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Impact of VAT Reforms on Moroccan Household's Food Consumption: Microsimulation Analyses Through the QUAIDS Model (2001-2014)

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Abstract

This study consists in determining how changes in indirect taxation, particularly VAT, affect differently various groups of household consumption's structure. To do so, a Quadratic Almost Ideal Demand System (QUAIDS) is applied to data from the 2000/2001 and 2013/2014 National Household Consumption and Expenditure Surveys in order to estimate elasticities of demand for eight food groups and at the level of five household strata. Living standard differences of the diverse layers of the population make their preferences and reactions to economic shocks very different and change over time. It appears that Moroccan households tend to consume less vegetables and high-calorie products (sugars and cereals) and more fruit and protein-rich foods (meat, fish, fats, milk and dairy products). Moreover, the poorest households consume insufficient quantities of nutritious food products such as dairy products, fish and fruit in 2014, compared to 2001. It also shows that extending the scope of VAT to basic products, for cereals as well as for other products rich in nutrients such as fish and fruit.

تأثير إصلاحات الضريبة على القيمة المضافة على استهلاك الأسر المغربية: تحليل بالمحاكاة الجزئية من خلال نموذج QUAIDS (2014-2011)

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ملخص

يتمثل هذا العمل في تحديد كيفية تأثير ترتيبات الضرائب غير المباشرة، لا سيما الضربية على القيمة المضافة، على هيكل استهلاك مختلف طبقات الأسر المغربية. وللقيام بذلك، قمنا بتطبيق نظام الطلب التربيعي الشبه مثالي "QUAIDS"، باستعمال بيانات المسح الوطني لاستهلاك وإنفاق الأسر المغربية لسنوات 2001/2000 و2014/2013، من أجل تقدير مرونة الطلب لثماني مجموعات غذائية من طرف مختلف طبقات الأسر. مع العلم أن اختيارات وردود أفعال هذه الاسر تجاه الصدمات الاقتصادية تختلف على حسب المسترى المعيرية لسنوات 2001/2000 و2014/2013، من أجل تقدير المغربية تميل إلى تقليل استهلاكها من الخضار والمنتجات الغنية بالسعرات الحرارية (السكريات والحبوب) لصالح المغربية تميل إلى تقليل استهلاكها من الخضار والمنتجات الغنية بالسعرات الحرارية (السكريات والحبوب) وبالإضافة إلى ذلك، تستهلكها من الخضار والمنتجات الغنية بالسعرات الحرارية (السكريات والحبوب) وبالإضافة إلى ذلك، تستهلكها من الخضار والمنتجات الغنية بالسعرات الحرارية (السكريات والحبوب) وبالإضافة إلى ذلك، تستهلك الأسر الفقيرة كميات غير كافية من المنتجات الغنية غذائيا كمنتجات الألبان والأسماك والفواكه في عام 2014، على عكس عام 2001. كما يبدو أن توسيع نطاق الضريبة على القيمة المضافة على المتجات الأساسية، ولا سيما الحبوب، من شائه أن يؤثر على هيكل استهلاك الأسر المغربية، وخاصة المضافة على المنتجات الحبوب أو للمنتجات الأخرى الغنية مائيا مثل الأسماك والفواكه. كمانتجات الأساسية

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1. Introduction

In Morocco, the Value Added Tax (VAT) constitutes 70% of indirect taxes revenues and 36% of overall tax revenues, on average over the last decade, representing the main source of funding for the State and local authorities' budget .

Because of its importance, Morocco has been led to undertake a gradual reform of VAT, which since 1986 tried, through rate differentiation and exemptions, to make it an instrument of equity and redistribution. Until 1986, the Turnover Tax "TCA", prior to VAT, had 11 different rates which were reduced to 6 when VAT have been introduced on 1992, then to 5 rates currently (0%, 7%, 10%, 14% and 20%).

However, poverty and inequality are still considered the most important problems in Morocco. In fact, more than 1.6 million people are considered poor and 4.2 million vulnerable, although the situation has generally improved: in recent years, monetary poverty and vulnerability have decreased by 4.8% and 12.5% respectively between 2001 and 2014 and Gini coefficient has slightly reduced from 39,9 in 1985 to 39,5 in 2014 (HCP⁽¹⁾, World Bank; 2017).

Those inequalities are mostly observed at the level of household expenditure: poor households benefit least from the VAT rates differentiating policy. They also spend more than half of their expenditure on food, while the wealthiest ones spend only a quarter of their expenditure on it. It's important to mention that food consumption is characterized by strong disparities between the wealthiest 10% of the population and the poorest 10%. These disparities are very marked for nutritionally rich products, notably dairy products (150.5 against 15.6 liters per person per year), eggs (191 against 35 units per person per year), meat (59.8 against 11.1 Kg per head per year), fish (25.1 against 4.8 Kg) and fruit (147 against 21.6 Kg). On the other hand, these disparities are less important for cereals, vegetables, oils and sugars (HCP 2016).

Furthermore, the rich class benefits the most from the subsidies: In 2014, the structure of household consumption of subsidies, according to social classes,

shows that the wealthier class benefits from 14.4% of the total subsidies, which is higher than its demographic weight of 10.0%. The middle class represents 58.7% of the population and receives 62.2% of food and butane subsidies. By product, this proportion is 60.6% for sugar, 63.0% for national soft wheat flour and 62.3% for butane. In contrast, the modest class, with a demographic weight of 31.2%, only benefits from 23% of food and butane subsidies (HCP and World Bank; 2017). Similarly, the highest quintile benefits 5 times of the reduced VAT rates (7% and 10%) compared to the poorest quintile in 2001 and 6 times in 2007⁽²⁾ (Mourji and Ezzrari, 2018; DEPF⁽³⁾, 2007).

Contrary to what was expected from its reforms, it appears that VAT with multiple rates cannot be an effective instrument for reducing income inequality (Mourji and Ezzrari, 2018). This is why the second-generation reforms have been carried out since 2005 in order to modernize this tax. They mainly aim to consolidate the principles of the VAT progressiveness and neutrality through the reorganization of its different rates: 0% for basic necessities, 10% for large consumption items, 20% as the standard rate and a higher rate for luxury goods. Also, these reforms aim to limit exemptions, especially the new ones, and tax some goods and services that are currently exempted .

From this perspective, this paper intends to evaluate the effects, in 2001 and 2014, of VAT rates changes on the food consumption structure of the Moroccan households' various strata. For this, a QUAIDS model "Quadratic Almost Ideal Demand System" is applied to the National Household Consumption and Expenditure Surveys of 2000/2001 and 2013/2014⁽⁴⁾ data produced by the HCP, in order to estimate elasticities of demand for 8 food groups by five household strata. Differences in living standards among different strata of the population mean that their preferences and responses to economic shocks are very different from each other and change over time.

QUAIDS modelling is also used to simulate the impact of the VAT reforms on the structure of food consumption of various strata of Moroccan households. In this regard, and because of the absence of details on the implementation of the proposed tax reform by the national conferences on taxation, especially those

concerning the composition of product groups (basic necessities, mass consumption or luxury goods), this paper proposes to evaluate the consequences of the VAT liability of some basic products that are currently exempted, such as cereals⁽⁵⁾, on the "superior" food products consumed volumes (such as meat and dairy products...). The purpose is to identify the households that will suffer most from an increase of strategic products prices (as a result of a higher taxation) and that will have to be targeted by direct aids, at the time of the VAT reform .

After a review of the theoretical framework that sheds light on household consumption analyses techniques as well as on the model and data used, the results of the different estimates will be discussed.

2. Theoretical framework and methodology 2.1. The demand function analysis

Consumer theory has made substantial progress over the last three decades. Today it is one of the most developed fields of economic theory. This progress has been not only theoretical but also practical.

Indeed, the establishment of comprehensive systems of demand functions (CSDF), as well as the estimation of price and income elasticities, now covers the majority of developed countries and some developing countries .

In the present paper a QUAIDS model (Quadratic Almost Ideal Demand System) is applied, which is the extension (with a quadratic form) of the AIDS model of Deaton and Muellbauer (1980) developed by James Banks, Richard Blundell, and Arthur Lewbel, in order to estimate the price and income effects of changes in VAT rates on food expenditure by different classes of Moroccan households.

2.1.1. The almost ideal demand system: AIDS

The AIDS model is built from the Working (1943) and Leser (1963) model. Deaton and Muellbauer's developments of the Working and Leser's model include the price effect. The AIDS demand system therefore links the budget coefficients of each good to the logarithms of prices and real disposable income .

