How incentives matter ? An illustration from the Targeted Subsidies reform in Iran*

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Abstract

We use the Targeted Subsidies Reform implemented in Iran in 2011 to recover empirically the social valuations of Iranian households relying on the assumption of optimal consumption and income taxes, for welfarist and non-welfarist poverty alleviation social criteria. Unlike the existing literature, we do not restrict attention to a specific pattern for the incentive constraints implied by nonlinear income taxation. Instead we recover this pattern by estimating the Lagrange multipliers associated with the incentive constraints. Before the reform we find evidence of redistribution toward the bottom poor income deciles that is limited by an incentive constraint where the rich envy the social treatment of the poor. At the outcome of the reform incentives no longer matter and the social welfare function of the government of Iran displays a Benthamite-like form.

JEL classification: D12, D82, H21, L51

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1 Introduction

Most theoretical models of public intervention into the economy rely on the principal-agent setup and emphasize incentive issues due to asymmetric information between the two parties. Regulators are assumed to deal with firms better informed about their technology or the market where they operate while tax authorities design taxes observing neither labor skill nor effort of taxpayers. Asymmetric information puts limits on the scope of possible public intervention. Large compensating transfers to high cost firms lead more efficient firms to misreport their cost, and high skilled taxpayers in the face of generous pro-poor income support programs are tempted to relax labor effort. Although incentive issues often seem theoretically sound, little is known about how much they constrain public intervention in practice.

The existing empirical literature is mostly aimed at detecting informational asymmetries. Often it assumes that agents differ according to a few dimensions and have preferences satisfying some version of the single-crossing condition. Only the local (downward) incentive constraints then are relevant and one can infer the presence of asymmetric information from specific features of observed outcomes associated with this pattern of incentives. In insurance markets, for instance, this pattern makes high risk insurees ready to switch to the contract designed for low risk. If so, the optimal response of insurers consists to reduce the insurance coverage designed to low risk. Since contracts fully cover insurees in the absence of asymmetric information, a positive correlation between risk and coverage in the offered contracts can be interpreted as revealing informational asymmetries. This so-called positive correlation test first proposed by Chiappori and Salanié (2000) however yields 'decidedly mixed' evidence (Finkelstein and Poterba, 2004).

The pattern of local downward incentive constraints is sometimes used directly as an identifying assumption that allows us to recover some underlying parameters of the economy. An example from the applied industrial organization litterature is Bontemps and Martimort (2014) who estimate the weight put on firms' profits by the regulator of the French water industry using first-order conditions for optimal contracts that are valid if low cost firms may switch to the contract designed for the less efficient ones. In the same vein, in the public finance literature, Bourguignon and Spadaro (2012) estimate the social valuations of various classes of taxpayers who only differ according to labor skill, relying on first-order conditions for optimal income taxes assuming a local downward pattern of incentive constraints; see also Immervoll et al. (2007), Eissa et al. (2008), Blundell et al. (2009), Bargain and Keane (2011) or Jacobs and al. (2017) for similar exercises and recent developments.

As stressed by Finkelstein and McGarry (2006) the reduction of individual heterogeneity to a few dimensions may be overly restrictive. This reduction is especially problematic when agents are consumers who choose among many different consumption goods: we know from the econometrics of demand that a very high number of free parameters indeed is needed to

achieve a flexible demand form. Finkelstein and Poterba (2013) propose new empirical tests for detecting asymmetric information in the case where agents differ according to several dimensions. However, it remains unclear how the estimates of the underlying parameters that we recover still depend on additional theoretical restrictions introduced to deal with incentive constraints, e.g., some version of single crossing conditions.

In our paper, unlike the main strand of the literature, we do not a priori restrict attention to some specific pattern of incentive constraints. Instead we rely on the assumption of an optimal tax system to recover this pattern. This is done by working with first-order conditions that still depend on the Lagrange multipliers associated with incentive constraints. These multipliers are estimated and, when found positive, the Kuhn-Tucker conditions imply that the associated constraints are binding. Thanks to identifying mimickers and mimicked categories of agents, this strategy allows us to delineate precisely the limits to redistribution due to asymmetric information, rather than simply detect whether asymmetric information operates or not in the market.

This strategy is illustrated on the Targeted Subsidies reform implemented in Iran. Until 2011 Iran was using the oil wealth to finance massive consumption subsidies. President Ahmadinejad launched in December 2010 an ambitious reform that replaced the subsidies with a VAT-like scheme accompanied with compensating income transfers (see Guillaume et al., 2011). Gahvari and Taheripour (2011) and Gharibnavaza and Waschik (2015) discuss the redistributive impact of this reform abstracting from incentive issues. We find evidence that incentive considerations matter before the reform: the redistribution toward the poor appears limited by the desire to preserve a rich elite. The middle income class is never concerned by incentives, a feature that is inconsistent with the familiar local downward pattern. In order to assess how our measure of the quantitative importance of incentives relates to incorrect assumptions about the pattern of incentives, we run a counterfactual exercise that a priori restricts attention to the familiar local downward pattern. The importance of incentives appears biased downwards.

The paper is organized as follows. Section 2 derives necessary conditions for optimal consumption and income taxes that depend on Lagrangian multipliers associated with incentive constraints. Section 3 presents the Iranian Targeted subsidies reform as well as consumption and tax data that we use to recover empirically these multipliers. Section 4 gives the Lagrangian multipliers and the associated households' social valuations assuming a welfarist social objective. Section 5 assesses the assumption of optimal taxes and discusses the robustness of our results to non-welfarist social objectives.

2 Theoretical benchmark

The economy is populated with one government and a total unit size continuum of agents. There are n_i agents of type i ($i = 1, \ldots, I$) whose preferences are represented by the utility function $u_i(\mathbf{x}, y)$, where $\mathbf{x}$ is a bundle of K consumption goods and y stands for pre-tax

labor income. The utility function is increasing quasi-concave in $(\mathbf{x}, -y)$, a higher pre-tax income requiring a greater amount of labor effort. The index i accounts for individual heterogeneity in, e.g., consumption tastes and/or labor skill. The individual characteristics captured by this index are private information to the agent and so cannot be directly used for taxation purpose.

The government has to finance an amount $G \neq 0$ of public expenditures from linear excise consumption taxes $\mathbf{t}$ and nonlinear income taxes. In the illustration on Iran G will be a negative number that stands for the oil wealth to be redistributed. Assuming fixed producer prices $\mathbf{p}$, the vector of consumer prices is $\mathbf{q} = \mathbf{p} + \mathbf{t}$. The income tax is $y - R(y)$ when pre-tax income is y.

Given y_i and post-tax income $R_i = R(y_i)$ a type i agent consumes the bundle $\boldsymbol{\xi}_i(\mathbf{q}, y_i, R_i)$ that maximizes $u_i(\mathbf{x}, y_i)$ subject to her budget constraint $\mathbf{q}'\mathbf{x} \leq R_i$. The corresponding indirect utility $u_i(\boldsymbol{\xi}_i(\mathbf{q}, y_i, R_i), y_i)$ is denoted $v_i(\mathbf{q}, y_i, R_i)$.

Given some profile (y_i) the government chooses $\mathbf{q}$ and a profile (R_i) that maximize

$$W(\dots, v_i(\mathbf{q}, y_i, R_i), \dots) \tag{1}$$

subject to the feasibility constraint

$$\sum_i n_i(\mathbf{q} - \mathbf{p})'\boldsymbol{\xi}_i(\mathbf{q}, y_i, R_i) + \sum_i n_i(y_i - R_i) \geq G, \tag{2}$$

and the incentive constraints

$$v_i(\mathbf{q}, y_i, R_i) \geq v_i(\mathbf{q}, y_j, R_j). \tag{3}$$

for all i and $j \neq i$.

