequality

The Lorenz curve is typically used to depict information on income inequality, but also, to check for inequality orderings. When the Lorenz curve for a distribution \(F_A\) lies everywhere above that of \(F_B\), then all inequality indices that exhibit a social aversion to inequality will rank \(F_A\) as the more equal distribution. Table 3 summarizes the information regarding the 15 pair-wise comparisons between the six scenarios mentioned above. If the Lorenz curve for \(F_A\) lies everywhere above that of \(F_B\), then this information can be conveyed by plotting the difference between the Lorenz curves of these two distributions. The resulting curve should have an inverted \(U\) shape. Figure 4 presents such plots for differences in Lorenz curves between selected scenarios.

The first line of Table 3 contains comparisons between the benchmark scenario \(base\) and the other retained scenarios. The cell \((base, nit100f)\) has a + sign, signifying that the benchmark scenario exhibits more inequality than \(nit100f\) in a Lorenz dominance sense. The cell \((base, inc supp)\) conveys the information \((+, p=1)\) indicating that the underlying Lorenz curves cross at the first income decile, with the

\(^{14}\)In what follows, the scenarios flat tax and flat taxf are dropped from the analysis.
Lorenz curve of the benchmark scenario lying below prior to the intersection, and above from the second to ninth decile. As the \textit{inc supp} programme is targeted to top up the resources of families living below the poverty line, this result is indeed expected. With crossing Lorenz curves, a summary measure which is sufficiently sensitive to inequality at the bottom of the distribution, may rank \textit{inc supp} as the more egalitarian of the two scenarios. This is why the Atkinson index indicates that \textit{inc supp} is more favourable than the benchmark scenario from the perspective of income inequality. There is a similar crossing of Lorenz curves between the benchmark scenario and \textit{eitc100}, even though the latter does not provide the income top up to families where both adults do not work. The next two cells indicate that the benchmark scenario exhibits more inequality than both variants of the partial negative income tax allowance retained, namely \textit{nit50f} and \textit{pi50f}. In this sense, our results show an unambiguous effect of inequality reduction when operating a full NIT allowance, a partial NIT allowance or a (partial) participation income.

It is not without interest to compare also the scope for redistribution between the various policy scenarios. The second line of Table 3 indicates that the Lorenz curve of \textit{nit100f} lies everywhere above that of the other five scenarios examined in this section. The cost of operating such a scheme (a flat tax rate of 0.62 and a 9.3\% loss of average disposable income) may be evaluated in the light of the gains in income redistribution. Figure 4 plots Lorenz curve differences between \textit{nit100f} and \textit{base}, and between \textit{nit100f} and each of \textit{inc supp}, \textit{eitc100}, \textit{nit50f} and \textit{pi50f}. It is to be noted that all curves have the inverted $U$ shape discussed earlier, with the extent of redistribution being more pronounced when moving from a partial NIT allowance \textit{nit50f} to a full NIT allowance. The reductions in income inequality in moving from either the benchmark scenario, \textit{inc-supp} or \textit{eitc100} to the negative income tax allowance are however substantial. As is most often the case, the extent of redistribution is usually largest for the middle income groups (see for instance Davidson and Duclos, 1997). Consider for instance the transition from the base scenario to \textit{nit100f}. There, at the fifth decile, there is a redistribution of 6\% of total income from the richer to poorer groups.

The third to sixth lines of Table 3 compare the remaining policy scenarios. It may be noted that the participation requirement introduced in \textit{eitc100} makes this scenario less egalitarian than \textit{inc supp} for the bottom income decile. The distribution entailed by the partial NIT allowance \textit{nit50f} Lorenz dominates all other distributions with the exception of the distribution related to the full NIT allowance. The distribution resulting from the operation of the participation income is Lorenz dom-
inated by the distributions pertaining to \textit{nit100f} and \textit{nit50f}, as discussed earlier. However \textit{pi50f} Lorenz dominates \textit{eitc100}. As a consequence of the participation requirement, the Lorenz curve pertaining to \textit{pi50f} lies below that of \textit{inc supp} up to the 4th percentile ($p = 0.6$); the inequality ranking of these two distributions will therefore not be robust to the choice of inequality index.

### 4.2 Poverty

The poverty headcount in our sample takes a value of 0.033 under the base scenario. This figure is low because on one hand there is comparatively less poverty in Switzerland than in other European countries, but also because our sample excludes the elderly and self-employed populations. As such, it would be somewhat misleading to judge the overall performance of our various policy scenarios in the light of one single poverty line which identifies very few cases as being in a state of deprivation. We check therefore for potential crossings of poverty deficit curves (the first cumulant of the cumulative distribution function), where we consider all poverty lines ranging from zero to 50’000 Swiss francs (i.e. 210\% of the CSIAS poverty threshold). When the poverty deficit curve for a distribution $F_A$ lies everywhere in this income domain \textit{below} that of $F_B$, then all poverty indices that exhibit a social aversion to inequality will rank $F_A$ as the socially preferred distribution, within the range of poverty lines under consideration.

Table 4 reports the fifteen pair-wise scenario comparisons from an ordinal poverty perspective. The first line of Table 4 indicates that the distribution of the base scenario entails more poverty than the distributions pertaining to the two variants of the NIT allowance. It also comes out clearly from the second line of Table 4, and Figure 5, that the full NIT allowance \textit{nit100f} outperforms all other income schemes in reducing poverty. Note also that the deficit curve of the partial NIT allowance scheme lies in the income range of interest everywhere below the deficit curves pertaining to \textit{base}, \textit{eitc100} and \textit{pi50f}.