The share of expenditure spent on the good i is written as:

$$\frac{\text{Piqi}}{Y} = ai + \sum bij \ln Pi + Ci \ln \frac{Y}{P} (1)$$

where Wi is the budget share,

Y: total expenditure per household

P is the price index defined by:

$$Ln P = a_0 + \sum_k a_k Ln P_k + \frac{1}{2} \sum_j \sum_k b_{jk} Ln P_k Ln P_j (2)$$

and a_i , b_{ii} and c_i are the parameters to be estimated.

The parameters must be estimated under the following restrictions:

Additivity: $\sum_{i} a_{i} = 1$; Homogeneity: $\sum_{i} b_{ij} = 0$; $\sum_{i} c_{i} = 0$; $\sum_{j} b_{ij} = 0$; and Symmetry: $b_{ij} = b_{ji}$.

Due to the non-linearity of the parameters, Deaton and Muellbauer suggest replacing the general price index P by a linear approximation of Stone's geometric index (Stone. R. 1954) as follows :

$$Ln P^* = \sum_i w_i Ln P_i \tag{3}$$

This linear approximation of the AIDS system called LA/AIDS (linear approximate/ almost ideal demand system), which is the most commonly used, greatly facilitate the estimation of the parameters.

From this simplification, a system of linear equations is obtained in respect of all their parameters that can be easily estimated by imposing the constraints

previously defined. Even if the OLS estimator appears unbiased for each of the equations, it seems that the SURE (Seemingly Unrelated Regressions) estimation method proposed by Zellner (1962) is the most efficient for these systems of equations (Sadoulet and De Janvry, 1992).

Price and income elasticities are obtained from the parameters estimated as follows:

Direct price elasticity: $\mathbf{E}_{ij} = -\mathbf{1} + \frac{b_{ij}}{w_i} - c_i \operatorname{Cross}$ price elasticity: $\mathbf{E}_{ij} = \frac{b_{ij}}{w_i} - \frac{c_i}{w_i} w_j$;

Income elasticity: $\eta_i = 1 + \frac{c_i}{w_i} - c_i$

2.2 The QUAIDS demand system: Introduction of a quadratic term in the AIDS model

Because of the non-linearity of the Engel curves for certain goods, the estimation of the AIDS model becomes insufficient. Consequently, Banks, Blundell and Lewbel (1997) have completed this model by introducing the square of the logarithm of income into the demand function. The AIDS model becomes the QUAIDS model (Quadratic Almost Ideal Demand System). As a result, the following system of equations is obtained:

$$W_i = a_i + \sum_j b_{ij} \ln(P_i) + c_i \ln \frac{Y}{P_s} + d_i \ln (\frac{Y}{P_s})^2 \qquad (4)$$

Where:

- Wi: represents the budgetary share of each product group in food expenditure.
- Pi: the price of commodity sub-group i;
- Y: is the predicted value of food expenditure obtained from the estimate made in step one ;

Ps: is the Stone's geometric price index of food .

The ratio (Y/Ps) is the food expenditure deflated by the price, and makes it possible to take into account real household income.

The advantage of this specification is that it retains the existing flexibility properties in the AIDS model. In addition, it is more practical for the analysis of several goods demand and introduces relative flexibility in income and price effects.

The system is conditionally linear in d(p), Blundell and Robin (1999) propose an iteration procedure and use the iterated least squares estimator (ILLS).

Additivity, price and income homogeneity and symmetry are constraints to estimate the model parameters.

The additivity constraint that requires the sum of the budget shares to be equal to one is written as: $\sum_{i=1}^{n} a_i = 1$

The homogeneity constraint in relation to prices and income is expressed as follows: $\sum_{j=1}^{n} b_{ij} = 0$; $\sum_{i=1}^{n} c_i = 0$; $2 \sum_{i=1}^{n} ad_i = 0$ Finally, the symmetry constraint $b_{ij} = b_{ji}$.

2.3. Presentation of the data and of the performed treatments

To estimate the elasticities of demand, three kinds of data are generally required: household income (or total expenditure), the quantity consumed of different goods and their purchase prices. When considering differences across the various population strata, it is necessary to have a representative sample for each household group.

Data used in this study are from two national surveys on household consumption and expenditure, one of 2000/2001 and the other of 2013/2014, carried out by the HCP throughout the Moroccan territory on a sample of 14.243 households in 2000/2001 and 16.000 households in 2013/2014.

In this study, five social classes $^{\rm (6)}$ have been selected as described in the following table:

Classes	Description					
Poor and vulnerable	Per capita expenditure \leq (relative threshold = $0.6 \times$ median per capita expenditure)					
Modest	$0.6 \times \text{median per capita expenditure} < \text{per capita}$ expenditure $\leq 0.75 \times \text{median per capita expenditure}$					
Lower average	0.75 × median expenditure per capita < expenditure per capita ≤ median expenditure per capita					
Upper average	The median expenditure per capita \leq per capita \leq 2.5 \times the median expenditure per capita					
Wealthy	Expenditure per capita > 2.5 × median expenditure per capita					

Table (1): Definition of social classes

This paper considers the absolute poverty line⁽⁷⁾ adopted by the HCP for 2001 and for 2014. In 2001 (HCP, 2006) it was 3421 DH for urban areas, 3098 DH for rural areas (per capita and per year), and in 2014, it was 4667 DH in urban areas and 4312 DH in rural areas (HCP, 2016).

Also, 8 groups of food products consumed by different types of households have been selected from the analytical nomenclature of goods and services. Aggregating the groups of products allows us to reduce the number of missing values, which poses statistical complications when estimating the parameters.

The goods classification is the same as used in the analytical nomenclature of goods and services presented by the HCP. However, our analysis will focus on eight product groups: "Cereals", "Milk and milk products", "Fats", "Meat", "Fish", "Vegetables", "Fruits" and "Other food goods". It should be mentioned that the quantities demanded of the different food products in the study are all expressed in kilograms.

Before proceeding with the estimation of the demand parameters themselves, a major data reconciliation exercise was carried out, especially with regard to the prices (or unit values) of the products. In fact, outliers have been removed and the product prices have been replaced with their averages by region. This regional variability may be due to the costs linked to transport from the point of production to the points of actual consumption of the products (Deaton Angus (1988)).

2.4. Estimation method

As already mentioned, this study adopts the QUAIDS model to describe household food consumption behavior. The parameters of the model are estimated by the two-step SURE (Seemingly Unrelated Regressions) method developed by Zellner (1962) and specified by Surabhi Mittal (2010) for the food sector in India.

The two-stage QUAIDS model is fundamentally based on the assumption of separability of preferences (Deaton and Muellbauer 1980) of households in their budget allocation between commodity groups and sub-groups.

The SURE method is widely used in the literature for the estimation of flexible demand models (such as AIDS, QUAIDS, IQUAIDS). Indeed, for a given system, the equations interact with each other, implying correlations between the error terms of the different equations. The advantage of the SURE estimator is that it takes into account these correlations by regressing each equation independently and with a specific error term (Zellner, 1962).

In order to evaluate the expenditure and price elasticities, they are calculated as follows:

Expenditure elasticity (or conditional elasticity) of product group i:

$$\eta_i = \left(c_i + \frac{2d_i \operatorname{Ln}(Y)}{W_i}\right) + 1 \tag{5}$$

Non-compensated price elasticity⁽⁸⁾ :

$$\boldsymbol{\varepsilon}_{ij} = \left(\frac{b_{ij}}{W_i}\right) - \left(\boldsymbol{c}_i + 2\boldsymbol{d}_i \operatorname{Ln}(\mathbf{Y})\right) \left(\frac{W_j}{W_i}\right) - K_{ij} \qquad (6)$$

- Y : is the predicted value of the food expenditure deducted from the estimate made in the first step;
- K_{ij} : designates the Kronecker delta which is equal to 1 for direct price elasticities and equal to 0 for cross price elasticities;
- W_i : refers to the budget share of group i used, inter alia, to calculate Stone's price index.

Based on the expenditure elasticity and the non-compensated price elasticities, direct and cross-price elasticities pure or compensated⁽⁹⁾ have been deduced from Slutsky as follows:

$$\boldsymbol{\varepsilon}_{ij}^{H} = \boldsymbol{\varepsilon}_{ij} + \boldsymbol{W}_{i}\boldsymbol{\eta}_{i} \tag{7}$$

The unconditional elasticity of aggregate demand for each commodity group i « η_i^{γ} » is obtained as the multiple of the conditional elasticity and the elasticity of food expenditure relative to total expenditure (η^{γ}) obtained from the first stage estimation: $\eta_i^{\gamma} = \eta_i * \eta^{\gamma}$ (8)

The expenditure elasticities of the different goods were estimated for each strata (Table 3). These elasticities measure the change in the quantity demanded of a good as a result of a change in total expenditure. Since total expenditure is used as a proxy for income, expenditure elasticities are, therefore, interpreted as income elasticities. However, they do not mean exactly the same thing in the sense that total expenditure includes the quantities requested themselves and describe the outcome of the consumption attitude of individuals .

