EVALUATION OF SIMULTANEOUS REFORMS IN PERSONAL INCOME TAXES AND INDIRECT TAXES

Belgium 1988-1993

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by

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TABLE OF CONTENTS

Nederlandstalige samenvatting

Doelstelling

In onze buurlanden is de techniek van microsimulaties reeds jarenlang ingeburgerd als instrument om fiscaal en sociaal beleid te ondersteunen of te evalueren. De techniek bestaat erin om de gevolgen van voorgestelde of reeds genomen maatregelen in de fiscale en parafiscale sfeer uit te rekenen op micro niveau, d.w.z. voor individuen of gezinnen. Dit laat niet alleen een veel fijner afgestelde analyse toe, maar is zelfs een noodzakelijke voorwaarde om de verdelingsimpact van de bestudeerde maatregelen te kunnen inschatten. Bovendien verhoogt het de kans om theoretisch zinvolle gedragsreacties in de simulaties te integreren.

In België dringt de techniek van microsimulaties slechts langzaam door. Pionierswerk werd jarenlang verricht door het Centrum voor Sociaal Beleid voor wat betreft maatregelen in de sociale zekerheid (het model *MISISZ*). De laatste jaren werd, mede dank zij de projecten van D.W.T.C. in het Programma Publieke Economie, een inhaalbeweging uitgevoerd. Dit leidde tot twee microsimulatiemodellen voor de personenbelasting (*SIRe* van het Ministerie van Financiën, en *PICSOUS* van FUNDP in Namur) en één voor indirecte belastingen (*ASTER* van KULeuven).

Alle hierboven vermelde modellen hebben, wat hun toepassingsveld betreft, een partieel karakter. Ze beslaan een zeer beperkt gedeelte van het terrein waarop de beleidsmaker actief is, en laten geen interactie, noch doorsijpelings-effecten toe tussen de verschillende domeinen. Nochtans duiken veel door de overheid relevant beoordeelde karakteristieken simultaan op in de verschillende domeinen (bvb. leeftijd, gezinslast, inkomen). Bovendien wordt niet zelden een geïntegreerd pakket van maatregelen genomen, waarbij tezelfdertijd gesleuteld wordt aan de personenbelasting, aan de indirecte belasting en aan de sociale zekerheid. Eén van de volgende stappen die zich daarom opdringt in de verdere ontwikkeling van een beleidsrelevant micro-simulatiemodel voor België, is de geleidelijke opheffing van dit partiële karakter. Dit vormt de basisdoelstelling van het D.W.T.C.-project PE/VA/007.

Het vermelde project betreft enkel de integratie binnen één microsimulatie-model, van de personenbelasting en de indirecte belasting. Het spreekt vanzelf dat de verdere uitbouw in de richting van het beleidsdomein van de sociale

zekerheid zich opdringt. Een belangrijk uitgangspunt is de strategische keuze om twee bestaande modellen (SIRe en ASTER) aan elkaar te koppelen, in plaats van een nieuw microsimulatiemodel van de grond af op te bouwen. Dit laat toe optimaal gebruik te maken van de in beide modellen gestolde expertise en ontwikkelingstijd.

Om zicht te krijgen op de kloof tussen beide modellen vatten we hieronder kort de belangrijkste kenmerken van SIRe en ASTER samen.

	SIRe	***ASTER***
Beleidsdomein	personenbelasting	indirecte belasting (BTW en accijns)
vertrekpunt	belastbare inkomens	bestedingen aan 32 goederen en diensten
eindpunt	verschuldigde personenbelasting beschikbaar inkomen	verschuldigde indirecte belasting
databestand	IPCAL (fiscale aangiften) niet noodzakelijk representatief	budgetenquête N.I.S. bedoeld als representatief
jaar	1993	1987-88
eenheid	fiscale eenheid	sociologisch gezin
gedragsreacties?	Neen (impactmodel)	ja, via een vraagsysteem
andere opmerkingen	weinig extra informatie in IPCAL	zeer rijke extra informatie in budgetenquête

In essentie zijn er twee "missing links" tussen beide modellen, een horizontale en een verticale. De verticale ontbrekende schakel heeft te maken met het feit dat ASTER niet vertrekt waar SIRe ophoudt. Om van het beschikbaar inkomen (output van SIRe) over te stappen naar de bestedingen (vertrekpunt van ASTER) is er een spaarfunctie nodig. De horizontale kloof heeft te maken met de verschillen in de onderliggende gegevensbestanden van beide modellen. Op welke manier we in beide gevallen een brug kunnen bouwen tussen SIRe en ASTER vatten we samen in de volgende paragraaf.

Methodologie

De beperkte onderzoekstijd van het project PE/VA/007 werd in hoofdzaak geïnvesteerd in de horizontale link. De samenvatting van de constructie van de verticale link, de spaarfunctie, kan dan ook kort zijn. We veronderstellen dat de verhouding tussen de consumptieve uitgaven en het beschikbaar inkomen ongewijzigd blijft bij veranderingen in het beschikbaar inkomen. Het spreekt vanzelf dat we van plan zijn in de toekomst deze eenvoudige proportionele spaarfunctie te vervangen door een meer gesofisticeerde.

De tweede hindernis, het wegwerken van de verschillen tussen de gegevensbestanden, is minder gemakkelijk te nemen. Het basisprobleem ligt in

het ontbreken van informatie in de budgetenquête betreffende de belastbare inkomens. Daardoor kunnen we deze survey niet gebruiken als inputbestand voor SIRe. Een sequentiële run van SIRe en ASTER op één en hetzelfde gegevensbestand is dus onmogelijk. We zouden het probleem natuurlijk ook kunnen formuleren in termen van ontbrekende bestedingsinformatie in de fiscale dataset, IPCAL. Stel dat we bij de belastingaangifte niet enkel de belastbare inkomens, maar ook de gedetailleerde bestedingsstructuur vinden, dan zou IPCAL kunnen gebruikt worden als inputbestand voor ASTER. Toch menen we dat beleid beter kan geëvalueerd worden op basis van een representatieve budgetenquête, dan op een fiscaal bestand. Eén van de hoofdredenen hiervoor ligt in het verschil in definitie van de eenheid van observatie. In het fiscaal bestand gaat het om fiscale gezinseenheden. In de budgetenquête om sociologische gezinnen, die meerdere fiscale gezinnen kunnen omvatten. Bovendien is het fiscale bestand zeker niet representatief voor de onderste staart van de inkomensverdeling De meeste lage inkomens dienen immers geen belastingaangifte in te vullen. Naast deze twee hoofd-problemen, spruiten ook enkele kleinere verschillen voort uit verschillende definities van vergelijkbare grootheden, en uit het verschillend tijdstip waarop de twee gegevensbestanden betrekking hebben.

Om deze kloof te overbruggen, kunnen we in principe twee wegen volgen. Ofwel proberen we voor de netto-inkomens in de budgetenquête, de ermee corresponderende belastbare tegenwaarde te reconstrueren. Dan zouden we SIRe kunnen laten lopen op de budgetenquête. Het spreekt voor zich dat de reconstructie van dit netto-bruto traject een omslachtige zaak is, die , behoudens het verschil tussen fiscale eenheid en sociologisch gezin, in feite neerkomt op het invers programmeren van SIRe. Het is trouwens zeer de vraag of de budgetenquête voldoende informatie bevat om in deze terugrekening een bevredigende graad van nauwkeurigheid te halen. De tweede mogelijkheid zou er kunnen in bestaan voor elke fiscale eenheid in IPCAL bestedingen te berekenen, bijvoorbeeld aan de hand van geschatte Engelcurven. Dan kunnen we ASTER laten lopen of IPCAL. Engelcurven worden echter meestal geschat op gezinsniveau, zodat we voor deze techniek eerst de fiscale eenheden in IPCAL zouden moeten fusioneren tot sociologische gezinnen. Dit lijkt ons nog meer hypothetisch dan het netto-bruto traject.

We hebben daarom geopteerd voor een derde, minder frequent toegepaste, techniek: *statistische koppeling* (in het Engels: *statistical matching*). Voor elk gezin in de budgetenquête vullen we de ontbrekende informatie, m.n. de belastbare

inkomens, aan door een gelijkaardig gezin te zoeken in het fiscaal bestand en die inkomensgegevens te transfereren. Een groot deel van dit rapport is dan ook gewijd aan de concrete toepassing van deze techniek. Daarbij hebben we enerzijds problemen ontmoet die zeer specifiek zijn voor het voorliggende probleem, m.n. de koppeling van de budgetenquête en het fiscaal bestand. Anderzijds zijn we tijdens de matching oefening ook op meer algemene methodologische problemen gestoten.

De specifieke problemen hebben we hierboven reeds aangehaald: het verschil in eenheid van observatie, en de verschillende tijdsperiode waarop de gegevens betrekking hebben. Het zoeken van een "gelijkaardig" gezin, kan natuurlijk maar nadat we de eenheid van observatie op elkaar hebben afgestemd. De budgetenquête bevat genoeg individuele inkomensinformatie om het gezin in voorkomend geval te ontbinden in meerdere fiscale eenheden. We splitsen dus inwonende kinderen en/of andere gezinsleden die zelf een belastbaar inkomen verdienen, naast het koppel of de alleenstaande die de kern van het gezin uitmaken, af van het gezin en maken er een afzonderlijke belastbare eenheid van. Daarna zonderen we in deze budgetenquête op fiscaal eenheden niveau (in de tekst *Fiscal Unit Budget Survey*, *FUBS*), deze fiscale eenheden af die geen belastingformulier ontvangen en derhalve niet vertegenwoordigd zijn in het IPCAL-bestand. Het spreekt vanzelf dat we deze gezinnen opnieuw toevoegen op het moment dat we uitspraken zullen doen over de verdelingseffecten van de belastinghervorming. Ze worden enkel niet betrokken in het koppelings-proces.

Het tweede probleem dat specifiek is voor de door ons gebruikte gegevens-bestanden, betreft de verschillende tijdsperiodes: 1987-88 voor de budget-enquête, 1993 voor de fiscale data. Dit verschil in de gegevensbestanden is belangrijker dan op het eerste gezicht lijkt. De statistische koppeling kan immers gebeuren met of zonder beperkingen op de marginale verdelingen van de te koppelen grootheden. Indien de twee steekproeven die gekoppeld worden uit dezelfde populatie komen, dan is het aangewezen de marginale verdelingen van de te koppelen grootheden constant te houden. De hypothese dat de budgetenquête en het IPCAL bestand trekkingen zouden zijn uit dezelfde populatie, wordt in ons onderzoek statistisch verworpen. Het tijdsverloop tussen de twee trekkingen zal zeker een rol spelen in deze verwerping. Wij opteren daarom voor een koppeling zonder beperkingen. Concreet betekent dit dat één en hetzelfde fiscaal gezin uit IPCAL meerdere keren kan gekoppeld worden aan verschillende gezinnen uit de budgetenquête.

Daarnaast werden we in dit project ook genoodzaakt oplossingen te bedenken voor problemen van meer algemene aard bij de keuze voor statistische koppeling. Vanzelfsprekend zijn in het kader van dit project sommige van de voorgestelde of toegepaste oplossingen tentatief en voorlopig. Enkele van de door ons toegepaste procedures werpen trouwens weer nieuwe vragen op. Het sterk gerelateerde D.W.T.C.-project over statistische koppeling (DB/01/032) zal hierop een meer algemeen theoretisch en empirisch antwoord geven. We vermelden er hier twee: het determineren van de gemeenschappelijke grootheden in de twee bestanden, en de specificatie van de afstandsfunctie.

Statistische koppeling bestaat uit het identificeren van "gelijkaardige" observaties in de twee bestanden. Dit gebeurt op basis van gemeenschappelijke grootheden in de twee bestanden. Dus dienen in de eerste plaats deze gemeenschappelijke grootheden bepaald te worden. De basisvoorwaarde voor een succesvolle koppeling is dat deze grootheden op dezelfde manier gedefinieerd zijn in beide bestanden, en dat ze sterk gecorreleerd zijn met de niet overlappende grootheden. In het rapport tonen we aan hoe een *stapsgewijze regressie* hier grote diensten kan bewijzen. Ze laat niet alleen toe de grootheden zelf te identificeren (in ons geval 17), maar levert als bijproduct meteen ook de gewichten op van deze grootheden in de afstandsfunctie. Deze afstandsfunctie is de meetlat waarmee we "gelijkaardig" kwantificeren. Voor elk van de 17 variabelen meten we de afstand als het verschil in de waarde in de gezinsbudgetenquête, en de waarde voor deze zelfde grootheid in IPCAL. We normaliseren deze afstand door te delen door de standaardafwijking van deze grootheid in de budgetenquête. De afstandsfunctie is dan het gewogen gemiddelde van deze 17 genormaliseerde afstanden. De statistische koppeling bestaat er dan in voor elk fiscaal gezin uit de budgetenquête, die fiscale eenheid te zoeken in IPCAL waarvoor deze afstand minimaal is. De belastbare inkomens, en ook de met SIRe berekende verschuldigde personenbelasting op die inkomens, voor deze "meest gelijkaardige" fiscale eenheid uit IPCAL worden dan getransfereerd naar de budgetenquête.

Het uiteindelijke resultaat van deze koppeling is een verrijkte budgetenquête. Voor elk sociologisch gezin in deze representatieve steekproef beschikken we nu niet enkel over de bestedingen en de daarop betaalde indirecte belastingen, maar ook over de belastbare inkomens en de verschuldigde personenbelasting.

Resultaten

We hebben bovenstaande techniek toegepast voor de personenbelasting en de indirecte belastingen in 1988 en 1993. In 1988 werd immers een belangrijke

hervorming van de personenbelasting doorgevoerd. De tarieven werden grondig herschikt en vereenvoudigd, de veralgemeende decumul voor de beroepsinkomsten werd ingevoerd, voor de koppels met één arbeidsinkomen trad het huwelijksquotiënt in werking, en er werd nogal wat gesleuteld aan aftrekken en verminderingen. De belangrijkste verandering in de indirecte belastingen voltrok zich in april 1992. Om de BTW-tarieven wat meer in lijn te brengen met de aanbevelingen van de Europese Commissie, werden de tarieven van 17, 25 en 33% afgeschaft. Het normale tarief werd 19.5% en het verminderde tarief bleef op 6%. Deze herschikking leidde vanzelfsprekend tot minder opbrengsten voor de schatkist. Als compensatie werden daarom de accijnzen op brandstoffen en tabakswaren verhoogd. Globaal kwam de hele operatie in elk geval neer op een verschuiving van de belastingdruk, weg van de personenbelasting naar de indirecte belastingen.

De empirische resultaten van deze geïntegreerde analyse laten twee conclusies toe. Vooreerst leidt de verschuiving van personenbelasting naar indirecte belastingen tot een erosie van de herverdelende werking van het globale belastingsysteem. Indien we de herverdelende werking van een belasting-systeem meten aan de hand van de reductie in de ongelijkheid van de inkomens na belasting, dan bedraagt deze erosie ongeveer 5%. Deze vaststelling beantwoordt aan de verwachtingen. Minder verwacht is, dat dit in grote mate te wijten is aan de verhoging van de indirecte belastingen. De herverdelende werking van de personenbelasting is immers onderhevig aan twee elkaar neutraliserende krachten. De niet onbelangrijke daling van de gemiddelde belastingvoet in een progressief systeem zou, ceteris paribus, geleid hebben tot een sterke daling van de herverdelende kracht van het systeem. Maar de reductie van de gemiddelde belastingvoet wordt in grote mate gecompenseerd door een toename van de progressiviteit van de structuur (*liability progression*).

De tweede conclusie illustreert treffend de relevantie van het proces van statistische koppeling. Zonder deze koppeling kon de personenbelasting enkel geëvalueerd worden op het fiscale bestand IPCAL. Dank zij de koppeling kon de evaluatie van dezelfde belastinghervorming herhaald worden voor een andere, wellicht zelfs beleidsrelevantere, analyse-eenheid zoals het sociologische gezin, en konden we ook de gezinnen die geen belastingen betalen aan de analyse toevoegen. Bovendien laat de rijkdom aan beschikbare informatie in de budgetenquête toe een correctie aan te brengen voor gezinsomvang aan de hand van een equivalentieschaal. De resultaten tonen aan dat dit een heel ander licht kan werpen op de belastinghervorming. Enkel voor

de personenbelasting zou men op basis van IPCAL concluderen dat de herverdelende werking van het systeem met 12% verminderd is ten gevolge van de hervorming van 1988. Na correctie met een equivalentieschaal, en op basis van de budgetenquête blijft van die reductie nog slechts 3,6% over.

1. INTRODUCTION

Models that rely on individual or household observations to predict the consequences of policy measures are known as microsimulation models. Such models have now become very popular, both for the preparation and evaluation of policy measures, as well as for the empirical implementation of theoretical research[1].

Despite their popularity, the existing models generally have a partial nature and only cover a very limited subset of the instruments at the disposal of the policy maker[2]. Well known examples are the microsimulation models for personal income taxes, and the models for indirect taxes.

This separate development might surprise since the core and structure of both types of models is very similar: simulation and evaluation of a change in policy parameters at the *individual or household level*. The segregation becomes even more striking if one remembers that, in the last decade, policy makers of several countries have opted for a mix of changes in personal income taxes and indirect taxes, usually installed through a single tax reform act[3]. Hence, if one presents an evaluation of such reforms, it seems legitimate to ask for an overall evaluation of the whole policy change rather than for a partial analysis[4].

One could of course try to obtain the overall picture by adding-up the results obtained from the separate models. But in most cases this procedure is hampered by several problems. Firstly, the underlying databases may be different in several respects, of which the different definition of the unit of

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[1] For a recent, well documented survey of the power, the limitations, and the practical applicability of the methodology of microsimulation, see Redmond, Sutherland and Wilson (1998)

[2] This point is well documented in the overview of existing static models in Europe, see Sutherland (1996).

[3] During the eighties, personal income taxes have been reduced in many European countries. To compensate for the reduction in government revenue one often has increased indirect taxes.

[4] The public reaction of the Belgian prime minister in April 1992 on our calculation of the distributional consequences of the indirect tax reform carried out by his government, is illustrative in this context. We found that the reform was regressive. But the prime minister replied that we 'forgot' to take into account the progressive effect of the measures taken at the same time and resulting in higher taxation of income from movable property.

observation is one of the most important ones. Many models for personal income taxes, e.g., run on a fiscal database, which uses the fiscal unit as the basic unit of observation. But an indirect tax model will mostly be based on a database with expenditures, and hence on a sociological definition of the household. Secondly, there is a spill over effect of the change in disposable income, induced by the change in personal income taxes, to the change in expenditures and hence to the indirect tax liabilities. This might be relevant, both for the calculation of the net effect on government revenue, as for the assessment of the distributional effects of the reform.

Therefore the first and major objective of the work, reported here, is to construct a microsimulation model in which the partiality of the current models is lifted to some extent[5]. Instead of starting from scratch to construct such a model, we have investigated the possibility to integrate two existing models. As a consequence, our quest will not result in a new user - friendly model that can be used to simulate reforms. Rather we keep the outlook of each model as it is, but introduce ad hoc adjustments to the databases and routines of each model, to solve the problems mentioned above.

The models we will be concerned with, are two Belgian microsimulation models: the personal income tax model SIRe and the indirect tax model ASTER. Although there is a fair chance that some of the integration problems depend on the peculiar nature of these specific models, it is likely that other problems are of a more general kind. Hence, the proposed solutions should also be applicable for the integration of other models.

If a link between the models is established, this construction can be exploited to analyse the overall effects of a reform of personal income taxes, taking into account the induced effect through indirect tax liabilities. But we have extended the empirical analysis towards a *simultaneous reform* in personal income and indirect taxes. The simulated reform is a collection of the most important reforms that have been implemented, between 1988 and 1993, in the Belgian personal income and indirect tax system[6].

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[5] The partial character is only lifted to a limited extent because the simulation of social security benefits will not be considered and because the only spill over we allow for is one from direct tax reforms into the indirect tax base.

[6] It is deliberate, that we do not refer to these years as tax years. A tax year is a concept that refers to the year during which the rules are applied to determine the indebted tax amount. Since indirect taxes can be applied without delay, the tax year coincides with the year of

Summing up, two major parts can be distinguished in the discussion below. On the one hand, and in the first place, we deal with model construction issues. Next to that we also discuss a simulated tax reform. The model construction issues are dealt with in two sections. An overview of the existing models and the possibilities to integrate them is given in section 2. In section 3, we then discuss the choices that have been made to combine the existing models. Section 4 contains information on the simulated reforms and the evaluation of them. In section 5 we summarise the main insights that emerged throughout the other sections.

consumption. The precise income tax rules on the other hand are applied on income with a lag of one year, although they are known already when income is generated. Hence, an exercise that looks at direct and indirect taxes at the same time brings about a terminology problem since the rules applied during one year are officially referred to as two different tax years. Therefore, if we refer to *a year* we refer to the set of tax rules that are to be applied on either income generated or expenses done during that year but if we use the term *tax year*, we follow the official terminology.

2. DESCRIPTION OF TWO EXISTING MICROSIMULATION MODELS AND THE DIFFICULTIES TO INTEGRATE THEM

To appreciate the integration problems that arise, a brief description of the strengths and weaknesses of the existing models is required. The discussion of the models is kept short and the focus is put on the elements that appear to be problematic when integrating both models. A more detailed description of SIRe can be found in Standaert en Valenduc (1996), and about ASTER in Decoster, Schokkaert and Van Dongen (1994), Decoster (1995) and Decoster, Delhaye and Van Camp (1996).

2.1 Description of the existing models

2.1.1 The microsimulation model for personal income taxes, SIRe

SIRe calculates personal income taxes for each unit in the underlying data base instead of personal income taxes and social security benefits as most models, surveyed in Sutherland (1996), do. Crudely sketched, the model uses the following information as input for each unit: gross income figures, the costs that have to be made to gain this amount of income, information on family composition and certain expenditure figures such as expenditures on mortgage loans and contributions to pension funds.

This information can of course be processed in many different ways, but in specifying reforms one is basically limited to the information collected by the tax administration since the underlying sample is yearly drawn from an administrative tax file, called IPCAL. IPCAL consists of the tax forms that are entered by persons who are liable to pay income tax in Belgium. The sample we used, which will be referred to as the *fiscal data set* later on, consisted of tax forms entered in 1994[7]. The administrative base on which the model rests, also shows up very clearly in the basic version of the model. In fact, the basic version of SIRe reproduces the calculation of the tax administration of a given year. The advantage of this approach lies in the degree of accuracy of the model. The calculated tax liabilities are nearly exact. A drawback of this is some loss in flexibility to define reforms. Furthermore, the model does not contain estimates

[7] This implies that the reported income figures are expressed in prices of 1993.

of behavioural responses for changes in personal income taxes. In direct tax benefit models this is rather the rule than the exception, however.

The administrative origin of the data base also implies that administrative units of observation are used. In principle such a fiscal unit is an individual, since each Belgian citizen that is gaining a sufficient amount of income is liable to pay income taxes and thus has to enter a tax form. If a person is legally married however, he will enter only one tax form together with his spouse[8]. Therefore, the final tax liabilities, produced by the model, are calculated on the basis of income that is gained by either one or two physical persons.

Despite the fact that the tax liability for each of these units is nearly exact and the fact that the sum of all tax liabilities is a good approximation of the total revenue, the underlying data base is not representative for the Belgian population as a whole. This is so because for some people it is obvious that the administrative calculation of the indebted tax liability will point out that they do not have to pay income taxes which dismisses them from entering a tax form. Therefore, the 10343 units in the sample we use are representative only for the population of fiscal units that have filed taxable income and for whom it was not immediately clear whether they had to pay taxes or not[9].

2.1.2 The microsimulation model for indirect taxes, ASTER

Since indirect taxes are levied on consumption, the microsimulation model for indirect taxes uses a budget survey as its basic data source rather than administratively collected information. The household budget survey, used by ASTER, has been designed as a representative sample of Belgian households[10]. Participating households were asked to register expenditures during the period of May 1987-May 1988[11]. This resulted in a large amount of different items on which households reported expenses. In the final version of ASTER, 747 different items have been retained.

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[8] Both, the definition of the fiscal unit and the condition to be part of it when married, are only crude sketches of the real conditions. See f.e. Standaard Belasting-Almanak (1996), p. 7-15 for more detail.

[9] These 10343 units are supposed to represent a population of 4.109.965 fiscal units.

[10] Households are defined as all people living under the same roof, using the same accommodation and deciding commonly on their expenses.

[11] Despite the fact that a new survey had been finalised in 1996, the data of 1987-1988 where the most recent available to us at the time this exercise was done.

Within the Belgian indirect tax system three different tax types can simultaneously apply on each of these items. These types are Value Added Taxes (VAT), Excises and Ad Valorem Excises. Ad Valorem Excises are expressed as a percentage of consumer prices, Excises increase the producer price with a fixed amount and Value Added Taxes are expressed as a percentage of the overall combination of the producer price, the Excise and the Ad Valorem Excise. The link between consumer price p_i and producer price q_i therefore can be represented as in equation (1), where a_i, v_i and t_i symbolise the Excise, the Ad Valorem Excise and the Value Added Tax respectively.

$$p_i = (1 + t_i) \cdot (q_i + a_i + v_i \cdot p_i) \tag{1}$$

The model provides the possibility to change the taxes, applied on each item, in a fairly easy way. After a reform has been defined, the pre and post reform prices on these items are aggregated up to 32 commodity price indexes[12]. Consequently the expenses of each household are aggregated into 32 classes which then makes it possible to calculate the amount of indirect taxes paid by each household before and after the reform.

The obtained tax figures can only be approximations of the true amount of indirect taxes since now and then one requires more information, than that available in the budget survey, to apply the exact tax rules[13]. This is simply a consequence of the fact that the budget survey was not especially designed for this kind of calculations, contrary to, for example, the administrative information that was used to calculate personal income taxes. Despite this lack of information for the calculation of indirect taxes, the budget survey contains much more information on the background of its units of observation than that registered in the fiscal data set.

Beside the expenditures on household level, the budget survey also contains information on common income sources like labour income and most social

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[12] During simulations the producer price q_i is assumed to remain constant. Since these prices can not be observed either, they are set equal to 1 in the pre and post reform situation. To express the excises in a unit-free way as well, we divide the excises by the observed consumption prices. The consumer prices of exccise commodities and the excises expressed in BEF, are reported in tables A4.2 and A4.3 of appendix 4.