It is difficult to deal with an undisputed social objective when agents differ according to both tastes and skills (see Fleurbaey and Maniquet [12] for a recent discussion on issues at stake). In (1) we consider a welfarist social objective, one that relies on indirect utilities of agents.[1] This covers Utilitarian social welfare functions that add up individual utilities, possibly using given Pareto weights, as is often done in optimal taxation theory, or endogenous marginal social weights varying with individual characteristics and the whole profile of consumption and pre-tax income. More generally this accommodates social objectives that respect individual preferences.[2] The focus on individual utilities is however question-

[1] We do not put explicit restrictions on the shape of the social welfare function W but enough concavity is needed to ensure that the second-order conditions for the tax system to be a local maximum of the government's program are fulfilled. In the sequel we shall work with necessary first-order conditions for optimal taxes and abstract from second-order conditions.

[2] For instance, referring to some given type i^* who faces prices $\mathbf{q}^*$ and earns pre-tax income y^*, the indirect utility $v_i(\mathbf{q}, y, R)$ can be replaced in (1) with the money-metric conditional indirect utility function $\mu_i(\mathbf{q}, y, R)$ defined by $v_{i^*}(\mathbf{q}^*, y^*, \mu_i(\mathbf{q}, y, R)) = v_i(\mathbf{q}, y, R)$ for every admissible $(\mathbf{q}, y, R)$. That is, the reference type i^* in the reference situation would need income $\mu_i(\mathbf{q}, y, R)$ to get utility $v_i(\mathbf{q}, y, R)$. The

able in the context of oil producing countries such as Iran, where pro-poor fiscal and social policies are often regarded as targeting standard of living and poverty reduction rather than utility (Salehi-Isfahani, 2006). In section 5 we shall assess this view by replacing (1) with a non-welfarist objective of poverty alleviation.

In the feasibility constraint (2) public expenditures G are financed by the total collected tax reported in the left-hand side of the constraint, which is the sum of consumption and income taxes.

Type i agents are assumed to pay the income tax $y_i - R_i$ but, since the individual type i is private information, they must be better off when choosing (y_i, R_i) than any other pair (y_j, R_j) designed to other types $j \neq i$ of agents. The incentive constraints given in (3) ensure that these self-selection requirements are met. They highlight that asymmetric information about agents' tastes and skills makes difficult to implement a tax system that is very harmful to type i by stipulating a high amount of labor effort (a high y_i) and a heavy income tax (a low R_i). Indeed type i agents then are likely to prefer a bundle of pre and post-tax incomes that is not designed to them: if they switch to this alternative preferred bundle, they no longer contribute to the redistribution as initially planned by the government, thus violating (3). Section 4.1 uses information about the taxes that solve the government's program to identify empirically the limits of possible redistribution due to the presence of asymmetric information.

Let ρ and (λ_{ij}) be the Lagrange multipliers associated with (2) and (3), and $t^k = q^k - p^k$ be the tax applied on good k. The necessary first-order condition for R_i to solve the government's program is

$$\frac{\partial W}{\partial v_i}\alpha_{ii} + \rho n_i \left(\sum_\ell t^\ell \frac{\partial \xi_{ii}^\ell}{\partial R} - 1 \right) + \sum_{j \neq i} \left(\lambda_{ij}\alpha_{ii} - \lambda_{ji}\alpha_{ji} \right) = 0, \tag{4}$$

where ξ_{ji}^ℓ and

$$\alpha_{ji} = \frac{\partial v_j}{\partial R}(\mathbf{q}, y_i, R_i)$$

respectively stand for the consumption of good ℓ and the marginal utility of income of a type j agent endowed with (y_i, R_i). Using (4) and appealing to the Slutsky decomposition, the first-order condition in the consumer price q^k of good k can be written

$$\sum_i n_i \sum_\ell t^\ell \frac{\partial \hat{\xi}_{ii}^\ell}{\partial q^k} + \sum_i \sum_{j \neq i} \frac{\alpha_{ij}\lambda_{ij}}{\rho} \left(\xi_{ij}^k - \xi_{jj}^k \right) = 0, \tag{5}$$

first-order conditions (4) and (5) for optimal taxes are unchanged provided that the marginal utility of income is suitably renormalized. Since we will not make use of the first-order conditions for optimal pre-tax income, one could as well control for the pre-tax income by replacing y^* with y and refer to income $\tilde{\mu}_i(\mathbf{q}, y, R)$ such that $v_{i*}(\mathbf{q}^*, y, \tilde{\mu}_i(\mathbf{q}, y, R)) = v_i(\mathbf{q}, y, R)$.

where $\hat{\xi}_{ij}^{\ell}$ is the compensated demand of good ℓ for a type i agent endowed with the income bundle (y_j, R_j).

It is clear from (5) that optimal consumption taxes can be uniformly set to 0 if incentives do not matter ($\lambda_{ij} = 0$ for all i and j). Otherwise, if some type i mimics another type j ($\lambda_{ij} > 0$ for some i and j), the consumption of good k should be discouraged when the mimicking type i agents have a greater consumption of this good than the mimicked type j ($\xi_{ij}^{k} > \xi_{jj}^{k}$). This is how consumption taxes contribute to deter mimicking behavior.

3 Targeted Subsidies reform

3.1 Empirical strategy

Our aim is to assess the relevant pattern of incentives and the associated redistributive stance over the period where the Targeted Subsidies reform was implemented in Iran. We rely on the assumption that the first-order conditions (4) and (5) for optimal taxes are satisfied. This system of $I + K$ equations is linear in the $I + I(I-1) = I^2$ ratios

$$a_i^* = \frac{1}{n_i}\frac{\partial W}{\partial v_i}\frac{\alpha_{ii}}{\rho} \qquad \text{and} \qquad \lambda_{ij}^* = \frac{\alpha_{ij}\lambda_{ij}}{\rho}.$$

These are the parameters that we want to recover empirically. A 1 rial transfer toward one type i agent yields a_i^* rials to the society, which gives us a natural measure for type i social valuation at the optimum. Similarly, if the government were able to track type i agents when they mimic type j, a 1 rial tax paid by every such type i agents would yield λ_{ij}^* rials to the society. By Kuhn-Tucker slack conditions, the relevant pattern of incentives is characterized by the constraints associated with the normalized multipliers λ_{ij}^* that are positive. The profile (λ_{ij}^*) thus allows us to delineate the limits to redistribution implied by asymmetric information about agents' types: if $\lambda_{ij}^* > 0$ for some i, a greater transfer toward type j agents may be socially valuable ($a_j^* > 1$) but it cannot be implemented because this would violate incentive requirements.

The specificity of our paper is to put no a priori restriction on the pattern of incentives. This gain in generality in return yields $I(I-1)$ unknown Lagrange multipliers to be estimated. This narrows the individual heterogeneity that can be empirically recovered from the data: there exists a unique set of $I + I(I-1)$ parameters (a_i^*, λ_{ij}^*) solution to the $I + K$ first-order conditions (4) and (5) only if $I(I-1) \leq K$.

It will be convenient to rewrite (4) and (5) in a form that is better suited for empirical purpose, switching to expenditures and demand elasticities,

$$n_i a_i^* = n_i \left(1 - \sum_{\ell} \frac{t_{\text{val}}^{\ell}}{1 + t_{\text{val}}^{\ell}} \frac{n_i q^{\ell} \xi_{ii}^{\ell}}{n_i R_i} \varepsilon_{ii}^{\ell R}\right) - \sum_{j \neq i} \left(\frac{\alpha_{ii}}{\alpha_{ij}} \lambda_{ij}^* - \lambda_{ji}^*\right), \tag{6}$$

$$\sum_{\ell} \frac{t^{\ell}_{\text{val}}}{1+t^{\ell}_{\text{val}}} \sum_{i} \frac{n_i q^k \xi^k_{ii}}{q^k \xi^k} \hat{\varepsilon}^{k\ell}_{ii} + \sum_{i} \sum_{j \neq i} \frac{\lambda^*_{ij}}{n_i} \left(\frac{n_i q^k \xi^k_{ij}}{q^k \xi^k} - \frac{n_i}{n_j} \frac{n_j q^k \xi^k_{jj}}{q^k \xi^k} \right) = 0, \tag{7}$$

with ad valorem taxes (t^{ℓ}_{val}) defined by

$$\frac{t^{\ell}}{q^{\ell}} = \frac{t^{\ell}_{\text{val}}}{1+t^{\ell}_{\text{val}}}.$$

The income and compensated price elasticity of demand $\varepsilon^{\ell R}_{ij}$ and $\hat{\varepsilon}^{k\ell}_{ij}$ of good ℓ apply to a type i agent earning y_j before tax and R_j after tax.