3. Results

3.1. Budget coefficients and total expenditure elasticities by social class between 2001 and 2014

The analysis of the budgetary coefficients (table 2) shows that between 2001 and 2014, the food basket of Moroccans tends more to be balanced and diversified while keeping almost the same structure. Among the food groups selected, Moroccan household expenditure is mainly assigned to the "Meat" group with a share of 23% in 2014, up 3 points compared to 2001. However, households have reduced their consumption of calorie-rich products, particularly "other food items" and "cereals", by 4 and 5 points compared with 2001, representing 18% and 17% respectively of total expenditure in 2014.

Moroccans have also reduced their consumption of vegetables by 2 points, representing 12% in 2014, to consume more "milk and dairy products" (+1pts), fats (+2pts), fish (+2pts) and fruit (+1pts).

Thus, Moroccan households tend to consume less vegetables and products rich in calories (other food items - especially sugars and sweet products - as well as cereals) and more fruit and protein-rich foods (meat, fish, fats, milk and dairy products).

			2000/2	001			2013/2014						
	National	C1	C2	C3	C4	C5	National	C1	C2	C3	C4	C5	
Cereals	22%	28%	25%	23%	20%	16%	17%	20%	19%	18%	17%	13%	
Milk and	7%	4%	5%	6%	7%	10%	8%	6%	7%	8%	9%	10%	
dairy products													
Fat	9%	10%	9%	9%	9%	7%	11%	13%	12%	12%	11%	9%	
Meat	20%	16%	18%	19%	22%	23%	23%	22%	23%	23%	23%	24%	
Fish	2%	2%	2%	2%	2%	3%	4%	3%	3%	3%	4%	5%	
Vegetables	14%	14%	15%	14%	13%	11%	12%	15%	14%	14%	12%	9%	
Fruits	5%	3%	3%	4%	5%	7%	6%	4%	5%	6%	7%	8%	
Other food	22%	24%	23%	23%	22%	22%	18%	18%	17%	17%	18%	21%	
items													

Table (2): Budget shares "Wi" by food groups at national level and by stratum

C1: Poor and vulnerable; C2: Modest; C3: Lower average; C4: Upper average; C5: Wealthy.

Calculations realized by the HCP based on ENCDM 2000/2001 and 2013/2014 .

At the level of the five household groups (Table 2) it's observed that :

- The shares of the "meat" and "other food items" groups are predominant in the food basket of the different groups, as at the national level;
- Data from the 2013/2014 survey shows that an improvement in household income increases the consumption of nutritionally rich products, particularly dairy products (+4pts), fruit (+4pts) and fish (+2pts), which account for 10%, 8% and 5% respectively of the food consumption of the wealthiest households, compared with 6%, 4% and 3% of the food basket of the poor;
- On the other hand, the rich households consume less cereals (13%), fats (9%) and vegetables (9%) than the poor (20%), (13%) and (15%) respectively.
- Compared to the 2000/2001 survey data, the richest households improved their consumption of fish (+2pts), fats (+2pts), fruit (+1pt) and meat (+1pt) instead of cereals (-3pts), vegetables (-2pts) and other food items (-1pt).
- Concerning the poorest classes, it's noticed that between 2001 and 2014, they have significantly improved their consumption of meat (+6pts), to represent 22% of their budget in 2014, and to a lower extent the consumption of fats (+3pts), milk and dairy products (+2pts), fish (+1pt), vegetables (+1pt) and fruit (+1pt). However, their consumption has fallen by 8 points for cereals, which occupy only 20% of their food basket in 2014, and by 6 points for other food items (18% in 2014).

						2						
			2000/2	001					2013/2	014		
	National	C1	C2	C3	C4	C5	National	C1	C2	C3	C4	C5
Cereals	0.56	1.24	1.39	1.01	0.92	1.32	0.98	1.23	1.34	1.32	1.22	1.18
Milk and dairy products	1.28	0.34	0.72	0.34	0.21	0.04	1.22	1.15	1.18	1.12	1.07	1.09
Fat	1.19	0.49	0.52	0.84	1.24	1.18	0.85	0.77	0.79	0.79	0.86	0.85
Meat	1.15	0.49	1.48	1.44	1.32	1.50	0.80	0.57	0.46	0.45	0.58	0.64
Fish	1.05	0.50	-1.09	-0.50	1.10	1.06	0.96	1.18	0.69	0.74	0.70	0.76
Vegetables	0.74	1.05	1.38	0.45	0.77	0.88	0.98	1.30	1.31	1.32	1.27	1.31
Fruits	1.39	0.77	1.30	-0.32	-0.43	-0.55	1.49	1.69	1.68	1.54	1.56	1.26
Other food items	1.21	1.42	0.32	1.53	1.38	1.18	1.13	0.95	1.02	1.11	1.07	1.13

Table (3): Expenditure elasticities by food commodity groups at the national

level and by strata

C1: Poor and vulnerable; C2: Modest; C3: Lower average; C4: Upper average; C5: Wealthy.

Authors' calculations from ENCDM 2000/2001 and 2013/2014

Overall, the expenditure elasticities obtained are statistically significant and, at the national level, they are statistically different from zero (Table 3) .

At the national level, it can be observed that the expenditure elasticities of meats, fats and fish are below 1 in 2014, in contrast to 2001, which means that these products are increasingly becoming essential or mass consumption items, as is the case of "cereals and cereal products" and "vegetables", which are characterized by expenditure elasticities below 1 since 2001. These goods can, moreover, be considered as essential or incompressible goods. Their consumption is not very sensitive to a variation in total expenditure. As soon as the standard of living exceeds the subsistence level, other needs (luxury goods) appear to absorb an increasingly important part of the income growth.

Furthermore, the elasticities of the "milk and dairy products", "fruit" and "other food items" groups are structurally greater than 1, reflecting the fact that expenditure on these items increases more than proportionally to income growth. Thus, the quantity demanded for these products varies more than proportionally when the budget allocated to food varies either up or down.

By household class, the consumption behavior varies significantly. Among poor households, for example, it's noticed that:

- In 2014, these households have increased their consumption of products, with total expenditure elasticities relatively close to 1, i.e., "other food items" (0.95%) and fats (0.77%) in proportion as their expenditure on food is risen.
- The elasticity of meat is 0.56% in 2014 against 0.49% in 2001. This means that this group of products is a basic necessity (or a large consumed food) for the poor and that its consumption is not very sensitive to a variation in total expenditure.
- The other nutritionally rich food groups, namely the 'milk and milk products', 'fish' and 'fruit' groups, are on average being consumed in insufficient quantities by the poor and vulnerable people in 2014, in contrast to 2001, so these commodities are the most qualified to absorb any increase in their budgets. These products have expenditure elasticities exceeding 1 in 2014, of 1.15% for

milk and dairy products, 1.18% for fish and 1.7% for fruit, compared to 0.34%, 0.50% and 0.77% respectively in 2001.

3.2. Direct price elasticities

Estimates of direct price elasticities, which measure the reaction of the demand for a product to changes in its price, are shown in Table 4. It appears that all these elasticities are statistically significant and, in accordance with theory, negative, except for fish, which shows, in 2001, a positive value of direct price elasticity at the national level and for the first 3 classes of households (C1, C2 and C3). This could be explained by the fact that these classes are ready to consume this product whatever its price.

At national level, the most sensitive products to price variations, according to the two surveys, are "other food items", "cereals and cereal-based products", "meat" and the "milk and dairy products" group, with elasticities of -1.01, -0.91, -0.88 and -0.83 respectively in 2014 instead of -1.04; -0.87, -1.13 and -0.79 respectively in 2001. This implies that a rise in prices will generate a sharp drop in the quantities requested for these goods .

By social class, direct price elasticities are slightly higher in absolute terms among the poorest households than among the wealthier ones, and are still higher overall in 2014 compared with 2001, especially for meat, cereals, milk and dairy products and fish. As a result, a 1% increase in the price of meat, for example, will result in decreases of 1.02% and 0.65% in the quantities demanded respectively among the very poor and the rich groups in 2014 compared to decreases of 1.02% and 0.93% respectively in 2001.