[13] Recently a temporary VAT reduction from 21% to 12% was applied on construction materials, to be used for newly constructed houses. Since the invested amount of income is not reported in the survey the impact of this measure could not be calculated.

security benefits. These income sources are reported for each member of the household individually while, for example, income from real estates and savings are reported on a household level. Next to that, the survey also contains a large amount of variables that characterise both the household as well as its members[14]. Especially when it comes down to the evaluation of reforms, the informational richness of the underlying data base offers ASTER an advantage over SIRe.

However, the budget survey has a major disadvantage as well. Because of the lengthy registration period the 3235 households, one is left with in the final sample, only make up 11% of the sample one originally started with[15]. Despite the fact that weights have been constructed to compensate for the attrition bias, this low response rate casts doubts on the representativity of the simulated results[16].

2.2 Difficulties when integrating SIRe and ASTER

2.2.1 Two basic problems

As the above description of the models has illustrated, one should take the following steps to obtain one tax figure, consisting of both personal income taxes and indirect taxes paid by one unit of observation: apply a personal income tax system on an income concept to obtain income net of personal income taxes, split up the latter into savings and consumption and finally determine how these total consumption expenditures are disaggregated into different consumption goods such that the indirect tax rates can be applied on these consumption bundles[17]. Ideally, one would therefore dispose of one data set containing both gross income, some other input elements, required to calculate the taxes that have to be paid on this amount of income, and

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[14] Counted over all households, 812 different expenditure codes, 234 different revenue codes and 285 characteristics were registered.

[15] These 3235 units should be representative for the household population in 1988, which consisted of 3.867.506 household units.

[16] See Verma and Gabilondo (1993), p. 99.

[17] We will speak about income, net of taxes rather than net income. This is done to avoid confusion with the net income concept that plays a prominent role in the discussion of the direct tax system, given in section 4.1.1. There net income refers to income minus costs made to obtain the income amount rather than to income minus taxes.

disaggregated consumption levels for each observational unit. In that case one would only have to concentrate on the behavioural links between gross income and consumption.

One limitation of the described ideal should be stressed immediately however. The ideal data set is sketched as one that contains inputs that are relevant according to the current tax legislation. Therefore, what is considered as ideal here, is dependent on the current practice which obviously brings about limitations for the simulations that can be carried out if this data set is used as input. Nonetheless, focusing on these variables seems to be a defensible choice since the input generally remains constant over different tax systems. What varies is the way these inputs are processed.

It should not come as a surprise however that the available data are even not of this "restricted" ideal type. The data base underlying the personal income tax model does not contain expenditures on consumption goods. The budget survey, as is the case with most surveys, does not go further than asking the respondents their income, net of taxes, rather than the gross income concept that is required. None of the other micro level data sets, available in Belgium, contain both expenditure figures with sufficient detail and gross income at the same time. Therefore, two major hurdles should be taken before being able to simulate the kind of reforms we aim at. First of all *an appropriate data set* should be constructed and next to that the necessary *behavioural responses* should be determined. In the remainder of this section we describe some alternative ways to overcome these hurdles and set out the problems in more detail. The steps that have been taken in practice, are discussed then in section 3.

2.2.2 Data Problems

2.2.2.1 Why statistical matching?

One obvious solution for our data problems would be to organise a new survey such as to register information on all the items, relevant for the specified simulation exercise. A more modest variant of this option would be to interrogate the respondents of the budget survey only on their gross income of the specified year. Neither of these options has been considered seriously however since these are expensive alternatives. Furthermore, it seems quite unlikely to have a high rate of success if one would ask people about the gross income they earned ten years ago. At best, one could consider it to be an appropriate question if one would organise a new budget survey anyhow. But

even then the argument applies that many respondents have a better knowledge of their income, net of taxes, rather than their gross income. This is because most people are paid gross income minus withholding taxes each month.

Because of these objections, we did not choose to do a survey ourselves but rather we have focused on the possibilities to construct, out of the available data, one data set that contains both gross income and detailed expenditures for each observational unit.

One possibility to construct such a data set would be to complement the budget survey with gross income figures if one exploits the available information on the withholding taxes that each observational unit is supposed to pay. This solution could not be used however, since the information on withholding taxes of people with for example self employed income is less accurate than that of employees.

Instead of using the withholding taxes, the lacking information will be complemented by transferring income from one data set to the other one. One could choose either to complement the budget survey with gross incomes that are observed in the fiscal data set or conversely determine the detailed expenditure pattern of the observational units in the fiscal data set by exploiting the observations made in the budget survey.

Independent of the transfer direction one chooses, two major possibilities can arise, depending on the information available in both data sets. If the same units have been used in both data sets and if they appear with a unique identification number one could combine both data sets in an exact way. If one of these conditions is not fulfilled one has to rely on statistical procedures to combine comparable units of different data sources.

It is clear that the exact option is the one that requires least time and will have the highest degree of accuracy with respect to the final objective. Furthermore, one could think that this exact option is available to us since each individual that appears in either of the two data sets can in principle be identified with a unique national identification number. Unfortunately, for reasons of privacy, these identification numbers are discarded when the data are distributed among potential users. The privacy legislation in Belgium even seems to be so strict that it is not possible to ask the National Institute for Statistics, which

governs both data bases, to establish this link and to discard the national number afterwards[18].

Since it is not possible to apply the exact procedure, we have to rely on statistical procedures that combine comparable units of both data sources. A unit of one data set is said to be comparable with that of another one if a variable, that appears in both data sets, takes on comparable values. For example, when marital status is observed in both data sets, one could transfer the gross income of a married couple in the fiscal data set to a married couple that is observed in the budget survey. These comparable variables take over the role played by the identification number since the idea is again to establish a link between the units, that appear in both data sets, on the basis of the observed variable values. But it is obvious that the identification on the basis of these observed variable values will be exact only under very special circumstances. If exactly the same observational unit was selected for both of the independently drawn samples, one could have a unique identification through the observed variable values. Since this is a matter of luck rather than the rule, procedures relying on substitute identifiers, like observed variable values, are also referred to as statistical matching procedures.

2.2.2.2 Statistical matching procedures

As the above exposition suggests, statistical matching procedures exploit the information that is common to two data sets to establish a link between the observational units within these data sets. Therefore, if two data sets can be combined by statistical matching procedures, they must fall apart in two subsets each. One subset containing overlapping variables, also referred to as matching variables, while the other contains non-overlapping variables. To stay within the above example, the subsets of matching variables within the budget survey and the fiscal data set will be denoted by the matrixes X^{BS} and X^{FD} respectively, while Y and Z denote the matrixes with non-overlapping information of these respective data sets.

In the data sets, sketched in tables 1 and 2, the first and the second column of the matrixes X^{BS} and X^{FD} contain observations on sex and age respectively. Since the first data set is supposed to be a budget survey and the second a fiscal

[18] We must admit that we did not start an official procedure to enter this request but we were dissuaded from doing it after some discussions with experts in the field of privacy legislation that all indicated a zero rate of success.

data set one could imagine Y and Z to be vectors containing consumption and gross income respectively. Next to the observations on these variables, both data sets also contain weights that make the observations representative for the same population.

Table 1: An example of a budget survey

Case	Sex	Age	Consumption	Weight
	x_1^{BS}	x_2^{BS}	y_1	w^{BS}
A1	M	42	600	3
A2	M	35	500	3
A3	F	63	700	3
A4	M	55	800	3
A5	F	28	200	3
A6	F	53	400	3
A7	F	22	100	3
A8	M	25	300	3

Table 2: An example of a fiscal data set

Case	Sex	Age	Gross Income	Weight
	x_1^{FD}	x_2^{FD}	z_1	w^{FD}
B1	F	33	1400	4
B2	M	52	1200	4
B3	M	28	1100	4
B4	F	59	1300	4
B5	M	41	1500	4
B6	F	45	1000	4

There are then basically two ways to exploit this overlapping information in such a way that either of the two data sets can be extended with observations of variables that are currently missing[19].

One possibility would be to estimate the relation between a non - common variable and the common ones in one data set and use the estimated parameter

[19] It should not matter which one of the two is complemented with the lacking information since both samples are said to be representative for the same population.

values to impute the expected value of the non - common variable in the other data set[20]. This procedure requires that both samples cover the same population, otherwise the estimates of one sample will turn out to be biased for the other sample.

Alternatively one could minimise a distance function that is specified over the overlapping observations[21]. If one can indicate, for a record in one data set, its distance minimising counterpart in the other data set one can transfer the missing observations from one data set to the other. Distance functions that are suited to do this identification job therefore can be seen as aggregate constructions, made up by the differences between matching variables and the weights attributed to these differences. An example of such a function is given in equation (2).

$$D1_{jk} = \sum_{i=1}^{2} w_i^A \left| x_{ij}^{BS} - x_{ik}^{FD} \right| \qquad (2)$$

In this specific function the weights are denoted by w^A and absolute differences between the common variables are used. While i is used to index different variables in this equation, j and k run through the different cases of the budget survey and the fiscal data set respectively. For each record j in the budget survey, the minimisation runs over k.

We will use a distance function approach because it allows for the imputation of several missing variables at the same time while the estimation procedure requires the estimation of a separate set of parameter values for each non-common variable that is to be imputed. But even if one has chosen to apply a distance measure, one still faces two basic options to apply such a procedure. One could either use it in a constrained or an unconstrained way.

Unconstrained procedures only minimise the distance function over the records in both data sets. Therefore if one record minimises the distance with several records in the other data set, the values of this record will be used several times to impute the missing observations. As a consequence it can happen that the imputed values of this record appear with a larger proportion in the newly constructed data set than they did in the original one which implies that the distribution of the imputed and the original variable differ from each other.

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[20] See, for example, Klevmarken (1982), Angrist and Krueger (1992) and Arellano and Meghir (1992) on this procedure.

[21] See, for example, Paass (1982, 1985 and 1986) and Rodgers (1984)

For example, when *D*1 would be applied in an unconstrained way on the above data sets and the results are used to impute observations on gross income in the budget survey one would obtain the extended data set, reported in table 3. The weights of the records that are produced by an unconstrained match are denoted by w_{jk}^{UM}. These weights are indexed to refer to the cases of the original data sets that lie at the basis of this newly constructed records. The original cases themselves are reported in the first two columns of table 3.

The comparison of the imputed distribution on gross income with the original one, observed in table 2, makes clear that both distributions differ. For example, the highest income observation, originating from case B5, appears with a higher proportion in the imputed distribution than it did in the original distribution.

Table 3: Extending the data on the basis of an unconstrained match

Case BS	Case FD	Sex	Age 1	Age 2	Consumption	Gross income	Weight
		$x_1^{BS} = x_1^{FD}$	x_2^{BS}	x_2^{FD}	y_1	z_1	w_{jk}^{UM}
A1	B5	M	42	41	600	1500	3
A2	B5	M	35	41	500	1500	3
A3	B4	F	63	59	700	1300	3
A4	B2	M	55	52	800	1200	3
A5	B1	F	28	33	200	1400	3
A6	B4	F	53	59	400	1300	3
A7	B1	F	22	33	100	1400	3
A8	B3	M	25	28	300	1100	3

One could avoid this bias if one imposes an additional condition on the weights given to each of the newly constructed records. This condition says that the weight of each original record in the newly constructed data set has to be the same as the one it had in the original data set. This would imply that if one makes the sum of the weights that appear in the last column of table 3 over all the cases in which, for example, record B5 has been used, one should end up with a relative weight of 4/24 rather than 6/24 which is currently the case. The formal translation of this condition is to be found in equations (3) and (4), where w_{jk}^{CM} denotes the constrained matching weight.

$$\sum_{k=1}^{6} w_{jk}^{CM} = w_j^{BS} \qquad \forall \qquad j = 1,\ldots,8 \tag{3}$$

$$\sum_{j=1}^{8} w_{jk}^{CM} = w_k^{FD} \qquad \forall \qquad k = 1,\ldots,6 \tag{4}$$

Hence, to decide upon the application of a constrained or an unconstrained procedure it should be tested whether both data sets come from the same population. The most complete test to do this would be to investigate whether the multivariate distribution of the matching variables is the same within both data sets. A minimal requirement for this to be true would be to see whether the marginal distributions of the matching variables are the same over both data sets[22]. On the other hand, a rejection of this population hypothesis would not prevent the application of a matching procedure if the units within both data sets are comparable. To test whether the latter is the case, one could directly apply a matching procedure and see whether parameters such as the mean distance are of an acceptable height.

Beside the basic choice between the constrained or unconstrained application of distance functions, one faces the choice of the exact form of the distance function itself. Several forms have been applied in the literature but empirical experiments could not come up with clear cut conclusions on which form performs best[23]. These experiments also illustrated that distance functions with subjectively chosen weights w^A did not perform worse than those where weights were data driven[24]. Hence, it seems fair to assume that the quality of the match is determined in the first place by the variables that are used rather than by the exact form of the distance function.

Within the simplified example, used in this subsection, it was obvious which variables had to be used as matching variables. In practice, the situation is generally less straightforward. Therefore the next subsection will spell out in more detail how the quality of common variables as matching variables can be assessed. This discussion will also provide some perspective on how to choose the distance function weights.

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[22] This requirement is only a minimal one since all marginal distributions can still be the same while the multivariate distribution is different.

[23] See among others, Armington and Odle (1975), Barr, Stewart and Turner (1982) and Rodgers and DeVol (1982).

[24] See Rodgers (1984) p. 100.

2.2.2.3 Selection of matching variables and weights

The more a variable is capable of identifying the uniqueness of an observational unit over both data sets, the better it will serve as a matching variable. To take up this identification job the matching variables should be comparable over both data sets and they should be highly correlated with the missing observations.

That matching variables got to have a comparable nature implies that they have to cover the same subject and have to be registered for the same observational unit level, as was assumed in the example of the previous section. While this comparability requirement as such may appear as obvious, it is less evident to check if it is satisfied or not. Whether two variables both cover for example the subject of earned income depends on what the observational units of both data sets are supposed to understand when registering this information. Since differences on this part can not always be traced back, one has to assume at a certain stage that the definitions are sufficiently uniform.

When the aforementioned tests on the origin of the data would not reject the hypothesis that the data represent the same population this could be seen as a confirmation of the fact that the same definitions have been used. However, when these tests reject the hypothesis, it becomes difficult to judge on the comparability of the subject of the so-called comparable variables. Such a rejection could be entirely due to real differences in the structure of the population. Alternatively it could also be that the hypothesis is rejected because the definitions that have been used within both data sets differ. These tests will not discriminate between these two types of rejections. In such cases one should either reconsider the definitions that were used or explicitly assume that rejections are only due to differences in the structure of the population.

Although the comparability of the variables is of major importance with respect to the final result of the matching exercise, the quality of the match will improve the higher the *correlation* between the matching variables and the non-overlapping variables is[25]. Hence for the current exercise, we look for variables that are highly correlated with gross income and consumption in the first place.

This correlation issue could be of guidance if one is forced to select among the available comparable variables. One is generally forced to select among these variables since two elements have to be traded off. If one uses more matching

[25] See, for example, Paass (1982)

variables the correlation with the non-overlapping variables is likely to increase but this will decrease the probability of finding a comparable observational unit within both data sets.

Hence it seems warranted to narrow down the set of matching variables by translating this correlation story into a selection procedure. This could either be done by applying formal correlation tests or by relying on a priori information. While the formal tests only exploit detectable data relations, the a priori information boils down to the postulation of some model one has in mind within which the matching variables appear as explanatory variables of the non-common variables.

It should be forewarned however that the selection of these variables must not be driven too far. If one pushes the selection to its limit one remains with one variable only, which seems a bad thing to do if one has more than one comparable variable. This point is confirmed by Barr, Stewart and Turner (1982) who experimented with up to six different matching variables and concluded that one obtained a better match when at least more than one matching variable was used. Rather than reducing the number of matching variables, it seems worthwhile to use as much as possible variables in the distance function but if necessary with differentiated weights. Higher weights should then be given to those variables that are more highly correlated with the missing variables.

2.2.2.4 Can statistical matching procedures be applied on the available data?

According to the above exposition on matching procedures and matching variables one should check whether matching variables cover the same subject, are expressed at the same observational unit level and are distributed in the same way over both data sets before a matching procedure is applied. All these topics seem to be relevant for the data that will be used in this exercise.

Without a detailed inspection of the definitions of variables that are used in both data sets and without listing all comparable variables there are already two sources of differences that leap to the eye.

The fiscal data set was drawn from the tax file of the income tax year 1994 while the budget survey was organised in 1987-1988. This implies that the nominal variables in both data sets refer to different basic price levels. Because of these differences in covered time period one should also be careful when using income, net of taxes as a matching variable. Income variables in the budget survey are directly registered net of taxes. It is possible to construct such

observations in the fiscal data set as well since it contains both gross income and taxes. But, since the tax system has changed throughout the years the income variables, net of taxes, within both data sets do not necessarily refer to the same gross income figure. Hence, even if variables carry the same label in both data sets, it can be that they are inappropriate as input for a matching procedure.

On top of these subject problems we face the problem that the observational units of the available data sets differ. In the fiscal data set the observational units are fiscal units while the basic observational units of the budget survey are households. It is not hard to imagine that households and fiscal units do not necessarily coincide since many non-married but income earning people can live under the same roof and therefore make up one household. To deal with this problem one basically faces two options. Either one manipulates the observational levels of the fiscal data set by constructing households on the basis of fiscal units or one disentangles the households, observed in the budget survey, into fiscal units.

Even if one would be able to deal with these problems and express the data at the same observational unit level one would still face the problem that the current data cover different populations. While the budget survey is designed to represent the population of Belgian households in a given year, the fiscal data set only contains a subset of the fiscal units that appear within these households. This is so because fiscal units do not enter the fiscal data set if it is obvious that they do not have to pay income taxes.

If these differences are dealt with, one could proceed and match the data. Whether this match should be done in a constrained or an unconstrained way remains still to be seen however. Dealing with the problems mentioned here, would only bring about observations that are comparable but which do not necessarily appear with the same frequency within both data sets.

2.2.2.5 Distinction between matching level and level of analysis

If one has manipulated the data such that they can be matched and if a matching procedure has been applied, the lacking information can be transferred from one data set to the other one. But, the data set one obtains after these steps have been taken, is not necessarily the one to be used in the final analysis. This will be the case if the matching level and the level of analysis are different from each other.

The matching level is the observational unit level, within which both data sets are expressed when they are used as input for statistical matching procedures.

As explained above, either the fiscal unit level or the household level could be chosen as the matching level. These same observational unit levels can be chosen as well to analyse and express the results of the simulated tax reform. But it is not necessarily so that the level that provides the easiest way to match is also the level to be used when analysing the simulated results.

Hence, in some cases one is forced to apply an additional manipulation on the matched data such that the observations, expressed at the matching level, are translated into the preferred level of analysis. In general, this manipulation has to be executed before behavioural responses are estimated since the arguments in favour of one of the two levels of analysis usually depends on differences in behavioural responses. For example, if expenditures are part of the analysis, one generally prefers the household level as level of analysis since decisions on expenditures are taken at the household level. If the matching was done then with fiscal units, one additionally has to transfer the matched observations from the fiscal unit level to the household level before one can appropriately apply a behavioural demand system on the simulated results.

2.2.3 Behavioural response problems

Next to the construction of an appropriate data base, the integrated simulation exercise also requires us to make assumptions on the behavioural impact of changes in the tax parameters. Three major sets of such behavioural assumptions can be distinguished in the calculation process that starts with gross income and ends with disaggregated consumption levels.

First of all, the tax parameters of the personal income tax system will influence the behaviour of the tax paying unit. For example, the Belgian income tax system gives more fiscal stimuli to construct new houses rather than to buy an existing one and to rebuild it. Another decision that could be influenced by the income tax system is that between marriage or cohabitation. In the current system it depends on the professional income of both spouses whether marriage is advantageous in comparison to cohabitation from a fiscal point of view. While all these behavioural responses seem to be relevant for the evaluation of tax burdens, the only behavioural element one has usually concentrated on in the literature is the effect of income taxes on the labour supply decision. This is probably due to the fact that such behavioural decisions have a direct impact on the total amount of earned gross income.

No matter what assumptions one makes on this first set of behavioural responses, a change in the income tax parameters will change the income, net of

taxes, for some individuals. It is this latter concept which one thinks about as the decision variable that the observational unit will separate into savings and consumption. Hence if we are willing to proceed in the direction of disaggregated consumption levels before and after the reform in the personal income tax system we will have to lay down a second set of responses, reflecting savings behaviour.

If income, net of taxes, is split up in an aggregate amount of savings and consumption one still requires a third set of behavioural responses that specify how the aggregate amount of consumption is disentangled in more detailed consumption classes.

3. POSSIBLE SOLUTIONS FOR THE INTEGRATION PROBLEMS

3.1 DATA PROBLEMS

3.1.1 Constructing a matched data base

3.1.1.1 Preparing the data for matching

Since the choice of the matching level is logically prior to any other choice for the emerging data problems, this choice will be dealt with in the first subsection. The second subsection then describes the variables that have been selected as matching variables. As has been discussed above, these variables should be manipulated before they become comparable over both data sets. The manipulations, executed in the budget survey and the fiscal data set, will be described in the third and the fourth subsection respectively. The fifth and final subsection then contains the results of the comparability tests that have been applied on these variables.

3.1.1.1.1 Choosing the matching level

One can either choose to construct households on the basis of fiscal units or to tear apart households into the constituting fiscal units. Since the fiscal data set does not contain any indication as to what extent several fiscal units make up one household, we will have to split up the households into fiscal units if we are willing to proceed. Luckily, the budget survey contains a sufficient amount of information to do this in a reliable way. This does not imply however, that the budget survey contains the information that is necessary to make it an exact split. As will become apparent in the third subsection, some assumptions must be made to process the available information from a household level into a fiscal unit level.

3.1.1.1.2 Choosing the matching variables

Because of the differences in observational level between both data sets, a direct comparison of overlapping variables between both data sets was impossible. It had to be investigated first what kind of variables could be reconstructed at the fiscal unit level within both data sets. Rather than investigating these

reconstruction-possibilities in an exhaustive way we used a priori information to scan the opportunities. On the basis of this a priori information we were led to the set of 28 variables listed in table 4. Hence, the variables mentioned in table 4 will be reconstructed at the fiscal unit level since they are considered to be important when explaining both gross income and consumption. As is clear from table 4, this set of 28 variables can be divided into three subsets of variables.

The first set contains five different professional income components, being labour income, pensions, health insurance benefits, unemployment benefits and self-employed income, all expressed net of taxes. Since each fiscal unit contains two income earning elements at maximum, the reconstruction of these concepts should result in ten matching variables. It is not possible however to tear apart self-employed income, observed in the budget survey, in two income components. Therefore only one self-employed income concept is retained while for the other components the distinction is made between highest and lowest income, net of taxes, within the fiscal unit. In the second set, ten different family characteristics such as marital status and number of children are collected. The third set contains some other, non-professional income variables such as real estate income and expenditure variables such as charity gifts and expenses on mortgage loans. It is obvious that all variables in the second set have a discrete nature. In the other two sets all variables are measured in nominal terms, except for the real estate income variables.

Whether these matching variables are highly correlated with consumption as well, is an empirical matter but since family characteristics and income variables play a prominent role as explanatory variables of consumption one might again assume that this is the case.

The selection of exactly these variables as matching variables also provides a better insight in what matching does if it tries to determine a fiscal units gross income. When doing this it is simply a shorthand for a tax calculation process which could have been done as well by making use of a microsimulation model. If one calculates back, starting from the income concept, net of taxes, and if one processes the other tax determining information according to a certain tax legislation, one should end up with the gross income concept one would have started with, if that specific legislation applied. Matching then simply dismisses you from having to program the whole legislation in the opposite direction and thus from putting the available simulation models upside down.

Table 4: Three Sets of Matching variables

Set 1
Highest Labour Income
Lowest Labour Income
Highest Pension
Lowest Pension
Highest Health Insurance Benefit
Lowest Health Insurance Benefit
Highest Unemployment Benefit
Lowest Unemployment Benefit
Self-employed Income
Set 2
Number of Dependent Children
Number of Children <3j.
Number of Disabled Dependent Children
Number of Other Dependent Persons
Number of Disabled Dependent Other Persons
Tax Unit Disabled Yes Or No
Tax Units Spouse Disabled Yes Or No
Did The Spouse Die And Had An Income <68.000 Yes Or No
Widow, Single Or Divorced With Dependent Children
Fiscal Couple
Set 3
Received Maintenance Allowance
Paid Maintenance Allowance
Charity Gifts
Pension Savings Schemes
Life-insurance Contributions
Mortgage Capital Repayments
Real Estate Income (house) Yes Or No
Real Estate Income (unbuilt property) Yes Or No
Mortgage Interest

3.1.1.1.3 Construction of matching variables in the budget survey

The first step to be taken in the budget survey is the deconstruction of households into fiscal units. To do this one should basically know two things: the income position of each household member and information on the family ties that exist between the different household members.

Since information on family ties is most carefully registered in the survey for what is called the reference individual, this individual seems to be a logical starting point if one wants to check the fiscal unit conditions[26]. The first step in checking these conditions has been to see whether the reference individual was part of a fiscal couple yes or no. This basically comes down to checking whether

[26] One can imagine this individual as the one that registers the expenditures of the household and who was interviewed on the other subjects, registered in the survey.

the individual is married and still lives together with his partner. Next to that the family ties between the reference individual and the other members were investigated. When some bloodrelationship-conditions apply on the relationship between the reference individual and another member of the household, the latter individual can be seen as being potentially dependent on the reference individual or the couple of which the reference individual is part. If such conditions did not apply, the individual was split off as a potential fiscal unit. However, not all of the units, obtained in this way, should be treated as separate units. For example, when a mother and her child are living together with another married couple, both mother and child are split off from the couple but the child is still potentially dependent on the mother. Therefore these two elements have to be brought together again into one fiscal unit. To check whether some fiscal units had to be reconnected, the fiscal couple and family tie conditions had to be applied mutually on them[27].

After these operations had been applied we were left with fiscal units containing couples or individuals and other people being potentially dependent on either this couple or individual. For those being potentially dependent, it was necessary to check then the height of their income. If their income was sufficiently high they were split off again as a separate fiscal unit. To check this income condition we had to construct an income variable for each member of the household. An assumption was required here however, since not all the income observations in the budget survey were registered for a specific member of the household. For example real estate income was registered as a household variable. When such household income was observed, it was attributed to the household member that already had the highest amount of individually registered income.