Once endowed with estimates for the various elasticities, our data will leave us with (a^*_i) and (λ^*_{ij}) as the only unknowns in (6) and (7). Since the profile (a^*_i) is absent from (7), one can proceed in two steps. First we recover the profile of the $I(I-1)$ multipliers (λ^*_{ij}) by minimizing the sum of the K squared left-hand side of (7). Then, we reintroduce these multipliers into the I equations (6) to get the I exact social valuations (a^*_i).

3.2 Data from Iran

The first-order conditions (6) and (7) take expenditures, demand elasticities and consumption taxes as inputs obtained from consumption and tax data. Consumption data comes from the Household Income and Expenditure Survey (HIES) collected every year from 1388 to 1393 of the Iranian calendar by the Statistical Center of Iran.[3] The HIES provides us with household expenditures on goods aggregated according to the 2-digit level of the COICOP international classification,[4] as well as a few households' demographic variables. Our sample consists of the 5-year (1388-1393) pooled observations of urban literate Iranian households.[5]

Households are classified referring to adult-equivalent post-tax income (consumption expenditures). Although the poor receive great public attention since the Islamic Revolution, there is wide variation in the measured poverty in Iran. In our sample, referring to the traditional 2/3 of the median (adult-equivalent) post-tax income standard poverty line applied to developed countries, we find 30% of urban poor in 1388. Salehi-Isfahani (2006) reports poverty rates ranging from 20% (United Nations, 2003) to 40% (Central Intelligence Agency, 2005) in the whole (urban and rural) population. Official measures of

[3]The Iranian calendar origin is year 621 (or 622) of the Gregorian calendar. Iranian years begin the 21st of March of the Gregorian calendar: year 1388 is from March 2009 to March 2010, and year 1393 from March 2014 to March 2015.

[4]Details about the COICOP classification are available at `http://unstats.un.org/unsd/cr/`.

[5]The initial pooled sample has 112,251 observations (on urban Iranian households). We keep observations with non-negative total expenditures, with no missing information about expenditures, with a literate head of household between 18 and 70 years old. We also remove observations in the bottom and top 1 percent of the income distribution, and those where more than 99 percent of the household budget is allocated to one consumption category only. Our final sample consists of 77,364 observations.

the urban poverty rate computed by the Statistical Center of Iran even go to 55% in 2011 (Attar, Kiani and Habibi, 2011). We have chosen as a benchmark a midway alternative that allocates observations to three income classes with a similar size: the poor consist of the bottom four deciles of the per consumption unit total (positive) expenditures distribution[6] while the rich are in the top three deciles of this distribution. To deal with the high inflation that prevails over the sample window, we build these classes referring to each year separately, e.g., the poor income class consists of the (adult-equivalent) households that belong to the bottom four deciles in 1388, plus those in the same quantiles in 1389, and so on.

Table 1: Summary statistics

	Poor	Middle	Rich
Households statistics			
Age[1] (years)	42.9	43.8	45.2
Male[1] (percent)	94.2	94.8	94.1
Number of persons	4.1	3.9	3.6
Number of consumption units	2.28	2.21	2.1
Education[1]			
Primary education	41[2]	31.2	22.5
Secondary education	43.2	44	41
Higher education	15.8	24.8	36.5
Top 5 provinces of Iran			
	Tehran (8.3)[3]	Tehran (8.6)	Tehran (7.7)
	Golestan (5.2)	Razavi Khorasan (4.7)	Esfahan (4.5)
	Hamadan (5.1)	Bushehr (3.9)	South Khorasan (4.4)
	Yazd (4.6)	Khuzestan (3.9)	Hormozgan (4.4)
	Qôm (4.6)	Hormozgan (3.9)	Gilan (4.3)
Number of observations	30,790	23,678	22,896

Note 1: This refers to the sex of the head of household.
Note 2: 41 percent of poor household heads have primary education.
Note 3: 8.3 percent of the poor live in the province of Tehran.

Table 1 provides summary statistics about these three classes. Richer households display a lower size with a head of the family both older and higher educated. The province (ostân) of Tehran (the most populated among the 31 provinces of Iran) is the one where we find the greatest number of observations in the sample for every income class.[7] Otherwise we observe traces of some geographical segregation: the poor are mostly found in the cities of central Iran bordering Dasht-e Kavir and Dasht-e Lout deserts whereas the middle and upper income classes tend to cohabitate in the South-West Arabian gulf and the prosperous

[6] Alternative classifications in Section 5 and further robustness checks examined in Appendix 10 suggest that a 20% threshold could be more relevant. Results are similar in the two specifications.

[7] Price indexes are missing for Alborz province, which was formed by division of Tehran province in 2010. Our analysis treats Alborz and Tehran as one consolidated province, and thus considers 30 different provinces only.

Khorassan provinces in the West. A high fraction of the richest families also lives around the Caspian Sea in the North province of Gilan that concentrates agricultural resources.

The HIES gives expenditures $q^k \xi_{ii}^k$ on 2-digit COICOP categories of consumption goods and total expenditures R_i of each class i household. Appendix A shows that the main differences in the consumption of the various classes relate to Food, Clothing and Health. Food appears as inferior whereas the budget shares of Clothing and Health are up to three times higher for the rich than in the poor class.

The subsidies used before the reform are difficult to assess because of hidden components that are not reflected in the official tax scale (Salehi-Isfahani and Taheripour, 2002). In what follows we impute the levels of subsidies used by Gahvari and Taheripour (2011) to year 1388, which constitutes our pre-reform period. Appendix A shows that subsidies are concentrated on Transport and Food, with respective rates of 54 and 28 percent. We neglect the 1% standard rate of VAT applied in 1388 because we have no information about how it was interacting with the subsidies at this moment. In our post-reform period, which is year 1393, we have considered that the tax base is shaped by the 7% rate of VAT.

The elasticities and the fictitious demand of a class i household adjusting labor to earn class j pre-tax income that appear in (6) and (7) obtain by estimating demand from an Almost Ideal Demand System (AIDS) on $K = 8$ categories of goods, using the sample of pooled HIES observations from every year between 1388 and 1393.[8] The price indexes of the COICOP categories come from the Central Bank of Iran for every province of Iran and month from 1388 to 1393. The AIDS specification and the estimated elasticities are given in Appendix B.[9]

The Targeted Subsidies reform takes its name from the per head fixed income transfers introduced to compensate households for losses in purchasing power. At the completion of the reform, these transfers coexist with the progressive income tax ruled in Iran by the Direct Taxation Act. Our data provides us neither with household pre-tax nor post-tax income. We treat pre-tax income as an unobserved component of household taste heterogeneity by estimating demand for every income class separately, i.e., demand functions are conditional to the pre-tax income. Final consumption expenditure is used as a proxy for the post-tax income.

[8]Our use of a three-class economy follows from the condition $I(I-1) \leq K = 8$ for a unique set of parameters (a_i^*, λ_{ij}^*) solution to (6) and (7).

[9]Since the AIDS budget share is log-linear in post-tax income (total expenditures), we have removed the bottom and top 1 percent of the income distribution to improve the quality of demand estimation (see footnote 1). We use family size as demographic control. The COICOP categories Alcoholic beverages, tobacco and narcotics (02), Housing, water, electricity, gas and other fuels (04), Recreation and culture (09) and Education (10) are considered as fixed expenditures and treated as individual controls.