It is also clear that \textit{inc supp} will eliminate poverty up to the threshold (here CHF 23690) where the income top up ceases to operate. However, the incentive effects of such a scheme are such that its deficit curve cuts from below the deficit curve of the base scenario at CHF 27550. Its deficit curve intersects the deficit curve of \textit{eitc100} at CHF 26740, that of \textit{nit50f} at CHF 24870 and that of \textit{pi50f} at CHF 25440. As discussed in subsection 3.3, once we vary the level of the poverty line, there is therefore scope for ranking \textit{inc supp} and other scenarios (with the exception of \textit{nit100f}) differently depending on the choice of distributionally sensitive poverty
Of related interest is the performance of the participation income in relation to \textit{inc supp} and \textit{eitc100} in reducing poverty. For all poverty lines considered here, the deficit curve pertaining to \textit{pi50f} lies below that of \textit{eitc100}. Both schemes require participation in the labour market in order to qualify for social assistance, while \textit{inc supp} does not. This partly explains why the deficit curve of \textit{pi50f} cuts that of \textit{inc supp} from above.

4.3 Social welfare

This final sub-section attempts to synthesize the previous findings by asking the question as to which scenarios present a social welfare improvement over the current situation in Switzerland. We have seen that the full NIT allowance scheme \textit{nit100f} while eliminating poverty and bringing inequality to its lowest level in the findings of Table 2, entails an important cost in terms of income loss (a 9.3% reduction of average disposable income). The question regarding the social welfare test is therefore important to address, especially in the face of general scepticism about the feasibility of NIT allowance and flat tax proposals.

In order to weigh the gains from redistribution against efficiency losses, it is useful to summarize distributions by means of social welfare functions which satisfy a social aversion to inequality axiom (Pigou-Dalton transfer principle), and one of preference for higher incomes. Akin to the Lorenz curve, the generalized Lorenz curve is typically used to test for social welfare orderings: when the generalized Lorenz curve for a distribution $F_A$ lies everywhere above that of $F_B$, then all social welfare indices that exhibit a social aversion to inequality and a preference for higher incomes will rank $F_A$ as the more equal distribution. As shown by Shorrocks (1983), it is also the case that the generalized Lorenz criterion is biased toward efficiency preference: $F_A$ cannot dominate $F_B$ if the mean of the former distribution is lower than that of the latter.

An examination of the fifth column of results in Table 2 is particularly informative in this sense, since it shows that with the exception of the participation income \textit{pi50f} all policy reform scenarios considered in this Section entail losses of total income in comparison to the benchmark scenario. It is nonetheless useful to examine the social welfare effects of the various schemes considered in this section even though it is clear now that the only likely candidate for passing the social welfare test is \textit{pi50f}.

If the generalized Lorenz curve for $F_A$ lies everywhere above that of $F_B$, up to,
say the $q$th income decile, then this information can be conveyed by plotting the difference between the generalized Lorenz curves of these two distributions. The resulting curve should initially lie in the positive domain of the vertical axis, should cut the origin at the $q$th decile, and from then on should lie in the negative domain of the vertical axis. Such a graph would also indicate that the social welfare of families belonging to the bottom $q$ income deciles is higher in $F^A$ over $F^B$. Figures 6 and 7 provide such plots of vertical differences in generalized Lorenz curves, of the type $GLC(\text{base}; q) - GLC(\text{j}, q)$, where $j$ is the vector of incomes pertaining to one of the remaining five scenarios.

In Figure 6 we provide plots for two comparisons, between the base scenario, and each of inc supp and eitc100. Both curves are initially below zero. The curve $GLC(\text{base}; q) - GLC(\text{inc supp}; q)$ crosses the zero horizontal line half way between the fifth and tenth percentiles. The curve $GLC(\text{base}; q) - GLC(\text{eitc100}; q)$ is however closer to the zero horizontal line up to the fourteenth income percentile. These findings may readily be seen as confirming the results previously reported in Table 4. There, we had reported (i) that inc supp dominates base for all poverty lines ranging from zero to CHF 27550, and that (ii) the eitc100 deficit curve cuts that of base a first time from below at CHF 6260, from above at CHF 12760, and a final time, from below, at CHF 31930.\(^{15}\) The welfare improvements obtained from these income maintenance schemes therefore essentially accrue to the bottom groups, but not to the entire population.

Figure 7 contains remaining plots when the benchmark scenario is compared to the full NIT allowance, the partial NIT allowance and the participation income. For the bottom 65% of the population, nit100f and nit50f entail welfare improvements over base. The heavy tax burdens entailed by these two schemes, and the resulting effect on work hours contribute to the negative finding with respect to the overall level of social welfare. The participation income on the other hand, while not achieving the same level of effectiveness in reducing poverty and inequality does not result in losses of average disposable income. The remaining graph of Figure 7 lies in the negative orthant of the vertical axis, indicating that the income distribution pertaining to the participation income $\text{pi50f}$ social welfare dominates the benchmark scenario.

\(^{15}\)It is to be noted that in the sample there are only two households with incomes below CHF 6260 and an additional thirteen with incomes short of CHF 12760.
5 Participation income reexamined

We have seen in the above section that, out of all reform scenarios considered in the study, pi50f was the only reform leading to a social welfare improvement over the base scenario. In order to understand this finding, it is instructive to examine how households respond to the participation condition underlying the policy scenario pi50f. To do so, we plot in Figures 8 and 9 the changes in tax burdens underlying respectively the nit50f and pi50f schemes. The horizontal axis reports the disposable income of the base scenario, while the vertical axis measures the difference in tax payments in moving from the base scenario to nit50f (Figure 8), and the change in tax burdens in moving from base to pi50f (Figure 9). Positive values along the vertical axis indicate that a household pays more tax under a given scheme than in the base scenario.

A comparison of Figures 8 and 9 highlights several phenomena. First, a positive slope of the data scatter indicates that the tax-benefit scheme in the reform scenario is globally more progressive than in the base scenario. The steeper slope of the data underlying nit50f confirms our earlier conclusion that this scenario is more redistributive than pi50f. Second, the data of Figure 9 are more compactly distributed along the middle horizontal line (the locus of zero change in tax burdens). There are two main clusters in the data generated by the pi50f scenario. The upper left cluster pertains to households who fail to qualify for the income allowance. Third, the data points are more spread out below the main cluster in Figure 8, whereas they are more evenly distributed, below and above the two main clusters, in Figure 9. As hourly wages are held fixed across scenarios, this is indicative of different labour supply responses in the two scenarios, an issue to which we turn now.

