Is the Moroccan fiscal system progressive ? A Shapley decomposition

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Background

- One of the main social and economic roles of governments : to improve and maintain the standard of living of their populations
- Put in place efficient redistribution systems based on direct and indirect taxation combined with a system of subsidies and cash transfers to provide accessible public services (e.g. education and health)

Background

- But effectiveness of these systems in fighting poverty and reducing inequality is neither guaranteed nor proven ([Lustig and Higgins, 2012])
  - Combinations of components of these systems could even increase poverty and/or deepen inequality
  - Impact of same combinaison of income tax and transfers could be different from one country to another

Background - In Morocco

- Reforms of VAT and Income taxes on the agenda (Third National Assises of Fiscality, 2019)
- Reform of the social protection system becomed a national priority for the country recognized at the highest level of the Moroccan government,
- Explicit objectives : fighting poverty, improving the living conditions of the most vulnerables and reduce inequality and strengthing the middle class

Objectives and contributions

- Question the efficiency of fiscal policy and subsidies in Morocco by characterizing its progressive or pro-poor nature
- Contributions
  - Update of works of [Abdelkhalek and Ejjanoui, 2018] and [Ehrhart et al., 2020] for 2019
  - Enhance these works by conducting an in-depth distributional analysis
  - Assess the contributions of different tax components (taxes and subsidies) to the variation in welfare measures (poverty and inequality) between the two incomes (market and observed) using Shapley decomposition method

Generalities on Moroccan fiscality

- Deep tax reform in the 1980s for a modern, coherent, efficient and more universal tax system
- Creation of the General Tax Code (CGI) for definition and content of taxes
- Tax/GDP ratio in Morocco in 2019 : 28.4% (OECD - 2021) $\Rightarrow$ MAD 238 999 million (BAM - 2020)

Generalities on Moroccan fiscality

	2020	2021	Ecarts	
			en %	en valeur
Recettes ordinaires	**253,1**	**278,3**	**10,0**	**25,2**
Recettes fiscales*	222,8	242,3	8,8	19,5
- Impôts directs	92,7	90,4	-2,4	-2,2
Dont I.S	48,8	44,5	-8,8	-4,3
I.R	40,2	44,2	10,0	4,0
- Impôts indirects	107,4	124,2	15,6	16,8
TVA	80,0	93,3	16,5	13,2
TIC	27,4	31,0	13,0	3,6
- Droits de douane	9,5	11,9	25,3	2,4
- Enregistrement et timbre	13,3	15,8	19,3	2,6

Source : BAM (2021)

Fiscal taxes

- Two main taxes : Income taxes (IT) and Value added tax (VAT)
- IT : based on a *a priori* progressive scale set by law

Net taxable income range	IT rates	Amount to deduct
Until 30,000MAD	Exemption	–
De 30,001 à 50,000MAD	10%	3,000MAD
De 50,001 à 60,000MAD	20%	8,000MAD
De 60,001 à 80,000MAD	30%	14,000MAD
De 80,001 à 180,000MAD	34%	17,200MAD
More than 180,000MAD	38%	24,400MAD

Source : [Royaume du Maroc, 2022]

Fiscal taxes

- VAT : Indirect tax since 1986
- Not necessarily progressive among consumers : proportional with same effet among population
- VAT rates applied in Morocco : 0% for basic necessities, 7% , 10% , 14% and 20%

Subsidies

- Social policies through direct and indirect transfers to fight against poverty and reduce inequalities
- A compensation system implemented to control the prices of some commodities
- Subsidized products : soft wheat flour, sugar, butane gas

Subsidies

Table – *Subsidies by product - 2019*

	Floor		Sugar		Butane gas	
	2012	**2019**	**2012**	**2019**	**2012**	**2019**
Subsidy (MAD/kg or liter)	0.83	1.55	2.5	2.85	7.5	3.75
Total compensation cost (in millions of MAD)	3,000	1,008	5,027	3,407	15,795	9,472

Source : [Ministère de l'Economie, des Finances et de la Réforme de l'Administration, 2022] ; [Cours des Comptes, 2020] ; [Cours des Comptes, 2014].

Subsidies

- Subsidies to households *via* services provided for free by the government : education and health
- Direct or indirect subsidies : AMO, schools, Tayssir, "1 million de cartables"
- Other subsidies : Widows, divorced, unemployed, ...

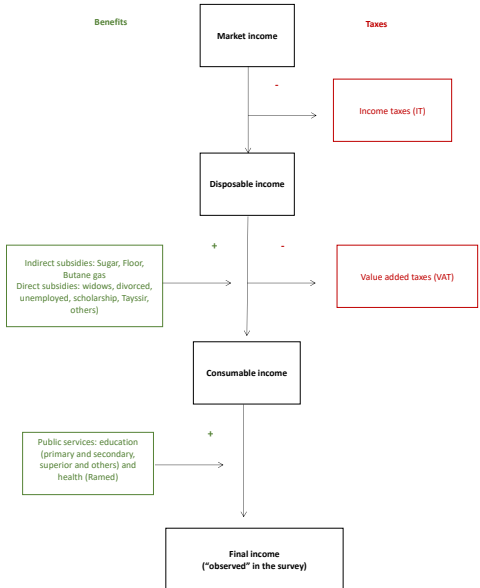
General framework

- Adaptation of the micro-simulated approach developed in the Commitment to Equity Assessment (CEQ) project to assess taxation and public expenditure systems and their impacts on poverty and inequality [Lustig and Higgins, 2012]
  - Applied to many countries in Latin America and in the MENA region : Tunisia [Jouini et al., 2018], Egypt [Lara Ibarra et al., 2019], Jordan [Inchauste and Lustig, 2017], and Morocco [Abdelkhalek and Ejjanoui, 2018] for 2012 and [Ehrhart et al., 2020] for 2017