According to these rules, the 3235 households in the budget survey could be separated into 3444 fiscal units. This manipulated budget survey, which contains observations expressed at the fiscal unit level, will be referred to as the fiscal unit budget survey while the original source can be seen as the household budget survey. After the split of households into fiscal units it was still necessary to construct the matching variables, discussed above, for each of these units.

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[27] Since information on family ties for the individuals that are split off was less accurate some assumptions had to be made to apply the appropriate conditions.

The basis of each professional income variable was provided by the individualised observations in the survey that obviously had to be classified under one of the respective components. For example, if three individualised variables referred to male labour income they were combined into one male labour income variable.

The variables of the second set were constructed by applying the definitions of these variables that appeared in the tax legislation. Since these definitions are the same as those used to split the household into fiscal units, the above discussion also describes how these family characteristics have been constructed.

The basic budget survey observations, used to construct the variables of the third set at the fiscal unit level, were only observed at the household level. Therefore we had to attribute these household-observations to one of the fiscal units if multiple units occurred within one household. To solve this problem it was said that the fiscal unit, containing the reference person, was the one that could claim these expenses. Next to that we were forced to translate the real estate income variables into discrete observations indicating whether these income sources occurred at the fiscal unit level, yes or no. This translation from a nominal variable into a discrete one had to be done since it was impossible to reconcile the definitions of the variables that occurred in the respective data sets. In the budget survey people had to registrate real estate income as the current rent they would obtain if the property was rented while the administrative concept of cadastral income appears in the fiscal data set. The latter certainly differs from imputed rent and we did not dispose of information that could translate one concept into the other one. Finally, some tax legislation information was used to adapt the expenses on charity gifts and pension savings schemes. Since charity gifts can not be deducted below 1000 BEF, it is clear that they will not occur below this limit in the fiscal data set. Therefore, observations below 1000 BEF were set to zero in the fiscal unit budget survey as well. Expenses on pension savings schemes on the other hand did not occur in the fiscal data set above a limit of 44.000 BEF since they do not result in a tax reduction above this limit. This upper limit was therefore also used to construct the expense variable in the fiscal unit budget survey.

To express the constructed nominal variables in a level that is comparable over both data sets, the nominal variables of the fiscal unit budget survey have been

adapted with a factor that expresses the nominal growth in Belgium between 1988 and 1993[28].

These constructed variables could be used then to check whether a unit was liable to pay income taxes by applying the administrative rules on them. After this operation, the number of units in the fiscal unit budget survey dropped from 3444 to 3217.

The unweighted sample of fiscal units, that remains after this operation, can hardly be assumed to be representative for the population of fiscal units. The households, that were split up in fiscal units, had to be weighted themselves to be representative for the household population. To cope with this problem we have assumed that each fiscal unit can be represented with its household weight in the population of fiscal units[29]. This implies that fiscal units A and B in the fiscal unit budget survey were given a weight of hundred, if they were derived from one household that was observed itself with a weight of hundred in the household distribution.

According to this weighting rule the adapted fiscal unit budget survey represents 3.746.799 units. This amount is different from the 4.109.965 units that the fiscal data set is supposed to represent. An explanation for this difference between the real number of fiscal units and the number of fiscal units in the fiscal unit budget survey is the fact that the budget survey is not representative as far as the variables are concerned that are important to determine whether an individual should be treated as a separate fiscal unit. This is the case since there is a difference between the number of households with more than two income earners that are observed in reality and those that are represented by the household budget survey[30].

3.1.1.1.4 Construction of matching variables in the fiscal data set

The data within this data set are already expressed at the preferred observational unit level. But the subject of some variables, constructed in the

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[28] All nominal variables have been multiplied with a factor 1.404. This number has been derived on the basis of figures reported in the National Accounts of 1996, p. 75 (see Instituut voor de Nationale Rekeningen (1996)). We have taken the ratio between the average of the figures for 1987 and 1988, and the figure for 1993.

[29] The alternative would have been to construct weights starting from scratch.

[30] This point is documented in appendix 6.

fiscal unit budget survey, is not directly comparable with that of the variables in the fiscal data set. Therefore some data manipulations are still required.

Since the constructed professional income variables in the budget survey are registered net of taxes, and were reported with the 1988 tax system in mind, their counterparts in the fiscal data set have to be translated from gross into net of tax expressions for that system as well.

To do this, one could reconstruct for each individual the taxes paid according to the 1988 tax legislation and then distribute this total amount over the relevant professional income components. The main problem one faces in this case is to define a rule that says how these taxes have to be distributed over the relevant income components. This is not what has been done in this exercise, however. Instead of distributing the whole tax bill over all items according to some arbitrary rule, we used the withholding tax payments that are directly available in the data set but which are calculated according to the 1993 tax legislation.

Using this approximation had the advantage that no additional calculations had to be made and that no distribution rule had to be applied on the tax figure as a whole since these payments are registered for the distinguished items of professional income. Furthermore, it probably is such a concept people have in mind when registering income figures net of taxes in the budget survey since it is that what they observe on their bank account each month. The more sophisticated income concept on the other hand is only observable on a yearly basis.

Since the variables of the second set were constructed in the fiscal unit budget survey according to the tax legislation rules, they are directly comparable with their fiscal data set counterparts.

The variables of the third set are simple aggregates of the different components that were observed in the fiscal data set. In the fiscal data, one observes for example several different items of real estate income. These items were added together such as to approximate the aggregate concept that was observed in the fiscal unit budget survey. It should be noted however that no attempt is made to approximate the variant, net of taxes of these income concepts. This implies that we assume that people in the budget survey register these income concepts in gross terms rather than their net of tax counterparts.

3.1.1.1.5 Comparing the matching variables constructed within both data sets

Despite the indications of the differences in the distribution of the fiscal unit budget survey and the overall distribution of fiscal units, we still require formal tests to see whether the multivariate distribution of the matching variables was drawn from the same population yes or no.

The mean and the standard deviation of the 16 nominal variables, observed in the fiscal unit budget survey and the fiscal data set, are reported in column 2 and 3 of table 5 respectively. Column 4 of this table gives the tail probabilities of a two tailed Kolmogorov - Smirnov test. These probabilities are obtained by first calculating the test statistic itself. The statistic is used then to compute the probability of observing that specific value, given that the hypothesis H_0, which states that the data are identically distributed, is true[31].

[31] See Siegel and Castellan (1988) for a discussion on this test.

Table 5: Mean and standard deviation of the 16 nominal matching variables (in BEF of 1993) observed in the fiscal units budget survey and the fiscal data set

	Budget Survey (Fiscal units) Mean (std)	**Fiscal data set Mean (std)**	**Kolmogorov - Smirnov Tail probability**
1 Highest Labour Income	348379 (430583)	306964 (319458)	0.000000
2 Lowest Labour Income	75315 (188359)	55746 (149873)	0.000015
3 Highest Pension	220460 (322844)	139547 (426534)	0.000000
4 Lowest Pension	10707 (60584)	11064 (59057)	**0.999192**
5 Highest Health Insurance Benefit	17972 (83789)	22940 (84258)	0.000000
6 Lowest Health Insurance Benefit	703 (13275)	579 (8830)	**0.945808**
7 Highest Unemployment Benefit	32741 (98342)	30512 (75073)	0.000000
8 Lowest Unemployment Benefit	1047 (10809)	1668 (13482)	**0.400325**
9 Self-employed Income	136183 (423922)	84288 (389753)	0.000000
10 Received Maintenance Allowance	3979 (38667)	1507 (20086)	**0.436362**
11 Paid Maintenance Allowance	2631 (23000)	4123 (29244)	**0.432194**
12 Charity Gifts	444 (1904)	997 (20756)	0.007982
13 Pension Savings Schemes	4561 (13783)	4806 (11935)	0.000000
14 Life-insurance Contributions	5488 (16973)	8268 (19119)	0.000918
15 Mortgage Capital Repayments	23705 (102215)	12687 (48906)	0.000000
16 Mortgage Interest	34587 (74275)	29236 (72758)	0.000000
Note: the figures in bold in column (4) indicate that the hypothesis that the mentioned variable comes from the same population can not be rejected at a 5% significance level.			

As the results in table 5 indicate, the hypothesis that these nominal variables come from the same overall population, could not be rejected at a 5% significance level for only five variables (Lowest Pension, Lowest Health Insurance Benefits, Lowest Unemployment Benefit, Received and Paid

Maintenance Allowance). Since these tests were applied on univariate distributions but intended to draw inferences on the origin of the multivariate distribution, one could object here that the significance levels should be adapted for this purpose[32]. However, the obtained probabilities of some variables are so low that one would always reject that the multivariate distributions are the same.

Next to these tests on the nominal variables, we also applied tests on the comparability of the distribution of the 12 discrete variables. The mean of each variable, observed in the fiscal unit budget survey and the fiscal data set, is reported in column 2 and 3 of table 6. Column 4 then contains the results of the Kolmogorov - Smirnov test. Since this test is said to be conservative if the hypothesis of continuity is not satisfied, these results are complemented with those of a test that does not suffer from this deficiency[33]. Column 5 therefore reports the results of a Chi-Square test. Using the corresponding degrees of freedom, reported between brackets in this column, one can check that the null hypothesis is not rejected for only one variable at a 5% significance level[34].

[32] See Savin (1984), p. 834-835

[33] That the test is said to be conservative implies that it would not reject the null hypothesis in cases where it should be rejected. See Siegel and Castellan (1988) p. 167.

[34] Only for 'Disabled Dependent other persons' the hypothesis is not rejected.

Table 6: Comparison of the 12 discrete common variables observed in the fiscal units budget survey and the fiscal data set

		Budget Survey (Fiscal units)	**Fiscal data set**	**Kolmogorov - Smirnov**	**Chi-Square (d.f.)**
17	Real Estate Income (built property) (Yes=1)	0.70794	0.52499	0.000000	398.12(1)
18	Real Estate Income (unbuilt property) (Yes=1)	0.03365	0.003383	0.010274	237.90(1)
19	Dependent Children(Max=9)	0.79326	0.58735	0.000000	638.96(8)
20	Children <3j. (Max=3)	0.12436	0.05917	0.000000	302.18(3)
21	Disabled Dependent Children (Max=3)	0.00232	0.00851	0.999999	10.56(3)
22	Other Dependent persons (Max=4)	0.03581	0.00164	0.003794	321.13(4)
23	Disabled Dependent other persons (Max=2)	0.00063	0.00097	0.999998	0.39(2)
24	Disabled tax unit (Yes=1)	0.02741	0.04041	0.416937	22.08(1)
25	Disabled spouse (Yes=1)	0.00657	0.01363	0.998242	12.56(1)
26	Spouse died, with income <68.000 (Yes=1)	0	0.00087	0.999999	5.92(1)
27	Widow(=1), single(=2) or divorced(=3) with dependent children	0.05344	0.02591	0.000308	373.48(3)
28	Fiscal Couple (Yes=1)	0.62758	0.50827	0.000000	588.56(1)

Note: Variables 19 to 23 contain a varying amount of persons. The maximal observed value over both data sets is reported under max in column 1. All other variables, except variable 27, are equal to 1 if the condition is satisfied while 0 if not.

The overall conclusion, to be drawn on the basis of these hypothesis tests, is that the multivariate distributions of the matching variables differ. Therefore it makes no sense to apply a matching procedure that would transfer this distribution from one data set to the other one. We therefore opt to apply an unconstrained matching procedure.

3.1.1.2 Matching the data

Next to the selection of the matching variables and the decision to match these variables in an unconstrained way, we should still decide upon the exact form of the distance function and the weights that should be given to each of these variables within that distance function.

The distance function, given in equation (5), has been used to match:

$$D2_{jk} = \sum_{i=1}^{n} w_i^A \left| \frac{x_{ij}^{BS} - x_{ik}^{FD}}{Std(x_{ij}^{BS})} \right| \tag{5}$$

It closely resembles the one given in equation (2), except for the fact that the observations are now divided by the standard deviation of one of the matching variables. The latter is done to get rid of the unit in which the variables are expressed. We have experimented with several sets of weights. The first, and probably most obvious choice, was to give all variables an equal weight of 1/28.

The results of this match will be referred to as Match0. Next to this match, 14 other matches have been executed. The weights of these 14 other matches have been determined on the basis of a data driven procedure.

The idea has been to determine weights such that they would be a reflection of the importance of the matching variables as explanatory variables of the non - overlapping variables. Because consumption data, gross income and personal income tax figures are of major importance for the analysis later on, it seems defensible to inspect the relationship between these variables and the matching variables that have been defined above. Consumption figures were not directly available at the fiscal unit level. And the crucial variables for the analysis in section 4 are the personal income tax liabilities before and after the reform. Hence we have chosen for a regression of both the tax liability before and after the reform on the common explanatory variables.

Instead of regressing each of these tax variables on the total set of 28 matching variables, all possible combinations from 1 to 28 variables have been tried out[35]. For each of these possible combinations a linear specification has been estimated on the IPCAL data. Within this extensive set of estimated relationships, we selected the one that minimised two information criteria[36].

The variables that appeared in the selected regressions are reported in table 7. Within this table the variables are ordered according to the stage at which each of the selected variables entered the regression when applied in a stepwise way. We also report the partial R^2 that is related to each of the listed variables at the stage this variable enters the regression.

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[35] To execute these regressions we did not use the discrete Real Estate Income variables but their nominal counterparts that were originally observed in the fiscal data set. This was done because the parameters of the nominal variables capture the relationship between Real Estate Income and Taxes in a better way than the discrete variables. That discrete variables had to be used to execute the match itself is simply a consequence of the definition problems we already discussed in sections 3.1.1.1.3 and 3.1.1.1.4.

[36] The information criteria that have been checked are Akaike's and Sawa's Baysian information criteria. These criteria are dealt with, among others, by Judge e.a. (1985) p. 870-872.

Table 7: Explanatory variables in the selected regressions

	Dependent variable: Pre Reform Tax liability	Partial R^2	Dependent variable: Post Reform Tax liability	Partial R^2
1	Highest Labour Income	0.3146	Highest Labour Income	0.3330
2	Self-employed Income	0.3070	Self-employed Income	0.2870
3	Highest Pension	0.1328	Highest Pension	0.1463
4	Lowest Labour Income	0.0479	Lowest Labour Income	0.0447
5	Real Estate Income (built property)	0.0183	Real Estate Income (built property)	0.0174
6	Dependent Children	0.0088	Dependent Children	0.0140
7	Lowest Pension	0.0064	Lowest Pension	0.0062
8	Highest Health Insurance Benefit	0.0054	Highest Health Insurance Benefit	0.0055
9	Highest Unemployment Benefit	0.0035	Highest Unemployment Benefit	0.0042
10	Fiscal Couple	0.0027	Fiscal Couple	0.0054
11	Mortgage Capital Repayments	0.0017	Mortgage Capital Repayments	0.0009
12	Received Maintenance Allowance	0.0005	Received Maintenance Allowance	0.0005
13	Mortgage Interest	0.0005	Mortgage Interest	0.0004
14	Charity Gifts	0.0003	Charity Gifts	0.0003
15	Paid Maintenance Allowance	0.0002	Pension Savings Schemes	0.0002
16	Disabled spouse	0.0001	Paid Maintenance Allowance	0.0002
17	Pension Savings Schemes	0.0001	Life-insurance Contributions	0.0001
18	Children <3j.	0.0000	Disabled Dependent Children	0.0001
19			Disabled spouse	0.0001
20			Lowest Unemployment Benefit	0.0001

The appearance of the explanatory variables is very similar in the regression for the pre reform and in the regression for the post reform tax liability. Only from variable 15 on, there is some divergence in the set of explanatory variables. Since we want to proceed with only one set of weights, based on both regressions, we decided to work only with the first 14 variables.

We then carried out fourteen different matches, labelled *Match1* to *Match14*. In *Match1*, only the first variable (highest labour income) entered the distance function (5). In *Match2*, the first two variables were used in (5), in *Match3* the third variable entered the scene, etc. To construct the weights of these different sets of variables we first divided the partial R^2 of each selected variable through the sum of the partial R^2's of the selected variables. Hence, for example for *Match2* we first divided the partial R^2's of the highest labour income and self-employed income within both regressions through the sum of both partial R^2's. The weight for each variable in the distance function was obtained by taking the mean of these rescaled partial R^2's over both regressions. These weights are reported in appendix 7.

The distance function (5) was applied then to search, for each of the 3217 units in the fiscal unit budget survey, the most resembling counterpart in the 10343 units that are observed in the fiscal data set. In table 8 we give the main characteristics for the fifteen matches.

Table 8: Parameters of the minimal distance distribution of the fifteen matches

	N	Mean	Stdv	Min	Max
Match0	3217	0.062394	0.086446	0	1.394287
Match1	3217	0.000860	0.007152	0	0.258995
Match2	3217	0.004813	0.041822	0	1.843349
Match3	3217	0.007108	0.039712	0	1.505239
Match4	3217	0.009450	0.039571	0	1.428264
Match5	3217	0.010909	0.040120	0	1.397327
Match6	3217	0.014946	0.042125	0	1.390910
Match7	3217	0.015455	0.041937	0	1.380498
Match8	3217	0.016288	0.042265	0	1.371625
Match9	3217	0.017141	0.042089	0	1.365434
Match10	3217	0.018040	0.042056	0	1.359021
Match11	3217	0.018383	0.042094	0	1.356942
Match12	3217	0.018425	0.042067	0	1.356150
Match13	3217	0.018685	0.042126	0	1.355713
Match14	3217	0.018906	0.042210	0	1.355460

The minimal value of zero indicates that for all matches we find an exact match for at least one fiscal unit. But for the rest it is difficult, not to say impossible, to identify the most appropriate match on the basis of the figures in table 8. The reason is that these figures are obtained from different distance functions, and hence not comparable as such. As the results for *Match1* illustrate, one can come up with very good scores on the distance criterion if one uses only one variable in the distance function. But this single variable only covers between 30% and 40% of the variation in taxes, while the ultimate objective of the match is to cover 100% of the variation within the tax variables.

To investigate whether we could discriminate between the different matches on the basis of explanatory power of the common variables, we have estimated two "identical" regressions. In the first regression we regressed the tax liability, that was imputed in the fiscal unit budget survey, on the original matching variables that were observed within this data set. The second regression had the same specification but used the values that had been imputed for each of these matching variables. The second regression thus relied entirely on variable values that were originally observed in the fiscal data set but had been transferred to the fiscal unit budget survey. Therefore this regression could serve as a kind of benchmark for the explanatory power that should be achieved by the first regression. With perfectly matched units one should end up with identical estimates of the parameters of both models. Comparing for example the R^2 of both models should reveal then the same information as the one that can be derived from the distance function. The R^2 has the additional advantage, however, that it reveals how much variation, within the tax variables, is taken up by the matching variables. In table 9 we report the

adjusted R^2, obtained for each of the estimated models[37]. We did the estimation both for the pre reform and for the post reform tax liability.

It now becomes clear that Match0 is indeed the worst match. Within the set of the other 14 matches there are indications for a larger distance between the matched variables the more variables one includes within the distance function. The latter conclusion is based on the ongoing decrease in the ratio of the adjusted R^2's. Since the objective is to end up as close as possible in the neighbourhood of a 100% ratio, one would choose Match3 if one would solely rely on the minimal distance aspect of the match and express the distance as the ratio of adjusted R^2's. However, it is obvious that this conclusion should be complemented with a judgement about the height of the R^2 as well. We have therefore chosen to base our analysis of the tax reforms in the next section on *Match14*. The fiscal unit budget survey regressions of *Match14* have indeed one of the highest adjusted R^2's and the deviation of the R^2-ratio from 100% is not too cumbersome in comparison with the other matches. Obviously, this judgement is rather subjective. On the other hand one could argue that from *Match4* on, the results on both criteria are only weakly different. Hence, these criteria do not lead us to a very decisive conclusion. In that case it seems wise to choose the match which uses most matching variables, and hence explains most of the variation in tax liabilities.

[37] All estimates, together with some additional tests, are reported in appendix 8.

Table 9: Adjusted R²'s of regressions estimated on the basis of Fiscal Unit Budget Survey Data and Imputed Fiscal Data

	Dependent variable: Pre Reform Tax Liability in Fiscal Unit Budget Survey			**Dependent variable: Post Reform Tax Liability in Fiscal Unit Budget Survey**		
	Adj. R²			Adj. R²		
	Explanatory variables from the Fiscal Unit Budget Survey (1)	Explanatory variables from the Imputed Fiscal Data (2)	Ratio (1)/(2) (x100)	Explanatory variables from the Fiscal Unit Budget Survey (3)	Explanatory variables from the Imputed Fiscal Data (4)	Ratio (3)/(4) (x100)
Match0	0.6477	0.8680	74.6	0.6480	0.8706	74.4
Match1	0.4589	0.4593	99.9	0.4471	0.4474	99.9
Match2	0.5611	0.5586	100.4	0.5362	0.5336	100.5
Match3	0.7542	0.7568	99.7	0.7607	0.7634	99.6
Match4	0.8343	0.8327	100.2	0.8300	0.8287	100.2
Match5	0.8292	0.8271	100.3	0.8245	0.8224	100.3
Match6	0.8352	0.8369	99.8	0.8375	0.8413	99.5
Match7	0.8454	0.8471	99.8	0.8473	0.8512	99.5
Match8	0.8505	0.8535	99.6	0.8508	0.8557	99.4
Match9	0.8549	0.8623	99.1	0.8555	0.8655	98.8
Match10	0.8611	0.8708	98.9	0.8662	0.8807	98.4
Match11	0.8613	0.8753	98.4	0.8664	0.8838	98.0
Match12	0.8619	0.8757	98.4	0.867	0.8841	98.1
Match13	0.8598	0.8739	98.4	0.8678	0.885	98.1
Match14	0.8597	0.8741	98.4	0.8675	0.8851	98.0

3.1.2 Choosing the level of analysis

Until now, we have only dealt with variables expressed at the fiscal unit level. If the joint simulation is to be done at this level, the consumption data, reported at the household level in the budget survey, should also be expressed at the fiscal unit level.

It would not only be a difficult task to do so, but it would also be counterintuitive. The joint decision on consumption expenditures is precisely an element of the household definition. Therefore consumption taxes should be analysed at the household level. Since the final aim of this exercise is to come up with an analysis of the overall tax burden, the personal income taxes will have to be expressed at the household level as well. Hence, the split of the households into fiscal units must only be seen as a go between to arrive at this final stage.

To express all variables at the household level, one can only use the budget survey as the basic data source. Therefore the lacking observations will be transferred from the fiscal data set to the fiscal unit budget survey after the

match. The transferred data are added together then to come up with variables expressed at the household level. This is easily done since one observes for each unit in the fiscal unit budget survey the household number of the household it originated from. After these additions have been carried out one disposes of a data set that contains gross income, personal income taxes and consumption figures, all expressed at the household level.

Since personal income taxes, and consequently gross income, are lacking in the current budget survey one could choose to transfer both concepts from the fiscal data set to the fiscal unit budget survey. This will not be done however. Instead, only the simulated amount of personal income taxes will be imputed. Gross income figures at the household level are obtained then by adding the household tax concept to a household income concept, net of taxes, that is based on original budget survey observations.

It should be noted that, although we end up with the necessary data to analyse reforms in personal income and indirect taxes at the same observational level, we have not been forced to construct a new simulation model. Personal income tax reforms are still simulated with the originally described data set and with the same simulation model SIRe. What will be transferred to the budget survey is the outcome of these simulations and not the necessary input to do the calculations. These simulated personal income taxes can be processed then at the household level, using behavioural response assumptions on savings behaviour and detailed consumption behaviour. The behavioural assumptions that have been made throughout the calculation process will be sketched in the next subsection.

3.2 Behavioural response assumptions

At least one argument to say that personal income and indirect taxes are different in nature, is that they induce different behavioural responses on the same item. It is possible for example that changes in personal income and indirect taxes influence labour supply in a different way. The nature of our exercise would therefore warrant a close inspection of such behavioural effects. Nonetheless such a detailed analysis has not been carried out for the moment. Instead a minimal option has been followed. Within this option a spill over from the personal income tax reform into the indirect tax base is introduced without having to provide estimates in addition of those already available in the existing models.

It is assumed, in the first place, that personal income tax reforms have no impact on gross income. Therefore such a reform is only assumed to change income, net of taxes. This changing amount of income has been processed under two different savings behaviour assumptions. First, it was assumed that the whole change would be absorbed by savings. Excluding any influence of this change in income on total consumption would provide then the results of an analysis on the basis of two separate microsimulation models. In an alternative scenario the change in income was partially carried over to the overall level of consumption as well. This was done under the assumption of a constant share of consumption and savings in income, net of taxes. The amount of total consumption, consequently obtained, was interpreted as the new overall budget that had to be distributed over the 32 consumption classes. To obtain such detailed expenditures, the estimates of a demand system were exploited[38].

3.3 Summary

We summarise the different steps we have taken to build a household database with both expenditures and tax liabilities at the household level.

1. Use individual income information and characteristics to split up the 3235 households of the budget survey into 3444 fiscal units.
2. Determine which fiscal units fall below the threshold for paying income taxes. The remaining set of fiscal units consists of 3217 units.
3. Identify the 14 common variables which explain the tax liabilities by means of a stepwise regression. The weights in the distance function are derived from the partial R^2 in this stepwise regression.
4. Apply the weighted distance function with these 14 common variables, to find for each fiscal unit in the fiscal unit budget survey, its most resembling counterpart in the fiscal data set. Transfer these tax liabilities to the fiscal unit budget survey.
5. Add the subset of non-tax paying units, set apart in 2.
6. Join the fiscal units again into households.

The resulting budget survey is suited to calculate indirect tax liabilities based on observed expenditures (by means of ASTER). But it is enriched with personal

[38] More information on this demand system can be found in appendix 5.

income tax liabilities, coming from a separate personal income tax model (SIRe). In the next section we use this database to evaluate the reforms of personal income and indirect taxes in the period 1988-1993.

4. DESCRIPTION AND EVALUATION OF SOME TAX REFORMS

In the previous two sections it has been explained how we will bring together the simulated tax figures at the same level of observational unit. In what follows, this unification procedure will be used to analyse the major changes in the Belgian tax system that have been implemented between 1988 and 1993. One should not imagine this as the simulation of several reforms in a step by step way but rather as the simulation of two different tax systems: the pre and post reform situation represent the tax rules applied in 1988 and 1993 respectively.