4 Empirical results

4.1 Pattern of incentives

In order to recover (λ_{ij}^*) from (7), we need the fictitious consumption $\xi_{ij}^k = \xi_i^k(\mathbf{q}, y_j, R_j)$. To deal with the lack of information about household pre-tax income (y_i) in the data, we approximate ξ_{ij}^k by the fitted AIDS of type i evaluated at the post-tax income of class j, i.e., ξ_{ij}^k is set to $\xi_i^k(\mathbf{q}, y_i, R_j)$. The mimicker's utility $v_i(\mathbf{q}, y_j, R_j)) = u_i(\boldsymbol{\xi}_i(\mathbf{q}, y_j, R_j), -y_j)$ in the incentive constraint (3) is then approximated by $u_i(\boldsymbol{\xi}_i(\mathbf{q}, y_i, R_j), -y_j)$. This approximation sounds more plausible at a high level of aggregation of consumption categories: changes in labor supply may then mostly trigger within category substitutions, e.g., buying within a broad Clothing category some tailored-suit rather than casual wear when an individual is working. The approximation is exact when utility is separable in pre-tax income, e.g.,

$$u_i(\mathbf{x}, y) = U_i(\mathbf{x}) - V_i(y), \tag{8}$$

since then consumption no longer depends on pre-tax income.

Since the AIDS is log-linear in post-tax income, imputing the mean post-tax income of class j would bias upwards the fitted demand of the types mimicking type j, and thus this would dampen the estimated magnitude of the Lagrange multipliers in (7). To tackle this issue we have used a matching procedure imputing to each household of class i, if mimicking some class j household, the post-tax income of the household of class j who has the nearest score computed from demographics.[10] Appendix C reports the resulting consumption ratio differences

$$\frac{n_i q^k \xi_{ij}^k}{q^k \xi^k} - \frac{n_i}{n_j} \frac{n_j q^k \xi_{jj}^k}{q^k \xi^k} \tag{9}$$

that appear in (7). The most significant differences (in bold in Appendix C) are concentrated on Clothing, Transport and Communication. They mostly involve the poor in 1388, while all the income classes are concerned in 1393.

The 6 non-negative per household multipliers (λ_{ij}^*/n_i) solving (7) are found using the method of moments, by minimizing the sum of the K squared left-hand sides of (7) in 1388 and 1393. Only the incentive constraint involving the rich mimicking the poor is binding in 1388. The associated (normalized) multiplier equals 1.29. The interpretation is that, if the government could design a specific tax of 1 rial applying to one rich household when mimicking its matched poor, the social gain would amount to 1.29 rial. We have computed upper one-sided confidence intervals using the non-Studentized pivotal bootstrap method. The upper bounds for all the remaining multipliers can safely be set to 0.

This exercise allows us to identify clear limits to redistribution in Iran before the im-

[10] The score is computed for each year 1388 and 1393 separately from a logit model that regresses the probability of belonging to class i rather than j on age, education, household size and province of residence.

Table 2: Incentive pattern in Iran

		Actual		Restricted	
	Tax system of year	1388	1393	1388	1393
Actual class	Imputed income				
Poor	Middle	4.68e-03	3.88e-02	0	0
		(1.71e-02)	(1.34e-01)		
	Rich	1.50e-08	1.04e-06	0	0
		(5.42e-08)	(3.58e-06)		
Middle	Poor	1.17e-04	3.31e-07	4.82e-09	3.24e-02
		(4.92e-04)	(1.41e-06)	(7.95e-09)	(3.29e-02)
	Rich	2.77e-10	1.10e-08	0	0
		(1.13e-11)	(4.65e-08)		
Rich	Poor	1.29	8.17e-10	0	0
		(5.44)	(3.37e-09)		
	Middle	1.06e-06	4.01e-06	7.06e-01	1.38e-09
		(4.47e-06)	(1.82e-05)	(7.46e-01)	(2.41e-09)

1. Poor (D1-D4); Middle (D5-D7); Rich (D8-D10).
2. Upper one-sided 1000-iteration bootstrap confidence interval at the 90 percent level.

plementation of the Targeted Subsidies reform: the social desire to preserve the existence of the upper income class prevents the government of Iran to implement more generous income transfers toward the poor. This finding suggests political economy justifications to Ahmadinejad's Targeted subsidies program as a change in both consumption and income taxes suitably designed to favor the poor and/or hurt the rich.

In 1393 all the multipliers stand close to 0: the highest multiplier is associated with the incentive constraint where the poor are ready to mimic middle income class households, but a 1 rial tax bearing on a poor would then yield 0.04 rial to the society only.

As might be expected in a setup where agents differ according to consumption tastes and labor skill, we find no compelling evidence for the familiar local downward incentive pattern. In 1388 a non-neighboring downward incentive constraint binds (the rich envy the poor but they do not envy the middle class); in 1393 the most relevant constraint is a neighboring upward constraint. To assess the impact of the a priori restriction that only local downward incentive constraints can bind, we have reproduced our analysis under the additional requirement that the Lagrange multipliers associated with either non local or local upward incentive constraints are 0 in (7). The results are reproduced in columns 3 and 4 of Table 2. They show that the rich would then be mistakenly identified as mimicking the middle class in 1388. The magnitude of 0.7 rial of the multiplier associated with

this incentive constraint is much lower than 1.29 rial: on this data the standard pattern of local downward incentive constraints biases downwards the quantitative importance of incentives.

4.2 Redistributive impact of the reform

The profile (a_i^*) given in columns 1 and 2 of Table 3 obtain by reintroducing into (6) the multipliers (λ_{ij}^*) reported in Table 2. The marginal utility of income α_{ij} of class i mimicking class $j \neq i$ households is approximated by the fitted post-tax income derivative of the AIDS indirect utility for a class i household receiving the post-tax income R_j of its matched class j household,

$$\alpha_{ij} = \frac{\partial v_i}{\partial R}(\mathbf{q}, y_j, R_j) \simeq \frac{\partial v_i}{\partial R}(\mathbf{q}, y_i, R_j).$$

The approximation is exact for the class of separable preferences (8). The resulting ratios of marginal utilities of income α_{ii}/α_{ij} in (6) are given in Appendix C.

Table 3: Social valuations in Iran (a_i^*)

Tax system	Actual		Restricted	
Year	1388	1393	1388	1393
Income class i[1]				
Poor	2.37	0.91	1.36	1.01
	(1.96 – 3.7)[2]	(0.84 – 0.99)	(1.36 – 1.36)	(1.01 – 1.01)
Middle	1.29	1.04	2.03	0.97
	(0.30 – 1.4)	(0.98 – 1.21)	(2.00 – 2.08)	(0.97 – 0.98)
Rich	0.95	0.98	0.95	0.98
	(0.41 – 1.43)	(0.88 – 0.98)	(0.94 – 0.97)	(0.98 – 0.98)

1. Poor (D1-D4); Middle (D5-D7); Rich (D8-D10).
2. Two-sided (symmetric) 1000-iteration bootstrap confidence interval at the 90 percent level.

There is little agreement in the existing literature about the role played by the oil-financed consumption subsidies in the decline of the percentage of Iranians below the poverty line following the Iran-Iraq war (Salehi-Isfahani, 2017). The decline actually occurs over a period of possibly confounding economic growth where pro-poor bread subsidies co-exist with energy subsidies that tend to benefit richer households (Guillaume and al., 2011; Salehi-Isfahani, 2016). The results reproduced in column 1 of Table 3 clearly display a sharp progressive design of taxes that is in line with the view of Mahmoud Ahmadinejad as a populist leader favoring the poor in 1388. We find that a 1 rial transfer to a poor

household yields more than 2 rials to the society while the recovered social valuations of richer households do not exceed 1.4 rial.[11]

The new Rohani government faces severe recession in 1393. According to Salehi-Isfahani (2017), 'for the time being, delivering on the promise of greater equity seems to be low on the agenda of policy makers in Iran $[\cdots]$ and not much should be expected $[\cdots]$ other than what market forces make possible.' The social valuations reported in column 2 are much in line with this diagnosis: the social welfare function of the government of Iran meets a Benthamite (unweighted Utilitarian) objective valuing identically the various households.