Figure 10 depicts histograms of the change in labour supply by households, measured in terms of yearly hours worked by household members. Although most households do not change their work behaviour when the reforms are introduced (zero hours changes are not plotted in the histograms), there is a striking difference between the two scenarios with respect to the behaviour of those who adjust their labour supply. Whereas households almost exclusively reduce their hours of work in the nit50f scenario, the histogram of the hours changes in the pi50f scenario is roughly symmetric around zero. The latter result indicates that there is a considerable amount of heterogeneity in individual behaviour which underlies the small variation in aggregate labour supply.

Additional insight can be obtained from the variation in participation rates and hours choices, as shown in Table 5. Two results stand out. First, the participation
requirement has a powerful effect on the participation rate. If the benefit is paid unconditionally, as in scenario nit50f, some individuals tend to reduce their participation in the labour market. This effect is particularly pronounced for secondary earners in couples: female workers reduce their participation rates from 62.5% (base) to 56.8% (nit50f). The participation condition of scenario pi50f more than compensates for this disincentive to work: female workers increase their participation rate to over 70%. The conditionality of the benefit also prevents a fall in the participation rate of single-adult households.

Second, individuals who hold a full-time job in the base case tend to reduce their hours of work in the nit50f and pi50f scenarios. This effect, which is linked to the increase in the marginal tax rate, is again particularly strong for secondary earners. Women who worked full-time in the base scenario reduce on average their weekly amount of work by 3.2 hours under the pi50f scenario (see Table 5). The higher marginal tax rate in the nit50f scenario (51% compared to 42% in pi50f) leads to an even stronger reduction in weekly work hours of full-time female workers, by 9.4 hours on average.

To sum up, the increase in the participation rate compensates for the reduction in work hours of full-time workers in scenario pi50f. As a result, aggregate labour supply and average disposable income increase slightly despite the more progressive tax system. By contrast, the reduction in work hours in the nit50f scenario involves a feedback effect between labour supply and the balanced government budget: a reduction in labour supply yields a fall in income tax revenues, compelling the government to increase the flat tax rate. This, in turn, leads to a further reduction in labour supply. This adjustment process finally settles to a 6.4% drop in average disposable income.

Finally, it is interesting to analyze the role of the participation conditionality with respect to poverty. As discussed above, the pi50f reform does not reduce the poverty headcount to the level achieved by the nit50f scheme primarily because those who do not participate in the labor market are not entitled to benefits under the former scheme. There is, however, another important difference between the two policies which becomes apparent by comparing the transitions in and out of poverty these two scenarios entail, starting from the base scenario. These transition matrices are reported in Table 6. They show that, although the nit50f reform lifts a greater proportion of population out of poverty than pi50f, there is also a greater share of households whose disposable income now falls below the poverty line (almost 1% of population at the CSIAS poverty line). Under the pi50f scenario, the participation
requirement largely prevents this movement into poverty.

6 Concluding comments

The purpose of this study was to examine the effects on the distribution of household disposable income of various income maintenance programmes. Our benchmark scenario was the current situation in Switzerland, and the various schemes examined were a full NIT allowance, a partial NIT allowance, a participation income covering 50% of subsistence costs, an income support scheme which topped up household resources to the level of subsistence expenditure and finally a (simplified) earned income tax credit. We were interested in capturing the effect of introducing such schemes on income inequality and poverty. However, we also wanted to examine the effect of the various income maintenance schemes on the overall level of social welfare. To address this last point, it was particularly important to model household labour supply responses to the alternative budget constraints entailed by the tax and benefit schedules of the various policy scenarios studied here.

By definition, the full NIT granting an allowance equal to subsistence needs was designed to eliminate poverty. The resulting scheme was shown to reduce income inequality most drastically. The ordinal analysis of income distributions also allowed us to establish that in comparison to the current situation in Switzerland, the bottom 65% group would unambiguously benefit from the introduction of a full NIT allowance. However, such an income maintenance scheme is expensive to fund: our results suggest that an integrated federal linear tax rate of 62% is required to make it viable. Under such taxation, aggregate work hours are reduced by 10% and average disposable income falls by 9.3%.

The partial NIT allowance is less generous in terms of social assistance, and is accordingly less effective than the full NIT allowance in reducing poverty and inequality. However, it also entails a smaller, though still significant, 5.9% sacrifice of total income for it to be viable. The participation income was designed to restrict the income allowance (50% of subsistence needs) to families with all adults in employment. Again, this last scheme was less effective than the full and partial NIT allowances in reducing poverty and inequality. However, of all the schemes examined in this paper, the participation income was the only scenario that resulted in an unambiguous social welfare improvement over the distribution of income pertaining to our benchmark scenario.

Finally, we discuss some limitations of our analysis, some of which may present
directions for further research. Our family utility model abstracted from problems of rationing; i.e. unemployment, taking the state of not working as synonym to non-participation. Likewise, we have simplified our analysis by assuming non-existence of welfare stigma on the side of claimants. We have also ignored the administrative costs required to evaluate the situations of families with respect to the schemes that were designed to top up resources to the target subsistence level. In this respect, our results may have over-estimated the costs of operating variants of the negative income tax, and likewise may have under-estimated the tax revenues required to top up resources in relation to our two means tested schemes.

Our analysis has omitted two major socio-economic groups: the self-employed and individuals on retirement. It is not likely that schemes that provide incentives for participation such as the participation income and earned income tax credit will have much impact on the decision of the elderly to take up employment again. However, it is clear that occupational choices between salaried employment and self-employment may be very much influenced by the existing structure of social safety nets. One major extension of our analysis therefore could consist in modelling occupational choices and work decisions jointly using a sample of salaried and self-employed workers. Then, it is expected that this additional source of heterogeneity will result in larger reactions of households in terms of both income and hours changes in the face of the alternative policy scenarios considered here.