General framework

- Component construction : 4 income levels, 2 taxes and 6 subsidies (direct and indirect)
  - Final income by individual and household
  - Consumable income
  - Disposable income
  - Market income
  - Taxes : IT, VAT
  - Benefits : commodities, health, primary and secondary education, superior education, other education and others

Income structure



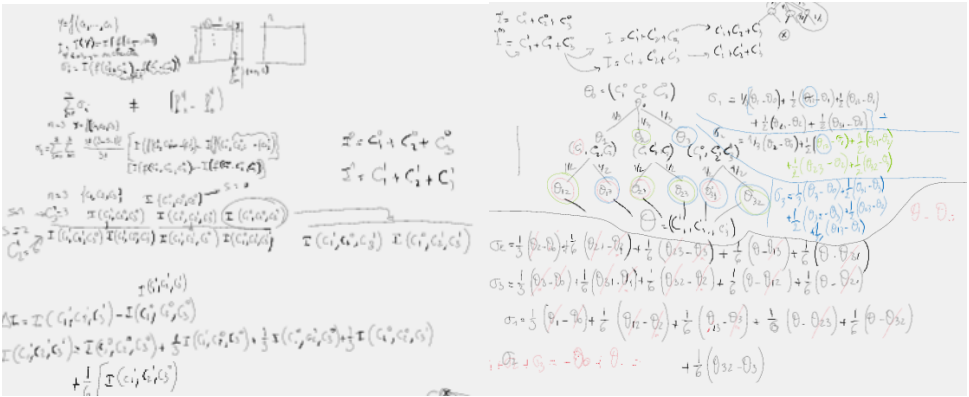
Ponctual and distributional analysis

- For Morocco and by areas (urban and rural)
- Ponctual analysis
  - Monetary poverty (FGT) with relative poverty line $z_p = 0.5$ median
  - Inequality (Gini, Theil)
  - Concentration indices [Kakwani, 1977]
- Distributional analysis
  - Density functions
  - Stochastic dominance
  - Incidence curves
  - Lorenz and concentration curves

Shapley decomposition - Principle

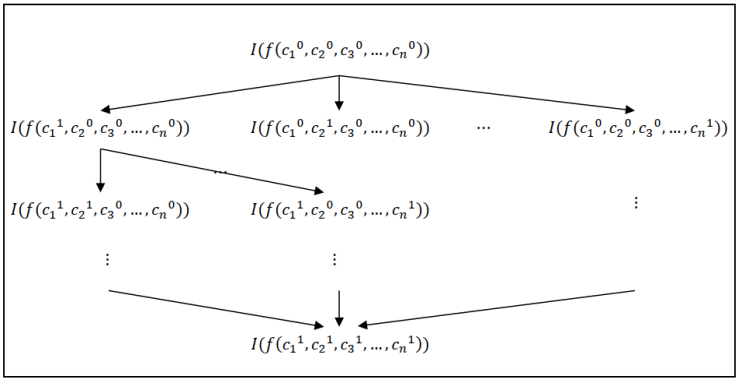
- Decomposition method based on the Shapley value [Shapley, 1953] from cooperative models of game theory
- Allow to evaluate the contribution of components on welfare indices through microsimulations of counterfactuals used to measure poverty and inequality
- Principle
  - Measure the marginal effect of the successive elimination of each of the components taken one by one
  - Take the average of all the possible combinations of elimination because of the pathdependence

Shapley decomposition - Principe



Source : Authors

Shapley decomposition - Principe



Source : [Azevedo et al., 2012a]

Shapley decomposition - Method

- Let a well-being indicator Y^h for the individual h ($h = 1, \ldots, H$)
- Y^h is a function of N components c_k^h (with k an element of the set $\mathrm{K} = \{1, \ldots, N\}$) such as $Y^h = f\left(c_1^h, c_2^h, \ldots, c_N^h\right)$
- Let I, an index of interest, function of Y^h such that $I(Y^1, Y^2, \ldots, Y^H) = I\left(f\left(c_1^1, c_2^1, \ldots, c_N^1\right), f\left(c_1^2, c_2^2, \ldots, c_N^2\right), \ldots, f\left(c_1^H, c_2^H, \ldots, c_N^H\right)\right)$
- Let $\mathrm{S} \subseteq \mathrm{K}$ and $I(\mathrm{S})$ the value that the interest index takes on when the components c_k, $k \notin \mathrm{S}$ remain unchanged between two states of nature (t) (two periods or scenarios)