			2000/2	001					2013/	2014		
	National	C1	C2	C3	C4	C5	National	C1	C2	C3	C4	C5
Cereals	-0.87	-0.93	-0.94	-0.89	-0.93	-0.94	-0.91	-0.95	-0.97	-0.97	-0.93	-0.76
Milk and	-0.79	-0.63	-0.77	-0.73	-0.78	-0.62	-0.83	-0.89	-0.82	-0.83	-0.782	-0.79
dairy												
products												
Fat	-0.28	-0.12	-0.16	-0.19	-0.42	-0.33	-0.41	-0.34	-0.33	-0.32	-0.42	-0.38
Meat	-1.13	-1.02	-1.08	-1.06	-0.78	-0.93	-0.88	-1.02	-0.91	-0.82	-0.77	-0.65
Fish	0.13	0.40	0.26	0.24	-0.18	-0.16	-0.09	-0.22	-0.32	-0.11	-0.18	-0.15
Vegetables	-0.63	-0.73	-0.79	-0.63	-0.84	-0.69	-0.75	-0.81	-0.86	-0.86	-0.84	-0.89
Fruits	-0.62	-0.27	-0.53	-0.55	-0.82	-0.58	-0.78	-0.59	-0.77	-0.76	-0.82	-0.79
Other food	-1.04	-1.10	-0.84	-1.12	-1.01	-1.02	-1.02	-0.99	-1	-1.02	-1.01	-1.03
items												

Table (4): Direct price elasticities at the national level and by strata

C1: Poor and vulnerable; C2: Modest; C3: Lower average; C4: Upper average; C5: Wealthy.

Authors' calculations from ENCDM 2000/2001 and 2013/2014

3.2.1. Cross-price elasticities

Cross-price elasticities measure the response of the quantity demanded of one good to the variation in the price of another good. The positive or negative sign of the cross-price elasticity shows whether goods are substitutes or complements.

Table 5 presents the cross-price elasticities at the national level⁽¹⁰⁾ with values other than zero. The diagonal of the matrix represents the non-compensated direct price elasticities.

Cross-price elasticities seem very low⁽¹¹⁾, on average in 2014 compared to 2001, especially for some goods such as " cereals ", " fats ", " milk and dairy products ", " vegetables " and " other food items ". This means that the variation in the prices of these goods affects less the consumption of other goods. This leads to relatively insignificant substitution or complementarity effects .

Moreover, cross-price elasticities are more significant, in 2014, for "fish" and "meat". Indeed, the increase in the prices of "fish" and "meat" particularly affects the consumption of other types of goods. In fact, households react differently to the increase in meat and fish. For them, meats are considered substitutes,

especially with fish, with an elasticity of +0.28%, while fish is rather complementary with other goods (especially fats with an elasticity of -0.34%).

Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Cereals	-0.87	0.11	-0.34	0.19	-0.32	-0.04	-0.31	-0.05
Milk and dairy products	0.35	-0.79	-0.09	-0.14	-0.04	0.03	-0.02	-0.16
Fat	0.10	-0.11	-0.28	-0.12	-0.24	-0.04	-0.07	-0.11
Meat	0.31	-0.14	-0.12	-1.13	-0.23	-0.03	-0.03	-0.02
Fish	0.91	-0.07	-0.13	-0.31	0.13	0.21	-0.04	-0.49
Vegetables	0.12	-0.09	-0.16	-0.08	-0.03	-0.63	-0.14	-0.11
Fruits	0.40	-0.03	-0.07	-0.15	-0.01	0.06	-0.62	-0.20
Other food items	0.08	-0.02	0.01	0.01	-0.25	-0.03	0.15	-1.04

Table (5): Non-compensated price elasticities of demand by food groups at national level 2000/2001

Authors' calculations based on ENCDM 2000/2001.

 Table (6): Non-compensated price elasticities of demand by food groups at the national level 2013/2014

Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Cereals	-0.912	0.057	-0.146	0.094	-0.139	0.005	-0.075	-0.027
Milk and dairy products	0.041	-0.827	-0.093	0.123	-0.059	-0.033	-0.030	-0.051
Fat	-0.097	-0.165	-0.404	0.032	-0.339	0.014	-0.107	-0.049
Meat	0.043	-0.021	-0.128	-0.884	-0.096	-0.097	-0.064	0.054
Fish	-0.012	-0.070	-0.061	0.280	-0.094	-0.006	-0.090	-0.142
Vegetables	0.008	-0.067	0.028	0.034	-0.047	-0.751	-0.127	-0.072
Fruits	-0.013	-0.032	-0.020	0.159	-0.064	-0.051	-0.780	-0.024
Other food items	-0.021	-0.017	-0.010	0.117	-0.157	-0.056	0.106	-1.015

Authors' calculations based on ENCDM 2000/2001

4. Simulations of the effects of a VAT change on cereals

Reforms of the indirect tax system, through changes in VAT rates, lead to changes in prices to which consumers are exposed. In this paragraph, non-compensated price elasticities have been used to run simulations (Allen 2010) in order to predict the impact of commodity VAT reforms on the consumption behavior of various quintiles of households .

This paper considers a 20% price increase of the "cereals and cereal-based products" group, which is actually exempt from VAT, to evaluate the effect of this price increase on the considered commodities. It is however assumed that the observed VAT increase is fully reflected in the price of cereals .

The table below summarizes the non-compensated cross-price elasticities of cereals.

			200)1					201	4		
Social class Product	National	C1	C2	С3	C4	C5	National	C1	C2	C3	C4	C5
Cereals	-0.87	-0.93	-0.94	-0.89	-0.91	-0.94	-0.91	-0.95	-0.97	-0.97	-0.93	-0.76
Milk and dairy products	0.11	-0.02	0.13	0.18	0.14	0.11	0.06	0.08	0.09	0.10	0.11	-0.01
Fat	-0.34	-0.41	-0.42	-0.42	-0.29	-0.22	-0.15	-0.27	-0.26	-0.19	-0.14	-0.13
Meat	0.19	0.28	0.10	0.13	0.07	-0.12	0.09	0.25	0.24	0.18	0.12	0.11
Fish	-0.32	-0.51	-0.48	-0.40	-0.30	-0.18	-0.14	0.00	-0.07	-0.05	-0.09	-0.19
Vegetables	-0.04	-0.08	-0.09	-0.04	-0.05	-0.05	0.00	-0.07	0.00	-0.03	0.00	-0.06
Fruits	-0.31	-0.32	-0.28	-0.25	-0.18	-0.04	-0.07	-0.16	-0.06	-0.01	-0.06	-0.01
Other food items	-0.05	-0.11	0.10	-0.15	-0.11	-0.04	-0.03	-0.04	-0.06	-0.04	-0.04	-0.03

 Table (7): Summary of non-compensated cross-price elasticities of demand for food

 groups relative to cereals at national level and by stratum

C1: Poor and vulnerable; C2: Modest; C3: Lower average; C4: Upper average; C5: Wealthy. Authors' calculations based on ENCDM 2000/2001 and ENCDM 2013/2014

Considering that the elasticity (Eij) of the demand for good i in relation to good j is written as follows :

 $Eij{=}$ Variation in % of the quantity demanded of good i / Variation in % of the price of good j

Thus, for a 20% variation in the price of cereals, the variation in the quantity requested from group i (in %) is equal to the cross-price elasticity of demand for good i in relation to cereals multiplied by 20%. The results for each group of goods are summarized in Table 8.

Table (8): Percentage changes in the quantity consumed of each product group and per
stratum as a result of a 20% VAT increase on cereals.

			200	1					2014	4		
Social class Product	National	C1	C2	C3	C4	C5	National	C1	C2	C3	C4	C5
Cereals	-17.3	-18.6	-18.9	-17.7	-18.2	-18.7	-18.2	-18.9	-19.5	-19.5	-18.6	-15.3
Milk and												
dairy	2.1	-0.3	2.6	3.6	2.7	2.2	1.1	1.5	1.7	2.0	2.2	-0.2
products												
Fat	-6.8	-8.1	-8.3	-8.5	-5.8	-4.4	-2.9	-5.3	-5.3	-3.8	-2.8	-2.6
Meat	3.8	5.6	1.9	2.6	1.4	-2.5	1.9	4.9	4.7	3.7	2.4	2.2
Fish	-6.4	-10.1	-9.5	-8.0	-6.0	-3.5	-2.8	0.1	-1.5	-0.9	-1.9	-3.9
Vegetables	-0.7	-1.6	-1.7	-0.8	-0.9	-1.1	0.1	-1.3	0.0	-0.6	0.0	-1.3
Fruits	-6.3	-6.5	-5.6	-4.9	-3.5	-0.8	-1.5	-3.1	-1.2	-0.1	-1.1	-0.2
Other food items	-1.0	-2.2	2.0	-2.9	-2.3	-0.9	-0.5	-0.8	-1.2	-0.8	-0.8	-0.7

C1: Poor and vulnerable; C2: Modest; C3: Lower average; C4: Upper average; C5: Wealthy. Authors' calculations based on ENCDM 2000/2001 and ENCDM 2013/2014

The simulation results show that a 20% increase in VAT on cereals would lead to a decrease in the domestic consumption of cereals by 17.3% in 2001 and 18.9% in 2014. At the group level, this impact would lead to an 18.6% drop in poor and vulnerable households' demand in 2001, which will increase by 0.4 points in 2014.