Columns 3 and 4 give the valuations obtained in the counterfactual experiment where only the local downward incentive pattern can bind. The theoretical rule (6) for optimal income taxes shows that the valuation of a mimicked type i ($\lambda^*_{ji} > 0$ for some $j \neq i$) tends to be high compared to the situation where this type would be not envied ($\lambda^*_{ji} = 0$ for all $j \neq i$). Symmetrically the valuation of a mimicker type i ($\lambda^*_{ij} > 0$ for some $j \neq i$) is low compared to the situation where this type would envy nobody ($\lambda^*_{ij} = 0$ for all $j \neq i$). In 1388 the rich mimic the middle class in the counterfactual experiment while they actually mimic the poor. The valuation of the poor (middle income class) is accordingly adjusted downwards (upwards) from column 1 to 3. Thus the social importance of the poor is underestimated when restricting attention to the local downward incentive pattern.

5 Optimal taxes and social welfarism

Our results are derived from the assumption that the government of Iran chooses consumption and income taxes maximizing a social objective relying on the welfare of taxpayers. The value of the sum of the K squared left-hand sides of (7) is 0 when this assumption is satisfied. In practice the estimation of $I(I-1) = 6$ multipliers (λ^*_{ij}) from $K = 8$ equations yields a positive residual. The first column of Table 4 shows that this residual equals 2.486 in 1388 and 0.312 in 1393. In order to assess whether these values can be regarded as close to 0, they are compared to the residuals that would be obtained if taxes were instead randomly drawn. The residuals then are 3.133 in 1388 and 2.851 in 1393.[12]

In 1393 the low ratio 0.312/2.851 makes the assumption of optimal taxes plausible given a welfarist objective. The quality of the fit is consistent with the high precision of

[11] The estimated social valuations in column 1 lack of precision. This may be due to high within class taste homogeneity inducing poor quality of the estimated AIDS before the reform. This could follow from our use of a welfarist objective, which would not accurately account for the trade-off relevant to the government of Iran before the reform. In section 5 we deal with a social non-welfarist poverty alleviation objective relying on purchasing power rather than individual utility of the poor.

[12] We have re-estimated $1,000$ times for every year the multipliers that minimize the sum of the squared left-hand sides of (7) using consumption taxes drawn uniformly in an interval $[t^{\min}, t^{\max}]$ where $t^{\min}$ is the lowest actual tax rate minus 10 percentage points and $t^{\max}$ is the highest actual tax rate plus 10 points. From Table 7, we have $[t^{\min}, t^{\max}] = [-0.64, 0.17]$. This interval are fairly conservative: the residual values get much higher for slightly larger ranges.

the estimated multipliers in Table 2.

Table 4: Optimal taxes from a welfarist social objective

	Residuals								
	Total	Food	Clothing	Furnishings	Health	Transport	Communication	Restaurants	Other
1388									
Actual	2.486	0.027	0.393	0.538	0.294	0.987	-0.795	-0.547	1.935
Random[1]	3.133	-0.031	0.291	0.134	0.177	-0.239	-0.312	-0.023	-0.252
1393									
Actual	0.312	0.031	0.03	-0.011	0.07	0.033	-0.021	-0.293	-0.053
Random[1]	2.851	-0.018	0.268	0.147	0.062	-0.120	-0.295	-0.003	-0.040

1. Average of the (least estimated) sum of squared LHS of (7) over $1,000$ random draws of consumption taxes uniform on $[-0.64, 0.17]$

However the likelihood of optimal taxes in 1388 is less obvious. The decomposition of the residual across consumption categories in Table 4 shows that the poor performance of the welfarist model in 1388 relates to Other Goods and Services and the heavily subsidized Transport categories. One possible explanation is that Iranian subsidies are part of some non-welfarist redistribution program favoring the poor, rather than a welfarist one. Indeed this would accord with the theoretical tax rule obtained by Pirrtilä and Tuomala (2004) for non-welfarist poverty alleviation social objective that points toward high subsidies on consumption goods entering the basket of poor households.

To assess the non-welfarist view we now replace (1) with a social objective $\Phi(R_1, \ldots, R_I)$ that only depends on the after-tax income profile.[13] This formulation encompasses the goal of poverty alleviation (Kanbur, Keen and Tuomala, 1994) measured by the Foster, Greer and Thorbecke (1984) index, which only weights agents whose after-tax income R_i falls below a pre-defined exogenous poverty line z.[14]

Given (y_i) the program of the government is now to choose $\mathbf{q}$ and (R_i) maximizing $\Phi(R_1, \ldots, R_I)$ subject to (2) and (3). Letting

$$\Phi_i^* = \frac{1}{\rho} \frac{\partial \Phi}{\partial R_i},$$

be the aggregate social valuation of class i agents, the first-order conditions can be written in a form reminiscent to (4) and (5),

$$\Phi_i^* + n_i \left(\sum_\ell t^\ell \frac{\partial \xi_{ii}^\ell}{\partial R_i} - 1 \right) + \sum_{j \neq i} \left(\frac{\alpha_{ii}}{\alpha_{ij}} \lambda_{ij}^* - \lambda_{ji}^* \right) = 0 \tag{10}$$

[13] The function $\Phi : \mathbb{R}^I \to \mathbb{R}$ is assumed piecewise differentiable except at a finite number of points.

[14] The recent developments in the measurement of anti-poverty by Maniquet and Neumann (2015) involve redistribution controlling for labor time, on which we have no information in the data.

for every agent i, and

$$\sum_i \Phi_i^* \xi_{ii}^k + \sum_i n_i \sum_\ell t^\ell \frac{\partial \hat{\xi}_{ii}^\ell}{\partial q^k} + \sum_i \sum_{j \neq i} \lambda_{ij}^* \left(\xi_{ij}^k - \xi_{jj}^k \right) = 0 \tag{11}$$

for every good k. Table 5 reports the multipliers (λ_{ij}^*) and the valuations (Φ_i^*) obtained in the three-class case scanning the poverty line z from the first to the seventh income decile in 1388, with $\Phi_i^* = 0$ for all $R_i \geq z$. By definition the (adult-equivalent) income of the poor household is below the poverty line. Middle class and rich households are split equally above the line, e.g., the rich consist of the four top deciles if the poor comprise the two bottom deciles of the income distribution. For every scan we re-estimate the AIDS for the three classes separately and we accordingly compute the profiles of (λ_{ij}^*) and (Φ_i^*) that minimize the sum of the $I + K$ squared left-hand sides of (10) and (11).

Table 5: Incentives and poverty alleviation in 1388

Poverty line (z)	Residual[1]	Lagrange multipliers (λ_{ij}^*)						Social valuation Φ_{P}^*
		MP[2]	MR	PM	PR	RM	RP	
0.1[3]	2.054	1.19e-01	1.11e-08	6.44e-06	3.83e-05	9.40e-05	4.12e-01	8.59e-09
0.2	1.992	2.48e-04	1.90e-04	5.91e-06	2.58e-09	2.00e-09	3.68e-01	3.52e-08
0.3	2.807	8.27e-08	8.73e-03	8.26e-06	5.85e-07	9.57e-02	1.99e-01	8.63e-09
0.4	2.639	2.93e-08	1.78e-07	8.18e-04	1.59e-08	1.87e-01	9.03e-08	2.27e-05
0.5	2.888	6.06e-09	1.20e-08	1.30e-09	4.68e-04	2.11e-01	6.48e-06	3.40e-06
0.6	2.173	5.42e-08	1.52e-06	2.07e-07	1.06e-02	1.40e-01	3.41e-06	1.69e-09
0.7	2.083	7.07e-06	6.49e-09	6.32e-08	2.34e-02	9.55e-02	5.63e-09	9.58e-07

1. Sum of the $I + K$ squared left-hand sides of (10) and (11).
2. P(oor), M(iddle), R(ich). Lagrange multiplier λ_{MP}^* associated with the middle class M mimicking the poor P.
3. Poverty line at the first decile of the adult-equivalent income distribution: Poor (-D1), Middle (D1-P55), Rich (P55-).