Shapley decomposition - Method

- Let ϕ_k be the marginal contribution of each of the N components c_k to the total variation of the interest index I between $t = 0$ and $t = 1$
- Shapley's method calculates the c_k contribution as the weighted average of the marginal contributions of the k components, $I(\mathrm{S} \cup \{k\}) - I(\mathrm{S})$, for any subset S $(\mathrm{S} \subseteq \mathrm{K} - \{k\})$ with Cardinal $|\mathrm{S}| = s$

$\Rightarrow$ This marginal contribution therefore represents the change in I associated with the addition of the k^{th} component

Shapley decomposition - Method

- Pathdependence problem $\Rightarrow$ Important to consider the order σ in which the component k is added to the components already considered in S such that $\sigma = (\sigma_1, \sigma_2, \ldots, \sigma_{k-1}, \sigma_k, \sigma_{k+1} \ldots, \sigma_N)$
- The contribution of the components included in S is measured by the probability that the s first components of σ belong to S
- This probability is obtained by considering a number of favorable cases (numerator) over a number of possible cases (denominator)

Shapley decomposition - Method

$\Rightarrow$ Shapley value of the component k, ϕ_k :

$$\phi_k = \sum_{s=0}^{N-1} \sum_{\substack{S \subseteq K-\{k\} \\ |S|=s}} \frac{s!(N-s-1)!}{N!} [I(S \cup \{k\}) - I(S)]. \qquad (1)$$

Shapley decomposition - Implementation

- Interpretation : average is the contribution of each component to the indicator of interest
- Operationalization :
  - Generalization of the Shapley decomposition method by [Shorrocks et al., 2013]
  - Using *adecomp* Stata's *ado* file developed by [Azevedo et al., 2012b]

Data

- Data from the 2019 wave of the Household Panel Survey (EPM) of the *Observatoire national du développement humain* (ONDH)
  - 16 793 households (58,44 % urban and 41,56 % rural)
  - Several components were explored : income (24 sources), expenditures by product (1,283), employment, socio-economic characteristics, ...

Poverty by *per capita* incomes and expenditure and areas

		FGT0	FGT1	FGT2
Market Income	Morocco	**0,226**	0,075	0,037
	Urban	**0,231**	0,072	0,033
	Rural	**0,217**	0,080	0,043
Disposable Income	Morocco	0,218	0,071	0,035
	Urban Why ?	0,218	0,066	0,030
	Rural	0,218	0,080	0,043
Consumable Income	Morocco	0,220	0,070	0,034
	Urban	0,221	0,066	0,029
	Rural	0,219	0,078	0,041
Final Income	Morocco	**0,114**	0,020	0,005
	Urban	**0,132**	0,024	0,007
	Rural	**0,084**	0,014	0,003
Expenditure	Morocco	**0,110**	0,019	0,005
	Urban	**0,123**	0,022	0,006
	Rural	**0,087**	0,013	0,003

Source : Calculus done by authors from EPM 2019.

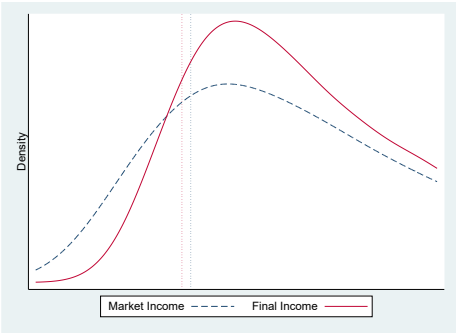
Inequality by *per capita* incomes and expenditure and areas

		Gini	Theil
Market Income	Morocco	**0,470**	**0,434**
	Urban	**0,449**	**0,397**
	Rural	**0,401**	**0,290**
Disposable Income	Morocco	0,438	0,369
	Urban	0,418	0,338
	Rural	0,380	0,253
Consumable Income	Morocco	0,435	0,365
	Urban	0,416	0,336
	Rural	0,376	0,249
Final Income	Morocco	**0,378**	**0,284**
	Urban	**0,367**	**0,296**
	Rural	**0,272**	**0,159**
Expenditure	Morocco	**0,359**	**0,252**
	Urban	**0,343**	**0,234**
	Rural	**0,280**	**0,135**

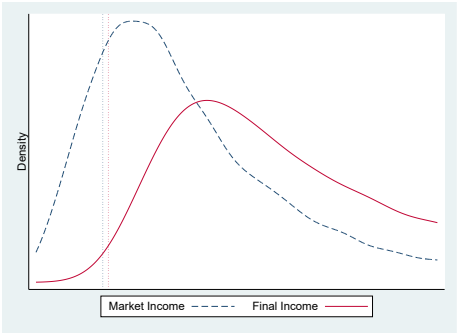
Source : Calculus done by authors from EPM 2019.

Density functions

a - Urban



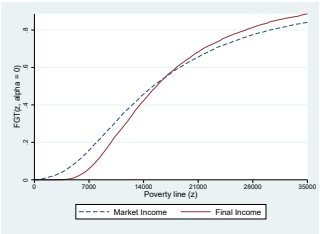
b - Rural



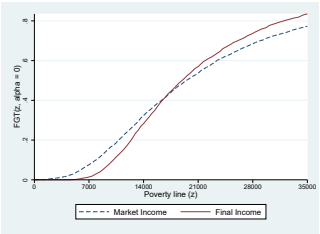
Source : Calculus done by authors.