Therefore, the first subsection below discusses the tax rules, applied in 1988, in a more systematic way than they were explained in the previous two sections. This year has been chosen as the pre reform situation since important reforms of the personal income tax system were voted on 7 December 1988[39]. The major reforms that took place afterwards, and which resulted in the tax system applied on 1993 income and consumption, will be discussed in a second subsection. The discussion spans this period because in April 1992 the Belgian system of indirect taxes was adapted considerably such as to bring it more in line with the EC recommendations.

Although the pre and post reform situations are meant to represent the tax rules of the respective years, we have not been able to reconstruct exactly these systems. Especially for the personal income taxes we have to rely on a selection of the major reforms rather than a detailed reconstruction of both tax systems. In the third subsection we will therefore discuss the reforms that have been selected for the simulation exercise itself.

Despite the approximative character of the pre and post reform situation, one can point at considerable changes of the systems, both for the calculation of personal income and indirect taxes. Whether they also result in considerable distributional and revenue changes remains to be seen however. This will be discussed in the fourth and final subsection.

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[39] These reforms therefore became effective for the first time during the tax year 1990 and thus are applied for the first time on income generated in 1989 .

4.1 Description of the tax rules applied on income and consumption of 1988

4.1.1 Personal Income tax system

As explained above, a fiscal unit contains either one or two physical persons that gain a certain amount of income themselves. Since tax rules applied on singles are a less complex variant of those applied on couples we will only discuss the latter rules[40].

The tax system can in principle be seen as one of global taxation. This means that one first determines one taxable income figure for the unit as a whole, after that a single tax scheme is applied on this amount of income. There are however exceptions to this rule. As will become apparent, some income elements are not part of this global income concept and the taxes to be paid on them are determined by single tax rates, rather than by a tax scheme.

To determine this global income concept one proceeds in two steps: first one constructs *net total income*, next to that one deducts some general expenditures from this income concept to obtain *net global income*. The net total income concept basically originates from four different types of income: *professional income, real estate income, income from movable property and miscellaneous income.* Beside the differences in source, these different income components are usually processed by different rules to determine the part that slips into the net total income concept.

The simplest case probably applies for professional income, which itself is a term covering income elements such as labour income, self-employed income, pensions, health insurance benefits and unemployment benefits. From these gross income types one can deduct costs that had to be made to gain this amount of income. The most obvious examples of such costs are transportation and representation costs. If no costs are declared, the administration automatically applies a standard cost scheme on wages and profits. Next to these costs one also deducts expenses on life insurance contributions and mortgage loan capital repayments, up to an amount of 45.000BEF per spouse,

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[40] It should be stressed that this description still is a crude sketch of the system itself. Rules that were considered to be too specific or not relevant to understand what has been reformed throughout the considered period, were left out.

and expenses on group insurance contracts from these professional income amounts.

To determine the amount of real estate income that ends up in the net total income concept, two steps should be taken. One first has to determine the income amount which is basically a combination of rent figures and cadastral income. The rent figures are used when the property is hired while cadastral income serves as a substitute for this if the property is the private dwelling of the taxpayer. On this income concept one then applies a fixed deduction to determine the net amount of real estate income. This deduction is set so high however that it often happens that those possessing only one private dwelling, do not pay income taxes on this amount[41].

While net professional income and net real estate income always end up in the net total income concept, this is no longer the case for some miscellaneous income items and income obtained from movable property.

A major source of miscellaneous income, used to determine net total income, are the maintenance payments made by a spouse from which one is divorced[42]. Other items within this class, such as Prizes for Scientific Publications or Capital Gains on Unbuilt Real Property, are taxed separately at a uniform rate.

For income from movable property, separate taxation is even the rule rather than the exception. This income component also differs from the previous ones in another respect. While for the previous items one has to report the income amount on which taxes have to be paid, this is generally not the case for income from movable property. The withholding taxes, generally 25% of the tax base, are often said to be final, which makes declarations on this income unnecessary in most cases[43]. That it is unnecessary to declare these income amounts does not mean one is prohibited from doing so, and in some cases it can be profitable but these cases are scarce[44].

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[41] If this would make the net real estate income negative the amount is set equal to zero.

[42] One also uses a kind of net concept here since only 80% of this income amount is liable for income tax payments.

[43] The liberating withholding tax has been installed on income from movable property to ease the process of tax collection which is now directly done by banks. The resulting non-declaration of the tax base, has some obvious limitations for the simulations one can execute with the available data.

[44] It can be profitable since one always calculates two tax figures before it is decided how much one has to pay. The first tax figure is obtained as described in the main text and thus a

Therefore the following picture emerges on what the net total income concept basically is: the sum of net professional income, net real estate income and maintenance income of both spouses. Next to that there are a number of items that are taxed separately. Since these last items are less important in explaining the final amount of taxes, the tax system was principally said to be one of global taxation.

The described net total income concept can still be adapted further if the unit has made certain expenditures for which a *general deduction* is installed. A major class of deductions originated from interest payments both on mortgage loans as well as loans contracted to obtain movable income. Next to these interest payments one could, among other things, deduct charity gifts up to 5% of the net total income figure, maintenance expenses and expenses on pension savings schemes and shares of one's employer from the net total income concept.

After these expenses are deducted from the net total income concept, one obtains the net global income concept. The tax scheme, that consists of the 14 different rates that are reported in table 10, is applied on the latter concept.

Table 10: Rate structure in the 1988 tax system

Tax bracket (in BEF of 1988)		**Marginal tax rate for the part of taxable income $\geq$ L and $\leq$ U**
L	U	
0	120.000	300 BEF.
120.001	209.500	24,0%
209.501	262.000	27,7%
262.001	314.000	35,8%
314.001	419.000	39,443%
419.001	524.500	43,6%
524.501	787.000	45,0%
787.001	1.049.000	46,6%
1.049.001	1.574.000	51,6%
1.574.001	2.099.000	56,5%
2.099.001	3.148.000	61,9%
3.148.001	4.197.000	67,8%
4.197.001	14.685.085	70,8%
14.685.686		66,3%

combination of the tax amount obtained after applying the tax scheme and the separately applied tax rates. The second tax figure is determined by applying the tax scheme on a combination of all reported income figures, including those that were taxed separately in the first calculation process. One only has to pay taxes up to the smallest of these two tax figures. However, the second tax amount is seldom seen to be the more profitable one of the two.

In general the tax figure, obtained after the scheme has been applied, only gives an upper limit of the tax amount to be paid, according to the tax scheme. This is so because for a number of reasons *a tax reduction* could be applied on the original tax figure.

A first possible reduction is the one applied for married couples. The major reason to apply such a reduction was the fact that married couples were disadvantaged with respect to non married ones if both spouses are obtaining income on their own. For the married couple the income figures were added together thus ending up in tax brackets that are higher than those faced by collaborating partners, who are treated as separate fiscal units.

The way this reduction for married couples was calculated complicated the tax calculation scheme considerably since in some cases the reduction could only be determined by picking out the most advantageous reduction that resulted after different calculation possibilities. Three different calculation possibilities could be applied, depending on the height of the net global income figure and the distribution of professional income between both partners[45]. One alternative made use of a reduction scheme that was directly applied on the net global income concept. Next to that one also applied the tax scheme on 71% of the net global income concept. The resulting tax figure was then linearly extrapolated afterwards by the inverse of this factor. A third alternative treated the professional income figures of both partners as separate but augmented the resulting tax figure with an additional amount. This amount was obtained after applying a fixed percentage on part of the net global income concept.

One also applies tax reductions that compensate for family composition, dealing with such things as the number of children, the number of disabled children and other dependent and/or disabled persons.

Next to these there are reductions that take into account the source of income, especially those dealing with cases where income was obtained through the social security system (replacement income) and income obtained abroad.

A final reduction can be applied if the life insurance expenditures and capital repayments exceed the aforementioned amount of 45.000BEF.

Adding together then the tax figure, obtained on the basis of this tax scheme, with those obtained on the basis of the separately taxed items gives a first idea

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[45] It should be stressed that this still is a rough description of what took place in reality. But for the sake of the exposition we have only opted to describe the broad lines.

of the overall tax amount to be paid. This amount can be increased or decreased during the tax clearing process because too few or too much withholding tax payments have been made.

4.1.2 Indirect tax system

VAT rates of 0, 6, 17, 19, 25 and 33 percent were applied on goods consumed in 1988. The 6% rate was applied on necessary goods such as most food consumption, while luxuries and durables were mainly taxed at 25% or 33%. Consumption goods containing alcohol were generally taxed at 25% as well. The intermediate tariffs of 17% and 19% were, among other things, applied on things like clothing and housing construction material.

Excises were mainly levied on three different items: consumption goods containing alcohol, tobacco and energy products, both those used to heat houses as well as those used for transportation modes.

Ad Valorem Excises are only applied on tobacco products.

It would lead us too far to report all items and their corresponding VAT rate, used to model the 1988 indirect tax system. The items on which Excises and Ad Valorem Excises are levied, are much more limited in number, and more detailed information on this is given in appendix 4.

4.2 Major changes between 1988 and 1993

4.2.1 Personal Income tax system

As will become apparent below, the income tax system has primarily changed because the net professional income of both spouses is determined differently and because a different tax scheme is applied on the net global income concept. Net professional income is determined differently both because one determines the income base in a different way and because one has adapted the rules to deduct costs from this income base[46].

The deductible costs, made to obtain professional income, have been restricted throughout the years. One can now only deduct and declare transportation

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[46] Since it would go too far to discuss all the changes, we only concentrate on what we think to be the more important ones. In appendix 1 an attempt has been made to give a list of all the reforms that have been implemented throughout the reform period. In appendix 2 an attempt is made to position these changing tax rules within the tax calculation process.

costs up to 6BEF per kilometre. Next to that, one also limited the deductions for representation expenditures such as expenses on meals and clothing. These restrictions on actual and declared expenses also found their counterpart in the limitation of the fixed amount that is applied when no costs are declared. Next to these changes in cost deductions one no longer deducts capital repayments on mortgage loans and expenses on group insurance contracts from the amount of professional income. Instead, the latter expenses now result in a tax credit.

Real estate income is treated differently since one now deducts the mortgage interests directly from this income concept, while previously it was deducted from the net total income concept. Since the real estate income concept is prohibited from becoming negative, it often happens that one is left with an amount of mortgage interest that can not be deducted at this stage. Therefore, this exceeding level of mortgage interests can still be deducted from the net total income concept in case these payments are related to newly constructed houses.

The major changes in the components covering miscellaneous income and income from movable property are to be found in the applied tariffs, rather than in the determination of their net variants. The major withholding tax on movable income has been reduced from 25% to 10%[47]. Within the miscellaneous income component there has been a tendency to treat less items as part of the net total income concept. Maintenance payments were already mentioned to be the major item, within the miscellaneous income component, that was part of net total income. In the 1993 system it even became the only miscellaneous income item, to be integrated in this overall income concept.

The fact that some of these items are no longer retained to be part of the net total income concept is of minor importance however when compared to the move in the direction of an income concept that is individually rather than couple based. In the 1993 system one no longer adds together the professional income items over both spouses. The other global income items, such as real estate income and miscellaneous income, are still added to the highest professional income however.

Next to this segregated treatment of professional income, the 1993 tax system contains the possibility, for married couples, to split their professional income over both partners if there is a very unequal distribution. For example, this

[47] In general this withholding tax is final.

possibility to redistribute would give the non-working spouse a hypothetical professional income if only one of the two spouses would be gaining professional income.

What these reforms result in, is a net total income concept for each partner rather than a single income concept for the couple. One net total income concept consists of professional income of one of the partners plus the other items that are liable for global taxation while the other concept is made up by professional income of the other partner only. The latter can be a real earned amount or a constructed one.

The costs, to be deducted from the net total income concept previously, are now distributed in a proportionate manner over these two income concepts. Next to this different treatment of the costs, the types to be deducted have been changed as well. Interest payments on loans, made to obtain movable income, are no longer deductible. As was already explained, the interest payments on mortgage loans are cleared with real estate income in the first place. The remainder can still be deducted from these net total income concepts if these payments are related to newly constructed houses. Expenses on pension funds and purchases of employers shares are no longer deducted at this stage and charity gifts are deductible now up to 10% of the net total income concept. Finally, a new class of deductions has been created to compensate for child care expenses.

Next to these changes in the tax base one also changed the tax brackets. There are 7 brackets now instead of 14, as illustrated in table 11[48].

[48] In appendix 3 a table is given in which the tax brackets within both systems are compared.

Table 11: Rate structure in the 1993 tax system

Tax bracket (in BEF of 1988) L		U	**Marginal tax rate for the part of taxable income ≥ L and ≤ U**
0	-	230.000	25%
230.001	-	305.000	30%
305.001	-	435.000	40%
435.001		1.000.000	45%
1.000.001		1.500.000	50%
1.500.001		2.200.000	52,5%
2.200.001			55%

When this new tax scheme is applied on each of the net global income figures, family composition is taken into account. Instead of the previously applied tax reduction, one now applies the *exemption* levels, reported in table 12. These exemptions are applied at the base of the income amount which implies that taxes are calculated by applying the corresponding rates on the income amounts that exceed the exemption level. Because the exemptions are applied at the base, the tax savings that are due to these exemptions are independent of the income level.

Table 12: Exemption levels in the 1993 tax system (in BEF of 1988)

Married or not	
single	165.000
married person	130.000
Number of dependent children	
1 child	35.000
2 children	90.000
3 children	202.000
4 children	327.000
each child above the fourth	125.000
Special exemptions	
other dependent persons	35.000
spouse with handicap	35.000
widow(er) with dependent children	35.000
lone parent	35.000
in year of marriage	35.000
in year of death	90.000

The described changes in the treatment of professional income and family composition, lead to the abolishment of the tax reductions, previously applied for married couples and family composition. In the 1993 tax system, expenses on pension funds and purchases of employers shares are also used to calculate a

tax reduction. Next to this, capital repayments on mortgage loans and life insurance contributions are now completely translated into a possible tax reduction rather than treating them at two stages, as was done in the 1988 system. There, a part of these expenses was deducted from professional income, while another part resulted in a tax reduction. The reductions for replacement income and income obtained abroad still exist and were basically left unchanged.

The taxes to be paid by each unit, now consist of two tax figures that are determined on the basis of the tax scheme and the taxes paid on separately taxed items. The sum of all these items is scaled up with a 3% "crisis surcharge".

4.2.2 Indirect tax system

The main change in the indirect tax system, during the period of analysis, took place in April 1992. This reform had the intention to bring the indirect tax system more in line with the EC directive that prescribed a normal rate of at least 15% and one or two rates of at least 5%. The newly installed government decided to drop the rates of 17, 25 and 33%. The normal rate became 19.5%. The reduced rate of 6% was maintained and a second reduced rate of 12% was introduced.

To compensate for the decrease of the VAT rate on car fuels, excises on these products were simultaneously increased. This increase in excises was only one step in a continuous increase of excise taxation on these products during the period of investigation. Per litre of gasoline, the consumer paid an excise of 11,2 BEF in 1988 and 18,45 BEF in 1993. For gasoil the figures are respectively 5,25 BEF in 1988 and 11,33 BEF in 1993. The same continuous increase in excise holds to a lesser extent for cigarettes, although in this case it has partially been offset by a decrease in the ad valorem tax. The excises on most other products remained constant throughout the studied period, which implies an effective decrease of the tax burden[49].

The impact on the consumer price of the 32 commodities of all changes in indirect taxes between 1988 and 1993 can be found in appendix 5. As could be expected, the price of gasoline (+31%), gasoil (+39%) and tobacco products

[49] See table A4.2 to check this point.

(+12%) has gone up substantially. The abolition of the rate of 33% and of 25% shows up in a price decrease of durables (-3%).

4.3 Simulated Reforms

The pre and post reform situation, used to simulate changes in the indirect tax system, are the ones described above. The simulated personal income tax reform on the other hand is an approximation of the changes that were sketched above.

First of all the personal income tax system of 1993 has been used as a kind of reference situation. It is a reference year because the complete tax structure of this year, with all the necessary details to come up with exact administrative tax figures, is already available in SIRe. The reforms, to be mentioned below, therefore have been implemented within this structure, which implies that the non - reformed part of the pre and post reform system is calculated according to the rules that were applied in 1993.

Next to this assumption on the tax structure, data problems were an obstacle to reconstruct 1988 tax figures in an exact way. First of all because the data on which SIRe rests, are drawn for a specific tax year. Therefore, some data, relevant to calculate the 1988 tax figures, were no longer available in the tax file since they no longer had to be declared according to the tax system that was relevant at the time the data set was constructed. For example, the tax deduction that existed for interest payments related to income from movable property, has been abolished. On top of that there is the problem that income from movable property is generally not declared because of the final character of the withholding taxes paid on it. Therefore, the drop in the withholding tax rate that occurred can not be simulated properly.

Since these data problems primarily concern other than professional income components and because these professional income components are of major importance in both tax systems, no attempt has been made to reconstruct the tax bases of these other components. The registered professional costs, on the other hand, were scaled up to approximate the 1988 professional income concept[50]. This was done since the costs, deductible from professional income, have been restricted throughout the considered period which resulted in

[50] This scaling factor has been calculated on the basis of aggregate data on declared professional costs, that were available for the 1988 and 1993 tax system.

smaller amounts being declared in 1993. The newly constructed net professional income figures were added together then over both spouses in the pre reform situation and life insurance contributions and capital repayments were deducted from this sum, up to the appropriate amount.

All net income components of the couple were combined then in a single net total income concept. A smaller amount of charity gifts were deducted from the latter. Child care expenses were abolished completely. Expenses on pension saving funds and purchases of employers shares on the other hand were resurrected as a cost deduction. All these adaptations resulted in a pre reform net global income concept, that is considerably different from its post reform counterpart.

The old tax brackets were applied then on this net global income concept, without applying the exemptions that were used in the post reform situation[51]. Instead, we reconstructed the tax reduction for married couples and the additional tax reduction for life insurance contributions and capital repayments. Finally, the crisis surcharge, used to calculate the post reform taxes was not taken into account in the pre reform calculations.

4.4 Evaluation of reforms

The question of complementarity between personal income and indirect taxes, that mainly inspired this work, can now be approached from at least two different angles. First, one can look at the distributional effects of changes in either of the two instruments and their consequent impact on the overall distributional picture. Next to this one can also consider the changes in total revenue to asses the importance of both instruments on the overall reform.

The study of these total revenue effects does not require many instrumental tools. The distributional impact on the other hand, can be summarised in many different ways. In a first subsection we will therefore enlighten the tools that have been selected to provide this summary. The distributional analysis as well as the total revenue effects, will then be sketched in a second subsection.

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[51] If nominal amounts came into play, for example to determine the tax brackets, the officially reported figures of the 1988 tax system were used. For this purpose, the income figures, expressed in prices of 1993, were scaled down to their 1988 level by applying the index number, already mentioned above.

Because personal income taxes had to be transferred from the fiscal unit level to the household level, the simulated results can also reveal something about the differences in distributional impact of this instrument at different observational unit levels. These results will be discussed in the third subsection.

4.4.1 Description of the evaluation concepts

The exposition of the evaluation concepts, given here, relies heavily on the one given in Lambert (1993), Chapter 6 and 7. Nonetheless, the essentials, for the purpose at hand, will be recapitulated.

Since the main objective of this evaluation exercise is to give empirical content to the redistributive effects of different tax systems before and after the reform, a formal expression of the concept of redistribution is required. Redistribution is defined here as the shift of income which occurs in the post-tax distribution form high to low incomes. Hence, it can be measured by comparing the pre-tax Lorenz curve with the post-tax concentration curve. Our measure of redistributive effect is therefore defined as:

$$\Pi^{RS} = 2\int_0^1 \left[L_{X-T}(p) - L_X(p)\right]dp \tag{6}$$

where the superscript of Π^{RS} refers to Reynolds and Smolensky (1977) who applied this measure to the US tax system, and

$$L_X(p) = \int_0^y \frac{xf(x)dx}{\mu} \qquad 0 \le p \le 1 \quad \text{and} \quad p = F(y) \tag{7}$$

$$L_{X-T}(p) = \int_0^y \frac{(x - t(x))f(x)dx}{\mu(1-t)} \qquad 0 \le p \le 1 \quad \text{and} \quad p = F(y) \tag{8}$$

are, respectively, the Lorenz curve of pre-tax income (x) and the concentration curve of after-tax income ($x - t(x)$) with respect to pre-tax income. The following symbols have been used:

- p: the population shares of the pre-tax distribution
- $f(x)$: the density function of x
- $F(x)$: the distribution function of x
- μ: mean income (before tax)
- $t(x)$: the tax liability corresponding with taxable income x
- t: the average tax rate.

Defining areas by:

$$G_X = 1 - 2\int_0^1 L_X(p)\,dp \tag{9}$$

$$C_{X-T} = 1 - 2\int_0^1 L_{X-T}(p)\,dp \tag{10}$$

it is easily seen that the measure of redistribution Π^{RS}, can be rewritten as:

$$\Pi^{RS} = G_X - C_{X-T} \tag{11}$$

where G_X is of course the Gini coefficient of pre-tax income and C_{X-T} is the area between the diagonal and the concentration curve of post-tax income with respect to pre-tax income. The difference between the Lorenz curve of post-tax income, and the concentration curve of post-tax income is important, if there is reranking. Only in the absence of reranking, C_{X-T} equals the Gini coefficient of the post-tax income distribution, and Π^{RS} can be interpreted as the reduction of the Gini coefficient.

The redistribution, if any, is obtained because the tax system is not proportional. It should not surprise therefore that there have been proven interesting relationships between measures of redistribution like Π^{RS}, and measures of *disproportionality* of the tax system. The latter try to give an aggregate measure of the difference between the share in total income and the share in total taxes, for given fractions of the population. One of these measures has been proposed by Kakwani (1977), and is based on the formal definition of proportionality as the coincidence of the pre-tax income Lorenz curve $L_X(p)$ and the concentration curve of tax liabilities, $L_T(p)$. Disproportionality, also called liability progression, is measured then as the difference between both curves:

$$\Pi^K = 2\int_0^1 \left[L_X(p) - L_T(p)\right]dp = C_T - G_X \tag{12}$$

and can be used to measure the progressivity or regressivity of a tax structure, where progressivity is defined as an average tax rate which increases with pre-tax income. Theorem 6.1 in Lambert (1993) states that progressivity, defined as a departure from proportionality, and the redistributive effect defined as equalising post-tax incomes, are but two sides of the same coin. Hence, Π^{RS} and Π^K are closely related:

$$\Pi^{RS} = \frac{t}{1-t}\Pi^K \tag{13}$$

Remark however that the amount of income equalisation which is obtained does not only depend on the liability progression, but also on the average level of taxation, denoted by $\frac{t}{1-t}$, which is the tax rate as a percentage of income after tax.

We are interested in the change of the redistributive properties of the personal income and indirect tax system, caused by the reforms between 1988 and 1993. Denoting the pre-reform situation with a subscript 0 and the post-reform situation with 1, we will calculate:

$$\Delta \Pi^{RS} = \Pi_1^{RS} - \Pi_0^{RS} \tag{14}$$

This difference in redistributive effect can of course easily be decomposed in a term which captures the change in the liability progression, and a term which measures the change in the average tax level. Denoting the tax rate ($\frac{t}{1-t}$) as τ, and expressing the differences into percentage changes, we have:

$$\frac{\Delta \Pi^{RS}}{\Pi_0^{RS}} = \frac{\Delta \tau}{\tau_0} + \frac{\Delta \Pi^{K}}{\Pi_0^{K}} + \left(\frac{\Delta \tau}{\tau_0}\right) \cdot \left(\frac{\Delta \Pi^{K}}{\Pi_0^{K}}\right) \tag{15}$$

percentage change in redistribution	=	percentage change in tax rate	+	percentage change in liability progression	+	residual term

Both the reform of the personal income and of the indirect tax system separately, and their joint effect have been evaluated by means of (15). We present the results in the next subsection.

A final remark concerns the pre-tax income we have used in the calculations. In the budget survey households directly report their 'disposable income'. We presume that this variable gives a better indication of the expenditures and hence the welfare level of the households than the net global income concept that could be imputed through the match as well. Therefore we have constructed pre-tax income as the sum of this disposable income and the personal income tax liabilities which were obtained by the matching process. Depending on the application, the income after tax is then this pre-tax income minus, the personal income, the indirect or the total tax liability. Both pre-tax and post-tax income have been divided by the OECD equivalence scale to correct for household size.

4.4.2 Personal Income and indirect taxes at the same level of the unit of observation

4.4.2.1 Distributional considerations

To start with, we have assumed that the whole income effect of the personal income tax reform has been absorbed into savings. As said before, the results obtained under this assumption are the ones one would obtain by simulating the reforms with two unconnected microsimulation models. The results, based on this non-interactive analysis, are reported in table 13.

Let us first look at the tax systems before the reforms. As could be expected the personal income tax system has an equalising effect because of the progressivity of the tax schedule. The Gini is reduced from 0.2908 to 0.2410 (lines 2 and 3). As explained above, this might be contaminated by reranking of households, which is corrected for, by using the Reynolds-Smolensky index (line 4). This points to a positive redistributive effect of the same order of magnitude as the reduction in the Gini, mainly based on a substantial liability progression of 0.2047 (line 5). Expectations are also confirmed for indirect taxes. They are slightly regressive, but the redistribution from poor to rich households which follows from this is rather weak[52]. Taken together, this regressivity of the indirect tax system, only slightly erodes the redistributive power of the overall tax system. The measure of redistribution decreases with about 7.6% (from 0.0606 to 0.0560) when compared to the personal income tax system.

Table 13: Distributional evaluation of the reform of personal income taxes and indirect taxes: Belgium 1988-1993

[52] This confirms the results found earlier for the Belgian indirect tax system (see Decoster, Schokkaert, and Van Camp (1997)).