We first observe that the relevant Lagrange multipliers are lower in magnitude than those found in the welfarist case. In addition, as one raises the poverty line z, the recovered incentive pattern in 1388 switches from a situation where the rich mimic the poor to one where the rich instead envy the fiscal treatment of the middle income class. The switch occurs for a poverty line located around the 4th decile of the income distribution. Since, by construction, a rise in the poverty line is associated with a narrower upper income class, the switch can be exploited to extract information about incentives in a more disaggregated classification of the Iranian society than the three-class case. The switch is consistent with a pattern where the poorest households amongst the rich (located around the 6th to 8th deciles) envy the very poor, while the very rich instead envy households with income closer to the median income. Table 5 also shows that the switch is associated with a higher aggregate social valuation Φ_{P}^* of the poor: the government of Iran appears to pay special attention to the after-tax income of the 3rd income decile.

The residuals reported in the second column of Table 5 enable us to assess the non-welfarist poverty alleviation purpose against the welfarist approach. Referring to the same

classification as in Tables 2 and 3 (one involving a poverty line at D4), the residual of 2.639 is slightly greater than 2.486 obtained in the welfarist case. The best fit for a poverty alleviation social goal actually involves a much narrower poor class consisting of the first two bottom deciles of the income distribution, yielding the lowest residual of 1.992. Table 10 in Appendix D shows that the lowest residual in the welfarist case is 1.81 and also obtains for this same classification.

Table 6: Incentives and poverty alleviation in 1393

Poverty line	Residual	Lagrange multipliers (λ^*_{ij})						Social valuation Φ^*_{P}
		MP[1]	MR	PM	PR	RM	RP	
0.1[1]	0.705	9.47e-02	1.55e-05	5.76e-11	1.42e-06	2.49e-08	1.47e-07	9.75e-02
0.2	0.606	3.30e-02	7.24e-03	1.42e-06	7.10e-10	1.47e-09	1.16e-09	1.10e-01
0.3	0.564	1.87e-08	2.74e-06	3.71e-06	1.53e-02	2.29e-09	3.36e-09	1.08e-01
0.4	0.580	9.36e-08	1.33e-06	3.26e-06	2.06e-02	3.87e-10	4.94e-10	1.40e-01
0.5	0.546	2.33e-06	9.37e-10	8.69e-10	2.01e-02	1.19e-06	4.07e-09	1.15e-01
0.6	0.578	1.48e-10	4.10e-10	3.35e-03	1.96e-02	3.88e-07	6.50e-10	1.28e-01
0.7	0.641	3.06e-06	8.30e-08	7.05e-06	1.91e-02	1.19e-07	2.77e-08	1.32e-01

1. P(oor), M(iddle), R(ich). Lagrange multiplier λ^*_{MP} associated with the middle class M mimicking the poor P.
2. Poverty line at the 1st decile of the adult-equivalent income distribution: Poor (-D1), Middle (D2-P55), Rich (P55-).

In 1393, we still find no evidence of relevant incentive constraints, but the residuals then are twice the one found in the welfarist case (0.312), which goes against the non-welfarist case.

To summarize, the performances of welfarist and non-welfarist social criteria are similar in 1388.[15] Both point toward narrowing the poor class to the bottom two deciles of the income distribution and make the redistribution toward this socially favored class limited by the government's concern to preserve richer Iranians. In 1393 the welfarist criterion provides us with a better fit of the data.

6 Concluding comments

This paper assesses empirically the pattern of relevant incentive constraints by estimating the Lagrange multipliers associated with these constraints that appear in the first-order conditions for optimal taxes. An illustration on data from Iran over the period of the Targeted subsidies reform highlights the high social importance of the poor before the reform. The desired redistribution toward the poor is however limited by the social concern of preserving a rich elite: the incentive constraint where the rich are ready to mimic the poor is the only one to bind before the reform for a large variety of welfarist and non-welfarist

[15] We have also considered non-welfarist specifications where Φ^*_{M} and Φ^*_{R} may differ from 0. The improvement upon the constrained case reported in Table 5 is not enough to change this result.

social objectives. At the outcome of the reform, pressures from incentive constraints have completely disappeared and equity seems to be off the agenda of the government of Iran.

1. Our database does not provide us with information about pre-tax income. Under a suitable separability assumption on individual preferences, one can dispense from this information in the treatment of mimicking behavior. Separability, though widely used in theoretical models with informational asymmetries, is plausibly a demanding assumption in practice. Our methodology does not rely on separability: it would be interesting to apply it on a richer database that contains pre-tax income information to deal with non-separable preferences of taxpayers.

2. There are two important issues that would be worth to explore further in the specific case of Iran. A first issue concerns the production side of the economy, which is viewed as unaffected by the reform whereas energy subsidies certainly impact Iranian firms and producer prices. Second, anecdotal evidence suggests a weak enforcement of income taxes in the private sector. Our results should not change too much if the government of Iran designs taxes by assessing accurately the induced tax leakage. Otherwise the amended first-order conditions for optimal taxes will affect the recovered incentives and social valuations: it may be possible to adapt the approach developed in this paper to evaluate the perceived amount of tax evasion per category of consumption goods and/or households.

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A Taxes and expenditures

Table 7 gives the expenditures for the 8 COICOP categories that are considered as flexible, the total expenditures on these categories and the corresponding budget shares (into brackets).

Table 7: Taxes and expenditures[1]

	Food	Clothing	Furnishings	Health	Transport	Communication	Restaurants	Other	Total[2]
Taxes									
Year 1388[3]	-0.28	-0.14	-0.23	-0.26	-0.54	0	0	-0.09	
Year 1393	0	0.07	0.07	0	0.04	0	0.07	0.07	
Expenditures for year 1388 to 1393									
Poor[4]	66,699	5,100	4,105	5,897	9,645	7,172	1,143	4,630	104,394
	(63.9)[5]	(4.8)	(3.9)	(5.6)	(9.2)	(6.9)	(1.1)	(4.4)	
Middle[4]	79,245	12,036	5,465	9,705	12,886	8,461	2,203	5,905	135,909
	(58.3)	(8.9)	(4)	(7.1)	(9.5)	(6.2)	(1.6)	(4.3)	
Rich[4]	112,052	31,392	9,653	23,669	20,079	11,802	4,660	9,028	222,339
	(50.4)	(14.1)	(4.3)	(10.6)	(9)	(5.3)	(2.1)	(4)	
Number of observations	77,364								
Expenditures for year 1388									
Poor	5,302	577	382	588	700	655	96	356	8,656
	(61.3 – *0.132*)[6]	(6.7 – *0.086*)	(4.4 – *0.032*)	(6.8 – *0.096*)	(8.1 – *0.065*)	(7.6 – *0.060*)	(1.1 – *0.024*)	(4.1 – *0.029*)	
Middle	6,892	1,288	541	962	948	908	207	488	12,235
	(56.3 – *0.134*)	(10.5 – *0.101*)	(4.4 – *0.035*)	(7.9 – *0.103*)	(7.8 – *0.061*)	(7.4 – *0.053*)	(1.7 – *0.032*)	(4 – *0.026*)	
Rich	11,241	3,581	1,128	2,696	1,755	1,493	514	846	23,255
	(48.3 – *0.149*)	(15.4 – *0.113*)	(4.9 – *0.042*)	(11.6 – *0.136*)	(7.5 – *0.063*)	(6.4 – *0.051*)	(2.2 – *0.033*)	(3.6 – *0.027*)	
Number of observations	12,124								
Expenditures for year 1393									
Poor	16,967	1,130	1,060	1,515	2,549	1,662	266	1,296	26,444
	(64.2 – *0.125*)	(4.3 – *0.072*)	(4 – *0.028*)	(5.7 – *0.090*)	(9.6 – *0.071*)	(6.3 – *0.041*)	(1 – *0.022*)	(4.9 – *0.033*)	
Middle	19,711	2,797	1,397	2,397	3,457	1,866	538	1,656	33,819
	(58.3 – *0.128*)	(8.3 – *0.093*)	(4.1 – *0.030*)	(7.1 – *0.100*)	(10.2 – *0.073*)	(5.5 – *0.034*)	(1.6 – *0.028*)	(4.9 – *0.031*)	
Rich	25,292	6,776	2,186	5,108	4,952	2,321	1,069	2,285	49,990
	(50.6 – *0.138*)	(13.6 – *0.115*)	(4.4 – *0.038*)	(10.2 – *0.126*)	(9.9 – *0.069*)	(4.6 – *0.032*)	(2.1 – *0.030*)	(4.6 – *0.031*)	
Number of observations	13,312								