Stochastic dominance - Order 1

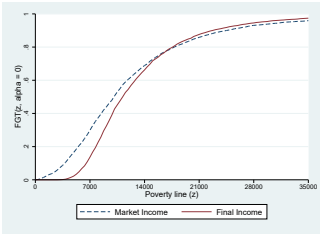
a - Morocco



b - Urban



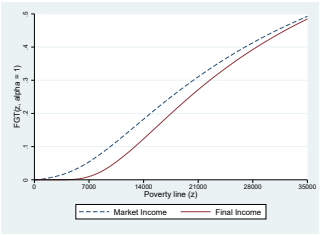
c - Rural



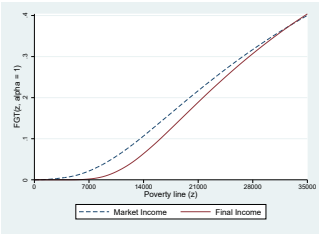
Source : Calculus done by authors.

Stochastic dominance - Order 2

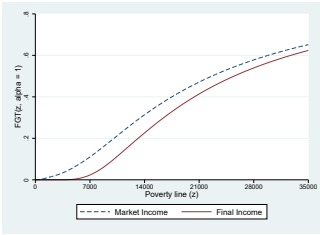
a - Morocco



b - Urban



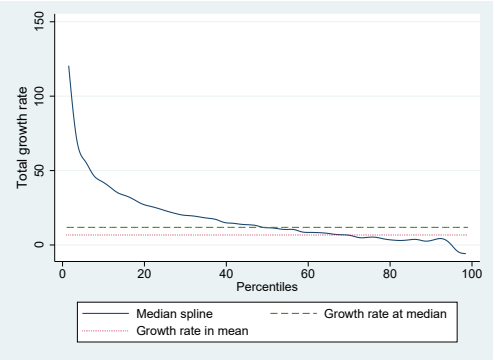
c - Rural



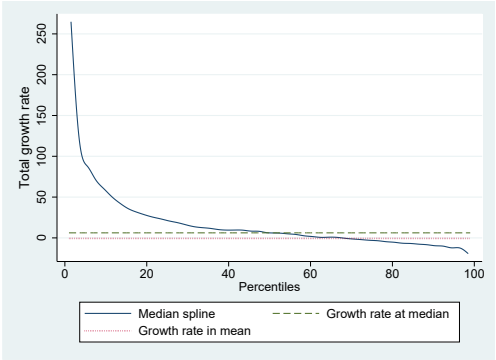
Source : Calculus done by authors.

Incidence curves

a - Urban



b - Rural



Source : Calculus done by authors.

Distribution of IT and VAT by quintile and area

		IncomeTaxes			VAT		
	Final Income	Total	% of total Income taxes	% of Final Income	Total	% of total VAT	% of Final Income
MOROCCO							
Quintile 1	123600407	3103996	1,43%	2,51%	6934928	8,06%	5,61%
Quintile 2	174523037	8824618	4.07%	5.06%	9915278	11.52%	5.68%
Quintile 3	219903177	17845735	8.23%	8.12%	12819252	14.89%	5.83%
Quintile 4	307737131	36244487	16.72%	11.78%	18336413	21.30%	5.96%
Quintile 5	595188688	130817319	60.36%	21.98%	33623332	39.06%	5.65%
Total	1499095708	216743095	100.00%	14.46%	86072456	100.00%	5.74%
URBAN							
Quintile 1	30754707	1019522	0.62%	3.32%	1685709	2.97%	5.48%
Quintile 2	80689127	4570495	2.79%	5.66%	4530104	7.99%	5.61%
Quintile 3	130670534	11444309	6.99%	8.76%	7539978	13.30%	5.77%
Quintile 4	216648891	27372212	16.71%	12.63%	12841228	22.66%	5.93%
Quintile 5	503708157	112881991	68.93%	22.41%	28757226	50.74%	5.71%
Total	985713689	163764523	100.00%	16.61%	56674738	100.00%	5.75%
RURAL							
Quintile 1	92314852	2003619	6.05%	2.17%	5230325	20.79%	5.67%
Quintile 2	93357786	4006011	12.09%	4.29%	5382848	21.40%	5.77%
Quintile 3	88987970	6058563	18.28%	6.81%	5294794	21.05%	5.95%
Quintile 4	90666046	7912767	23.88%	8.73%	5503229	21.88%	6.07%
Quintile 5	83760060	14772587	44.58%	17.64%	4226215	16.80%	5.05%
Total	440109913	33135001	100.00%	7.53%	25156425	100.00%	5.72%

Source: Calculus done by authors.