Our microsimulation exercises were undertaken, as is most often the case, assuming that policy reforms did not impact on the demand for labour, so that hourly (pre-tax) wages could be held constant across scenarios. This is certainly one important limitation of this type of partial equilibrium modelling of policy reform. In the current state of science, general equilibrium modelling however implies a greater degree of aggregation of families into broad socio-economic categories. In this sense, there is therefore perhaps the benefit of realism kept in the partial equilibrium microsimulation exercise, at the cost of some simplifying assumptions.
A Technical Appendix

Partial-equilibrium microsimulation relies on the assumption that wages of household members and non-labour income are exogenous. An exogenous change in social security benefits or taxes affects the net income that can be obtained in the different employment states. Each household then reconsiders its labour supply decision (see below) and chooses the new resulting optimal employment state. Changes in hours as well as the pre-reform and post-reform income distribution provide the main ingredients for the evaluation of the incentive and distributional effects of the envisaged policy changes.

A.1 Discrete choice modelling

We have used the Swiss expenditure and income survey of 1998 as our data base for modelling labour supply responses (see Appendix B for further detail). Coupled with a tax benefit module (see Section A.2 below), we have used the same data base for simulating the effects of various tax reform scenarios on the labour market and the distribution of income. We have estimated separate models for families comprising a single adult and two parent families. Our model focuses on the decision to take up a part-time or full-time job as an employee. Households in independent employment or on retirement are thus excluded from the analysis. Our main concern is to characterize labour force participation decisions between various employment states.

Our maintained assumption throughout this study is that employment states are discrete. People do not choose freely to vary their hours of work continuously, but rather, they can choose to work part-time, or full-time. We have used the distribution of work hours to define what may be sensible definitions of the discrete employment states for males and females. Our canonical setup is McFadden’s conditional logit model (McFadden, 1974). Let there be \( l \) alternatives the \( i \)th unit chooses from, denoted as \( e_{ij} \).

Under McFadden’s model, the probability that alternative \( j \) is chosen is given by the form

\[
\Pr(e_{ij} = 1 | x_i, w_{ij}) = \frac{\exp(x_i' \beta + w_{ij}' \gamma)}{\sum_{j=1}^{l} \exp(x_i' \beta + w_{ij}' \gamma)}
\]

where \( x_i \) are individual specific variables to unit \( i \), and \( w_{ij} \) are attributes of the individual conditional on the \( j \)th alternative being chosen. In our framework, \( e_{ij} = 1 \) if a particular employment state is chosen (for instance the individual does not
participate in the labour market) and $e_{ij'} = 0$ for all $j' \neq j$.

The utility function we use to characterize choice is a standard quadratic form. Consider first single adult households. If we let $h$ denote labour supply and $y$ the family’s disposable income, the utility function takes the form

$$u(y, h) = \alpha_{yy}y^2 + \alpha_{hh}h^2 + \alpha_{hy}yh + \beta_{y}y + \beta_{h}h$$

(2)

If $c$ denotes a money fixed costs of employment, the variable $y$ in (2) is to be replaced by $y - c$.

The extension to two parent families is straightforward. We now define utility over the family’s disposable income $y$, and the work hours of husband and wife, which we shall write below as $h_m$ and $h_f$:

$$u(y, h_m, h_f) = \alpha_{yy}y^2 + \alpha_{hh}^f h_f^2 + \alpha_{hh}^m h_m^2 +$$

$$\alpha_{hy}^f y h_f + \alpha_{hy}^m y h_m + \alpha_{fh}^m h_f h_m +$$

$$\beta_{y}y + \beta_{m}h_m + \beta_{f}h_f$$

(3)

If $c_f$ and $c_m$ denote money fixed costs of employment for female and male partners, the variable $y$ in (3) is to be replaced by $y - c_f - c_m$.

There has been in recent years considerable emphasis placed on the existing heterogeneity inherent in the processes generating labour supply responses. Separate models are estimated here for single and two adult families. We also allow for further heterogeneity in two different ways. Firstly, we specify the $\beta_y$ parameters to depend on family characteristics. Secondly, we also allow for heterogeneity in the costs of work $c$ parameters. As such, two limitations of our empirical framework may be stated. Firstly, we do not allow for unobserved heterogeneity in structural parameters (on this, see Blundell and MaCurdy, 1999). Secondly, while we do allow for costs of working, these may be increasing (and concave) in hours of work, as emphasized by Heim and Meyer (2004), whereas we have specified these to be fixed.

Estimation results for two parent and single adult families earning wages are reported in Tables A1 and A2 respectively.

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16 The $\beta_y$ parameter is made a function of demographic variables such as the age and education of the household head as well as dummies pertaining to the number and age structure of children under the age of eleven. For two parent families, the fixed costs of female employment are made a function of child demographics. Our preferred specification does not include fixed costs of male employment.
A.2 Tax benefit module

A tax benefit routine is used in order to model in some detail the budget constraints faced by households under the alternative policy scenarios. Taxes in Switzerland are levied at the cantonal level and at the federal level. Separate tax schedules operate in each of the twenty six Cantons that constitute Switzerland. The routine integrates this heterogeneity in taxation since it includes a federal income tax schedule and separate tax schedules for each canton.\textsuperscript{17} We also control for civil status (since different tax schedules apply to married and unmarried couples) and family size in the calculation of tax payments.