1. Expenditures are expressed in thousands of rials.
2. Average household expenditures (other than COICOP categories 02, 04, 09 and 10) are used as a proxy for total net income.
3. Computed using subsidies in Gahvari and Taheripour (2011).
4. Poor (D1-D3); Middle (D4-D9); Rich (D10).
5. Household budget share in percent.
6. Household budget share in percent – *within class standard error of budget shares.*

B AIDS estimation

The elasticities and the marginal utility of income are derived from an AIDS specification estimated for different income classes, which allows for taste heterogeneity perfectly correlated with income. The AIDS specification assumes that the budget share of good k for household h in income class i (which is her type of the theoretical setup) obeys

$$\frac{q^k \xi^k_{hh}}{R_h} = \delta^k_i + \zeta_i f_h + \sum_{k'} \gamma^{kk'}_i \log q^{k'} + \beta^k_i \log\left(\frac{R_h}{Q_i}\right) + \varphi^k_h,$$

where φ^k_h is an error term and Q_i is a personalized income class i price index defined by

$$\log Q_i = \delta^0_i + \sum_{k'} \delta^{k'}_i \log q^{k'} + \frac{1}{2} \sum_{k,k'} \gamma^{kk'}_i \log q^k \log q^{k'}.$$

Household h living in a given province and surveyed during a given month faces consumer prices indexes (q^k) computed by the Central Bank of Iran for this province and this month. The demand functions are estimated using family size and the (logarithm of) total household expenditures for COICOP categories 02, 04, 09 and 10 as household h demographic controls included into the 5-dimensional vector f_h. We also impose the usual AIDS restrictions on parameters

$$\sum_{k'>0} \delta_i^{k'} = 1,\ \sum_k \gamma_i^{kk'} = \sum_{k'} \gamma_i^{kk'} = 0,\ \sum_k \beta_i^k = 0,\ \gamma_i^{kk'} = \gamma_i^{k'k}.$$

These restrictions ensure that budget shares sum to 1, and that homogeneity and symmetry properties of demand are satisfied.

The demand functions are estimated for every income class using consumption data for the 6 pooled years from 1388 to 1393. Estimation is done on an arbitrary subset of 7 from the 8 categories of goods (since the disturbance terms φ_h^k sum-up to zero) appealing to Iterated Linear Least Squares Estimator developed by Blundell and Robin (1999). The estimation strategy goes as follows. In a first step the AIDS coefficients $((\delta_i^k), \zeta_i, (\gamma_i^{kk'}), (\beta_i^k))$ are estimated for every class i by linear estimation techniques given some (Translog) price index $Q_i(0)$. Then, in a second step, the estimated coefficients enter a revised price index $Q_i(1)$ and the linear estimation procedure is made given $Q_i(1)$. This iterative process is repeated until the coefficients converge.

The estimated demand functions yield the elasticities that appear in (6) and (7). These elasticities are computed separately for years 1388 and 1393 (referring to yearly prices and incomes). For the sake of space we report in Table 8 the elasticities computed on the whole sample (as well as the associated standard errors).[16]

[16]The estimation of the AIDS is made using the function `aidsEst` from the `micEconAids` package developed for `R`. The reported elasticities fit the original AIDS formula. They are computed using the function `aidsElas` after applying the renormalization of AIDS coefficients required in the presence of demographic controls (see page 10 of the `micEconAids` documentation available from the `cran` website). The standard errors of elasticities obtain using the wrapper function `elas`. Iranian data and the whole `R` code including the AIDS estimation and yielding our main Tables 2 and 3 are freely downloadable at `https://www.parisschoolofeconomics.eu/fr/gauthier-stephane/`.

Table 8: Compensated price and income elasticities

Price of	Food	Clothing	Furnishings	Health	Transport	Communication	Restaurants	Other	Income
Poor									
Food	-0.328	0.298	0.102	0.068	-0.018	-0.201	0.062	0.017	0.91
	(0.019)	(0.009)	(0.01)	(0.01)	(0.01)	(0.004)	(0.01)	(0.009)	(0.003)
Clothing	0.418	-0.556	0.121	0.17	-0.089	-0.213	0.024	0.124	1.12
	(0.013)	(0.01)	(0.006)	(0.008)	(0.008)	(0.003)	(0.006)	(0.007)	(0.003)
Furnishings	0.59	0.5	-0.877	0.226	-0.181	-0.159	-0.112	0.012	0.983
	(0.055)	(0.024)	(0.026)	(0.03)	(0.026)	(0.008)	(0.017)	(0.013)	(0.005)
Health	0.25	0.45	0.145	-1.027	0.216	-0.115	-0.011	0.092	1.051
	(0.038)	(0.022)	(0.019)	(0.036)	(0.024)	(0.011)	(0.02)	(0.022)	(0.009)
Transport	0.201	0.719	0.354	-0.66	-1.001	-0.013	-0.052	0.452	0.902
	(0.114)	(0.06)	(0.05)	(0.073)	(0.093)	(0.028)	(0.049)	(0.054)	(0.021)
Communication	0.632	0.477	0.086	0.098	-0.004	-1.365	0.037	0.039	1.05
	(0.014)	(0.008)	(0.004)	(0.01)	(0.008)	(0.005)	(0.004)	(0.007)	(0.004)
Restaurants	1.215	0.341	-0.381	-0.06	0.091	-0.235	-0.577	-0.395	1.131
	(0.188)	(0.078)	(0.057)	(0.104)	(0.086)	(0.024)	(0.073)	(0.04)	(0.013)
Other	0.244	1.241	0.029	0.347	-0.562	-0.173	-0.281	-0.845	0.926
	(0.125)	(0.068)	(0.032)	(0.082)	(0.067)	(0.03)	(0.029)	(0.049)	(0.012)
Middle									
Food	-0.403	0.351	0.098	-0.002	0.01	-0.12	0.059	0.006	0.82
	(0.028)	(0.014)	(0.014)	(0.016)	(0.015)	(0.006)	(0.014)	(0.015)	(0.007)
Clothing	0.33	-0.422	0.143	0.143	-0.111	-0.145	-0.013	0.074	1.137
	(0.014)	(0.012)	(0.007)	(0.01)	(0.008)	(0.004)	(0.007)	(0.009)	(0.005)
Furnishings	0.466	0.727	-1.057	0.11	-0.237	-0.093	0.025	0.059	0.971
	(0.066)	(0.035)	(0.031)	(0.041)	(0.03)	(0.01)	(0.022)	(0.019)	(0.008)
Health	-0.009	0.574	0.087	-1.095	0.302	-0.004	0.027	0.117	1.107
	(0.06)	(0.039)	(0.033)	(0.062)	(0.038)	(0.019)	(0.034)	(0.04)	(0.02)
Transport	-0.096	1.125	0.475	-0.766	-1.294	0.12	0.07	0.367	0.782
	(0.14)	(0.082)	(0.059)	(0.096)	(0.107)	(0.033)	(0.059)	(0.07)	(0.034)
Communication	0.566	0.728	0.093	0.005	0.06	-1.456	-0.032	0.038	1.022
	(0.03)	(0.02)	(0.009)	(0.023)	(0.016)	(0.01)	(0.009)	(0.014)	(0.011)
Restaurants	4.055	-0.913	0.357	0.498	-0.499	0.469	-2.054	-1.912	1.371
	(0.965)	(0.487)	(0.313)	(0.616)	(0.423)	(0.135)	(0.447)	(0.257)	(0.107)
Other	0.129	1.584	0.25	0.625	-0.772	-0.161	-0.562	-1.093	0.764
	(0.299)	(0.196)	(0.079)	(0.214)	(0.148)	(0.058)	(0.076)	(0.115)	(0.034)
Rich									
Food	-0.469	0.337	0.12	0.084	-0.045	-0.101	0.063	0.014	0.762
	(0.035)	(0.019)	(0.018)	(0.022)	(0.018)	(0.008)	(0.018)	(0.019)	(0.007)
Clothing	0.324	-0.466	0.207	0.312	-0.175	-0.181	-0.032	0.012	1.179
	(0.018)	(0.017)	(0.01)	(0.015)	(0.011)	(0.006)	(0.009)	(0.013)	(0.005)
Furnishings	0.368	0.661	-1.069	0.309	-0.254	-0.134	0.067	0.051	1.047
	(0.054)	(0.033)	(0.029)	(0.041)	(0.024)	(0.009)	(0.02)	(0.017)	(0.006)
Health	0.128	0.497	0.154	-0.824	0.054	-0.099	0.041	0.049	1.218
	(0.033)	(0.023)	(0.02)	(0.039)	(0.022)	(0.012)	(0.021)	(0.025)	(0.01)
Transport	0.222	0.888	0.403	-0.173	-1.486	-0.087	0.057	0.177	1.207
	(0.089)	(0.055)	(0.038)	(0.07)	(0.062)	(0.021)	(0.035)	(0.042)	(0.016)
Communication	0.399	0.741	0.171	0.254	-0.07	-1.504	-0.015	0.024	1.209
	(0.033)	(0.023)	(0.012)	(0.03)	(0.017)	(0.01)	(0.011)	(0.014)	(0.008)
Restaurants	1.835	-0.975	0.636	0.784	-0.346	0.109	-1.42	-0.623	1.144
	(0.52)	(0.29)	(0.19)	(0.397)	(0.212)	(0.079)	(0.248)	(0.139)	(0.045)
Other	0.973	0.875	1.2	2.326	-2.615	-0.439	-1.531	-0.789	-0.178
	(1.365)	(0.952)	(0.4)	(1.17)	(0.62)	(0.252)	(0.34)	(0.482)	(0.121)