Distribution of subsidies by quintile for Morocco

Morocco	Final Income	Compensed Products Subs.			Health Subs.		
		Total	% of total comp. Prod. Subs.	% of Final Income	Total	% of total health Subs.	% of Final Income
Quintile 1	123600407	3516102	16.05%	2.84%	916288	34.56%	0.74%
Quintile 2	174523037	3773112	17.22%	2.16%	693886	26.17%	0.40%
Quintile 3	219903177	4070055	18.58%	1.85%	545351	20.57%	0.25%
Quintile 4	307737131	4725821	21.57%	1.54%	405824	15.31%	0.13%
Quintile 5	595188688	5393978	24.62%	0.91%	175171	6.61%	0.03%
Total	1499095708	21907715	100.00%	1.46%	2651103	100.00%	0;18%

	Final Income	Education Superior Subsidies			PrimSec Education Subsidies		
		Total	% of total Sup. educ. Subs.	% of Final Income	Total	% of total PrimSec. educ. Subs.	% of Final Income
Quintile 1	123600407	1878606	8.63%	1.52%	34637042	29.66%	28.02%
Quintile 2	174523037	3196686	14.69%	1.83%	30146688	25.82%	17.27%
Quintile 3	219903177	4060145	18.66%	1.85%	25472508	21.82%	11.58%
Quintile 4	307737131	5468023	25.13%	1.78%	19574943	16.76%	6.36%
Quintile 5	595188688	6362314	29.24%	1.07%	9703719	8.31%	1.63%
Total	1499095708	21755990	100.00%	1.45%	116764634	100.00%	7.79%

	Final Income	Other Education Subsidies		
		Total	% of total Other. educ. Subs.	% of Final Income
Quintile 1	123600407	1153220	38.56%	0.93%
Quintile 2	174523037	772424	25.83%	0.44%
Quintile 3	219903177	559638	18.71%	0.25%
Quintile 4	307737131	469522	15.70%	0.15%
Quintile 5	595188688	152462	5.10%	0.03%
Total	1499095708	2990972	100.00%	0.20%

Distribution of subsidies by quintile for Urban area

URBAN	Final Income	Compensed Products Subs.			Health Subs.		
		Total	% of total comp. Prod. Subs.	% of Final Income	Total	% of total health Subs.	% of Final Income
Quintile 1	30754707	746689	5.99%	2.43%	224212	18.81%	0.73%
Quintile 2	80689127	1641810	13.17%	2.03%	314151	26.35%	0.39%
Quintile 3	130670534	2322719	18.63%	1.78%	294366	24.69%	0.23%
Quintile 4	216648891	3228329	25.90%	1.49%	256983	21.56%	0.12%
Quintile 5	503708157	4410982	35.39%	0.88%	123718	10.38%	0.02%
Total	985713689	12464643	100.00%	1.26%	1192163	100.00%	0.12%

	Final Income	Education Superior Subsidies			PrimSec Education Subsidies		
		Total	% of total Sup. educ. Subs.	% of Final Income	Total	% of total PrimSec. educ. Subs.	% of Final Income
Quintile 1	30754707	688049	4.51%	2.24%	9228048	15.09%	30.01%
Quintile 2	80689127	1800233	11.79%	2.23%	15070959	24.64%	18.68%
Quintile 3	130670534	2821337	18.48%	2.16%	15516925	25.37%	11.87%
Quintile 4	216648891	4188833	27.44%	1.93%	14290454	23.36%	6.60%
Quintile 5	503708157	5601918	36.69%	1.11%	7898165	12.91%	1.57%
Total	985713689	15267053	100.00%	1.55%	61171085	100.00%	6.21%

	Final Income	Other Education Subsidies		
		Total	% of total Other. educ. Subs.	% of Final Income
Quintile 1	30754707	99430.2	18.66%	0.32%
Quintile 2	80689127	105979	19.89%	0.13%
Quintile 3	130670534	121607	22.82%	0.09%
Quintile 4	216648891	143091	26.85%	0.07%
Quintile 5	503708157	71480.6	13.41%	0.01%
Total	985713689	532856	100.00%	0.05%

Distribution of subsidies by quintile for Rural area

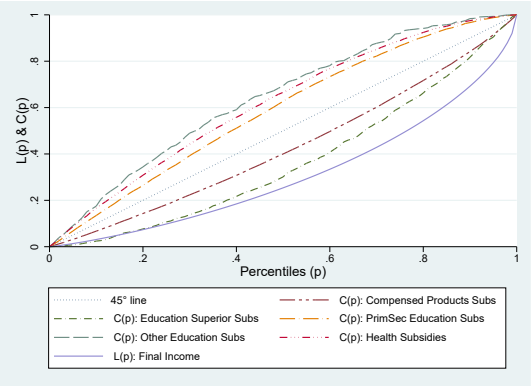
URBAN	Final Income	Compensed Products Subs.			Health Subs.		
		Total	% of total comp. Prod. Subs.	% of Final Income	Total	% of total health Subs.	% of Final Income
Quintile 1	92314852	2789334	30.26%	3.02%	689174	43.92%	0.75%
Quintile 2	93357786	2167895	23.52%	2.32%	380885	24.27%	0.41%
Quintile 3	88987970	1779638	19.31%	2.00%	261795	16.68%	0.29%
Quintile 4	90666046	1539383	16.70%	1.70%	162364	10.35%	0.18%
Quintile 5	83760060	1016954	11.03%	1.21%	65740.5	4.19%	0.08%
Total	440109913	9217050	100.00%	2.09%	1569246	100.00%	0.36%