In contrast to the poorest classes, the impact on the richest households is lighter, and their demand for cereals will only decrease by 15.3% in 2014 instead of 18.7% in 2001, which represents a reduction of 3.5 points. Thus, the VAT reforms, which aim to broaden the tax base by imposing taxes on basic products, such as cereals, would have an increasingly significant impact on the poor and vulnerable households' demand for cereals .

The by-product analysis shows that in 2001 this reform would reduce the quantities demanded for the majority of the product groups analyzed, especially fats (-6.8%), fish (-6.4%) and fruit (-6.3%). However, demand of "milk and dairy products" and "meat" groups would increase by 2.1% and 3.8% respectively in 2001.

These decreases would be clearly moderated in 2014. The most significant would be about -2.9% for fats, -2.8% for fish and -1.5% for fruit.

Also, these reductions would be more pronounced among the poorest households, for all products except meat, especially the demand for fish (-10.1%), fats (-8.1%) and fruit (-6.5%), which would also be significantly reduced in 2014 (0.1%, -5.3%) and -3.1% respectively).

The rest of the products, namely "vegetables" and "other food items", would have lower variations and their demand would be less affected by an increase in the VAT rate on cereals .

Generally, the extension of the scope of VAT to basic products, particularly cereals, would affect the consumption structure of households, especially the poorest ones, both as to the cereals themselves but also to other products, particularly nutrient-rich products such as fish, fruit, fats and, to a smaller degree, vegetables and other food items.

5. Conclusion

This paper examined how changes in indirect taxation, particularly VAT, affect differently the consumption structure of different strata of Moroccan households. For this purpose, the Quadratic Almost Ideal Demand System (QUAIDS) is applied to data from the 2000/2001 and 2013/2014 National Household Consumption and Expenditure Surveys to estimate elasticities of demand for eight food groups and for five household strata. Differences in livings standards of different strata of the population mean that their preferences and responses to economic shocks are very different from each other and vary over time .

It appears that Moroccan households tend to consume less vegetables and high-calorie products (sugars and cereals) and more fruit and protein-rich foods (meat, fish, fats, milk and dairy products). Moreover, the poorest households consume insufficient quantities of nutritious food products such as dairy products, fish and fruit in 2014, compared to 2001. In addition, extending the scope of VAT to basic products, especially cereals, would affect Moroccan households' consumption patterns, especially the poorest one, for cereals as well as for other products rich in nutrients such as fish and fruit.

Finally, this partial equilibrium analysis could be extended and enriched by a general equilibrium approach in order to identify the behavior of the different economic actors in the analysis of the impact of a VAT reform .

Footnote

⁽¹⁾ HCP: Haut commissariat au plan

⁽²⁾ The fifth quintile gets 1354 million MAD in 2001 and 4614 million MAD in 2007, while the first quintile gets only 272 million MAD in 2001 and 770 million MAD in 2007.

⁽³⁾ Financial Studies and Forecasting Department of the Moroccan Ministry of Economy and Finance.

⁽⁴⁾ Source: HCP, Micro-data from the National Household Consumption and Expenditure Survey 2013/14 available online at www.hcp.ma.

⁽⁵⁾ According to the classification used in this document and detailed below, cereals represent 20% of the consumption of the "Poor and Vulnerable" class, 19% of the consumption of the "Modest" class, 18% of the consumption of the "Lower Average" class, 17% of the consumption of the "Upper Average" class and 13% of the consumption of the "Wealthy" class.

⁽⁶⁾ This classification is inspired from Mourji and Ezzrari (2018).

⁽⁷⁾ Absolute poverty line: it is the sum of the food poverty line and a non-food allowance equivalent to the cost of non-food purchases made by households that actually reach the minimum food requirement (World Bank method).

⁽⁸⁾ Non-compensated price elasticity: adjustment of the quantity demanded after price change including the effect on disposable income.

⁽⁹⁾ They are used to highlight changes in demand due only to price changes. Total expenditure virtually varies in the same direction as the price change in order to keep the household's purchasing power constant.

⁽¹⁰⁾ Details of the cross-price elasticities per stratum are presented in the appendix.

⁽¹¹⁾ In absolute values less than 0.1.

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Appendix (1): Composition of the 8 food product groups analysed according to the HCP nomenclature of goods and services

Cereals and cereal- based products	Milk and dairy products	Fat	Meat	Fish	vegetables	Fruits	Other food items
011 Non- processed cereals (into grains)	021 untreated fresh milk	031 butter	041 beef and veal	051 fresh fish	06 fresh vegetables	081 citrus fruits	09 sugar, sugar products, chocolate-based products and products for desserts and pastries
012 purchased bread	022 long- life pasteurized milk	032 Oil	042 sheep or lamb meat	052 fresh shellfish and molluscs	07 dried or canned vegetables	082 fresh seeded fruit	10 chocolate- based breakfast products, dessert and pastry products
013 flour	023 condensed milk	033 other fats	043 other butcher meats	053 canned fish		083 fresh stoned fruits	11 tea, coffee and herbal teas
014 semolina	024 powdered milk		044 living animals	054 frozen or deep- frozen fish		084 dried fruit	12 food seasonings and various food products n.c.a
015 couscous	025 whey		045 tripery			085 oleaginous fruits	13 non- alcoholic beverages
016 alimentary pastas	026 cheese		046 charcuterie			086 tropical fruits	14 alcoholic beverages
017 other cereal- based products	027 other milk-based products		047 birds, rabbit and prey "non- live"			087 prepared fruits	15 food and drink taken outdoors
	028 baby milk and milk products		048 birds, rabbit and prey "live"			088 fruit mixture	17 various expenses related to the acquisition of food products (n.c. transport)
	029 eggs		049 other edible animals				18 exceptional expenses: purchases of food products

Product group	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Ln (Product prices)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-0.567	-0.225	0.098	0.834	0.000	0.052	-0.088	0.896
	0.013	0.018	0.397	0.000	0.999	0.701	0.209	0.000
Cereals	0.038	-0.001	-0.041	0.038	-0.008	-0.011	-0.009	-0.006
	0.000	0.747	0.000	0.000	0.000	0.006	0.000	0.000
Milk and dairy products	-0.001 0.747	0.014 0.000	0.000 0.773	-0.004 0.041	-0.002 0.004	-0.001 0.582	-0.001 0.388	-0.006 0.000
Fat	-0.041	0.000	0.081	-0.010	-0.003	-0.017	-0.004	-0.005
	0.000	0.773	0.000	0.001	0.003	0.000	0.000	0.009
Meat	0.038	-0.004	-0.010	-0.017	-0.003	-0.005	0.001	0.000
	0.000	0.041	0.001	0.002	0.030	0.153	0.696	0.978
Fish	-0.008	-0.002	-0.003	-0.003	0.021	0.004	-0.002	-0.007
	0.000	0.004	0.003	0.030	0.000	0.004	0.001	0.000
Vegetables	-0.011	-0.001	-0.017	-0.005	0.004	0.041	-0.005	-0.005
	0.006	0.582	0.000	0.153	0.004	0.000	0.000	0.000
Fruits	-0.009	-0.001	-0.004	0.001	-0.002	-0.005	0.020	0.001
	0.000	0.388	0.000	0.696	0.001	0.000	0.000	0.423
Other food	0.022	-0.006	-0.005	0.000	-0.007	-0.005	0.001	0.000
items	0.000	0.000	0.009	0.978	0.000	0.000	0.423	0.824
Deflated food	0.185	0.100	0.007	-0.134	0.010	0.035	0.040	-0.243
expenditure	0.033	0.005	0.878	0.037	0.572	0.494	0.131	0.002
(Deflated food expenditure)2	-0.008 0.318	-0.009 0.010	-0.004 0.341	0.004 0.558	-0.001 0.469	-0.002 0.685	-0.003 0.201	0.024 0.001
Observations	2354.000	2354.000	2354.000	2354.000	2354.000	2354.000	2354.000	2354.000

Appendix (2): Estimated parameters from the QUAIDS model (ENCDM 2000/2001) 1- Estimated parameters for the poor/vulnerable strata