Compared to countries where detailed tax-benefit models have been developed (e.g. EUROMOD for several European countries), Switzerland presents the difficulty of a highly decentralized federal structure. For our purposes, the income tax data reported in the survey used in the present study appeared to be rather unreliable. We have therefore decided to estimate (average) tax rate functions using data provided by the Administration fédérale des contributions (AFC, 1999) on income tax payments for typical households in 1998.\textsuperscript{18}

Consider first federal income taxes. AFC (1999) provides a collection of data points on the federal income tax burden of single individuals at various income levels. The same source provides also a comparable plot for families comprising two adults and two dependent children, and for couples without children. We have used these data points to estimate federal income tax schedules pertaining to lone adults, on the one hand, and married couples (or single-adult families), on the other hand. For our estimations, it was important to select a functional form that ensures that the average tax rate is non-decreasing everywhere in order to ensure progressivity. We have therefore selected a generalized logistic function, taking the form

\[ \tau_F(\eta) = \max \left[ 0, t_o + \left( t_1 - t_o \right) \frac{1}{1 + e^{-\left( \pi_1 + \pi_2 \eta \right)}} \right] \]

where \( \eta \) is gross household income and \( \tau_F \) is the federal tax rate function. Al-

\textsuperscript{17}Within cantons, there are also municipal taxes which are set as a proportion of cantonal taxes; the factor of proportionality may vary from one municipality to the other. The reform of local taxation not being a primary concern for this study, we have chosen in the routine to apply a representative municipal tax schedule within each canton.

\textsuperscript{18}Taxes have been reestimated for three reasons. First, the Swiss tax system is very complex and includes 26 distinct cantonal schedules. Second, the observed taxes in the data are not consistent with the tax schedules. For example, in the data we find many cases where the taxable income after deductions is larger than the gross income inclusive of benefit entitlements. This casts some doubts about the exactness of the reported tax data. Third, the estimation of these taxes simplifies the way we can simulate the reform scenarios.
though it represents a significant simplification, this specification yields a very good approximation of the original piece-wise linear average tax schedule.

To accommodate the presence of families with differing numbers of children, the two data files pertaining to married persons were merged in order to estimate a general tax schedule \( \tau_F(y - n\delta) \), where \( n \) now denotes the number of children in the family. This procedure amounts to a form of demographic translation of resources by subtracting a (constant) amount \( \delta \) per child living in the family.

In order to account also for income taxes levied at the cantonal and municipal levels, we have repeated the exercise pertaining to the federal income tax for each of the Canton data files (including average municipal taxes) provided by AFC (1999), thus estimating separate tax schedules for singles, and for families.

The module also computes payroll taxes; that is contributions towards pension funds and unemployment insurance. Other compulsory income deductions such as health insurance payments are also taken into account. We also compute social insurance entitlements, in particular contributions to health insurance payments.

B Data appendix

We have used the Swiss expenditure and income survey of 1998, ERC98, as our data base for modelling labour supply responses. Coupled with our tax benefit module, we have used the same data base for simulating the effects of various tax reform scenarios on the labour market and the distribution of income. The Swiss expenditure and income survey of 1998 has been designed by the Federal Statistical Office as a representative sample of the Swiss population. Details on sampling design, coverage and scope of the survey are to be found in Office Fédéral de la Statistique (1999).

We have split the sample into three files. The first file pertains to single adult households (with or without dependent children) where the family head is a salaried worker, or seeking employment and available for work. The second file pertains to two adult households, where again, the household head is a salaried worker or is seeking employment. A residual third file pertaining to households in independent employment or on retirement, is not used in the study. Our analysis being concerned with the labour market and the distribution of income, we have not made use of the data pertaining to households on retirement. We have also excluded individuals exercising independent employment because it was difficult to treat their earnings and taxable income data as being reliable.
Recognizing the collective nature of labour supply decisions in two-adult households, we have specified and estimated separate models for these and for single adult households. The latter file contained for the larger part individuals without children. Because of their small number, lone parents with children were also assigned to the file of single adults, even though their labour supply cannot fully be treated as equivalent to that of adults without children.

Note one further point. Before estimating the labour supply model, we require a methodology for predicting the wages of non-participating individuals. This method can be broken down into two steps. Firstly, we use an econometric selection model to predict the expected log-wage, \( \log w_i \), of an individual, conditional on the person being observed in the employment state of non-participation. Secondly, the predicted wage is obtained from the predicted expected log-wage \( \hat{\log w}_i \) of the first step as \( \exp(\hat{\log w}_i + \hat{\sigma}^2/2) \), where \( \exp \) is the exponential function and \( \hat{\sigma}^2 \) is the estimated variance of \( \hat{\log w} \) (the estimated variance of predicted log-wages for those observed to be in the employment state of non-participation).

### B.1 The sample of single adult families

As we are working with discrete choice models, we have had to define what we mean exactly by part time and full time employment. We have used the distribution of work hours in the ERC98 survey to define two employment states for single individual households. Non participation, \( NP \), was assigned to those who reported zero work hours. For individuals working up to 20 hours we have retained a part time employment state \( PT \), while those working 21 to 39 hours were assigned to a small full time employment state \( FT1 \), and those working 40 to 80 hours were classified under the definition \( FT2 \), taking to signify a large full time load. In the utility function, we have set \( NP \) at zero work hours, \( PT \) at 15 hours, \( FT1 \) at 31 hours and \( FT2 \) at 42 hours.

The tax-benefit module was then used to convert the gross income pertaining to these theoretical work hours, into a post-transfer net income, comprising taxes, social security contributions and the various income support schemes retained in this study. There were few cases of weekly employment exceeding 80 hours. These data (and those with missing observations) were dropped from the analysis. There were in total 1875 observations in this file.
B.2 The sample of two adult families

For two adult families we have defined separate employment states for husbands and wives. Given the shapes of the distributions of reported hours, we have considered three employment states for husbands, namely $NP, FT1, FT2$, while for wives we retained alongside non-participation two part-time employment states and a unique full time definition: $NP, PT1, PT2, FT$.

Taking wives first, we have defined $PT1$ as the state of working up to 14 hours, $PT2$ for wives working between 15 and 28 hours, and $FT$ for wives working 29 hours or more. In the family utility function, we have set $PT1$ to 7 hours, $PT2$ to 21 hours and $FT$ to 42 hours.