	Final Income	Education Superior Subsidies			PrimSec Education Subsidies		
		Total	% of total Sup. educ. Subs.	% of Final Income	Total	% of total PrimSec. educ. Subs.	% of Final Income
Quintile 1	92314852	1122222	22.41%	1.22%	25093720	44.27%	27.18%
Quintile 2	93357786	1240535	24.78%	1.33%	14476037	25.54%	15.51%
Quintile 3	88987970	1077131	21.51%	1.21%	9780860	17.26%	10.99%
Quintile 4	90666046	1105351	22.08%	1.22%	5007831	8.84%	5.52%
Quintile 5	83760060	531038	10.61%	0.63%	1891727	3.34%	2.26%
Total	440109913	5006924	100.00%	1.14%	56680243	100.00%	12.88%

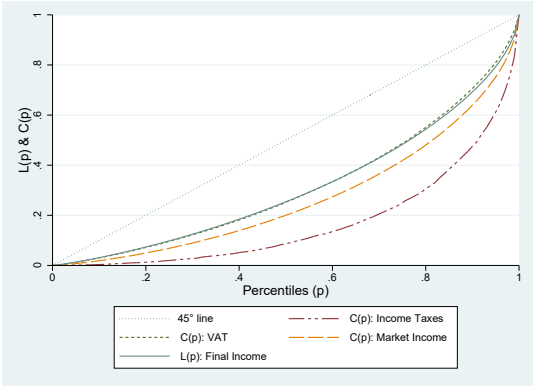
	Final Income	Other Education Subsidies		
		Total	% of total Other. educ. Subs.	% of Final Income
Quintile 1	92314852	1100064	37.47%	1.19%
Quintile 2	93357786	779046	26.53%	0.83%
Quintile 3	88987970	518517	17.66%	0.58%
Quintile 4	90666046	417681	14.23%	0.46%
Quintile 5	83760060	117854	4.01%	0.14%
Total	440109913	2936112	100.00%	0.67%

Lorenz and concentration curves : Morocco

a - Subsidies



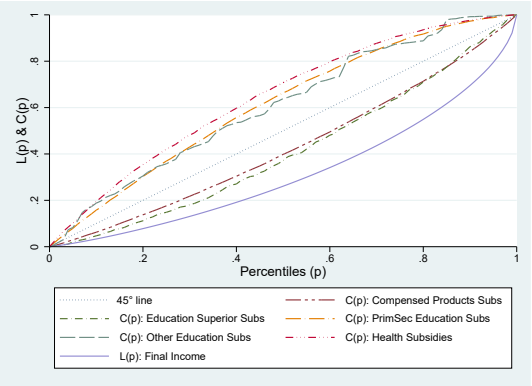
b - Taxes



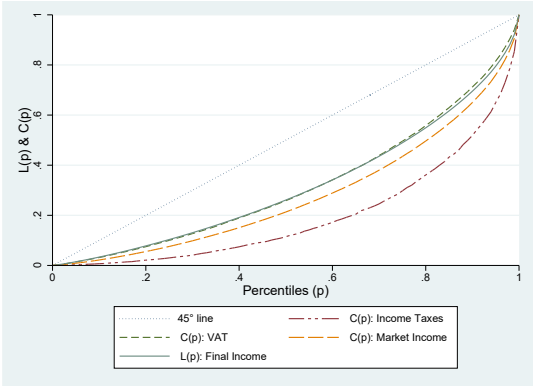
Source : Calculus done by authors.

Lorenz and concentration curves : Urban area

a - Subsidies



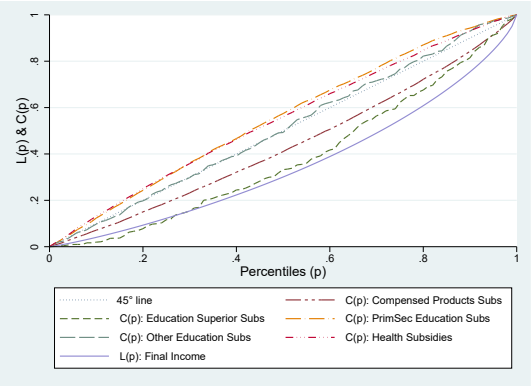
b - Taxes



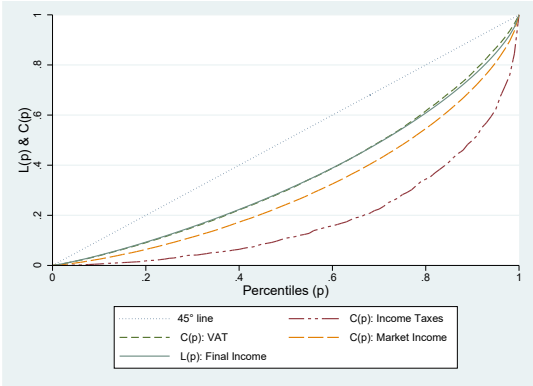
Source : Calculus done by authors.