Product group	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Ln (Product prices)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-1.127	0.062	-0.050	3.683	-0.229	0.311	0.040	-1.690
	0.008	0.779	0.827	0.000	0.033	0.260	0.794	0.000
Cereals	0.038	0.006	-0.040	0.029	-0.009	-0.008	-0.009	-0.009
	0.000	0.009	0.000	0.000	0.000	0.063	0.000	0.000
Milk and dairy	0.006	0.011	-0.005	-0.003	-0.001	-0.003	0.002	-0.009
products	0.009	0.000	0.002	0.200	0.095	0.139	0.017	0.000
Fat	-0.040	-0.005	0.074	-0.003	-0.005	-0.013	-0.003	-0.005
	0.000	0.002	0.000	0.417	0.000	0.000	0.032	0.013
Meat	0.029	-0.003	-0.003	0.002	-0.001	-0.011	-0.004	-0.009
	0.000	0.200	0.417	0.790	0.548	0.004	0.023	0.001
Fish	-0.009	-0.001	-0.005	-0.001	0.022	0.003	0.000	-0.009
	0.000	0.095	0.000	0.548	0.000	0.049	0.979	0.000
Vegetables	-0.008	-0.003	-0.013	-0.011	0.003	0.039	-0.004	-0.004
	0.063	0.139	0.000	0.004	0.049	0.000	0.003	0.002
Fruits	-0.009	0.002	-0.003	-0.004	0.000	-0.004	0.015	0.003
	0.000	0.017	0.032	0.023	0.979	0.003	0.000	0.013
Other food	0.033	-0.009	-0.005	-0.009	-0.009	-0.004	0.003	0.000
items	0.000	0.000	0.013	0.001	0.000	0.002	0.013	0.718
Deflated food	0.304	0.011	0.042	-1.030	0.092	-0.066	-0.004	0.651
expenditure	0.038	0.884	0.600	0.000	0.014	0.489	0.941	0.000
(Deflated food	-0.014	-0.002	-0.006	0.073	-0.008	0.008	0.001	-0.053
expenditure)2	0.288	0.804	0.418	0.000	0.009	0.334	0.851	0.000
Observations	1613.000	1613.000	1613.000	1613.000	1613.000	1613.000	1613.000	1613.000

2- Estimated parameters for the modest strata

Product group	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Ln (Product prices)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-1.471	-0.188	0.187	3.478	-0.111	-0.753	-0.436	0.294
Constant	0.000	0.354	0.340	0.000	0.230	0.001	0.004	0.476
Cereals	0.027	0.010	-0.039	0.039	-0.008	-0.013	-0.009	-0.007
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Milk and dairy	0.010	0.013	-0.004	-0.005	-0.001	-0.005	0.000	-0.007
products	0.000	0.000	0.001	0.004	0.031	0.001	0.899	0.000
Fat	-0.039	-0.004	0.071	-0.010	-0.004	-0.010	-0.003	-0.002
	0.000	0.001	0.000	0.000	0.001	0.000	0.018	0.240
Meat	0.039	-0.005	-0.010	0.004	-0.007	-0.010	-0.002	-0.008
	0.000	0.004	0.000	0.437	0.000	0.001	0.223	0.001
Fish	-0.008	-0.001	-0.004	-0.007	0.024	0.005	-0.001	-0.007
	0.000	0.031	0.001	0.000	0.000	0.000	0.072	0.000
Vegetables	-0.013	-0.005	-0.010	-0.010	0.005	0.042	-0.005	-0.005
	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000
Fruits	-0.009	0.000	-0.003	-0.002	-0.001	-0.005	0.015	0.006
	0.000	0.899	0.018	0.223	0.072	0.000	0.000	0.000
Other food	0.023	-0.007	-0.002	-0.008	-0.007	-0.005	0.006	0.000
items	0.000	0.000	0.240	0.001	0.000	0.000	0.000	0.791
Deflated food	0.438	0.095	-0.036	-0.941	0.057	0.302	0.160	-0.075
expenditure	0.000	0.164	0.586	0.000	0.067	0.000	0.002	0.592
(Deflated food	-0.028	-0.008	0.001	0.065	-0.006	-0.024	-0.013	0.012
expenditure)2	0.007	0.147	0.803	0.000	0.035	0.000	0.002	0.292
Observations	2232	2232	2232	2232	2232	2232	2232	2232

3- Estimated parameters for the lower middle strata

Product group	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Ln (Product prices)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-1.037	-0.642	0.347	2.894	0.175	-0.181	-0.749	0.191
	0.000	0.000	0.005	0.000	0.010	0.177	0.000	0.480
Cereals	0.015	0.008	-0.024	0.032	-0.007	-0.009	-0.009	-0.005
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Milk and dairy products	0.008	0.016	-0.007	-0.004	-0.001	-0.006	-0.001	-0.005
	0.000	0.000	0.000	0.002	0.032	0.000	0.220	0.000
Fat	-0.024	-0.007	0.058	-0.007	-0.005	-0.014	-0.003	0.003
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004
Meat	0.032	-0.004	-0.007	0.001	-0.006	-0.007	-0.005	-0.003
	0.000	0.002	0.000	0.704	0.000	0.000	0.000	0.067
Fish	-0.007	-0.001	-0.005	-0.006	0.025	0.001	0.000	-0.007
	0.000	0.032	0.000	0.000	0.000	0.240	0.998	0.000
Vegetables	-0.009	-0.006	-0.014	-0.007	0.001	0.043	-0.004	-0.005
	0.000	0.000	0.000	0.000	0.240	0.000	0.000	0.000
Fruits	-0.009	-0.001	-0.003	-0.005	0.000	-0.004	0.017	0.006
	0.000	0.220	0.000	0.000	0.998	0.000	0.000	0.000
Other food	0.010	-0.005	0.003	-0.003	-0.007	-0.005	0.006	0.000
items	0.000	0.000	0.004	0.067	0.000	0.000	0.000	0.459
Deflated food	0.312	0.224	-0.094	-0.726	-0.039	0.110	0.249	-0.036
expenditure	0.000	0.000	0.018	0.000	0.072	0.010	0.000	0.677
(Deflated food	-0.020	-0.017	0.007	0.048	0.002	-0.008	-0.019	0.007
expenditure)2	0.000	0.000	0.030	0.000	0.152	0.013	0.000	0.302
Observations	5960	5960	5960	5960	5960	5960	5960	5960

4- Estimated parameters for the upper middle strata

		Milk and						Other
Product group	Cereals	dairy	Fat	Meat	Fish	Vegetables	Fruits	food
		products						items
Ln (Product	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
prices)	(1)	(2)	(5)	()	(5)	(0)	(/)	(0)
Constant	-0.061	-0.882	0.086	3.110	0.129	-0.178	-1.130	-0.074
Constant	-0.027	0.974	1.974	2.974	3.974	4.974	5.974	6.974
Cereals	0.018	0.005	-0.016	0.011	-0.006	-0.007	-0.007	0.002
	0.000	0.029	0.000	0.002	0.000	0.006	0.001	0.238
Milk and dairy	0.005	0.028	-0.011	-0.016	0.002	-0.006	-0.004	0.002
products	0.029	0.000	0.000	0.000	0.039	0.000	0.004	0.238
Fat	-0.016	-0.011	0.051	-0.009	-0.008	-0.006	-0.005	0.006
	0.000	0.000	0.000	0.000	0.000	0.002	0.001	0.001
Meat	0.011	-0.016	-0.009	0.042	-0.004	-0.006	-0.011	-0.007
	0.002	0.000	0.000	0.000	0.027	0.060	0.000	0.015
Fish	-0.006	0.002	-0.008	-0.004	0.028	-0.008	-0.002	-0.003
	0.000	0.039	0.000	0.027	0.000	0.000	0.111	0.027
Vegetables	-0.007	-0.006	-0.006	-0.006	-0.008	0.033	0.000	-0.006
	0.006	0.000	0.002	0.060	0.000	0.000	0.769	0.000
Fruits	-0.007	-0.004	-0.005	-0.011	-0.002	0.000	0.023	0.007
	0.001	0.004	0.001	0.000	0.111	0.769	0.000	0.000
Other food items	0.001	0.002	0.006	-0.007	-0.003	-0.006	0.007	0.004
	0.601	0.238	0.001	0.015	0.027	0.000	0.000	0.000
Deflated food	0.023	0.296	-0.019	-0.758	-0.025	0.086	0.352	0.046
expenditure	0.826	0.000	0.752	0.000	0.580	0.199	0.000	0.794
(Deflated food	0.001	-0.021	0.002	0.047	0.001	-0.005	-0.025	0.000
expenditure)2	0.844	0.000	0.688	0.000	0.657	0.272	0.000	0.975
Observations	2079	2079	2079	2079	2079	2079	2079	2079

5- Estimated parameters for the wealthy strata

Appendix (3): Estimated parameters from the QUAIDS model (ENCDM 2013/2014)