For husbands, all persons working up to 41 hours weekly were assigned to the state $FT1$, and those working in excess of 41 hours were allocated to the state $FT2$. In the family utility function, we have set $FT1$ to 37.5 work hours while $FT2$ was assigned 44 hours.

For both husband and wife, the value $NP$ was set to zero work hours. In further estimations we have maintained the same definitions (i.e. cut-off values) of employment states, but considered alternative valuations of the husband’s states in the utility function. There was less variation of employment hours for wives, and the values selected for $PT1, PT2, FT$ corresponded well with local modes of the distribution of work hours.

There were in total 3559 observations in this file.

---

19For simplicity, we refer to “husbands” and “wives” despite the fact that not all couples are married. It is also to be noted that there are some households with more than two working adults. In these cases, the incomes of the additional adults are treated as exogenous.
References


Figure 1: Means tests, participation requirements and reform scenarios

Means (income) test

No hours of work requirement

Hours of work requirement

inc supp

eitc100

nit50f

nit100f

pi50f

No means test
Figure 2: Budget constraints for partial and full NIT allowance under an integrated linear tax system

Note: C denotes subsistence expenditure.
Figure 3: Poverty rates in four policy scenarios

- base
- eitc100
- inc supp
- nit50f
Figure 4: Full negative income allowance redistributive impact

vertical distance between Lorenz curves

income decile

- LC(nit100f) - LC(base)
- LC(nit100f) - LC(inc supp)
- LC(nit100f) - LC(eitc100)
- LC(nit100f) - LC(nit50f)
- LC(nit100f) - LC(pi50f)
Figure 5: Poverty deficit curves for four policy scenarios.
Figure 6: Social welfare test
base scenario versus income support and EITC100
Figure 7: Social welfare test
base scenario vs. three variants of the basic income
Figure 9

Change in tax burden (pi50f - base)
Figure 10: Histogram of changes in yearly work hours (scenarios nit50f and pi50f relative to base)

Note: Data plots refer only to households who experience non zero changes in hours of work. In scenario nit50f (pi50f), they represent 11.7% of all households (10.4%).
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Participation condition</th>
<th>Income subsidy / allowance</th>
<th>Flat tax region</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>base</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flat tax</td>
<td></td>
<td></td>
<td>as of subsistence expenditure</td>
<td>replaces federal tax schedule by a unique flat tax</td>
</tr>
<tr>
<td>flat taxf</td>
<td></td>
<td></td>
<td>as of subsistence expenditure</td>
<td>replaces federal, cantonal and municipal income taxation</td>
</tr>
<tr>
<td>nit50f</td>
<td></td>
<td>50% of subsistence expenditure</td>
<td>as of subsistence expenditure</td>
<td>replaces federal, cantonal and municipal income taxation</td>
</tr>
<tr>
<td>nit100f</td>
<td></td>
<td>subsistence expenditure</td>
<td>as of subsistence expenditure</td>
<td>replaces federal, cantonal and municipal income taxation</td>
</tr>
<tr>
<td>pi50f</td>
<td>Positive earnings for each adult</td>
<td>50% of subsistence expenditure</td>
<td>as of subsistence expenditure</td>
<td>replaces federal, cantonal and municipal income taxation</td>
</tr>
<tr>
<td>inc supp</td>
<td></td>
<td>income top-up with marginal tax rate of 100% up to subsistence expenditure</td>
<td>as of subsistence expenditure</td>
<td>replaces federal tax schedule by a unique flat tax</td>
</tr>
<tr>
<td>eitc100</td>
<td>Positive earnings for each adult</td>
<td>same as inc supp</td>
<td>as of subsistence expenditure</td>
<td>replaces federal tax schedule by a unique flat tax</td>
</tr>
</tbody>
</table>
Table 2
Tax reform: Summary statistics

<table>
<thead>
<tr>
<th>Scenario</th>
<th>$I_A^1$</th>
<th>Gini</th>
<th>poverty headcount$^2$</th>
<th>$P_\alpha^3$</th>
<th>av. disposable income$^4$</th>
<th>flat tax rate</th>
<th>hours$^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>base</td>
<td>0.149</td>
<td>0.211</td>
<td>0.033</td>
<td>0.002</td>
<td>0.00%</td>
<td>_</td>
<td>0.00%</td>
</tr>
<tr>
<td>Panel A: major reforms involving an integrated tax system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flat taxf</td>
<td>0.152</td>
<td>0.216</td>
<td>0.024</td>
<td>0.002</td>
<td>0.14%</td>
<td>28.69%</td>
<td>0.03%</td>
</tr>
<tr>
<td>nit50f</td>
<td>0.084</td>
<td>0.162</td>
<td>0.011</td>
<td>0.001</td>
<td>-5.87%</td>
<td>51.34%</td>
<td>-6.42%</td>
</tr>
<tr>
<td>nit100f</td>
<td>0.057</td>
<td>0.135</td>
<td>0.000</td>
<td>0.000</td>
<td>-9.25%</td>
<td>62.17%</td>
<td>-10.04%</td>
</tr>
<tr>
<td>pi50f</td>
<td>0.127</td>
<td>0.189</td>
<td>0.017</td>
<td>0.002</td>
<td>0.45%</td>
<td>42.09%</td>
<td>0.62%</td>
</tr>
<tr>
<td>Panel B: reforms involving a change in federal taxation only</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flat tax</td>
<td>0.155</td>
<td>0.217</td>
<td>0.034</td>
<td>0.002</td>
<td>0.16%</td>
<td>4.91%</td>
<td>0.38%</td>
</tr>
<tr>
<td>inc supp</td>
<td>0.139</td>
<td>0.219</td>
<td>0.000</td>
<td>0.000</td>
<td>-2.35%</td>
<td>9.11%</td>
<td>-3.21%</td>
</tr>
<tr>
<td>eitc100</td>
<td>0.152</td>
<td>0.215</td>
<td>0.031</td>
<td>0.002</td>
<td>-0.02%</td>
<td>6.69%</td>
<td>-0.03%</td>
</tr>
</tbody>
</table>

$^1$ The Atkinson index $I_A$ sets $\varepsilon$ at 2.