		Personal Income taxes	Indirect taxes	Personal Income + Indirect Taxes
	Before reform			
(1)	mean tax rate (t)	0.2283	0.0767	0.3050
(2)	Gini pre tax (G_X)	0.2908	0.2908	0.2908
(3)	Gini post tax (G_{X-T})	0.2410	0.2997	0.2482
(4)	redistributive effect (Π^{RS})	0.0606	-0.0085	0.0560
(5)	liability progression (Π^{K})	0.2047	-0.1018	0.1277
	After reform			
(6)	mean tax rate (t)	0.2111	0.0805	0.2916
(7)	Gini pre tax (G_X)	0.2908	0.2908	0.2908
(8)	Gini post tax (G_{X-T})	0.2416	0.3003	0.2492
(9)	redistributive effect (Π^{RS})	0.0584	-0.0091	0.0533
(10)	liability progression (Π^{K})	0.2183	-0.1034	0.1294
	Effect of the reform (in %)			
(11)	% change in redistributive effect	-3.6	-7.1	-4.9
(12)	% change in $t/(1-t)$	-9.6	5.5	-6.2
(13)	% change in liability progression	6.6	-1.6	1.4

Note: since the values for Π^{RS} and for Π^{K} are negative for indirect taxes, we have calculated the percentage change in rows (11) and (13) w.r.t. the absolute value of these measures. A negative sign then denotes that the indirect tax system becomes more regressive and still less redistributive

At first sight the reform of personal income taxes only had a minor influence on the equalisation of post-tax incomes. The redistributive measure declines with 3.6% from 0.0606 to 0.0584 (line 11). But here the decomposition of equation (15) proves its usefulness. The near neutrality of the reform as far as the redistributive effect of the personal income tax system is concerned, is itself the result of two opposite forces of considerable magnitude. There is an important decrease of the tax rate, expressed in terms of income, net of taxes, (-9.6%), which, ceteris paribus, would have lead to an important reduction of the redistributive power of the system. But this decrease of the tax level has, to a major extent, been offset by a considerable increase in the liability progression (+6.6%). Hence the amount of equalisation in the reformed tax system is nearly the same as in the previous one. But the decrease of the average tax rate has of course led to a substantial loss of revenue.

The picture that emerges for the indirect tax reform is different. Note first that we start from a regressive system, characterised by a negative Π^{RS} and Π^{K}. We have therefore expressed the percentage changes with respect to the absolute value of these measures. Although the main ingredients of the reform were the removal of the VAT rate of 33% and 25%, the mean tax rate has increased with

5.5. This is mainly due to the substitution of the 19.5% rate for the rate of 17% and the important increase in some excise duties. That these changes of rates and excise duties have also strengthened the regressivity of the system, does not come as a surprise. The liability progression has further decreased from -0.1018 to -0.1034 In a progressive system an increase of the average tax rate leads to an increase of the redistributive effect. In a regressive system however, the increased average tax rate amplifies the redistribution from poor to rich. This shows up in the decline of the redistributive effect of the indirect tax system with 7.1.

Combining the two reforms, results in an overall effect that is mainly determined by the fact that personal income taxes have a higher weight in the total revenue than indirect taxes. This explains the negative change in the overall average tax rate. Before the reform, the two tax systems together could be considered to be progressive and redistributive. Hence the decrease of the overall average tax rate reduces the redistributive effect. The moderate increase in liability progression of the combined system is not large enough to offset the overall tax reduction. The result is a diminution of the redistributive effect with 4.9%.

The additional effect from personal income taxes on the indirect tax base can now be studied in two ways: one could either look at the distributional changes they induce when the pre reform indirect tax rates apply or when the post reform indirect tax rates apply. The results we provide have been computed within the latter framework.

The redistributive effect of indirect taxes now decreases with 6.0%. This figure has to be compared with the reduction of 7.1 in table 13, where the change in disposable income following from the change in personal income taxes is not taken into account. When this additional income effect is taken into account the system is judged to be less regressive. The decrease in liability progression of 1.6 caused by the reform of indirect taxes, now switches to an increase of 0.8%. This could happen when those having a higher income spend proportionally more on commodities that are treated less favourably by the reform or when the benefits of the changes in personal income taxes decrease with income. Since the change of 0.8% in liability progression is very small, one could say now say that the negative redistributive effect is almost entirely due to the increased revenue collection within a regressive system.

4.4.2.2 Revenue effects

Table 14 reports the total revenue figures that can throw a light on the budgetary impact of the reforms, described above. However, before discussing them,some remarks are in order.

The indirect tax model is primarily conceived to deal with distributional considerations. The calculations of the revenue effects should therefore be interpreted with some caution. Furthermore, both the personal income and indirect taxes have been calculated on a data base containing a single income observation for each unit. This implies that they do not reflect the real budgetary impact because the change in real income in the period 1988-1993 has not been taken into consideration. Since only the major reforms in the personal income tax system have been considered the results on this will only be an approximation rather than an exact measure of what has happened in practice.

Table 14: Revenue effects of the reform of personal income and indirect taxes Belgium 1988-1993

		Personal Income taxes	Indirect taxes	Personal Income + Indirect Taxes
	Before reform			
(1)	revenue (10^9 BEF in prices of 1993)	929.876	678.103	1607.979
	After reform			
(2)	revenue (10^9 BEF in prices of 1993)	830.101	712.212	1542.313
	Effect of the reform			
(3)	% change in revenue	-10.73	5.03	-4.08
(4)	absol. Change in revenue (10^9 BEF in prices of 1993)	-99.775	34.109	-65.666

Yet, as far as the personal income taxes are concerned, the revenue loss of about 100 billion BEF comes close to the predictions made at the time of the reform. This is not the case for indirect taxes. The revenue figures of the indirect tax model are far off from the registered government revenues. The revenue figure in the pre reform situation has therefore been grossed up to match more closely the real revenues. The percentage change in revenue is used then to estimate the nominal change in revenue.

While a reduction of the personal income tax revenues with almost 11% is considerable, one can also see that a serious amount of this lost revenue is recollected through the adaptation of indirect tax rates since the indirect tax revenue increased with 5%. On top of this pure indirect tax reform effect there

has been an additional increase in the revenue because of the increase in disposable income. This effect was estimated here to be 1.47%, or about 10 billion BEF. This rise is considerable when compared to the 5% of the indirect tax reform itself.

4.4.3 Personal Income taxes for different definitions of the unit of observation

In the discussion above, the effects of the personal income tax reform were evaluated at the household level by use of a welfare concept expressed in equivalent household heads. We do not want to enter into the discussion of the choice of the unit itself (real household, fiscal household, individual). But the obtained tax liabilities provide the possibility to test whether the conclusions with respect to the redistributive effect are sensitive for the choice of the unit.

To test this, the calculations for the personal income tax reform have been done for four different concepts. The redistributive effect of the reform has been calculated for the fiscal units observed in the fiscal data set, for the fiscal units observed in the fiscal unit budget survey, at the household level without correction for family size, and finally at the household level after correction with an equivalence scale. The latter results have been presented in table 13. We present the results of the four different possibilities columnwise in table 15.

Table 15: Comparison of the personal income tax reform for different units of analysis

	Fiscal Units Fiscal Data Set	**Fiscal Units Budget Survey**	**Households Budget Survey without E.S.**	**Households Budget Survey with E.S.**
Before Reform				
mean tax rate (t)	0.2727	0.3110	0.2366	0.2283
Gini pre tax (G_X)	0.3675	0.3519	0.3339	0.2908
Gini post tax (G_{X-T})	0.2955	0.2669	0.2848	0.2410
redistributive effect (Π^{RS})	0.0760	0.0876	0.0582	0.0606
liability progression (Π^{K})	0.2027	0.1940	0.1878	0.2047
After Reform				
mean tax rate (t)	0.2435	0.2839	0.2160	0.2111
Gini pre tax (G_X)	0.3675	0.3519	0.3339	0.2908
Gini post tax (G_{X-T})	0.3054	0.2772	0.2904	0.2416
redistributive effect (Π^{RS})	0.0667	0.0781	0.0518	0.0584
liability progression (Π^{K})	0.2073	0.1971	0.1882	0.2183
Effect of the reform				
% change in redistributive effect	-12.2	-10.8	-10.9	-3.6
% change in $t/(1-t)$	-14.2	-12.2	-11.1	-9.6
% change in liability progression	2.3	1.6	0.2	6.6

The differences between the first and the fourth column of table 15 are striking. Only relying on SIRe and on the fiscal data set, one would conclude that the personal income tax reform substantially decreased the redistributive effect of the tax system (-12.2%). This comes mainly through a huge decrease of the average tax rate (-14.2%), while it is striking that there is only a small change in the liability progression(+2.3%).

The differences between column (1) and (2) must have to do with the difference in the underlying populations (remember the discussion in section 3.2) and/or with the matching process itself.

The transition from the second to the third column has to do with the reconstruction of real households out of the set of fiscal units. At the same time we add the important subset of households who are not paying taxes. This of course causes a dramatic drop of the average tax rate. In the pre reform system, e.g., the tax rate goes from 31.1% to 23.7%. The same holds in the post reform system. This decrease in the tax rate, measured at the household level, is accompanied by a slight decrease of the liability progression. In the bottom part of the table we see that the transition from fiscal units to real households leaves the redistributive properties of the tax *reform* fairly unchanged. The percentage change in the tax rate due to the reform is nearly the same in column (2) as in column (3) (and should not be confused with the decrease of the tax rate in the upper part of the table). Measured at the household level, the reform leaves the liability progression nearly unchanged (+0.2%) but together with the smaller reduction in the average tax rate (-11.1%), the change in the redistributive effect is nearly the same in column (3) as in column (2).

Finally, we move from column (3) to column (4) and introduce the correction for family size. Our results once more confirm the importance of this correction. With all well known and necessary caveats about the content of specific scales, the sensitivity of the results remains striking. The personal income tax reform, judged to be very unequalising when the figures of column (1) are used, seems after all to be rather neutral. The redistributive effect does not decrease with 12.2% (column (1)), but only with 3.6%.

Note again that it is important to distinguish the effect of the equivalising procedure itself, and the interplay of the equivalisation with the reform. The effect of the equivalence scales can best be judged in the upper part of the table. Both in the pre and in the post reform system, the correction for household size leads to a greater liability progression. This might suggest that equivalised tax liabilities are spread more disproportionately than the non equivalised ones.

The personal income tax reform has boosted the increase in liability progression due to the equivalisation process. This results in the considerable increase in liability progression in the bottom part of the table (+6.6%).

5. CONCLUSION

This project aimed at integrating two existing Belgian microsimulation models: one for personal income taxes (SIRe), and another one for indirect taxes (ASTER). At least from the perspective of the policy maker, there is an urgent need for this integration. Not seldomly, the government revenue constraint forces the policy maker to compensate a reduction in the personal income tax by an offsetting change in indirect taxes. This is what happened in Belgium in the years following the personal income tax reform of 1988.

To link both existing models, and to make the integrated result suitable for a policy application, two major obstacles had to be removed. The first concerns the difference between the datasets underlying both models. The personal income tax model is based on fiscal data. The model for indirect taxes runs on a representative budget survey. The second problem concerns the construction of a behavioural link between both models. A change in personal income taxes leads to a change in disposable income. This in turn possibly affects expenditure behaviour, and hence indirect tax liabilities.

We have deliberately chosen to invest our limited amount of research time available, into the data problem. Hence, the summary of the solution we have given to the second problem (the construction of the behavioural link between both models), can be very brief. We simply assumed that the ratio of total expenditures over disposable income remained constant during the simulation. Of course we plan to replace this proportional savings function by a more sound and sophisticated one in the future.

It was less straightforward to clear the hurdle of the differences between the underlying datasets. The basic problem is the lack of income information before taxes, in the budget survey. This makes it impossible to use the budget survey as the inputfile for the personal income tax model. Of course, we could as well state the problem as a lack of expenditure information in the fiscal data set (which might be used then as the inputfile for the indirect tax model). But it is our conviction that basically, it is more appropriate to base a policy analysis upon a budget survey than on a fiscal dataset. This is mainly due to the difference between the definitions of the units of observation in both datasets. The fiscal dataset uses fiscal units. The budget survey contains sociological households. Moreover the fiscal dataset is truncated at the bottom of the income distribution. Besides these important and essential differences, some minor

difficulties arose from the different years in which the samples were drawn and from eventual divergent definitions of similar variables.

In principle we might follow several directions to bridge the gap between the two underlying datasets. First, we could have tried to reconstruct from the net incomes in the household survey, the gross or taxable counterparts. This would have allowed us to calculate tax liabilities for the households in the budget survey by means of SIRe. But lack of information made this option a blind alley or at least a very hypothetical one since many ad hoc assumptions would have had to be made. The second possibility was even more unfeasible: determine expenditures for the IPCAL dataset, to allow a run of ASTER on the fiscal data. The reason was that, again due to lack of information, it was impossible to reconstruct IPCAL-households from the fiscal units. In addition we would have been obliged to correct the fiscal data set for its lack of representativity.

Therefore we have chosen a third, and less practised, solution. To complement the budget survey with the necessary gross income information to calculate tax liabilities, we have performed a *statistical match* between the administrative data set, IPCAL, and the household budget survey. The bulk of this report has been devoted to the description of the different steps and assumptions necessary for the application of this statistical matching procedure.

Some of the problems we have encountered during the application of this matching procedure were very particular to the underlying datasets. The major two were the difference between fiscal units and households, and the different time periods in which the samples were drawn. The first problem was tackled by using individual income information in the budget survey to split the households into fiscal units. After this operation we partitioned the fiscal unit budget survey into a subset of households that are liable for personal income tax payment, and those that are not. By matching only the first subset with the fiscal data, we got round the difficulty of non representativity of the fiscal dataset at the bottom of the income distribution. Of course, we have added the second subset to evaluate the outcome of the tax reforms. The second problem, the different years for which the samples were drawn (1987-1988 for the budget survey, and 1993 for the fiscal data), caused more fundamental methodological problems. An important choice in the matching procedure concerns the choice between constrained and unconstrained procedures. In constrained procedures, one tries to keep the marginal distributions of the matching variables unchanged. This is the appropriate method when both samples are drawn from the same population. We have tested this assumption statistically and the

assumption that both samples come from different populations could not be rejected. The considerable time gap between the drawing of both samples, will probably be one of the major explanations for this rejection. Therefore we have applied an unconstrained match.

Other problems, encountered during the matching exercise, had a more general character. Their treatment in the particular context of this report might prove useful for similar exercises in the future. First of all, matching techniques require the selection of appropriate matching variables. Essentially, the matching variables have to be defined similarly in both datasets, and they should be highly correlated with the non-overlapping variables. We have shown how a stepwise regression can be used to determine this set of appropriate matching variables. In our case we selected 17 matching variables. The stepwise regression was also attractive because at the same time it provided the weights of the matching variables, to be used in the distance function. The latter was defined as the weighted sum of the normalised distances between the value of the matching variable in the fiscal unit budget survey and in the fiscal dataset. The normalisation was done by means of the standard deviation of the variable in the budget survey. For each fiscal unit in the budget survey, we minimised the distance function by searching for the unit in the fiscal database, that was as close as possible to the unit in the fiscal unit budget survey. The personal income tax liabilities of this 'most ressembling' fiscal unit were then imputed on the fiscal unit of the budget survey.

Inevitably, some of the solutions that we have proposed in the matching procedure were tentative or have generated new questions. We only mention one of them: what's the difference between the technique we have applied and the imputation of missing variables by using the estimated parameters of a functional equation? We intend to investigate this and related questions in the near future in the closely related D.W.T.C.-project about statistical matching (Contract DB/01/032).

The final result of our matching procedure was an enriched budget survey. Before the matching we already disposed for each household of its expenditures, and hence, by means of ASTER, of its indirect tax liabilities. We now also had for each household its personal income tax liabilities, calculated with SIRe for its most ressembling counterpart. This allowed us to evaluate the effects of a simultaneous reform in personal income and indirect taxes.

We simulated the changes that took place between 1988 and 1993 in the Belgian system of personal income and indirect taxes. The integrated simulation

pointed at two major conclusions. First, as could be expected, the described shift from personal income taxes to indirect taxes led to a reduction of the redistributive effect of the combined tax system. This is mainly due to the increase in indirect taxes, since the substantial decrease of the personal income tax rate was accompanied by an equal sized increase in liability progression.

Second, the construction of our matched dataset opens the possibility to compare the analysis of the personal income tax reform evaluated on an administrative dataset, with the results obtained on a representative household survey. This allows us to take the non taxpaying units into account, and to introduce corrections for household size into the distributional analysis. Our results point towards at least some sensitivity of the evaluation of the personal income tax reform with respect to the unit of analysis. If the fiscal data set is used and the fiscal unit is chosen as the unit of analysis, then the personal income tax system has lost 12% of its redistributive potential. But if the analysis is carried out on the basis of equivalised household units, the redistributive potential of the personal income tax system has only changed to a minor extent, despite the considerable changes in the total revenue and the progressivity of the system. The sensitivity of distributional analysis with respect to the use or specification of an equivalence scale is of course not a new result. And more research is needed to investigate whether the difference is due to the correction for household size, the differences in the income concepts underlying the fiscal data and the budget survey, or the absence in the fiscal dataset of the bottom of the distribution. But anyway, this sensitivity as such proves the usefulness of disposing of an integrated microsimulation model running on an integrated database with both expenditures, taxable incomes and characteristics for each household.

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APPENDIX 1:
REFORMS IN THE PERSONAL INCOME TAX SYSTEM FROM THE INCOME TAX YEAR 1989 UNTIL 1996: DISCUSSION ON A YEAR BY YEAR BASIS

This appendix provides a reference to the measures that have changed the outlook of the income tax system within the period that stretches from the income tax year 1989 until the income tax year 1996[1]. The changes are listed for more years than those discussed in the main text since the original idea was to simulate the income tax year 1996 rather than 1994. Furthermore, only "real" measures are listed, instead of gradual changes that have occurred as well. Gradual changes are adaptations of the deductible amounts and exemptions by a measure that reflects changes in price level. The discussion is done on a year by year basis such as to obtain a list from which it is possible to select measures for other purposes than our specific simulation as well. When listing the changes, implemented for a certain tax year, the complete system of the previous year is taken as a reference point.

In what follows abbreviations will be used to refer to the sources that have been used to produce this list. Sta refers to the Standaard-Elsevier Belasting Almanak, TA refers to Test Aankoop Belastinggids, Mem to Fiscaal Memento and FET refers to Financieel Economische Tijd-Belasting & Belegginsgids.

1. Reforms applied on the income tax year 1990

1. The professional revenues of the two spouses that make up a fiscal couple are no longer added together to determine the amount of taxes that the couple is obliged to pay. They are taxed separately instead. (see Sta, 1989, p. 249-250)
2. The possibility to use the marital quotient or the system of assisting spouses was created for two spouses that make up a fiscal couple. These rules make it possible to redistribute a certain amount of professional income between the spouses. (see Sta, 1989, p. 249-250)

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[1] Since we only discuss changes in the income tax system in this and the next appendix, we use the administrative concept of a tax year here to refer to the respective years.

3. The tax reductions that took into account family composition were abolished. Exemptions that compensate for this were introduced instead. (see Sta, 1989, p. 249-250)
4. The tax brackets and their corresponding marginal tax rates were adapted. (see Sta, 1989, p. 249-250) The principle of a maximal mean tax rate was given up as well. (The old brackets and rates listed in Mem, 1989, p. 13 contain errors)
5. An additional deduction was created for expenses on child care services if it concerns children that are less than 3 years old. This cost can be deducted from net total income. (see Sta, 1989, p. 249-250) (see TA, 1990, p. 10)
6. Until 1989, one distinguished between types of houses to determine the deductions for capital repayments on mortgage loans. This distinction was abolished. In conjunction with point 15 this implies a change in the costs that are deducted from professional income. (see Sta, 1989, p. 249-250) (see TA, 1990, p. 26)
7. A new class of fixed costs, deductible from professional revenue, was created. Previously, one was allowed to deduct 5% of the amount of income above 500.000BEF. This fraction was reduced to 3%. Furthermore one decided to reduce the maximal deductible amount from 125.000BEF to 100.000BEF. (see Sta, 1989, p. 249-250)
8. The special Social Security contribution was no longer collected. This contribution had to be paid by high income earners. (see Sta, 1989, p. 79-80 and p. 249-250) (see Mem, 1990, p. 18)
9. A number of changes were implemented with respect to the deduction possibilities of costs related to professional activities. Some classes were abolished while others were limited. The main classes that were limited are car costs, restaurant and representation costs and professional clothing. (see Sta, 1989, p. 249-250) (see TA, 1990, p. 82-85)
10. Interest payments on money borrowed to obtain income from movable property can no longer be deducted. Interest paid on money that was borrowed to obtain real estate income can still be deducted. It is deducted at an earlier stage in the tax computation scheme however. Until 1989 one had to deduct these costs from net total income. One started to deduct it from real estate income. (see Mem, 1990, p. 4-5) (see Mem, 1989, p. 8)

11. The tax reduction, that existed for life insurance contracts and capital repayments of mortgage loans, was abolished. (Mem, 1990, p. 16)
12. Natural persons can no longer obtain a tax credit. (see TA, 1990, p. 23)
13. The fiscal definition of having a handicap was adapted to the one used in the social security system. (see TA, 1990, p. 8)
14. The costs related to income from movable property, such as safe-keeping fees, are no longer deducted from net total income but are directly deducted from income from movable property. This deduction is only done for the calculation of the second tax amount when all net income figures are integrated into net global income. (see Mem, 1989, p. 8) (see Mem, 1990, p. 8)
15. Expenses on group insurance contracts are deducted from professional income before costs are deducted. Assets distributed by one's employer are no longer deducted from net total income but are deducted from professional income instead. (see Mem, 1989, p. 10) (see Mem, 1990, p. 16-17)
16. Until 1989 a fixed reduction of the taxes was applied in the clearing process when income from movable property, that could have been taxed abroad, was declared. This clearing rule was abandoned. (see Sta, 1990, p. 76) (see TA, 1990, p. 35)
17. Some self employed people were allowed to deduct costs from their profits if they employed people under certain conditions. Some of the employment rules were changed. (see Mem, 1990, p. 14)

2. Reforms applied on the income tax year 1991

1. The basic withholding tax, that had to be paid on income from movable property, was diminished on 1 march 1990 from 25% to 10%. (see TA, 1991, p. 27)
2. Until 1990, charity gifts could only be deducted to a maximal amount of 5% of the net total income of the fiscal unit. This limit was increased from 5% to 10%. (see Sta, 1990, p. 249) (see TA, 1991, p. 36)
3. The rules used to deal with surplus values that are realized in professional activities or by ending these activities, were changed to a large extent. (see Sta, 1990, p. 249) (see TA, 1991, p. 80-85)

4. Until 1990, professional losses could only be deducted over a limited period in time. This limit was no longer applied from 1991 on. (see Sta, 1990, p. 249) (see Mem, 1991, p. 14)
5. Until 1990, one applied the rule that anybody, declaring real estate income, had paid 12.5% of taxes on this income in advance. If one then had paid too much taxes according to this rule they were paid back. This rule was still applied in the clearing process in 1991 but when too much taxes had been paid according to it, they were no longer paid back. (see Mem, 1991, p. 30)
6. A new tax reduction was created for elderly people with an unemployment benefit. (see Mem, 1991, p. 26) (see Mem, 1991, p. 25)
7. Until 1990, one determined the income paid to working partners and managers of a company in a different way. A more uniform system was applied in 1991. (see Sta 1990, p. 249)
8. The rules applied to write off capital investments in a digressive way, were changed. These rules have an impact on the calculation of the profits made by the investor and thus on his professional income. (see Sta, 1990, p. 249)
9. The clearing of withholding taxes, paid on income from movable property with fixed rents, was changed in 1991. (see Sta, 1990, p. 249)
10. When revenue from foreign assets was invested in companies, one still applied a fixed reduction of the taxes in the clearing process as a kind of compensation for the taxes that could have been paid abroad. The way these fixed amounts were computed, was changed in 1991. (see Sta, 1990, p. 249)
11. It was decided that main contractors had to subtract a fixed percentage from payments they made to subcontractors and that this amount had to be paid to the taxation services. (see Sta, 1990, p. 249)
12. One changed the conditions that allowed employers to keep money aside for the dismission of employees. These amounts of money have an impact on the profits made by the employer and thus on his professional income. (see Sta, 1990, p. 249) (see TA, 1991, p. 49)
13. Some people no longer had to make withholding tax payments on their professional income. This measure mainly concerned people with a non-sedentary profession. (see Sta, 190, p. 249)

3. Reforms applied on the income tax year 1992

1. A new item was created in the class of miscellaneous income sources. A special tax was created to tax the amount paid by one spouse to the other in case of a divorce. More specifically this tax deals with the amount that should have been paid in the past. (see TA, 1992, p. 31) (see Mem, 1992, p. 12 and 31)
2. If the tax payer does not declare professional transportation costs although he has to travel a long distance, the fiscal authority automatically applies a fixed deduction. Two of these deduction classes were made uniform. One also abolished a deduction on transportation costs paid by one's employer for those who did not use these fixed tariffs and declared car costs. On the other hand, a larger deduction was given to those declaring public transportation costs. (see Mem, 1992, p. 15) (see FET, 1991, p. 409)
3. It was decided that the cadastral income had to be adapted each year on the basis of a certain index measure. (see Mem, 1992, p. 6)
4. Investment costs can be deducted from profits such that they lower professional income. Some of the tariffs at which this deduction may be done, were changed. (see Sta, 1992, p. 101) (see FET, 1991, p. 409)

4. Reforms applied on the income tax year 1993

1. Some special assets (loten van effecten van lening) were no longer treated as miscellaneous income that had to be taxed by the tax scheme. Instead a specific tax was implemented to treat this item. (see Mem,. 1993, p. 11) (see Mem, 1992, p. 11) (see TA, 1993, p. 45)
2. Life insurance contributions, capital repayments on mortgage loans and purchases of employers shares were no longer deducted from professional income. They were translated into a tax reduction. (see Mem, 1993, p. 26-29) (see Mem, 1992, p. 17-19)
3. Travelling expenses that can be declared as professional costs will no longer be accepted as legitimate expenses if they are higher than 6BEF per kilometer. (see Mem, 1993, p. 14)
4. Private pension fund payments are no longer deducted from net total income. They as well, result in a tax reduction from now on. (see Mem, 1993, p 26-29) (see Mem, 1992, p. 23)

5. One already applied special tax rates on income from movable property that was related with financial surplus values and revenues obtained from a buy out of a life insurance contract. This system became more diversified however since one subdivided these income classes on the basis of their origin and applied different tax rates on them. (see Mem 1993, p. 34) (see Mem, 1992, p. 31-32) (see TA, 1993, p. 95)