Lorenz and concentration curves : Rural area

a - Subsidies



b - Taxes



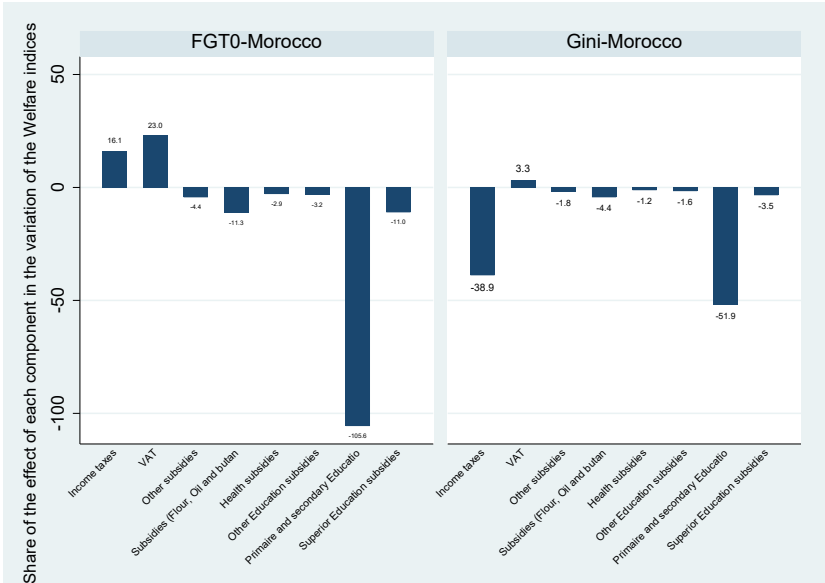
Source : Calculus done by authors.

Concentration index by subsidy and area

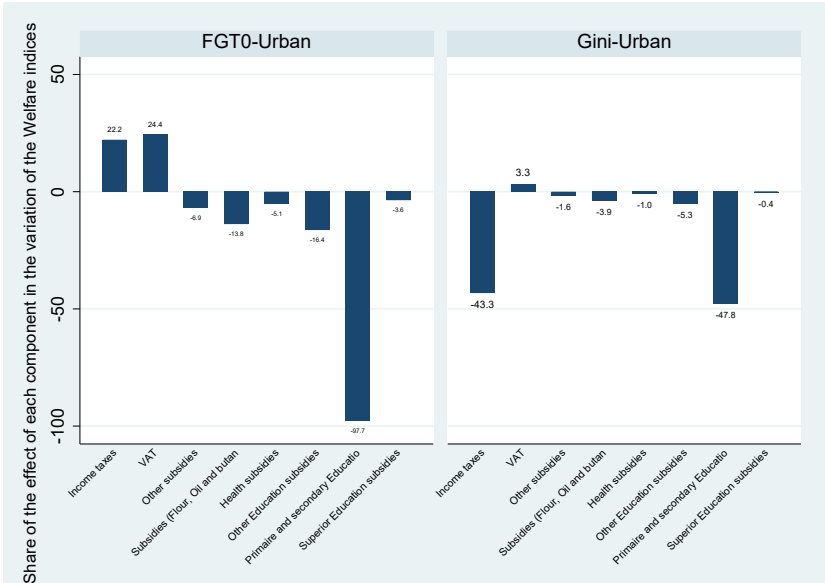
	Subsidies	Concentration index	SD	LB	UB
Morocco	Other Subventions	0,200	0,024	0,152	0,248
	Compensed Products Subsidies	0,142	0,002	0,139	0,145
	Education Superior Subsidies	0,265	0,008	0,250	0,281
	PrimSec Education Subsidies	-0,174	0,003	-0,179	-0,168
	Other Education Subsidies	-0,281	0,011	-0,303	-0,259
	Health Subsidies	-0,234	0,003	-0,240	-0,228
Urban	Other Subventions	0,242	0,032	0,179	0,304
	Compensed Products Subsidies	0,147	0,002	0,143	0,151
	Education Superior Subsidies	0,178	0,009	0,159	0,196
	PrimSec Education Subsidies	-0,224	0,004	-0,231	-0,216
	Other Education Subsidies	-0,211	0,025	-0,261	-0,162
	Health Subsidies	-0,288	0,005	-0,297	-0,279
Rural	Other Subventions	0,107	0,017	0,074	0,140
	Compensed Products Subsidies	0,129	0,003	0,124	0,135
	Education Superior Subsidies	0,239	0,015	0,210	0,268
	PrimSec Education Subsidies	-0,107	0,004	-0,114	-0,100
	Other Education Subsidies	-0,015	0,013	-0,041	0,011
	Health Subsidies	-0,092	0,004	-0,100	-0,084

Source: Calculus done by autors.