Product group	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Ln (Product prices)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.192	-0.079	-0.020	0.946	-0.021	-0.270	0.082	0.170
Constant	-0.400	-0.559	-0.911	0.000	-0.825	-0.112	-0.466	-0.433
Cereals	0.020	0.005	-0.036	0.031	0.000	-0.005	-0.006	-0.008
	0.000	-0.019	(0)	(0)	-0.943	-0.143	-0.002	0.000
Milk and dairy	0.005	0.007	-0.010	0.003	-0.001	0.000	0.003	-0.008
products	-0.019	0.000	0.000	-0.170	-0.501	-0.792	-0.005	0.000
Fat	-0.036	-0.010	0.082	-0.003	-0.013	-0.008	-0.004	-0.008
	(0)	0.000	(0)	-0.361	0.000	-0.011	-0.053	-0.005
Meat	0.031	0.003	-0.003	-0.026	-0.003	-0.010	-0.005	0.013
	(0)	-0.170	-0.361	0.000	-0.184	-0.003	-0.031	0.000
Fish	0.000	-0.001	-0.013	-0.003	0.022	0.005	-0.002	-0.008
	-0.943	-0.501	0.000	-0.184	(0)	-0.014	-0.058	0.000
Vegetables	-0.005	0.000	-0.008	-0.010	0.005	0.035	-0.009	-0.009
	-0.143	-0.792	-0.011	-0.003	-0.014	(0)	0.000	0.000
Fruits	-0.006	0.003	-0.004	-0.005	-0.002	-0.009	0.018	0.005
	-0.002	-0.005	-0.053	-0.031	-0.058	0.000	(0)	-0.007
Other food items	0.016	-0.008	-0.008	0.013	-0.008	-0.009	0.005	0.000
	0.000	0.000	-0.005	0.000	0.000	0.000	-0.007	-0.822
Deflated food	-0.065	0.051	0.043	-0.154	0.019	0.124	-0.039	0.021
expenditure	-0.447	-0.316	-0.515	-0.083	-0.600	-0.050	-0.355	-0.798
(Deflated food	0.010	-0.004	-0.007	0.005	-0.001	-0.007	0.006	-0.003
expenditure)2	-0.202	-0.422	-0.282	-0.510	-0.706	-0.211	-0.111	-0.715
Observations	0.010	-0.004	-0.007	0.005	-0.001	-0.007	0.006	-0.003

1- Estimated parameters for the poor/vulnerable strata

Product group	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Ln (Product prices)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-0.996	-0.259	-0.212	3.814	0.221	-1.329	-0.434	0.195
	-0.021	-0.357	-0.537	(0)	-0.261	0.000	-0.101	-0.665
Cereals	0.017	0.007	-0.033	0.020	-0.002	0.005	-0.003	-0.010
	-0.003	-0.003	(0)	0.000	-0.340	-0.197	-0.276	0.000
Milk and dairy products	0.007	0.015	-0.013	0.004	-0.003	0.001	0.000	-0.010
	-0.003	(0)	(0)	-0.125	-0.027	-0.658	-0.963	0.000
Fat	-0.033	-0.013	0.076	-0.001	-0.011	-0.008	-0.002	-0.007
	(0)	(0)	(0)	-0.734	0.000	-0.016	-0.311	-0.009
Meat	0.020	0.004	-0.001	-0.007	-0.005	-0.016	-0.003	0.010
	0.000	-0.125	-0.734	-0.240	-0.074	0.000	-0.188	-0.003
Fish	-0.002	-0.003	-0.011	-0.005	0.021	0.009	-0.002	-0.007
	-0.340	-0.027	0.000	-0.074	(0)	0.000	-0.249	0.000
Vegetables	0.005	0.001	-0.008	-0.016	0.009	0.025	-0.008	-0.008
	-0.197	-0.658	-0.016	0.000	0.000	0.000	0.000	0.000
Fruits	-0.003	0.000	-0.002	-0.003	-0.002	-0.008	0.014	0.004
	-0.276	-0.963	-0.311	-0.188	-0.249	0.000	0.000	-0.037
Other food items	0.018	-0.010	-0.007	0.010	-0.007	-0.008	0.004	0.000
	0.000	0.000	-0.009	-0.003	0.000	0.000	-0.037	-0.621
Deflated food	0.331	0.113	0.102	-1.110	-0.051	0.481	0.135	-0.001
expenditure	-0.026	-0.247	-0.391	(0)	-0.453	0.000	-0.140	-0.997
(Deflated food	-0.023	-0.009	-0.011	0.085	0.004	-0.038	-0.009	0.000
expenditure)2	-0.073	-0.309	-0.287	0.000	-0.543	0.000	-0.277	-0.978
Observations	1.648	1.648	1.648	1.648	1.648	1.648	1.648	1.648

2- Estimated parameters for the modest strata

		Milk and					-	Other
Product group	Cereals	dairy	Fat	Meat	Fish	Vegetables	Fruits	food
		products						items
Ln (Product	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
prices)	0.100	0.170	0.029	0.517	0.044	1.570	0.110	0.220
Constant	-0.188	-0.172	0.238	2.517	-0.044	-1.579	-0.110	0.338
-	-0.515	-0.429	-0.303	(0)	-0.768	(0)	-0.572	-0.318
Caraals	0.015	0.008	-0.024	0.006	-0.002	0.001	0.000	-0.004
Cereals	0.000	0.000	(0)	-0.083	-0.384	-0.795	-0.948	-0.008
Milk and dairy	0.008	0.014	-0.011	0.001	-0.004	-0.003	-0.002	-0.004
products	0.000	(0)	(0)	-0.704	0.000	-0.021	-0.156	-0.008
Eat	-0.024	-0.011	0.077	-0.005	-0.016	-0.009	-0.009	-0.003
rat	(0)	(0)	(0)	-0.094	(0)	0.000	0.000	-0.112
Mont	0.006	0.001	-0.005	0.014	-0.007	-0.009	-0.004	0.006
wicat	-0.083	-0.704	-0.094	-0.006	0.000	-0.001	-0.068	-0.028
Fish	-0.002	-0.004	-0.016	-0.007	0.030	0.007	-0.003	-0.006
1 1311	-0.384	0.000	(0)	0.000	(0)	0.000	-0.005	0.000
Vegetables	0.001	-0.003	-0.009	-0.009	0.007	0.025	-0.006	-0.006
vegetables	-0.795	-0.021	0.000	-0.001	0.000	(0)	0.000	0.000
Fruits	0.000	-0.002	-0.009	-0.004	-0.003	-0.006	0.015	0.007
Fruits	-0.948	-0.156	0.000	-0.068	-0.005	0.000	(0)	0.000
Other feed items	0.005	-0.004	-0.003	0.006	-0.006	-0.006	0.007	0.000
Other rood items	-0.038	-0.008	-0.112	-0.028	0.000	0.000	0.000	-0.962
Deflated food	0.070	0.084	-0.048	-0.646	0.040	0.542	0.030	-0.072
expenditure	-0.466	-0.243	-0.528	0.000	-0.411	(0)	-0.639	-0.522
(Deflated food	-0.001	-0.006	0.002	0.044	-0.004	-0.042	0.000	0.008
expenditure)2	-0.890	-0.299	-0.751	0.000	-0.315	(0)	-0.993	-0.415
Observations	2.693	2.693	2.693	2.693	2.693	2.693	2.693	2.693

3- Estimated parameters for the lower middle strata

Product group	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Ln (Product prices)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-0.164	-0.330	0.161	2.247	-0.039	-0.990	-0.763	0.878
	-0.266	-0.003	-0.181	(0)	-0.641	(0)	(0)	0.000
Cereals	0.018	0.010	-0.017	-0.004	-0.004	0.003	-0.003	-0.005
	(0)	(0)	(0)	-0.065	-0.002	-0.054	-0.020	0.000
Milk and dairy products	0.010	0.020	-0.014	-0.003	-0.003	-0.004	-0.002	-0.005
	(0)	(0)	(0)	-0.023	0.000	0.000	-0.040	0.000
Fat	-0.017	-0.014	0.061	-0.013	-0.009	-0.002	-0.005	-0.001
	(0)	(0)	(0)	(0)	(0)	-0.103	0.000	-0.619
Meat	-0.004	-0.003	-0.013	0.029	-0.004	-0.010	-0.003	0.006
	-0.065	-0.023	(0)	(0)	-0.006	0.000	-0.031	0.000
Fish	-0.004	-0.003	-0.009	-0.004	0.030	0.001	-0.004	-0.008
	-0.002	0.000	(0)	-0.006	(0)	-0.556	0.000	(0)
Vegetables	0.003	-0.004	-0.002	-0.010	0.001	0.023	-0.005	-0.005
	-0.054	0.000	-0.103	0.000	-0.556	(0)	(0)	0.000
Fruits	-0.003	-0.002	-0.005	-0.003	-0.004	-0.005	0.015	0.007
	-0.020	-0.040	0.000	-0.031	0.000	(0)	(0)	0.000
Other food items	0.006	-0.005	-0.001	0.006	-0.008	-0.005	0.007	0.000
	0.000	0.000	-0.619	0.000	(0)	0.000	0.000	-0.733
Deflated food	0.073	0.141	-0.021	-0.554	0.035	0.330	0.229	-0.232
expenditure	-0.111	0.000	-0.575	(0)	-0.183	(0)	(0)	0.000
(Deflated food	-0.003	-0.011	0.000	0.036	-0.004	-0.024	-0.015	0.019
expenditure)2	-0.432	0.000	-0.871	(0)	-0.074	(0)	0.000	
Observations	7.034	7.034	7.034	7.034	7.034	7.034	7.034	7.034