5. Reforms applied on the income tax year 1994

1. Tax brackets and other amounts that normally were adapted for price level changes, will not be adapted this year and the following two years.(see Sta, 1993, p. 273)
2. When a company rents a house from one of its partners, a part of this rent is no longer considered as real estate income for the partner but as a salary. (see Sta, 1993, p. 273) (see TA, 1994, p. 36) (see Mem, 1994, p. 6-7)
3. The possibility to obtain an additional tax reduction for capital repayments of mortgage loans were tightened. From now on this additional reduction is applied only for contracts that were concluded to obtain a dwelling house. (see Sta, 1993, p. 273)
4. From now on, two classes are distinguished in revenue coming from long term savings. This distinction is based on the moment the payments were made to the long term savings fund and thus depends on the moment the capital amount was created. Different tax rates are applied on these classes since they are considered to be different sources of income from movable property. (see Sta, 1993, p. 273) (see Mem, 1994, p. 35) (see Mem, 1993, p. 34)
5. A new special tax rate was implemented for some other sources of income from movable property such as specific amounts of capital and buy out values. (see Sta, 1993, p. 273) (see Mem, 1994, p. 35) (see Mem, 1993, p. 34)
6. Until now a clearing rule of 12.5% was applied to clear withholding tax payments on real estate income. This rule was applied without checking whether such taxes had to be paid. This principle was abandoned and the rule will now only be applied if one had to pay taxes in advance. (see Mem, 1994, p. 9) (see TA, 1994, p. 51)
7. Payments made to group-insurance contracts could be deducted from professional income until 1993. From 1994 on, this class of expenses is

treated as a tax reduction as well. (see Mem 1994, p. 27-28) (see Mem, 1993, p. 13)

8. A general crisis surcharge of 3% will be levied on all basic tax amounts. (see Mem, 1994, p. 39)
9. A new source of miscellaneous income was recognised and the special tax that had to be levied on it was specified. It concerns certain agricultural-subsidies coming from the EC. (see Mem, 1994, p. 35) (see Mem, 1993, p. 33-34)

6. Reforms applied on the income tax year 1995

1. Costs related to long-lease contracts were deductible for net total income until 1994. From 1995 on, they were deducted directly from real estate income. (see Mem, 1995, p. 7) (see Mem, 1994, p. 7)
2. The decision was taken to increase the income of some real estate income sources by 25% such that a higher amount of taxes could be levied on them. (see Sta, 1994, p. 289) (see TA, 1995, p. 86)
3. The clearing rule of 12.5% of withholding tax payments on real estate income was tightened further. From now on it will only be applied on the real estate income coming from the fiscal units dwelling house. (see Sta, 1994, p. 289) (see Mem, 1995, p. 9)
4. The costs related to long lease contract, previously deducted from net total income, cannot be deducted anymore to the extent they were made to obtain income from movable property. (see Mem 1995, p. 11)
5. The basic withholding tax on movable income was raised from 10.3% to 13.39% on 1 January 1994. (see Sta, 1994, p. 289)
6. The taxation rules, applied on some sources of income from movable property, were changed. From now on a different tax rate is applied on capital revenue minus dividends on the one hand and dividends on the other hand. (see Mem 1995, p. 11-12 and p. 38) (see Mem, 1994, p. 35)
7. An additional tax reduction was created for expenses on services of Local Employment Agencies (PWA's). (see Mem, 1995, p. 33)
8. The tax reductions, applied on replacement incomes were computed such that they would equal the amount of taxes that had to be paid by an individual in some reference situation. Since the reference situation changed

from year to year, these tax reductions had to be recomputed each year. To stop this ongoing recomputation, one decided to take the tax reductions of 1992 and to adapt them year by year on the basis of an index-measure. (see Mem, 1995, p. 34)

9. A special rule was stipulated to deal with real estate income of natural persons that used their property as capital input for their participation in a firm. (see Sta, 1994, p. 289)
10. An extra amount of taxes is determined on the basis of the net global income of the fiscal unit. For people that receive child allowances this extra amount is referred to as the reduction in child allowances. For people that do not receive these allowances, this extra amount of taxes is said to be a special extra tax. Basically, the amounts that have to be paid are the same however if the taxable base is equal. This construction was implemented to reduce child allowances in such a way that the operation was neutral with respect to family composition. (see Sta, 1994, p 289)
11. The net global income of the fiscal unit will be used as well to determine the amount of health care costs that have to be carried by the unit. On the basis of this prespecified scheme one can determine whether to much expenses are made with respect to health care services. If this is the case this extra amount is taken into account in the clearing process. (see Sta, 1994, p. 289) (see TA, 1995, p. 6)
12. A special contribution for the social security system, depending on the net global income of the fiscal unit, was implemented from 1995 onwards. (see Mem, 1995, p. 18) (see TA, 1995, p. 15)

7. Reforms applied on the income tax year 1996

1. An additional rule was specified to determine the taxable base of real estate income. When the property is rented to non-natural persons the final destination, that is specified by the renter, is taken into account to determine whether either rent or cadastral income is the taxable base. (see Mem 1996 p. 6) (see Mem, 1995, p. 6)
2. A new special tax rate was applied on some sources of income from movable property. (see Mem, 1996, p. 37) (see Mem, 1995, p. 38)

APPENDIX 2:
REFORMS IN THE PERSONAL INCOME TAX SYSTEM FROM THE INCOME TAX YEAR 1989 UNTIL 1996: POSITION OF THE REFORMS IN THE TAX CALCULATION PROCESS

In table A2.1 the changes, listed in Appendix 1, are classified according to their position in the tax calculation process. Some measures appear twice in this table since they had a double impact on the process. A separate overview of these double impact measures is given in table A2.2

Table A2.1: Classification of the changes according to their source

	Tax Base/Tax Rate[1]	Deductions
Professional Income	1990: 1, 2, 17	1990: 6, 7, 9, 15
	1991: 3, 4, 7, 8, 12	1992: 2 ; 1993: 2, 3
	1992: 4 ; 1994: 2	1994: 7
Real Estate Income	1992: 3 ; 1994: 2	1990: 10
	1995: 2, 9 ; 1996: 1	1995: 1
Income from Movable	1991: 1 ; 1993: 5	1990: 10, 14
Property	1994: 4, 5 ; 1995: 5, 6	1995: 4
	1996: 2	
Miscellaneous Income	1992: 1 ; 1993: 1	
	1994: 9	
General Deductions[2]		1990: 5, 10, 14, 15
		1991: 2 ; 1993: 4
		1995: 1, 4
Net Global Income		
Exemptions	1990: 3	
Tax Bracket Measures	1990: 4, 8 ; 1994: 1, 8 ; 1995: 10, 11, 12	
Tax Reductions	1990: 3, 11 ; 1991: 6 ; 1993: 2, 4 ; 1994: 3, 7	
	1995: 7, 8	
Clearing Measures	1990: 16 ; 1991: 5, 9, 10 ; 1994: 6 ; 1995: 3	
Amount of taxes to be paid		
Technical Measures	1990: 12, 13 ; 1991: 11, 13	

[1] The measures listed for professional income and real estate income refer to changes in the tax base since the applied tax rates are determined by the general taxation scheme. Measures for the other two income classes can be either changes in tax base or tax rate.

[2] This class refers to costs that can be deducted from the total net income concept

Table A2.2: Classification of the double impact measures

Tax Reduction and Exemption	1990: 3
General Deduction and Deduction from Professional Income	1990: 15
General Deduction and Tax Reduction	1993: 4
Deduction from Professional Income and Tax Reduction	1993: 2 ; 1994: 7
Real Estate Income and Professional Income	1994: 2
General Deduction and Deduction from Income from Movable Property	1990: 10, 14
General Deduction and Deduction from Real Estate Income	1990: 10 ; 1995: 1

APPENDIX 3:
COMPARISON OF THE RATE STRUCTURE APPLIED ON INCOME OBTAINED IN 1988 AND 1993

Table A3.1: Rate structure applied in the 1988 and 1993 tax system

Tax bracket (in BEF of 1988)			**Marginal tax rate for the part of taxable income ≥ L and ≤ U**	
L		U	1988	1993
0	-	120.000	300 BEF	25%
120.001	-	209.500	24,0%	25%
209.501	-	230.000	27,7%	25%
230.001	-	262.000	27,7%	30%
262.001	-	305.000	35,8%	30%
305.001	-	314.000	35,8%	40%
314.001	-	419.000	39,443%	40%
419.001	-	435.000	43,6%	40%
435.001	-	524.500	43,6%	45%
524.501	-	787.000	45,0%	45%
787.001	-	1.000.000	46,6%	45%
1.000.001	-	1.049.000	46,6%	50%
1.049.001	-	1.500.000	51,6%	50%
1.500.001	-	1.574.000	51,6%	52,5%
1.574.001	-	2.099.000	56,5%	52,5%
2.099.001	-	2.200.000	61,9%	52,5%
2.200.001	-	3.148.000	61,9%	55%
3.148.001	-	4.197.000	67,8%	55%
4.197.001	-	14.685.085	70,8%	55%
14.685.686	-		66,3%	55%

APPENDIX 4:
EXCISES AND AD VALOREM EXCISES

Table A4.1: Ad Valorem Excises

		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
nr + naam	**eenheid**										
140101 sigaren	per stuk	16.5	16.5	16.5	16.5	16.5	16.5	16	10	10	10
140102 sigarillo's	per stuk	21	21	21	21	21	21	16	10	10	10
140103 sigaretten pakje 20 st	per stuk	60.7	60.7	59.67	60.53	60.13	58.7	50	50	50	50
140104 sigaretten pakje 25 st	per stuk	60.7	60.7	59.67	60.53	60.13	58.7	50	50	50	50
140105 tabak	per kilogram	31.5	31.5	34.84	37.55	37.55	37.55	37.55	37.55	37.55	37.55
140107 sigaretten 10 of 15 st	per stuk	60.7	60.7	59.67	60.53	60.13	58.7	50	50	50	50

Table A4.2: Excises in BEF. the indicated year[1]

		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
nr + naam	**eenheid**										
119101 koffiebonen	per kilogram	10	10	10	10	10	10	10	10	10	10
119102 oploskoffie	per kilogram	28	28	28	28	28	28	28	28	28	28
120101 mineraal water	per liter	2	2	2	2	2	2	2	2	2	2
120102 alcoholvrije aperitieven	per liter	3	3	3	3	3	3	3	3	3	3
120103 andere alcoholvr dranken	per liter	3	3	3	3	3	3	3	3	3	3
130101 tafelbier	per liter	1.64	1.64	1.64	2.18	2.36	2.36	2.36	2.36	2.36	2.36
130102 pils	per liter	4.9	4.9	4.9	6.56	7.08	7.08	7.08	7.08	7.08	7.08
130103 ander bier	per liter	4.9	4.9	4.9	6.56	7.08	7.08	7.08	7.08	7.08	7.08
130205 whisky	per liter	225.6	225.6	254	254	254	254	254	254	254	254
130206 cognac	per liter	225.6	225.6	254	254	254	254	254	254	254	254
130207 jenever	per liter	192.1	192.1	216	216	216	216	216	216	216	216
130208 likeuren en andere	per liter	192.1	192.1	216	216	216	216	216	216	216	216
130201 wijn	per liter	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71	14.71
130202 cider	per liter	0	0	0	0	0	0	0	0	0	0
130203 champagne	per liter	51.49	51.49	51.49	51.49	51.49	51.49	51.49	51.49	51.49	51.49
130204 likeurwijn, aperitieven	per liter	27	27	27	27	27	27	27	27	27	27
140103 sigaretten pakje 20 st	per stuk	0.175	0.175	0.175	0.194	0.197	0.252	0.262	0.36	0.36	0.36
140104 sigaretten pakje 25 st	per stuk	0.175	0.175	0.175	0.194	0.197	0.252	0.262	0.36	0.36	0.36
140107 sigaretten 10 of 15 st	per stuk	0.175	0.175	0.175	0.194	0.197	0.252	0.262	0.36	0.36	0.36
322101 aardgas	MegaJoule	0	0	0	0	0	0	0	0.01	0.01	0.01
322102 butaangas	per kilogram	0	0	0	0	0	0	0	0.69	0.69	0.69
322103 propaangas	per kilogram	0	0	0	0	0	0	0	0.7	0.7	0.7
321101 elektr verwarming	Kwh	0	0	0	0	0	0	0	0.06	0.06	0.06
323101 gasoil	per liter	0	0	0	0	0	0	0	0.55	0.55	0.55
323102 andere vloeib brandstof	per liter	0	0	0	0	0	0	0	0.55	0.55	0.55
324106 aandeel collect verwarm		0	0	0	0	0	0	0	0.55	0.55	0.55
321101 elektr verlichting	Kwh	0	0	0	0	0	0	0	0.06	0.06	0.06
622101 normale benzine	per liter	11.2	11.2	12	13.85	14.67	16.72	18.45	19.5	19.5	21.15
622102 speciale benzine	per liter	11.2	11.2	12	13.85	14.67	16.72	18.45	19.5	19.5	21.15
622103 super benzine	per liter	11.2	11.2	12	13.85	14.67	16.72	18.45	19.5	19.5	21.15
622107 andere benzine	per liter	11.2	11.2	12	13.85	14.67	16.72	18.45	19.5	19.5	21.15
622108 loodvrije benzine	per liter	11.2	11.2	11	12.4	12.63	14.26	15.52	16.75	16.75	18.8
622105 diesel	per liter	5.25	5.25	6.05	8.27	8.83	10.8	11.33	11.7	11.7	11.7
324101 steenkool	per kilogram	0	0	0	0	0	0	0	0	0	0
622104 LPG	per liter	0	0	0	0	0	0	0	0	0	0
800000 scheerapparaten	per stuk	0	0	0	0	0	0	0	0	0	10
118101 klontjessuiker	per kilogram	0.6	0.6	0.6	0.6	0.6	0.6	0	0	0	0
118102 kristalsuiker	per kilogram	0.6	0.6	0.6	0.6	0.6	0.6	0	0	0	0
118103 bruine suiker	per kilogram	0.6	0.6	0.6	0.6	0.6	0.6	0	0	0	0
118104 andere suiker	per kilogram	0.6	0.6	0.6	0.6	0.6	0.6	0	0	0	0

[1] Note that for cider, kolen en LPG no excises were levied during the considered period. They are part of this and the following table because in a previous exercise we have experimented with installing excises on these goods.

Table A4.3: Consumer prices in BEF of the indicated year used to express Excises as a percentage of the consumer price

			1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
nr + naam	**eenheid**	**Bron Weekbericht NIS als er code**										
119101 koffiebonen	per kilogram	(A.1.i01)	380	264	286	254	222	221	214	227	309	300
119102 oploskoffie	per kilogram	(A.1.i02)*5	1155	1060	1045	1020	935	910	910	905	990	1050
120101 mineraal water	per liter	(A.2.1.101)	16.45	16.57	16.69	16.75	15.67	16.4	17	17.45	17.12	17.64
120102 alcoholvrije aperitieven	per liter	(A2.2.201/1.5 + A2.2.202)/2	38.66	38.935	39.08	39.18	40.5	43.05	43.22	43.95	44.7	42.355
120103 andere alcoholvr dranken	per liter	(A.2.202)	50.61	49.21	51.25	51.38	52.79	54.8	57.44	58.98	61.46	56.25
130101 tafelbier	per liter	(A.3.1.101)/0.75	24.14	24.13	24.9	25.46	29.53	31.05	32.66	33.66	33.92	32.45
130102 pils	per liter	((A.3.1.102+A.3.1.103)/2)*4	47.28	47.26	48.1	49.62	57.9	61.5	64.48	67.3	67.74	67.64
130103 ander bier	per liter	((A3.1.103)*4)*1.3	61.51	61.828	62.4	63.284	73.164	78	82.056	86.632	88.972	89.336
130205 whisky	per liter	(A3.3.302)/0.7	578.66	578.66	617.33	640	678.57	717.14	695.71	695.71	674.28	671.42
130206 cognac	per liter	((A3.3.302)/0.7)*1.37	792.77	792.77	845.74	876.8	929.64	982.48	953.12	953.12	923.77	919.85
130207 jenever	per liter	(A.3.3.301)	390	391	419	437	433	437	431	427	422	425
130208 likeuren en andere	per liter	(A.3.3.303)	740	756	796	804	875	908.57	907.14	892.85	892.85	898.57
130201 wijn	per liter	(((A.3.2.202 + A.3.2.203)/2)/0.75)*1.05	214.5	214.5	217.5	227.25	239.25	255.75	218.4	202.3	200.9	200.2
130202 cider	per liter	(A.3.4.401)*1.25	133.75	135	141.25	150	151.25	155	155	156.25	157.5	160
130203 champagne	per liter	(A.3.2.3.302)*1.97	854.98	854.98	912.11	945.6	935.75	988.94	959.39	959.39	929.84	925.9
130204 likeurwijn, aperitieven	per liter	(A.3.2.203)*2.25	281.25	281.25	288	303.75	315	337.5	321.75	288	281.25	279
140103 sigaretten pakje 20 st	per stuk	(A.4.1.1.2)/20	3.2725	3.369	3.3865	3.8595	3.9095	4.0375	4.502	4.8015	5	5.25
140104 sigaretten pakje 25 st	per stuk	(A.4.1.1.1)/25	2.808	2.92	2.9344	3.354	3.4032	3.5184	3.962	4.24	4.6	4.8
140107 sigaretten 10 of 15 st	per stuk	(A.4.1.1.2)/20	3.2725	3.369	3.3865	3.8595	3.9095	4.0375	4.502	4.8015	5	5.25
322101 aardgas	MegaJoule	(C.2.b.1.101 tem 106)/6	0.4791	0.4595	0.4476	0.4809	0.425	0.415	0.41	0.435	0.43	0.431
322102 butaangas	per kilogram	(C.2.b.2.201)	30.53	28.23	29.92	34	39.05	36.77	36.05	36.02	37.76	37.26
322103 propaangas	per kilogram	(C.2.b.2.202)	31.46	29.25	31.04	35.79	43.35	39.64	36.74	38.26	39.78	41.23
321101 elektr verwarming	Kwh	(C.2.a.07)	2.26	2.23	2.26	2.34	2.29	2.28	2.39	2.44	2.52	2.5
323101 gasoil	per liter	(C.2.c.01 tem 03)/3	8.55	7.29	7.73	9.01	11	7.46	8.43	8.38	7.67	8.41
323102 andere vloeib brandstof	per liter	(C.2.c.01 tem 03)/3	8.55	7.29	7.73	9.01	11	7.46	8.43	8.38	7.67	8.41
324106 aandeel collect verwarm		(C.2.c.01 tem 03)/3	8.55	7.29	7.73	9.01	11	7.46	8.43	8.38	7.67	8.41
321101 elektr verlichting	Kwh	(C.2.a.01 tem 07)/7	5.79	5.79	5.92	6.08	5.955	6.01	6.28	6.4	6.4	6.41
622101 normale benzine	per liter		23.7	23.7	25.5	27.7	29	27.9	28.5	30.1	30.4	33.3
622102 speciale benzine	per liter		23.7	23.7	25.5	27.7	29	27.9	28.5	30.1	30.4	33.3
622103 super benzine	per liter		24.7	24.5	26.3	29.5	30.8	30.6	31.2	33.9	34.2	36.3
622107 andere benzine	per liter		23.7	23.7	25.5	27.7	29	27.9	28.5	30.1	30.4	33.3
622108 loodvrije benzine	per liter		23.7	25.8	24.7	23.34	25.4	23	28.5	30.1	30.4	33.3
622105 diesel	per liter		17.05	16.8	17.9	18.2	20.8	22.7	24.5	25.2	24.5	25.2
324101 steenkool	per kilogram	(C.2.d.01 en 02)/2000	12.926	12.6085	12.3205	11.949	12.058	12.409	13.0645	12.9545	12.813	12.5825
622104 LPG	per liter		9.55	9.11	9.43	11.26	14.63	13.11	9.97	10.23	10.4	10.67
800000 scheerapparaten	per stuk	1 jan 1996=198										
118101 klontjessuiker	per kilogram	(A.h.01)	46.75	46.67	47.11	48	46.59	46.48	48.6	49.29	49.26	49.13
118102 kristalsuiker	per kilogram	(A.h.02)	39.56	39.8	39.91	40.26	39.03	38.83	39.06	38.79	38.68	38.47
118103 bruine suiker	per kilogram	(A.h.02)	39.56	39.8	39.91	40.26	39.03	38.83	39.06	38.79	38.68	38.47
118104 andere suiker	per kilogram	(A.h.02)	39.56	39.8	39.91	40.26	39.03	38.83	39.06	38.79	38.68	38.47

APPENDIX 5:
FUNCTIONAL FORM OF THE DEMAND SYSTEM AND PRICE CHANGES INDUCED BY THE INDIRECT TAX REFORMS

The functional form of the demand system is highly inspired by the SPIT-model of IFS-London. The model specifies budget shares and is a quadratic extension of the widely used AID-model (see Blundell, Pashardes and Weber (1993) and Baker, McKay and Symons (1990)). The functional form to be estimated for each budget share reads as:

$$w_{ih} = \alpha_i + \beta_i \log\left(\frac{y_h}{P}\right) + \lambda_i \left(\log\left(\frac{y_h}{P}\right)\right)^2 + \sum_j \gamma_{ij} \log p_j + \varepsilon_{ih} \qquad \text{(A5.1)}$$

with: $\log P = \sum_j w_{jh} \log p_j$ (the Stone price index)

and
- w_{ih} the share of expenditures on good i in the total expenditures of household h
- y_h total expenditures of household h
- p_j consumer price for good j
- β_i, λ_i total expenditure effects
- γ_{ij} price effect of price j on good i
- ε_{ih} disturbance term

We have chosen for a rather disaggregated demand system of 32 commodities. Therefore we have estimated the demand system under the restriction of weakly separable preferences. The results are summarised in the two rightmost columns of table A5.1.

Table A5.1: Price changes (1988-1993), own price elasticities and total expenditure elasticities

	Commodity	Consumer price			Elasticities	
		1988	1993	change (%)	own price	expenditure
1	Bread	1.0600	1.0600	0.0	-0.4519	0.4543
2	Meat	1.0600	1.0600	0.0	-1.1864	0.5314
3	Fish	1.0890	1.0841	-0.4	-0.4309	0.8039
4	Dairy products	1.0600	1.0600	0.0	-0.1125	0.4717
5	Oils and fats	1.0990	1.0788	-1.8	-0.2009	0.2134
6	Potatoes, vegetables, fruit	1.0703	1.0676	-0.3	-0.7275	0.5715
7	Coffee and tea	1.0972	1.0972	0.0	-0.2137	0.3825
8	Sugar and jam	1.0620	1.0600	-0.2	-0.6468	0.6891
9	Other food	1.0600	1.0600	0.0	-0.7272	0.5757
10	Soft drinks	1.3236	1.3291	0.4	-0.1481	0.6564
11	Beer	1.3337	1.4032	**5.2**	-0.8802	0.6892
12	Alcohol	2.1743	2.1831	0.4	-1.0055	0.8674
13	Wine	1.3768	1.3162	**-4.4**	-0.5597	1.1589
14	Tobacco	2.6528	2.9703	**12.0**	-0.8072	0.1439
15	Clothing	1.1881	1.1950	0.6	-0.7994	1.0621
16	Rent, tax and water	1.0131	1.0140	0.1	-0.0382	1.1830
17	Coal	1.0600	1.1122	**4.9**	-0.1220	-0.0503
18	Natural gas	1.1700	1.1950	2.1	-0.1461	0.5335
19	Electric heating	1.1700	1.1950	2.1	-0.0482	1.3088
20	Fuel	1.1700	1.1950	2.1	-0.7037	0.4419
21	Electric lighting	1.1700	1.1950	2.1	-0.1472	0.4742
22	Durables	1.2327	1.1938	**-3.2**	-0.7395	1.8031
23	Maintenance of the house	1.1030	1.1339	2.8	-0.9388	1.1453
24	Hygienics	1.0872	1.0706	-1.5	-0.1581	1.0825
25	Use of private transport	1.1038	1.0885	-1.4	-0.6992	1.1321
26	Gasoline	2.9264	3.8345	**31.0**	-0.6291	0.6587
27	Gasoil	2.0513	2.8482	**38.8**	-0.7786	0.9006
28	LPG	1.2500	1.1950	**-4.4**	-0.5474	0.8723
29	Public transport	1.0566	1.0566	0.0	-0.4319	0.7965
30	Other transport	1.0271	1.0282	0.1	-0.7266	1.2364
31	Leisure goods	1.1132	1.1256	1.1	-0.3499	1.0051
32	Services	1.0792	1.0826	0.3	-0.2254	1.0573

For ease of interpretation we have transformed the original parameters into elasticities. The elasticities are not constant, but vary with the budget shares. They have been evaluated for the average share in the budget survey. The limitation to own price elasticities follows from obvious space limitations. Most of the commodities are rather price inelastic (only two have an elasticity

exceeding unity). For the total expenditure effects we could make use of the budget survey. Since the real expenditure effect seems to be correlated with being a smoker or not and having a car or not, we have estimated the Engel curves for four different subgroups of households: car owners/smokers, car owners/non smokers, non car owners/smokers and non car owners/non smokers. We also included a white collar dummy, a dummy for higher education, the number of actives and the number of children in the household, the age of the head of the household and a dummy for the household living in a rural area. In the last column of table A5.1 we have for the sake of brevity calculated a weighted average of the total expenditure elasticities for the four subgroups. Coal is the only inferior good.

The impact on the consumer price of all changes in indirect taxes between 1988 and 1993 can be found in the third column of table A5.1. We have only calculated the direct impact of changed taxation, keeping producer prices and all other factors which might have changed the consumer price constant. The main price changes have been typed in bold.

APPENDIX 6:
COMPARISON OF THE NUMBER OF INCOME EARNERS WITHIN A HOUSEHOLD COVERED BY THE HOUSEHOLD BUDGET SURVEY AND THE CENSUS

The computations, reported in table A6.1, are taken from table 6.12 in Deboosere e.a. (1997) who themselves used the census of 1991 to construct these percentages. The reported percentages crucially depend on the age and marital status of the reference person. Despite its importance there seems to be no clear definition of whom the reference person is since the reference person offers himself to take up the responsibility to answer the questions when the people of the census announce themselves.

In table A6.1 these reference persons are then classified according to their age and marital status. Next to the obvious age classes, three marital status definitions can be distinguished. The label MAR0 refers to a household with a reference person that is married but where no kids are living in the household. When the reference person is married and has kids that are still living in the same house this is indicated with MAR+ while UNM+ refers to unmarried reference persons that still cohabitate with their kids.