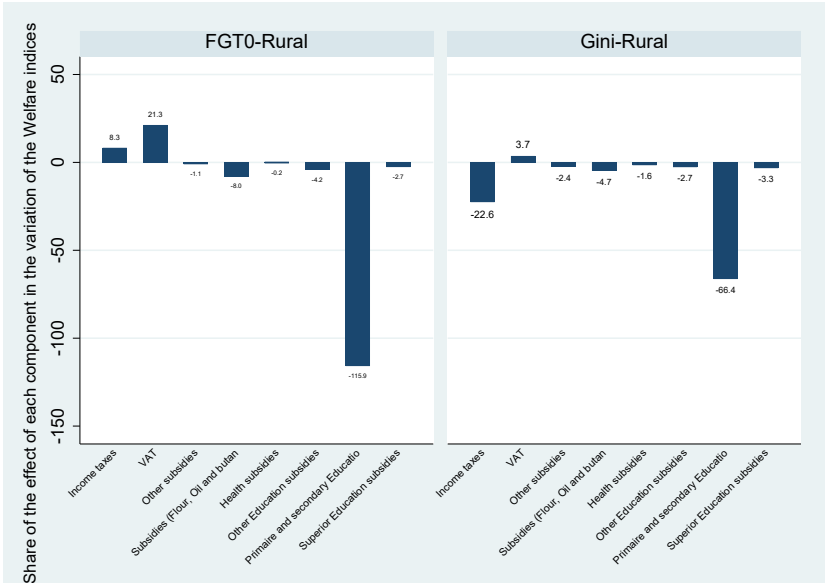
Shapley decomposition of welfare indices : Morocco



Shapley decomposition of welfare indices : Urban



Shapley decomposition of welfare indices : Rural



Conclusion

- Using the micro-simulated approach developed in the framework of the *Commitment to Equity Assessment* for 2019
  - The Moroccan tax and subsidy system, taken together, is redistributive and therefore reduces inequalities
  - Taken one by one, not all of these grants are progressive : higher education or compensation
  - In terms of poverty, the tax and subsidy system in place contributes significantly to the reduction of income poverty
  - Primary and secondary education, in addition to being a very progressive measure, contributes greatly to the reduction of poverty and inequality, especially among the poorest (rural area)

To go further ...

- Compare the evolution of these contributions between 2012 and 2019 and determine the factors behind it
- Further analysis of the impact of the abolition of the compensation system : CGE and microsimulation

Is the Moroccan fiscal system progressive ? A Shapley decomposition

T. ABDELKHALEK and D. BOCCANFUSO

Dakhla - May 22 to 24, 2024

Questions ?

References I

Abdelkhalek, T. and Ejjanoui, F. (2018).
Impact des politiques fiscales sur la pauvreté et les inégalités au Maroc1.
In *Economic Research Forum (ERF) 24st Annual Conference March*.

Azevedo, J. P., Nguyen, M. C., and Sanfelice, V. (2012a).
Adecomp : Stata module to estimate Shapley decomposition by components of a welfare measure.

Azevedo, J. P., Sanfelice, V., and Nguyen, M. C. (2012b).
Shapley decomposition by components of a welfare aggregate.
Technical report, University Library of Munich, Germany.

References II

Cours des Comptes (2014).
Rapport sur le système de compensation au Maroc diagnostic et propositions de réforme.

Cours des Comptes (2020).
Bulletin d'information du mois de janvier 2020. activité relative á l'année 2019.

References III

Ehrhart, H., Ihnach, H., El Ansary, A., Hamadi, A., Bakrim, H., Younger, S. D., et al. (2020).
Les effets de la politique budgétaire sur la pauvreté et les inégalités au Maroc.
Technical report.

Inchauste, G. and Lustig, N. (2017).
The distributional impact of taxes and transfers : Evidence from eight developing countries.
World Bank Publications.

References IV

Jouini, N., Lustig, N., Moummi, A., and Shimeles, A. (2018).
Fiscal policy, income redistribution, and poverty reduction : Evidence from Tunisia.
Review of Income and Wealth, 64 :S225–S248.

Kakwani, N. C. (1977).
Measurement of tax progressivity : an international comparison.
The Economic Journal, 87(345) :71–80.

References V

Lara Ibarra, G., Sinha, N., Fayez, R. N. S., and Jellema, J. R. (2019).
Impact of fiscal policy on inequality and poverty in the arab republic of Egypt.
World Bank Policy Research Working Paper, (8824).

Lustig, N. and Higgins, S. (2012).
Fiscal incidence, fiscal mobility and the poor : A new approach.
Technical report, Tulane University, Department of Economics.

References VI

Ministère de l'Economie, des Finances et de la Réforme de l'Administration (2022).
Projet de loi de finances pour l'année budgétaire. rapport sur la compensation.

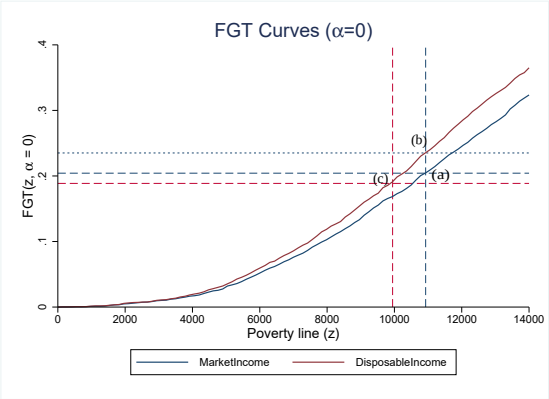
Royaume du Maroc (2022).
Code général des impôts.

Shapley, L. S. (1953).
Stochastic games.
Proceedings of the national academy of sciences, 39(10) :1095–1100.

References VII

Shorrocks, A. F. et al. (2013).
Decomposition procedures for distributional analysis : a unified framework based on the Shapley value.
Journal of Economic Inequality, 11(1) :99–126.

Impact of income taxes on incomes - Urban poverty



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Source : Calculus done by authors.