$^2$ Subsistence expenditure = Fr 23689

$^3$ The $P_\alpha$ index (Foster et al., 1984) sets $\alpha$ at 2.

$^4$ Relative change with respect to base case.
## Table 3
### Inequality Orderings

<table>
<thead>
<tr>
<th>Scenario</th>
<th>base</th>
<th>nit100f</th>
<th>inc supp</th>
<th>eitc100</th>
<th>nit50f</th>
<th>pi50f</th>
</tr>
</thead>
<tbody>
<tr>
<td>base</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>nit100f</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>inc supp</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+ p=0.6</td>
<td>-</td>
</tr>
<tr>
<td>eitc100</td>
<td>-</td>
<td>+ p=1</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>nit50f</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pi50f</td>
<td>-</td>
<td>+</td>
<td>+ p=0.6</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

$(F_i,F_j)=(-,q)$ means $F_i$ is less unequal than $F_j$ up to $q^{th}$ decile.
## Table 4
### Poverty Orderings ($Z \in [0;50'000]$)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>base</th>
<th>nit100f</th>
<th>inc supp</th>
<th>eitc100</th>
<th>nit50f</th>
<th>pi50f</th>
</tr>
</thead>
<tbody>
<tr>
<td>base</td>
<td>+</td>
<td>+ everywhere</td>
<td>+ up to 27'550</td>
<td>+ up to 6'260 - up to 12'760 + up to 31'930</td>
<td>+</td>
<td>up to 12'900 + after</td>
</tr>
<tr>
<td>nit100f</td>
<td>+</td>
<td>everywhere</td>
<td>- everywhere</td>
<td>everywhere</td>
<td>- everywhere</td>
<td>-</td>
</tr>
<tr>
<td>inc supp</td>
<td>- 27'550</td>
<td>everywhere</td>
<td>+ everywhere</td>
<td>26'740</td>
<td>up to 24'870</td>
<td>up to 25'440</td>
</tr>
<tr>
<td>eitc100</td>
<td>- 6'260 + 12'760 - 31'930</td>
<td>everywhere</td>
<td>+ 26'740</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>nit50f</td>
<td>-</td>
<td>+</td>
<td></td>
<td>up to 24'870</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pi50f</td>
<td>+ 12'900 - after</td>
<td>+</td>
<td>up to 25'440</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

$(F_i,F_j)=[-,z_0]$ means $F_i$ has less poverty than $F_j$ for all poverty lines in the $[0;z_0]$ interval.
<table>
<thead>
<tr>
<th></th>
<th>base</th>
<th>nit50f</th>
<th>pi50f</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participation rate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall participation rate</td>
<td>0.817</td>
<td>0.782</td>
<td>0.852</td>
</tr>
<tr>
<td>couples - male</td>
<td>0.959</td>
<td>0.947</td>
<td>0.961</td>
</tr>
<tr>
<td>couples - female</td>
<td>0.625</td>
<td>0.568</td>
<td>0.711</td>
</tr>
<tr>
<td>singles</td>
<td>0.906</td>
<td>0.867</td>
<td>0.910</td>
</tr>
<tr>
<td><strong>Change in weekly hours of work (relative to base, in hours)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average change</td>
<td>-1.94</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>couples - male</td>
<td>-0.61</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>NP&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.041</td>
<td>3.86</td>
<td>3.13</td>
</tr>
<tr>
<td>FT1</td>
<td>0.270</td>
<td>-0.16</td>
<td>0.47</td>
</tr>
<tr>
<td>FT2</td>
<td>0.689</td>
<td>-1.05</td>
<td>-0.35</td>
</tr>
<tr>
<td>couples - female</td>
<td>-3.09</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>NP</td>
<td>0.375</td>
<td>0.49</td>
<td>4.80</td>
</tr>
<tr>
<td>PT1</td>
<td>0.132</td>
<td>-0.23</td>
<td>-0.01</td>
</tr>
<tr>
<td>PT2</td>
<td>0.186</td>
<td>-1.95</td>
<td>-0.30</td>
</tr>
<tr>
<td>FT</td>
<td>0.307</td>
<td>-9.40</td>
<td>-3.17</td>
</tr>
<tr>
<td>singles</td>
<td>-2.25</td>
<td>-0.55</td>
<td></td>
</tr>
<tr>
<td>NP</td>
<td>0.094</td>
<td>1.11</td>
<td>2.60</td>
</tr>
<tr>
<td>PT</td>
<td>0.070</td>
<td>-0.24</td>
<td>-0.11</td>
</tr>
<tr>
<td>FT1</td>
<td>0.171</td>
<td>-3.01</td>
<td>-0.39</td>
</tr>
<tr>
<td>FT2</td>
<td>0.665</td>
<td>-2.74</td>
<td>-1.08</td>
</tr>
</tbody>
</table>

<sup>a</sup> The italic numbers under the heading "base" indicate the structure of employment in the base scenario. Therefore these numbers add to one for each category of individuals.