C Mimickers' behavior

The demand of a household of class i that would mimic the behavior of a household of class j is computed from the fitted demand of class i evaluated at the post-tax income (total expenditures) of the nearest score household of class j. The differences (9) are given in Table 9. The last column of this table gives the corresponding differences in marginal utilities of income in the ratio formulation relevant in (6).

Table 9: Mimickers' fictitious demand

		$\frac{n_i q^k \xi^k_{ij}}{q^k \xi^k} - \frac{n_i}{n_j}\frac{n_j q^k \xi^k_{jj}}{q^k \xi^k}$ in (9)								$\frac{\alpha_{ii}}{\alpha_{ij}}$ in (6)
class i	income j	Consumption category k								
		Food	Clothing	Furnishings	Health	Transport	Communication	Restaurants	Other	
1388										
Poor	Middle	-0.04[1]	**0.88**	0.36	0.28	-0.54	**-1.16**	0.26	-0.04	1.86
Poor	Rich	-0.03	**1.56**	0.59	0.30	**-0.98**	**-2.15**	0.33	-0.07	3.25
Middle	Poor	-0.05	0.49	0.16	0.08	-0.28	-0.34	-0.03	-0.09	0.56
Middle	Rich	-0.12	**1.53**	0.43	0.09	**-0.79**	**-1.05**	-0.35	-0.29	1.75
Rich	Poor	-0.05	0.31	0.22	0.21	-0.29	-0.30	0.01	-0.14	0.55
Rich	Middle	-0.09	0.53	0.41	0.41	-0.51	-0.55	-0.04	-0.24	0.31
1393										
Poor	Middle	-0.06	**1.33**	0.47	0.38	-0.59	**-1.82**	0.26	-0.09	1.89
Poor	Rich	0.01	**2.12**	**0.79**	0.43	**-0.94**	**-2.99**	0.33	-0.10	3.03
Middle	Poor	-0.05	**0.79**	0.25	0.13	-0.28	-0.59	-0.08	-0.08	0.56
Middle	Rich	-0.08	**1.94**	0.59	0.11	**-0.71**	**-1.45**	-0.51	-0.26	1.62
Rich	Poor	-0.05	0.48	0.31	0.26	-0.26	-0.47	-0.01	-0.12	0.61
Rich	Middle	-0.08	**0.74**	0.49	0.45	-0.46	**-0.77**	-0.11	-0.22	0.33

Note 1: The difference between the Food budget share (in total Food expenditures) of a Poor household who would earn the income of a Middle class household and the Food budget share of a Middle class household is -0.04 percentage points in 1388.

D Definition of income classes

In the welfarist case one can deal with $I = 3$ different income classes at most. To assess the robustness of the results in Tables 2 and 3 to the three-income classification we reproduce in Table 10 the results obtained scanning the poor threshold from D1 to D7, adjusting the threshold percentile that separates the rich from the middle class so that they form two equal size classes, as done in the non-welfarist case (Table 4).

In every variant the only binding incentive constraint involves the rich mimicking the poor in 1388 while the progressive redistribution pattern remains unaffected; as expected, the social valuation of the poor decreases as richer households are allocated to this class. The stability of the only positive multiplier suggests that the very rich envy the very poor at the optimal tax system, a puzzling feature that is different from the one found in the non-welfarist case. Note also that, referring to the residuals, the three equal size class choice may not be the most relevant: both the case of a narrow poor class (in the first two

deciles of the income distribution) and an expanded poor class consisting of the 7 bottom deciles of this distribution perform better.

In 1393 the absence of binding incentive constraints and the recovered Benthamite social welfare hold whatever the classification is: the three equal size class does not conceal within class heterogeneity in social valuations.

Table 10: Three-class results in the welfarist case

	Classes	Residual	Lagrange multipliers (λ^*_{ij})						a^*_{M}	a^*_{P}	a^*_{R}
			MP[2]	MR	PM	PR	RM	RP			
1388											
	0.1-0.55[1]	1.89	2.21e-07	5.61e-03	2.45e-04	4.52e-05	1.05e-08	1.01	1.31	4.2	1.09
	0.2-0.6	1.81	2.16e-08	3.00e-09	1.67e-08	5.45e-08	3.91e-05	0.93	1.33	3.61	1.07
	0.3-0.65	2.67	1.90e-03	1.60e-02	4.61e-03	2.46e-10	1.53e-07	1.29	1.3	3.06	0.96
	0.4-0.7	2.49	1.79e-05	1.95e-02	9.35e-10	6.61e-03	4.88e-05	1.21	1.28	2.34	0.98
	0.5-0.75	2.72	1.57e-05	3.36e-04	2.25e-08	7.74e-05	1.08e-07	1.79	1.31	2.32	0.77
	0.6-0.8	1.96	3.60e-04	1.72e-04	5.90e-10	1.54e-05	1.13e-07	1.62	1.29	1.92	0.82
	0.7-0.85	1.82	1.24e-08	1.88e-08	1.12e-06	1.61e-03	8.58e-07	1.86	1.34	1.76	0.76
1393											
	0.1-0.55	0.36	3.54e-04	4.17e-05	2.81e-01	2.12e-08	2.67e-06	1.52e-10	1.05	0.43	0.98
	0.2-0.6	0.22	1.44e-09	1.48e-04	9.25e-02	1.34e-04	6.75e-11	3.28e-09	1.03	0.81	0.98
	0.3-0.65	0.20	5.94e-09	3.01e-04	5.23e-02	5.49e-06	4.74e-11	3.43e-10	1.03	0.89	0.98
	0.4-0.7	0.31	4.71e-06	3.12e-08	3.90e-02	2.01e-08	1.25e-10	1.47e-06	1.04	0.91	0.98
	0.5-0.75	0.10	5.32e-07	3.26e-02	7.44e-10	9.79e-05	1.02e-07	1.15e-08	0.93	0.99	1.02
	0.6-0.8	0.11	7.98e-09	9.60e-10	7.28e-04	1.01e-02	8.73e-10	3.48e-09	0.99	0.95	1.01
	0.7-0.85	0.12	2.31e-09	3.59e-07	1.43e-08	7.48e-03	8.88e-09	1.77e-08	0.98	0.96	1.02

1. Poor (Rich) adult-equivalent after-tax income is below D1 (above P55).
2. P(oor), M(iddle), R(ich). Lagrange multiplier $\lambda^*_{\mathtt{MP}}$ associated with the middle class M mimicking the poor P.