Within these classes the distinction is made between households that have two or less income earners and those that have more than two income earners. Rather than percentages for the population as a whole, the census figures were reported class by class. Therefore we have tried to reconstruct them as such for the household budget survey as well. To provide these household budget survey calculations we had to assume that the reference persons of the household budget survey were appointed in the same way as those that appear in the census despite the fact that the budget survey seems to use the more objective definition to indicate reference persons. Normally one takes the principal income earner as a reference person.

If one assumes then that these definitions coincide over both surveys, the comparison between tables A6.1 and A6.2 learns that the budget survey contains to few households with more than two income earners if the results of the census are taken as the reference point.

Table A6.1: Census 1991

	MAR0	MAR+	UNM+
Age reference person between 25-29			
Two or less than two income earners	99.35	99.02	98.83
More than two income earners	0.65	0.98	1.17
Age reference person between 35-39			
Two or less than two income earners	98.24	97.60	95.45
More than two income earners	1.76	2.40	4.55
Age reference person between 45-49			
Two or less than two income earners	97.28	77.57	77.03
More than two income earners	2.72	22.43	22.97
Age reference person between 55-59			
Two or less than two income earners	97.81	63.28	64.52
More than two income earners	2.19	36.72	35.48

Table A6.2: Household Budget Survey

	MAR0	MAR+	UNM+
Age reference person between 25-29			
Two or less than two income earners	100.00	99.13	100.00
More than two income earners	0.00	0.87	0.00
Age reference person between 35-39			
Two or less than two income earners	100.00	92.44	95.11
More than two income earners	0.00	7.56	4.89
Age reference person between 45-49			
Two or less than two income earners	100.00	86.43	95.67
More than two income earners	0.00	13.57	4.33
Age reference person between 55-59			
Two or less than two income earners	100.00	78.62	100.00
More than two income earners	0.00	21.38	0.00

APPENDIX 7:
Weights used within the 15 matches

Table A7.1: Explanation of the variables used in table A7.2

1	ZE	Self-employed income
2	LA1	Highest Labour Income
3	PE1	Highest Pension
4	IN1	Highest Health Insurance Benefit
5	WE1	Highest Unemployment Benefit
6	LA2	Lowest Labour Income
7	PE2	Lowest Pension
8	IN2	Lowest Health Insurance Benefit
9	WE2	Lowest Unemployment Benefit
10	LOS1	Received Maintenance Allowance
11	LOS2	Paid Maintenance Allowance
12	LOS3	Charity Gifts
13	LOS4	Pension Savings Schemes
14	LOS5	Life-insurance Contributions
15	LOS6	Mortgage Capital Repayments
16	LOS7	Real Estate Income (house)
17	LOS8	Real Estate Income (unbuilt property)
18	LOS9	Mortgage Interest
19	GEZ1	Number of Dependent Children
20	GEZ2	Number of Children < 3 years.
21	GEZ3	Number of Disabled Dependent Children
22	GEZ4	Number of Other Dependent Persons
23	GEZ5	Number of Disabled Dependent Other Persons
24	GEZ6	Tax Unit Disabled Yes or No
25	GEZ7	Tax Units Spouse Disabled Yes or No
26	GEZ8	Spouse Died in the tax year and an Income < 68.000 Yes or No
27	GEZ9	Widow, Single Or Divorced With Dependent Children
28	GEZ10	Fiscal Couple

Table A7.2: Weights used within the 15 matches

		match0	match1	match2	match3	match4	match5	match6	match7	match8	match9	match10	match11	match12	match13	match14
1	ZE	0.035714	0	0.478395	0.390736	0.368267	0.360284	0.35542	0.35275843	0.350491	0.348912	0.347288	0.346752	0.34655	0.346367	0.346246
2	LA1	0.035714	1	0.521605	0.425788	0.401363	0.392679	0.387305	0.38440843	0.381937	0.380208	0.378402	0.37783	0.377609	0.377411	0.377279
3	PE1	0.035714	0	0	0.183476	0.172959	0.169219	0.166893	0.16564564	0.164581	0.163834	0.163051	0.162806	0.162711	0.162626	0.162569
4	IN1	0.035714	0	0	0	0	0	0	0	0.006429	0.0064	0.00637	0.00636	0.006357	0.006353	0.006351
5	WE1	0.035714	0	0	0	0	0	0	0	0	0.004518	0.004497	0.00449	0.004487	0.004485	0.004483
6	LA2	0.035714	0	0	0	0.05741	0.056166	0.055408	0.05499268	0.054639	0.054393	0.05414	0.054056	0.054025	0.053996	0.053977
7	PE2	0.035714	0	0	0	0	0	0	0.00748174	0.007434	0.0074	0.007365	0.007354	0.00735	0.007346	0.007343
8	IN2	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	WE2	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	LOS1	0.035714	0	0	0	0	0	0	0	0	0	0	0	0.000583	0.000583	0.000583
11	LOS2	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	LOS3	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00035
13	LOS4	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	LOS5	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	LOS6	0.035714	0	0	0	0	0	0	0	0	0	0	0.001522	0.001521	0.00152	0.001519
16	LOS7	0.035714	0	0	0	0	0.021653	0.02136	0.02119978	0.021063	0.020969	0.020871	0.020839	0.020826	0.020815	0.020808
17	LOS8	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	LOS9	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0.000525	0.000525
19	GEZ1	0.035714	0	0	0	0	0	0.013615	0.0135133	0.013426	0.013365	0.013297	0.013278	0.01327	0.013264	0.013259
20	GEZ2	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	GEZ3	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	GEZ4	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	GEZ5	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	GEZ6	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	GEZ7	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	GEZ8	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	GEZ9	0.035714	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	GEZ10	0.035714	0	0	0	0	0	0	0	0	0	0.004719	0.004713	0.00471	0.004708	0.004706

APPENDIX 8:
Regressions estimated on the basis of The Fiscal Unit Budget Survey Data and Imputed Fiscal Data

Each table within this appendix contains the estimated parameters of two similar regressions. The regressions are similar in the sense that they explain the same dependent variable with the same type of explanatory variables. While the type of the explanatory variables is the same, their origin differs. In one case we used the variables that were originally observed in the fiscal unit budget survey. In the other case we used the variables from the fiscal data set that were imputed on the fiscal unit budget survey by means of the described matching procedure. In principle we used all variables that were given a positive weight in the distance function to explain both the pre reform tax variable (ETAT89) and the post reform tax variable (ETAT94). An exception was made for Match0 since the matrix would not be of full rank if all variables are used. Therefore the variable, causing this problem, was left out in that case.

Next to the estimated parameters of each model and the standard deviation of these estimates, we also report the relative difference (in terms of percentage) between the estimates obtained for both models. We applied an F-test over both models to see whether the estimated parameters were statistically different. For each test we report the degrees of freedom of the numerator (DF Num), the degrees of freedom of the denominator (DF Denom), the value of the statistic itself (F-Value) and the corresponding probability value (P-Value).

At the bottom of each table one finds the result of an F-test applied on all variables, and the R-squared and the adjusted R-squared of each model.

Table A8.0-Pre: Estimated results of Match0 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.4952	0.8089	61.2	1	6378	518.23	0.0001	Highest Labour Income
	0.0110	0.0082	133.8					
ZE	0.3691	0.5927	62.3	1	6378	383.54	0.0001	Self-employed Income
	0.0092	0.0068	134.4					
PE1	0.2900	0.5184	55.9	1	6378	189.89	0.0001	Highest Pension
	0.0137	0.0094	145.9					
LA2	0.5880	0.7403	79.4	1	6378	38.51	0.0001	Lowest Labour Income
	0.0201	0.0140	143.8					
LOS7	21382.0000	22392.0000	95.5	1	6378	0.01	0.9097	Real Estate Income (house) Yes or No
	7560.9092	4711.8160	160.5					
GEZ1	-13902.0000	-33488.0000	41.5	1	6378	19.35	0.0001	Dependent Childeren
	3694.0825	2484.9334	148.7					
PE2	0.4241	0.5406	78.5	1	6378	3.35	0.0672	Lowest Pension
	0.0536	0.0342	156.7					
IN1	0.2173	0.4199	51.7	1	6378	7.52	0.0061	Highest Health Insurance Benefit
	0.0616	0.0408	151.1					
WE1	0.1530	0.5152	29.7	1	6378	69.60	0.0001	Highest Unemployment Benefit
	0.0350	0.0257	136.1					
GEZ10	-48097.0000	-64433.0000	74.6	1	6378	2.60	0.1070	Fiscal Couple Yes or No
	8646.4480	5285.1862	163.6					
LOS6	-0.1304	-0.2983	43.7	1	6378	10.43	0.0012	Mortgage Capital Repayments
	0.0334	0.0398	84.0					
LOS1	0.1807	0.4457	40.5	1	6378	7.14	0.0075	Received Maintenance Allowance
	0.0823	0.0553	148.7					
LOS9	0.0894	-0.0282	-316.9	1	6378	3.25	0.0715	Mortgage Interest
	0.0531	0.0379	140.4					
LOS3	1.9477	1.7846	109.1	1	6378	0.00	0.9330	Charity Gifts
	1.6577	1.0109	164.0					

Table A8.0-Pre (continued): Estimated results of Match0 with pre reform taxes

	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
IN2	-0.0805	0.4619	-17.4	1	6378	3.0585	0.0804	Lowest Health Insurance Benefit
	0.2529	0.1795	140.9					
WE2	-0.4219	0.2276	-185.3	1	6378	3.55	0.0597	Lowest Unemployment Benefit
	0.2911	0.1849	157.5					
GEZ2	-75962.0000	-36277.0000	209.4	1	6378	13.58	0.0002	Children <3j
	9080.7017	5791.8325	156.8					
GEZ3	-162672.0000	-28269.0000	575.4	1	6378	3.46	0.0628	Disabled Dependent Children
	61635.0000	37641.0000	163.7					
GEZ4	21465.0000	-38949.0000	-55.1	1	6378	8.6933	0.0032	Other Dependent Persons
	14383.0000	14593.0000	98.6					
GEZ5	-105933.0000	87937.0000	-120.5	1	6378	1.76	0.1847	Disabled dependent other persons
	124445.0000	76621.0000	162.4					
GEZ6	-37048.0000	13434.0000	-275.8	1	6378	1.99	0.1586	Disabled tax unit
	30481.0000	18776.0000	162.3					
GEZ7	-33018.0000	-50267.0000	65.7	1	6378	0.12	0.7278	Disabled spouse
	42243.0000	25925.0000	162.9					
GEZ8	NA	NA						Spouse died, with income < 68.000BEF
	NA	NA						
GEZ9	-28051.0000	10328.0000	-271.6	1	6378	4.3923	0.0361	Window, single, or divorced with dependent children
	15568.0000	9643.1072	161.4					
LOS2	0.6821	0.3829	178.1	1	6378	3.42	0.0646	Paid Maintenance Allowance
	0.1383	0.0842	164.2					
LOS4	0.1691	-0.0668	-253.3	1	6378	0.6174	0.4321	Pension Savings Schemes
	0.2365	0.1848	128.0					
LOS5	-0.0699	0.2567	-27.2	1	6378	1.81	0.1791	Life-Insurance Contributions
	0.1969	0.1426	138.1					
LOS8	-14116.0000	35762.0000	-39.5	1	6378	5.65	0.0175	Real Estate Income (unbuilt property) Yes or No
	17323.0000	11858.0000	146.1					
All Variables				27	6378	32.77	0.0001	
R-squared	0.6507	0.8691	74.9					
Adj. R-squared	0.6477	0.8680	74.6					

Table A8.0-Post: Estimated results of Match0 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed					
ETAT94	Budget Survey	Ipcal					
	Estimated Par.	Estimated Par.	% Difference	F-test			
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.4707	0.7632	61.7	1	6378	534.40	0.0001	Highest Labour Income
	0.0102	0.0075	135.1					
ZE	0.3348	0.5392	62.1	1	6378	380.36	0.0001	Self-employed Income
	0.0084	0.0062	135.8					
PE1	0.2637	0.4735	55.7	1	6378	189.90	0.0001	Highest Pension
	0.0126	0.0085	147.3					
LA2	0.5349	0.6751	79.2	1	6378	38.67	0.0001	Lowest Labour Income
	0.0186	0.0128	145.2					
LOS7	19504.0000	20574.0000	94.8	1	6378	0.02	0.8960	Real Estate Income (house) Yes or No
	6965.2533	4298.9880	162.0					
GEZ1	-17621.0000	-37161.0000	47.4	1	6378	22.83	0.0001	Dependent Childeren
	3403.0590	2267.2148	150.1					
PE2	0.4258	0.5302	80.3	1	6378	3.20	0.0739	Lowest Pension
	0.0494	0.0312	158.3					
IN1	0.2068	0.3923	52.7	1	6378	7.47	0.0063	Highest Health Insurance Benefit
	0.0568	0.0372	152.6					
WE1	0.1550	0.4897	31.6	1	6378	70.53	0.0001	Highest Unemployment Benefit
	0.0322	0.0235	137.4					
GEZ10	-67668.0000	-81539.0000	83.0	1	6378	2.22	0.1364	Fiscal Couple Yes or No
	7965.2722	4822.1221	165.2					
LOS6	-0.1105	-0.2369	46.6	1	6378	7.05	0.0080	Mortgage Capital Repayments
	0.0308	0.0363	84.8					
LOS1	0.1608	0.3917	41.0	1	6378	6.43	0.0112	Received Maintenance Allowance
	0.0758	0.0505	150.2					
LOS9	0.0840	-0.0302	-278.4	1	6378	3.63	0.0569	Mortgage Interest
	0.0490	0.0345	141.7					
LOS3	2.0668	1.9054	108.5	1	6378	0.00	0.9279	Charity Gifts
	1.5271	0.9223	165.6					

Table A8.0-Post (continued): Estimated results of Match0 with post reform taxes

	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
IN2	-0.0746	0.4450	-16.8	1	6378	3.33	0.0681	Lowest Health Insurance Benefit
	0.2330	0.1638	142.2					
WE2	-0.2832	0.3126	-90.6	1	6378	3.54	0.0600	Lowest Unemployment Benefit
	0.2682	0.1687	159.0					
GEZ2	-67861.0000	-30333.0000	223.7	1	6378	14.39	0.0002	Children <3j
	8365.3150	5284.3783	158.3					
GEZ3	-161858.0000	-35645.0000	454.1	1	6378	3.62	0.0572	Disabled Dependent Children
	56780.0000	34343.0000	165.3					
GEZ4	20199.0000	-41177.0000	-49.1	1	6378	10.6761	0.0011	Other Dependent Persons
	13250.0000	13315.0000	99.5					
GEZ5	-111058.0000	74260.0000	-149.6	1	6378	1.90	0.1676	Disabled dependent other persons
	114641.0000	69908.0000	164.0					
GEZ6	-34589.0000	12076.0000	-286.4	1	6378	2.01	0.1560	Disabled tax unit
	28080.0000	17131.0000	163.9					
GEZ7	-15457.0000	-37262.0000	41.5	1	6378	0.23	0.6321	Disabled spouse
	38915.0000	23654.0000	164.5					
GEZ8	NA	NA						Spouse died, with income < 68.000BEF
	NA	NA						
GEZ9	-30283.0000	6542.7938	-462.8	1	6378	4.79	0.0287	Window, single, or divorced with dependent children
	14341.0000	8798.2218	163.0					
LOS2	0.6020	0.3161	190.4	1	6378	3.70	0.0546	Paid Maintenance Allowance
	0.1274	0.0768	165.8					
LOS4	0.1797	-0.0300	-599.8	1	6378	0.58	0.4467	Pension Savings Schemes
	0.2179	0.1686	129.2					
LOS5	0.0392	0.3448	11.4	1	6378	1.87	0.1712	Life-Insurance Contributions
	0.1814	0.1301	139.4					
LOS8	-10621.0000	33354.0000	-31.8	1	6378	5.20	0.0226	Real Estate Income (unbuilt property) Yes or No
	15958.0000	10819.0000	147.5					
All Variables				27	6378	33.55	0.0001	
R-squared	0.6509	0.8717	74.7					
Adj. R-squared	0.6480	0.8706	74.4					

Table A8.1-Pre: Estimated results of Match1 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.5528	0.5529	100.0	1	6430	0.00	0.9940	Highest Income Labour
	0.0106	0.0106	100.1					
All Variables				1	6430	0.00	0.9940	
R-squared	0.4591	0.4595	99.9					
Adj. R-squared	0.4589	0.4593	99.9					

Table A8.1-Post: Estimated results of Match1 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.4934	0.4935	100.0	1	6430	0.00	0.9940	Highest Income Labour
	0.0097	0.0097	100.1					
All Variables				1	6430	0.00	0.9940	
R-squared	0.4472	0.4476	99.9					
Adj. R-squared	0.4471	0.4474	99.9					

Table A8.2-Pre: Estimated results of Match2 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.5821	0.5845	99.6	1	6428	0.03	0.8603	Highest Labour Income
	0.0097	0.0098	99.3					
ZE	0.3224	0.3291	98.0	1	6428	0.23	0.6308	Self-employed Income
	0.0099	0.0100	98.9					
All Variables				2	6428	0.12	0.8872	
R-squared	0.5613	0.5589	100.4					
Adj. R-squared	0.5611	0.5586	100.4					

Table A8.2-Post: Estimated results of Match2 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.5241	0.5261	99.6	1	6428	0.02	0.8782	Highest Labour Income
	0.0091	0.0092	99.3					
ZE	0.2756	0.2815	97.9	1	6428	0.20	0.6574	Self-employed Income
	0.0093	0.0094	98.9					
All Variables				2	6428	0.10	0.9038	
R-squared	0.5365	0.5339	100.5					
Adj. R-squared	0.5362	0.5336	100.5					

Table A8.3-Pre: Estimated results of Match3 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.8723	0.8844	98.6	1	6426	0.82	0.3645	Highest Labour Income
	0.0095	0.0095	99.4					
ZE	0.4869	0.5027	96.9	1	6426	1.72	0.1900	Self-employed Income
	0.0085	0.0086	99.0					
PE1	0.4781	0.4947	96.6	1	6426	0.85	0.3565	Highest Pension
	0.0127	0.0128	98.9					
All Variables				3	6426	0.68	0.5623	
R-squared	0.7544	0.7570	99.7					
Adj. R-squared	0.7542	0.7568	99.7					

Table A8.3-Post: Estimated results of Match3 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.8070	0.8183	98.6	1	6426	0.85	0.3566	Highest Labour Income
	0.0086	0.0086	99.5					
ZE	0.4396	0.4541	96.8	1	6426	1.76	0.1841	Self-employed Income
	0.0077	0.0078	99.1					
PE1	0.4353	0.4506	96.6	1	6426	0.87	0.3514	Highest Pension
	0.0115	0.0116	99.0					
All Variables				3	6426	0.70	0.5510	
R-squared	0.7609	0.7637	99.6					
Adj. R-squared	0.7607	0.7634	99.6					

Table A8.4-Pre: Estimated results of Match4 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7505	0.7695	97.5	1	6424	2.50	0.1140	Highest Labour Income
	0.0084	0.0085	98.2					
ZE	0.5068	0.5241	96.7	1	6424	2.93	0.0871	Self-employed Income
	0.0071	0.0072	98.1					
PE1	0.5084	0.5302	95.9	1	6424	2.05	0.1527	Highest Pension
	0.0106	0.0109	97.5					
LA2	0.7233	0.7299	99.1	1	6424	0.08	0.7801	Lowest Labour Income
	0.0166	0.0169	97.8					
All Variables				4	6424	1.17	0.3236	
R-squared	0.8345	0.8329	100.2					
Adj. R-squared	0.8343	0.8327	100.2					

Table A8.4-Post: Estimated results of Match4 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.6952	0.7119	97.6	1	6424	2.29	0.1306	Highest Labour Income
	0.0078	0.0079	98.3					
ZE	0.4556	0.4712	96.7	1	6424	2.78	0.0956	Self-employed Income
	0.0065	0.0067	98.2					
PE1	0.4597	0.4791	95.9	1	6424	1.92	0.1659	Highest Pension
	0.0098	0.0101	97.6					
LA2	0.6294	0.6367	98.9	1	6424	0.11	0.7411	Lowest Labour Income
	0.0153	0.0157	97.9					
All Variables				4	6424	1.11	0.3519	
R-squared	0.8302	0.8289	100.2					
Adj. R-squared	0.83	0.8287	100.2					

Table A8.5-Pre: Estimated results of Match5 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7405	0.7600	97.4	1	6422	2.55	0.1103	Highest Labour Income
	0.0085	0.0087	98.1					
ZE	0.5080	0.5252	96.7	1	6422	2.77	0.0963	Self-employed Income
	0.0072	0.0074	97.4					
PE1	0.5100	0.5309	96.1	1	6422	1.78	0.1826	Highest Pension
	0.0109	0.0113	97.0					
LA2	0.7410	0.7474	99.1	1	6422	0.07	0.7905	Lowest Labour Income
	0.0169	0.0174	97.3					
LOS7	-2146.6777	1729.0229	-124.2	1	6422	0.18	0.6682	Real Estate Income (house) (yes=1)
	6310.9381	6476.5451	97.4					
All Variables				5	6422	1.01	0.4109	
R-squared	0.8295	0.8274	100.3					
Adj. R-squared	0.8292	0.8271	100.3					

Table A8.5-Post: Estimated results of Match5 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.6866	0.7041	97.5	1	6422	2.41	0.1207	Highest Labour Income
	0.0079	0.0080	98.1					
ZE	0.4573	0.4731	96.7	1	6422	2.74	0.0977	Self-employed Income
	0.0067	0.0068	97.4					
PE1	0.4667	0.4856	96.1	1	6422	1.69	0.1934	Highest Pension
	0.0101	0.0104	97.0					
LA2	0.6454	0.6524	98.9	1	6422	0.10	0.7525	Lowest Labour Income
	0.0156	0.0161	97.3					
LOS7	-9424.8420	-5625.0392	167.6	1	6422	0.21	0.6494	Real Estate Income (house) (yes=1)
	5834.0670	5985.7727	97.5					
All Variables				5	6422	1.00	0.4166	
R-squared	0.8247	0.8227	100.2					
Adj. R-squared	0.8245	0.8224	100.3					

Table A8.6-Pre: Estimated results of Match6 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7563	0.7839	96.5	1	6420	4.99	0.0255	Highest Labour Income
	0.0087	0.0088	98.9					
ZE	0.5153	0.5376	95.9	1	6420	4.61	0.0319	Self-employed Income
	0.0073	0.0074	98.5					
PE1	0.4943	0.5057	97.7	1	6420	0.52	0.4689	Highest Pension
	0.0110	0.0113	97.3					
LA2	0.7671	0.7846	97.8	1	6420	0.53	0.4654	Lowest Labour Income
	0.0168	0.0172	98.0					
LOS7	3808.3146	9122.0831	41.7	1	6420	0.35	0.5565	Real Estate Income (house) (yes=1)
	6337.8212	6441.5560	98.4					
GEZ1	-13743.0000	-25909.0000	53.0	1	6420	8.31	0.0040	Dependent Childeren
	2846.1327	3117.6814	91.3					
All Variables				6	6420	2.31	0.0313	
R-squared	0.8355	0.8372	99.8					
Adj. R-squared	0.8352	0.8369	99.8					

Table A8.6-Post: Estimated results of Match6 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7077	0.7338	96.4	1	6420	5.49	0.0191	Highest Labour Income
	0.0079	0.0079	99.6					
ZE	0.4676	0.4887	95.7	1	6420	5.09	0.0241	Self-employed Income
	0.0066	0.0066	99.2					
PE1	0.4472	0.4548	98.3	1	6420	0.29	0.5904	Highest Pension
	0.0099	0.0101	98.0					
LA2	0.6685	0.6892	97.0	1	6420	0.92	0.3387	Lowest Labour Income
	0.0152	0.0154	98.7					
LOS7	-179.7913	5355.1232	-3.4	1	6420	0.46	0.4968	Real Estate Income (house) (yes=1)
	5730.8022	5786.2398	99.0					
GEZ1	-19819.0000	-33473.0000	59.2	1	6420	12.89	0.0003	Dependent Childeren
	2573.5380	2800.5115	91.9					
All Variables				6	6420	3.13	0.0046	
R-squared	0.8378	0.8416	99.5					
Adj. R-squared	0.8375	0.8413	99.5					

Table A8.7-Pre: Estimated results of Match7 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7545	0.7823	96.4	1	6418	5.44	0.0198	Highest Labour Income
	0.0084	0.0085	98.9					
ZE	0.5129	0.5351	95.9	1	6418	4.88	0.0272	Self-employed Income
	0.0070	0.0071	98.5					
PE1	0.4563	0.4707	96.9	1	6418	0.88	0.3484	Highest Pension
	0.0107	0.0110	97.5					
LA2	0.7671	0.7848	97.7	1	6418	0.58	0.4456	Lowest Labour Income
	0.0162	0.0165	98.1					
LOS7	1562.7082	6292.0718	24.8	1	6418	0.29	0.5872	Real Estate Income (house) (yes=1)
	6109.5444	6208.8414	98.4					
GEZ1	-14388.0000	-25702.0000	56.0	1	6418	7.69	0.0056	Dependent Childeren
	2743.7396	3017.6016	90.9					
PE2	0.4081	0.4219	96.7	1	6418	0.04	0.8322	Lowest Pension
	0.0459	0.0467	98.3					
All Variables				7	6418	2.00	0.0519	
R-squared	0.8457	0.8475	99.8					
Adj. R-squared	0.8454	0.8471	99.8					

Table A8.7-Post: Estimated results of Match7 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7063	0.7328	96.4	1	6418	6.08	0.0137	Highest Labour Income
	0.0076	0.0076	99.6					
ZE	0.4657	0.4868	95.7	1	6418	5.47	0.0194	Self-employed Income
	0.0064	0.0064	99.2					
PE1	0.4143	0.4246	97.6	1	6418	0.55	0.4589	Highest Pension
	0.0097	0.0099	98.3					
LA2	0.6686	0.6895	97.0	1	6418	1.00	0.3173	Lowest Labour Income
	0.0147	0.0149	98.8					
LOS7	-2143.6409	2800.3529	-76.5	1	6418	0.40	0.5294	Real Estate Income (house) (yes=1)
	5532.9610	5582.7874	99.1					
GEZ1	-20187.0000	-33314.0000	60.6	1	6418	12.73	0.0004	Dependent Childeren
	2484.8013	2713.3288	91.6					
PE2	0.3740	0.3834	97.6	1	6418	0.03	0.8737	Lowest Pension
	0.0415	0.0420	99.0					
All Variables				7	6418	2.76	0.0073	
R-squared	0.8476	0.8515	99.5					
Adj. R-squared	0.8473	0.8512	99.5					