<sup>b</sup> These acronyms denote the initial employment state, e.g., NP denotes "non participation" in the base scenario, FT1 a "small" full time in the base scenario, PT part time work etc.. See the data appendix for details.
Table 6  
Transitions in and out of poverty: scenarios nit50f and pi50f  
(population shares)

<table>
<thead>
<tr>
<th></th>
<th>poor</th>
<th>not poor</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>base</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>poor</td>
<td>nit50f</td>
<td>0.003</td>
<td>0.031</td>
</tr>
<tr>
<td>not poor</td>
<td></td>
<td>0.009</td>
<td>0.958</td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>0.011</td>
<td>0.989</td>
</tr>
<tr>
<td><strong>pi50f</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>poor</td>
<td></td>
<td>0.015</td>
<td>0.018</td>
</tr>
<tr>
<td>not poor</td>
<td></td>
<td>0.001</td>
<td>0.966</td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>0.017</td>
<td>0.983</td>
</tr>
</tbody>
</table>

*a The CSIAS poverty line is equal to 23690 CHF.*
Table A1: Estimates for couples with fixed costs of working

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>z-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y^2$</td>
<td>-0.014</td>
<td>0.002</td>
<td>-7.19</td>
</tr>
<tr>
<td>$h_f^2$</td>
<td>0.598</td>
<td>0.056</td>
<td>10.67</td>
</tr>
<tr>
<td>$h_m^2$</td>
<td>0.786</td>
<td>0.080</td>
<td>9.82</td>
</tr>
<tr>
<td>$y , h_f$</td>
<td>-0.065</td>
<td>0.010</td>
<td>-6.47</td>
</tr>
<tr>
<td>$y , h_m$</td>
<td>-0.057</td>
<td>0.015</td>
<td>-3.82</td>
</tr>
<tr>
<td>$h_m , h_f$</td>
<td>-0.210</td>
<td>0.067</td>
<td>-3.14</td>
</tr>
<tr>
<td>$y$</td>
<td>-0.146</td>
<td>0.078</td>
<td>-1.88</td>
</tr>
<tr>
<td>$y \times \text{age}$</td>
<td>0.082</td>
<td>0.004</td>
<td>20.77</td>
</tr>
<tr>
<td>$y \times \left(\frac{\text{age}^2}{1000}\right)$</td>
<td>-0.001</td>
<td>0.000</td>
<td>-22.35</td>
</tr>
<tr>
<td>$y \times 1\text{(less than 11 years schooling)}$</td>
<td>-0.095</td>
<td>0.037</td>
<td>-2.59</td>
</tr>
<tr>
<td>$y \times # \text{children under 10 years}$</td>
<td>-0.254</td>
<td>0.019</td>
<td>-13.55</td>
</tr>
<tr>
<td>$y \times 1\text{(child 0-2 years)}$</td>
<td>-0.117</td>
<td>0.050</td>
<td>-2.36</td>
</tr>
<tr>
<td>$y \times 1\text{(child 3-5 years)}$</td>
<td>-0.093</td>
<td>0.058</td>
<td>-1.61</td>
</tr>
<tr>
<td>$h_m$</td>
<td>-0.577</td>
<td>0.249</td>
<td>-2.32</td>
</tr>
<tr>
<td>$h_f$</td>
<td>-1.110</td>
<td>0.174</td>
<td>-6.37</td>
</tr>
</tbody>
</table>

**Fixed costs (female work)**

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>z-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>0.054</td>
<td>0.122</td>
</tr>
<tr>
<td>$\times # \text{children under 10}$</td>
<td>0.369</td>
<td>0.127</td>
</tr>
<tr>
<td>$\times 1\text{(child 0-2 years)}$</td>
<td>1.620</td>
<td>0.284</td>
</tr>
<tr>
<td>$\times 1\text{(child 3-5 years)}$</td>
<td>1.389</td>
<td>0.334</td>
</tr>
</tbody>
</table>

Log-likelihood: -6602.01

Size of sample: 3559
Table A2: Estimates for singles with fixed costs of working

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>z-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y^2$</td>
<td>-0.033</td>
<td>0.008</td>
<td>-4.28</td>
</tr>
<tr>
<td>$h^2$</td>
<td>0.742</td>
<td>0.106</td>
<td>7.02</td>
</tr>
<tr>
<td>$y \cdot h$</td>
<td>-0.196</td>
<td>0.037</td>
<td>-5.32</td>
</tr>
<tr>
<td>$y$</td>
<td>0.049</td>
<td>0.444</td>
<td>0.11</td>
</tr>
<tr>
<td>$y \cdot \text{age}$</td>
<td>0.062</td>
<td>0.020</td>
<td>3.04</td>
</tr>
<tr>
<td>$y \cdot (\text{age}^2/1000)$</td>
<td>-0.001</td>
<td>0.000</td>
<td>-3.63</td>
</tr>
<tr>
<td>$y \cdot 1(\text{university education})$</td>
<td>-0.164</td>
<td>0.065</td>
<td>-2.53</td>
</tr>
<tr>
<td>$y \cdot 1(\text{less than 11 years schooling})$</td>
<td>-0.359</td>
<td>0.063</td>
<td>-5.67</td>
</tr>
<tr>
<td>$y \cdot # \text{children under 10 years}$</td>
<td>-0.481</td>
<td>0.085</td>
<td>-5.67</td>
</tr>
<tr>
<td>$y \cdot 1(\text{child 0-2 years})$</td>
<td>-0.241</td>
<td>0.185</td>
<td>-1.30</td>
</tr>
<tr>
<td>$y \cdot 1(\text{child 3-5 years})$</td>
<td>0.235</td>
<td>0.211</td>
<td>1.12</td>
</tr>
<tr>
<td>$y \cdot 1(\text{female})$</td>
<td>0.618</td>
<td>0.063</td>
<td>9.75</td>
</tr>
<tr>
<td>$y \cdot 1(\text{Swiss citizen})$</td>
<td>-0.025</td>
<td>0.076</td>
<td>-0.33</td>
</tr>
<tr>
<td>$h$</td>
<td>-0.435</td>
<td>0.283</td>
<td>-1.54</td>
</tr>
<tr>
<td>Fixed costs of work</td>
<td>1.164</td>
<td>0.278</td>
<td>4.19</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td></td>
<td>-1466.05</td>
<td></td>
</tr>
<tr>
<td>Size of sample</td>
<td></td>
<td>1875</td>
<td></td>
</tr>
</tbody>
</table>
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INTERNET : http://www.unige.ch/ses/metri/cahiers


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