Table A8.8-Pre: Estimated results of Match8 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7638	0.7935	96.3	1	6416	6.35	0.0118	Highest Labour Income
	0.0083	0.0083	99.6					
ZE	0.5213	0.5408	96.4	1	6416	3.99	0.0459	Self-employed Income
	0.0069	0.0069	99.7					
PE1	0.4717	0.4888	96.5	1	6416	1.26	0.2613	Highest Pension
	0.0107	0.0109	98.2					
LA2	0.7543	0.7733	97.5	1	6416	0.71	0.3985	Lowest Labour Income
	0.0158	0.0160	98.7					
LOS7	228.7167	7164.6803	3.2	1	6416	0.67	0.4126	Real Estate Income (house) (yes=1)
	5944.0725	6027.0764	98.6					
GEZ1	-18748.0000	-29368.0000	63.8	1	6416	7.18	0.0074	Dependent Childeren
	2674.1165	2925.4499	91.4					
PE2	0.4152	0.4272	97.2	1	6416	0.04	0.8491	Lowest Pension
	0.0446	0.0451	98.8					
IN1	0.2615	0.3552	73.6	1	6416	3.84	0.0500	Highest Health Insurance Benefit
	0.0325	0.0351	92.7					
All Variables				8	6416	2.02	0.0403	
R-squared	0.8509	0.8539	99.6					
Adj. R-squared	0.8505	0.8535	99.6					

Table A8.8-Post: Estimated results of Match8 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7147	0.7433	96.1	1	6416	7.13	0.0076	Highest Labour Income
	0.0076	0.0076	100.3					
ZE	0.4755	0.4944	96.2	1	6416	4.52	0.0336	Self-employed Income
	0.0063	0.0063	100.3					
PE1	0.4287	0.4420	97.0	1	6416	0.91	0.3400	Highest Pension
	0.0098	0.0099	98.8					
LA2	0.6609	0.6822	96.9	1	6416	1.09	0.2965	Lowest Labour Income
	0.0144	0.0145	99.3					
LOS7	-3779.0940	2657.1219	-142.2	1	6416	0.70	0.4039	Real Estate Income (house) (yes=1)
	5432.1174	5471.5514	99.3					
GEZ1	-23306.0000	-35674.0000	65.3	1	6416	11.74	0.0006	Dependent Childeren
	2443.7984	2655.8066	92.0					
PE2	0.3806	0.3888	97.9	1	6416	0.02	0.8877	Lowest Pension
	0.0407	0.0410	99.5					
IN1	0.2382	0.3218	74.0	1	6416	3.69	0.0549	Highest Health Insurance Benefit
	0.0297	0.0318	93.3					
All Variables				8	6416	2.59	0.0079	
R-squared	0.8512	0.8561	99.4					
Adj. R-squared	0.8508	0.8557	99.4					

Table A8.9-Pre: Estimated results of Match9 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7844	0.8311	94.4	1	6414	15.01	0.0001	Highest Labour Income
	0.0085	0.0085	99.4					
ZE	0.5368	0.5655	94.9	1	6414	8.45	0.0037	Self-employed Income
	0.0070	0.0070	100.9					
PE1	0.5010	0.5343	93.8	1	6414	4.49	0.0340	Highest Pension
	0.0111	0.0111	99.7					
LA2	0.7629	0.7892	96.7	1	6414	1.43	0.2323	Lowest Labour Income
	0.0156	0.0156	100.1					
LOS7	2881.2350	10458.0000	27.6	1	6414	0.84	0.3604	Real Estate Income (house) (yes=1)
	5867.6500	5848.2358	100.3					
GEZ1	-22063.0000	-36483.0000	60.5	1	6414	13.51	0.0002	Dependent Childeren
	2658.4909	2885.2826	92.1					
PE2	0.4262	0.4438	96.1	1	6414	0.08	0.7776	Lowest Pension
	0.0440	0.0438	100.4					
IN1	0.2864	0.3926	72.9	1	6414	5.12	0.0236	Highest Health Insurance Benefit
	0.0322	0.0342	94.0					
WE1	0.2453	0.4594	53.4	1	6414	22.82	0.0001	Highest Unemployment Benefit
	0.0285	0.0346	82.6					
All Variables				9	6414	4.45	0.0001	
R-squared	0.8554	0.8627	99.2					
Adj. R-squared	0.8549	0.8623	99.1					

Table A8.9-Post: Estimated results of Match9 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7338	0.7791	94.2	1	6414	17.08	0.0001	Highest Labour Income
	0.0077	0.0077	100.3					
ZE	0.4901	0.5182	94.6	1	6414	9.76	0.0018	Self-employed Income
	0.0064	0.0063	101.9					
PE1	0.4558	0.4849	94.0	1	6414	4.15	0.0416	Highest Pension
	0.0101	0.0101	100.6					
LA2	0.6695	0.6984	95.9	1	6414	2.08	0.1490	Lowest Labour Income
	0.0142	0.0141	101.1					
LOS7	-1790.7078	5219.7471	-34.3	1	6414	0.87	0.3518	Real Estate Income (house) (yes=1)
	5357.2756	5289.2694	101.3					
GEZ1	-26505.0000	-42692.0000	62.1	1	6414	20.63	0.0001	Dependent Childeren
	2427.2525	2609.5112	93.0					
PE2	0.3915	0.4051	96.6	1	6414	0.06	0.8096	Lowest Pension
	0.0401	0.0396	101.3					
IN1	0.2622	0.3580	73.3	1	6414	5.04	0.0247	Highest Health Insurance Benefit
	0.0294	0.0309	94.9					
WE1	0.2276	0.4342	52.4	1	6414	25.76	0.0001	Highest Unemployment Benefit
	0.0261	0.0313	83.4					
All Variables				9	6414	5.45	0.0001	
R-squared	0.8560	0.8658	98.9					
Adj. R-squared	0.8555	0.8655	98.8					

Table A8.10-Pre: Estimated results of Match10 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7983	0.8472	94.2	1	6412	17.02	0.0001	Highest Labour Income
	0.0084	0.0084	100.6					
ZE	0.5503	0.5800	94.9	1	6412	9.12	0.0025	Self-employed Income
	0.0070	0.0069	102.5					
PE1	0.5205	0.5622	92.6	1	6412	7.20	0.0073	Highest Pension
	0.0110	0.0110	100.4					
LA2	0.8092	0.8406	96.3	1	6412	2.01	0.1559	Lowest Labour Income
	0.0158	0.0155	102.1					
LOS7	16356.0000	25324.0000	64.6	1	6412	1.19	0.2749	Real Estate Income (house) (yes=1)
	5849.1436	5763.5030	101.5					
GEZ1	-14164.0000	-23791.0000	59.5	1	6412	5.68	0.0171	Dependent Childeren
	2757.8020	2949.4281	93.5					
PE2	0.5196	0.5651	91.9	1	6412	0.54	0.4609	Lowest Pension
	0.0439	0.0433	101.3					
IN1	0.3189	0.4636	68.8	1	6412	9.56	0.0020	Highest Health Insurance Benefit
	0.0317	0.0344	92.1					
WE1	0.2866	0.5154	55.6	1	6412	27.14	0.0001	Highest Unemployment Benefit
	0.0282	0.0337	83.7					
GEZ10	-68556.0000	-83067.0000	82.5	1	6412	2.60	0.1069	Fiscal Couple Yes or No
	6483.4186	6241.0036	103.9					
All Variables				10	6412	4.38	0.0001	
R-squared	0.8615	0.8712	98.9					
Adj. R-squared	0.8611	0.8708	98.9					

Table A8.10-Post: Estimated results of Match10 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7504	0.7992	93.9	1	6412	21.53	0.0001	Highest Labour Income
	0.0075	0.0073	102.7					
ZE	0.5049	0.5347	94.4	1	6412	11.68	0.0006	Self-employed Income
	0.0063	0.0060	104.7					
PE1	0.4753	0.5150	92.3	1	6412	8.32	0.0039	Highest Pension
	0.0099	0.0096	102.5					
LA2	0.7230	0.7595	95.2	1	6412	3.44	0.0638	Lowest Labour Income
	0.0142	0.0136	104.3					
LOS7	14881.0000	24037.0000	61.9	1	6412	1.58	0.2090	Real Estate Income (house) (yes=1)
	5244.1237	5060.2689	103.6					
GEZ1	-18479.0000	-28694.0000	64.4	1	6412	8.14	0.0043	Dependent Childeren
	2472.5423	2589.5535	95.5					
PE2	0.5001	0.5515	90.7	1	6412	0.88	0.3473	Lowest Pension
	0.0394	0.0381	103.4					
IN1	0.2997	0.4443	67.5	1	6412	12.14	0.0005	Highest Health Insurance Benefit
	0.0284	0.0302	94.1					
WE1	0.2726	0.5000	54.5	1	6412	34.19	0.0001	Highest Unemployment Benefit
	0.0253	0.0296	85.4					
GEZ10	-80444.0000	-99522.0000	80.8	1	6412	5.70	0.0170	Fiscal Couple Yes or No
	5812.7909	5479.5072	106.1					
All Variables				10	6412	5.81	0.0001	
R-squared	0.8666	0.8811	98.4					
Adj. R-squared	0.8662	0.8807	98.4					

Table A8.11-Pre: Estimated results of Match11 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7980	0.8525	93.6	1	6410	21.37	0.0001	Highest Labour Income
	0.0085	0.0082	102.9					
ZE	0.5495	0.5772	95.2	1	6410	8.03	0.0046	Self-employed Income
	0.0070	0.0067	104.6					
PE1	0.5201	0.5493	94.7	1	6410	3.58	0.0586	Highest Pension
	0.0110	0.0108	101.6					
LA2	0.8092	0.8411	96.2	1	6410	2.12	0.1456	Lowest Labour Income
	0.0158	0.0152	104.0					
LOS7	16292.0000	39374.0000	41.4	1	6410	7.78	0.0053	Real Estate Income (house) (yes=1)
	5890.9527	5814.2528	101.3					
GEZ1	-14296.0000	-19973.0000	71.6	1	6410	2.00	0.1577	Dependent Childeren
	2761.7186	2917.9205	94.6					
PE2	0.5151	0.5626	91.6	1	6410	0.60	0.4394	Lowest Pension
	0.0439	0.0430	102.0					
IN1	0.3173	0.4635	68.5	1	6410	9.95	0.0016	Highest Health Insurance Benefit
	0.0317	0.0338	93.7					
WE1	0.2861	0.5245	54.5	1	6410	30.05	0.0001	Highest Unemployment Benefit
	0.0282	0.0331	85.0					
GEZ10	-68024.0000	-80909.0000	84.1	1	6410	2.09	0.1487	Fiscal Couple Yes or No
	6479.5494	6133.2045	105.6					
LOS6	0.0108	-0.8971	-1.2	1	6410	101.88	0.0001	Mortgage Capital Repayments
	0.0256	0.0862	29.7					
All Variables				11	6410	13.24	0.0001	
R-squared	0.8618	0.8758	98.4					
Adj. R-squared	0.8613	0.8753	98.4					

Table A8.11-Post: Estimated results of Match11 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7502	0.8031	93.4	1	6410	25.46	0.0001	Highest Labour Income
	0.0076	0.0072	104.6					
ZE	0.5044	0.5326	94.7	1	6410	10.56	0.0012	Self-employed Income
	0.0063	0.0059	106.4					
PE1	0.4754	0.5053	94.1	1	6410	4.77	0.0291	Highest Pension
	0.0099	0.0095	103.3					
LA2	0.7239	0.7605	95.2	1	6410	3.52	0.0606	Lowest Labour Income
	0.0142	0.0134	105.7					
LOS7	14649.0000	34595.0000	42.3	1	6410	7.34	0.0068	Real Estate Income (house) (yes=1)
	5283.2728	5128.7693	103.0					
GEZ1	-18591.0000	-25893.0000	71.8	1	6410	4.18	0.0410	Dependent Childeren
	2476.8341	2573.9062	96.2					
PE2	0.4961	0.5502	90.2	1	6410	0.98	0.3222	Lowest Pension
	0.0393	0.0379	103.7					
IN1	0.2990	0.4458	67.1	1	6410	12.70	0.0004	Highest Health Insurance Benefit
	0.0284	0.0298	95.2					
WE1	0.2726	0.5073	53.7	1	6410	36.92	0.0001	Highest Unemployment Benefit
	0.0253	0.0292	86.4					
GEZ10	-80160.0000	-97719.0000	82.0	1	6410	4.89	0.0270	Fiscal Couple Yes or No
	5811.1530	5410.1176	107.4					
LOS6	0.0080	-0.6839	-1.2	1	6410	75.84	0.0001	Mortgage Capital Repayments
	0.0229	0.0761	30.2					
All Variables				11	6410	12.18	0.0001	
R-squared	0.8669	0.8842	98.0					
Adj. R-squared	0.8664	0.8838	98.0					

Table A8.12-Pre: Estimated results of Match12 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.8008	0.8541	93.8	1	6408	20.38	0.0001	Highest Labour Income
	0.0085	0.0082	103.0					
ZE	0.5510	0.5781	95.3	1	6408	7.71	0.0055	Self-employed Income
	0.0070	0.0067	104.6					
PE1	0.5229	0.5513	94.9	1	6408	3.37	0.0665	Highest Pension
	0.0110	0.0108	101.6					
LA2	0.8085	0.8411	96.1	1	6408	2.21	0.1372	Lowest Labour Income
	0.0158	0.0152	103.9					
LOS7	16840.0000	39154.0000	43.0	1	6408	7.29	0.0069	Real Estate Income (house) (yes=1)
	5881.0123	5805.6422	101.3					
GEZ1	-15664.0000	-19997.0000	78.3	1	6408	1.16	0.2815	Dependent Childeren
	2774.5931	2913.5641	95.2					
PE2	0.5126	0.5631	91.0	1	6408	0.68	0.4103	Lowest Pension
	0.0438	0.0429	102.0					
IN1	0.3215	0.4654	69.1	1	6408	9.67	0.0019	Highest Health Insurance Benefit
	0.0316	0.0338	93.6					
WE1	0.2865	0.5287	54.2	1	6408	31.08	0.0001	Highest Unemployment Benefit
	0.0281	0.0331	84.9					
GEZ10	-64821.0000	-79995.0000	81.0	1	6408	2.88	0.0895	Fiscal Couple Yes or No
	6503.4726	6125.8771	106.2					
LOS6	0.0106	-0.8941	-1.2	1	6408	101.48	0.0001	Mortgage Capital Repayments
	0.0255	0.0861	29.6					
LOS1	0.2774	0.4936	56.2	1	6408	2.37	0.1237	Received Maintenance Allowance
	0.0664	0.1237	53.7					
All Variables				12	6408	12.20	0.0001	
R-squared	0.8624	0.8762	98.4					
Adj. R-squared	0.8619	0.8757	98.4					

Table A8.12-Post: Estimated results of Match12 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT94	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7527	0.8045	93.6	1	6408	24.30	0.0001	Highest Labour Income
	0.0076	0.0072	104.7					
ZE	0.5057	0.5334	94.8	1	6408	10.16	0.0014	Self-employed Income
	0.0063	0.0059	106.4					
PE1	0.4778	0.5069	94.3	1	6408	4.48	0.0342	Highest Pension
	0.0099	0.0096	103.3					
LA2	0.7233	0.7605	95.1	1	6408	3.64	0.0564	Lowest Labour Income
	0.0142	0.0134	105.6					
LOS7	15110.0000	34364.0000	44.0	1	6408	6.86	0.0088	Real Estate Income (house) (yes=1)
	5273.6750	5121.2997	103.0					
GEZ1	-19825.0000	-25920.0000	76.5	1	6408	2.90	0.0885	Dependent Childeren
	2488.0585	2570.1265	96.8					
PE2	0.4940	0.5507	89.7	1	6408	1.08	0.2979	Lowest Pension
	0.0393	0.0379	103.7					
IN1	0.3027	0.4475	67.7	1	6408	12.37	0.0004	Highest Health Insurance Benefit
	0.0284	0.0298	95.2					
WE1	0.2730	0.5109	53.4	1	6408	38.03	0.0001	Highest Unemployment Benefit
	0.0252	0.0292	86.3					
GEZ10	-77229.0000	-96870.0000	79.7	1	6408	6.10	0.0135	Fiscal Couple Yes or No
	5831.8533	5403.7867	107.9					
LOS6	0.0079	-0.6813	-1.2	1	6408	75.45	0.0001	Mortgage Capital Repayments
	0.0229	0.0760	30.1					
LOS1	0.2500	0.4286	58.3	1	6408	2.06	0.1508	Received Maintenance Allowance
	0.0595	0.1091	54.5					
All Variables				12	6408	11.20	0.0001	
R-squared	0.8675	0.8846	98.1					
Adj. R-squared	0.867	0.8841	98.1					

Table A8.13-Pre: Estimated results of Match13 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed						
ETAT89	Budget Survey	Ipcal						
	Estimated Par.	Estimated Par.	% Difference	F-test				
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.8046	0.8492	94.8	1	6406	13.72	0.0002	Highest Labour Income
	0.0086	0.0084	103.1					
ZE	0.5583	0.5715	97.7	1	6406	1.71	0.1908	Self-employed Income
	0.0073	0.0070	105.0					
PE1	0.5190	0.5489	94.5	1	6406	3.70	0.0544	Highest Pension
	0.0111	0.0109	101.9					
LA2	0.8205	0.8286	99.0	1	6406	0.13	0.7157	Lowest Labour Income
	0.0162	0.0155	104.9					
LOS7	24198.0000	36146.0000	66.9	1	6406	1.96	0.1613	Real Estate Income (house) (yes=1)
	6105.5074	5956.5643	102.5					
GEZ1	-14268.0000	-21234.0000	67.2	1	6406	2.92	0.0878	Dependent Childeren
	2803.3104	2964.4296	94.6					
PE2	0.5136	0.5610	91.5	1	6406	0.59	0.4429	Lowest Pension
	0.0441	0.0432	102.0					
IN1	0.3220	0.4563	70.6	1	6406	8.30	0.0040	Highest Health Insurance Benefit
	0.0319	0.0340	93.7					
WE1	0.2893	0.5312	54.5	1	6406	30.49	0.0001	Highest Unemployment Benefit
	0.0283	0.0334	84.9					
GEZ10	-65885.0000	-77947.0000	84.5	1	6406	1.79	0.1807	Fiscal Couple Yes or No
	6558.7586	6178.8240	106.1					
LOS6	0.0533	-1.1249	-4.7	1	6406	142.10	0.0001	Mortgage Capital Repayments
	0.0275	0.0949	29.0					
LOS1	0.2824	0.4909	57.5	1	6406	2.17	0.1403	Received Maintenance Allowance
	0.0669	0.1246	53.7					
LOS9	-0.1920	0.1614	-119.0	1	6406	36.47	0.0001	Mortgage Interest
	0.0429	0.0397	108.0					
All Variables				13	6406	15.19	0.0001	
R-squared	0.8604	0.8744	98.4					
Adj. R-squared	0.8598	0.8739	98.4					

Table A8.13-Post: Estimated results of Match13 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed					
ETAT94	Budget Survey	Ipcal					
	Estimated Par.	Estimated Par.	% Difference	F-test			
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7569	0.8020	94.4	1	6406	18.19	0.0001	Highest Labour Income
	0.0076	0.0073	104.8					
ZE	0.5113	0.5279	96.8	1	6406	3.52	0.0607	Self-employed Income
	0.0065	0.0061	106.7					
PE1	0.4757	0.5059	94.0	1	6406	4.90	0.0269	Highest Pension
	0.0098	0.0095	103.5					
LA2	0.7350	0.7528	97.6	1	6406	0.82	0.3654	Lowest Labour Income
	0.0144	0.0135	106.7					
LOS7	21359.0000	32465.0000	65.8	1	6406	2.19	0.1385	Real Estate Income (house) (yes=1)
	5409.0197	5190.6557	104.2					
GEZ1	-18800.0000	-26707.0000	70.4	1	6406	4.87	0.0274	Dependent Childeren
	2483.5219	2583.2565	96.1					
PE2	0.4957	0.5497	90.2	1	6406	0.99	0.3191	Lowest Pension
	0.0391	0.0377	103.7					
IN1	0.3051	0.4417	69.1	1	6406	11.12	0.0009	Highest Health Insurance Benefit
	0.0283	0.0297	95.3					
WE1	0.2785	0.5162	54.0	1	6406	38.24	0.0001	Highest Unemployment Benefit
	0.0251	0.0291	86.3					
GEZ10	-78616.0000	-95656.0000	82.2	1	6406	4.63	0.0315	Fiscal Couple Yes or No
	5810.5661	5384.3367	107.9					
LOS6	0.0469	-0.8600	-5.5	1	6406	110.61	0.0001	Mortgage Capital Repayments
	0.0244	0.0827	29.5					
LOS1	0.2558	0.4276	59.8	1	6406	1.93	0.1650	Received Maintenance Allowance
	0.0593	0.1086	54.6					
LOS9	-0.1683	0.1067	-157.7	1	6406	28.58	0.0001	Mortgage Interest
	0.0380	0.0346	109.8					
All Variables				13	6406	13.74	0.0001	
R-squared	0.8683	0.8854	98.1					
Adj. R-squared	0.8678	0.885	98.1					

Table A8.14-Pre: Estimated results of Match14 with pre reform taxes

Dependent Variable	Fiscal Unit	Imputed					
ETAT89	Budget Survey	Ipcal					
	Estimated Par.	Estimated Par.	% Difference	F-test			
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.8049	0.8490	94.8	1	6404	13.30	0.0003	Highest Labour Income
	0.0087	0.0085	102.2					
ZE	0.5590	0.5716	97.8	1	6404	1.54	0.2153	Self-employed Income
	0.0073	0.0071	103.7					
PE1	0.5191	0.5463	95.0	1	6404	3.02	0.0821	Highest Pension
	0.0111	0.0110	101.6					
LA2	0.8174	0.8262	98.9	1	6404	0.15	0.6948	Lowest Labour Income
	0.0163	0.0155	104.6					
LOS7	21946.0000	35457.0000	61.9	1	6404	2.50	0.1139	Real Estate Income (house) (yes=1)
	6116.3477	5966.9777	102.5					
GEZ1	-14087.0000	-21979.0000	64.1	1	6404	3.73	0.0536	Dependent Childeren
	2805.2753	2973.0548	94.4					
PE2	0.5183	0.5557	93.3	1	6404	0.37	0.5457	Lowest Pension
	0.0441	0.0435	101.5					
IN1	0.3218	0.4553	70.7	1	6404	8.18	0.0043	Highest Health Insurance Benefit
	0.0319	0.0340	93.8					
WE1	0.2904	0.5320	54.6	1	6404	30.43	0.0001	Highest Unemployment Benefit
	0.0284	0.0334	85.0					
GEZ10	-65674.0000	-78481.0000	83.7	1	6404	2.02	0.1555	Fiscal Couple Yes or No
	6569.4536	6174.3202	106.4					
LOS6	0.0538	-1.1054	-4.9	1	6404	139.83	0.0001	Mortgage Capital Repayments
	0.0275	0.0941	29.3					
LOS1	0.2768	0.4894	56.6	1	6404	2.26	0.1328	Received Maintenance Allowance
	0.0670	0.1245	53.8					
LOS9	-0.1825	0.1409	-129.5	1	6404	31.24	0.0001	Mortgage Interest
	0.0430	0.0387	111.2					
LOS3	1.6900	1.9441	86.9	1	6404	0.03	0.8677	Charity Gifts
	1.3460	0.7171	187.7					
All Variables				14	6404	13.81	0.0001	
R-squared	0.8603	0.8747	98.4					
Adj. R-squared	0.8597	0.8741	98.4					

Table A8.14-Post: Estimated results of Match14 with post reform taxes

Dependent Variable	Fiscal Unit	Imputed					
ETAT94	Budget Survey	Ipcal					
	Estimated Par.	Estimated Par.	% Difference	F-test			
	Std. Dev.	Std. Dev.		DF Num	DF Denom	F-Value	P-value	
LA1	0.7574	0.8024	94.4	1	6404	17.87	0.0001	Highest Labour Income
	0.0077	0.0074	104.0					
ZE	0.5118	0.5283	96.9	1	6404	3.43	0.0642	Self-employed Income
	0.0065	0.0062	105.5					
PE1	0.4768	0.5052	94.4	1	6404	4.28	0.0386	Highest Pension
	0.0099	0.0096	103.3					
LA2	0.7311	0.7500	97.5	1	6404	0.91	0.3396	Lowest Labour Income
	0.0144	0.0135	106.4					
LOS7	18781.0000	31269.0000	60.1	1	6404	2.76	0.0965	Real Estate Income (house) (yes=1)
	5420.9187	5199.8748	104.3					
GEZ1	-18845.0000	-27345.0000	68.9	1	6404	5.60	0.0180	Dependent Childeren
	2486.3153	2590.8447	96.0					
PE2	0.5002	0.5468	91.5	1	6404	0.73	0.3923	Lowest Pension
	0.0391	0.0379	103.2					
IN1	0.3055	0.4423	69.1	1	6404	11.12	0.0009	Highest Health Insurance Benefit
	0.0283	0.0297	95.4					
WE1	0.2801	0.5182	54.1	1	6404	38.34	0.0001	Highest Unemployment Benefit
	0.0251	0.0291	86.4					
GEZ10	-78059.0000	-96386.0000	81.0	1	6404	5.34	0.0208	Fiscal Couple Yes or No
	5822.5064	5380.5617	108.2					
LOS6	0.0474	-0.8398	-5.6	1	6404	107.57	0.0001	Mortgage Capital Repayments
	0.0244	0.0820	29.8					
LOS1	0.2516	0.4272	58.9	1	6404	2.02	0.1557	Received Maintenance Allowance
	0.0593	0.1085	54.7					
LOS9	-0.1574	0.0928	-169.7	1	6404	24.16	0.0001	Mortgage Interest
	0.0381	0.0337	113.1					
LOS3	1.4841	1.5377	96.5	1	6404	0.00	0.9683	Charity Gifts
	1.1930	0.6249	190.9					
All Variables				14	6404	12.48	0.0001	
R-squared	0.8681	0.8856	98.0					
Adj. R-squared	0.8675	0.8851	98.0					