4- Estimated parameters for the upper middle strata

Product group	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Ln (Product prices)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-0.522	-0.800	0.361	2.485	0.286	-0.915	-0.882	0.987
	-0.027	0.000	-0.079	(0)	-0.111	0.000	0.000	-0.044
Cereals	0.035	0.000	-0.013	-0.010	-0.010	-0.004	0.000	0.002
	(0)	-0.842	0.000	-0.001	0.000	-0.054	-0.903	-0.205
Milk and dairy products	0.000	0.022	-0.009	-0.013	0.000	-0.003	0.000	0.002
	-0.842	(0)	0.000	0.000	-0.963	-0.047	-0.990	-0.205
Fat	-0.013	-0.009	0.055	-0.019	-0.012	0.007	-0.009	-0.001
	0.000	0.000	(0)	0.000	(0)	0.000	0.000	-0.590
Meat	-0.010	-0.013	-0.019	0.065	-0.008	-0.007	-0.013	0.004
	-0.001	0.000	0.000	(0)	0.000	-0.010	0.000	-0.178
Fish	-0.010	0.000	-0.012	-0.008	0.043	-0.005	-0.001	-0.006
	0.000	-0.963	(0)	0.000	(0)	-0.001	-0.311	-0.001
Vegetables	-0.004	-0.003	0.007	-0.007	-0.005	0.012	-0.001	-0.001
	-0.054	-0.047	0.000	-0.010	-0.001	0.000	-0.541	-0.487
Fruits	0.000	0.000	-0.009	-0.013	-0.001	-0.001	0.019	0.005
	-0.903	-0.990	0.000	0.000	-0.311	-0.541	(0)	-0.014
Other food items	-0.003	0.002	-0.001	0.004	-0.006	-0.001	0.005	0.000
	-0.173	-0.205	-0.590	-0.178	-0.001	-0.487	-0.014	-0.622
Deflated food	0.188	0.272	-0.073	-0.611	-0.062	0.275	0.274	-0.263
expenditure	-0.006	0.000	-0.222	0.000	-0.234	0.000	0.000	-0.065
(Deflated food	-0.012	-0.020	0.004	0.039	0.004	-0.018	-0.019	0.022
expenditure)2	-0.013	0.000	-0.312	0.000		0.000	0.000	-0.037
Observations	2.399	2.399	2.399	2.399	2.399	2.399	2.399	2.399

5- Estimated parameters for the wealthy strata

Appendix (4): Price Elasticities by Household Strata (2000/2001)

Poor/vulnerable

		Milk and						Other
Product	Cereals	dairy	Fat	Meat	Fish	Vegetables	Fruits	food
		products						items
Cereals	-0.928	-0.015	-0.407	0.282	-0.506	-0.082	-0.323	-0.111
Milk and dairy products	-0.463	-0.631	0.127	0.310	-0.119	-0.030	-0.022	-0.618
Fat	-0.338	0.021	-0.119	0.076	-0.212	-0.130	-0.158	-0.265
Meat	0.023	-0.090	-0.069	-1.022	-0.206	-0.038	0.025	-0.147
Fish	-1.215	0.021	0.283	0.842	0.396	-0.035	-0.076	-1.557
Vegetables	-0.168	-0.015	-0.145	0.063	0.255	-0.726	-0.188	-0.185
Fruits	-0.715	0.022	0.138	0.500	-0.147	-0.071	-0.268	-0.876
Other food items	0.003	-0.145	-0.034	0.056	-0.442	-0.040	0.038	-1.100
Modest								
		M ² ll. a.						Other

Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Cereals	-0.945	0.128	-0.417	0.097	-0.476	-0.087	-0.282	0.102
Milk and dairy products	-0.459	-0.767	0.031	-0.327	-0.060	-0.183	0.068	0.655
Fat	-0.424	-0.084	-0.157	-0.185	-0.301	-0.177	-0.104	0.356
Meat	-0.018	-0.049	-0.006	-1.078	-0.057	-0.117	-0.144	0.151
Fish	-1.409	0.014	0.170	-0.893	0.258	-0.448	-0.017	1.930
Vegetables	-0.197	-0.047	-0.111	-0.164	0.188	-0.793	-0.136	0.217
Fruits	-0.812	0.068	0.095	-0.526	0.020	-0.294	-0.532	1.127
Other food items	0.022	-0.166	-0.037	-0.121	-0.480	-0.067	0.106	-0.845

Lower average

Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Cereals	-0.886	0.182	-0.425	0.129	-0.401	-0.041	-0.246	-0.146
Milk and dairy products	0.030	-0.734	-0.024	-0.324	-0.060	0.167	0.030	-0.516
Fat	-0.173	-0.052	-0.192	-0.235	-0.187	0.055	-0.059	-0.311
Meat	0.163	-0.086	-0.102	-1.065	-0.361	-0.013	-0.048	-0.177
Fish	-0.066	0.077	0.019	-0.860	0.240	0.590	0.056	-1.382
Vegetables	-0.059	-0.070	-0.102	-0.168	0.257	-0.628	-0.113	-0.212
Fruits	-0.058	0.053	0.001	-0.456	-0.047	0.267	-0.549	-0.705
Other food items	0.097	-0.110	-0.016	-0.116	-0.363	0.016	0.162	-1.120

-0.115

-0.150

-0.026

0.023

0.083

0.064

Upper average

Vegetables

Other food items

Fruits

Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Cereals	-0.932	0.111	-0.142	0.121	-0.094	0.001	-0.056	-0.038
Milk and dairy products	-0.008	-0.782	-0.114	0.241	-0.068	-0.080	-0.051	-0.048
Fat	-0.156	-0.165	-0.424	0.155	-0.238	-0.054	-0.103	-0.022
Meat	-0.049	-0.034	-0.112	-0.776	-0.092	-0.096	-0.053	0.026
Fish	-0.190	-0.044	-0.039	0.598	-0.184	-0.099	-0.121	-0.101
Vegetables	-0.034	-0.053	-0.007	0.148	0.020	-0.843	-0.097	-0.046
Fruits	-0.111	-0.025	-0.024	0.332	-0.092	-0.100	-0.817	0.006
Other food items	-0.001	-0.053	0.004	0.156	-0.216	-0.065	0.085	-1.011
Wealthy								
Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Cereals	-0.936	0.108	-0.222	-0.125	-0.176	-0.054	-0.040	-0.045
Milk and dairy products	-0.049	-0.619	-0.165	-0.343	0.066	-0.039	0.028	-0.077
Fat	-0.208	0.008	-0.332	-0.404	-0.245	-0.036	0.043	-0.088
Meat	0.039	-0.119	-0.131	-0.934	-0.124	-0.045	-0.118	-0.070
Fish	-0.268	0.297	-0.141	-0.817	-0.165	-0.025	0.223	-0.264

-0.092

-0.083

0.073

-0.268

-0.417

-0.155

-0.224

-0.055

-0.084

-0.687

0.016

-0.051

0.069

-0.578

0.137

-0.106

-0.083

-1.019

Appendix (5): Price elasticities by household strata (2013/2014)

Poor/vulnerable

.	~ .	Milk and	-				-	Other	
Product	Cereals	dairy products	Fat	Meat	Fish	Vegetables	Fruits	food items	
Cereals	-0.946	0.075	-0.265	0.247	0.005	-0.065	-0.156	-0.039	
Milk and dairy products	-0.119	-0.891	-0.016	0.345	-0.028	-0.098	0.054	-0.022	
Fat	-0.255	-0.160	-0.334	0.146	-0.448	-0.103	-0.099	-0.031	
Meat	0.117	0.045	-0.010	-1.022	-0.109	-0.100	-0.118	0.082	
Fish	-0.318	-0.032	0.035	0.723	-0.221	-0.192	-0.100	0.011	
Vegetables	-0.086	0.003	-0.035	0.095	0.174	-0.806	-0.211	-0.038	
Fruits	-0.246	0.036	0.060	0.472	-0.088	-0.209	-0.599	0.065	
Other food items	0.028	-0.138	-0.039	0.178	-0.300	-0.095	0.100	-0.990	
Modest									
		Milk and						Other	
Product	Cereals	Milk and dairy	Fat	Meat	Fish	Vegetables	Fruits	Other food	
Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items	
Product Cereals	Cereals	Milk and dairy products 0.086	Fat -0.264	Meat 0.235	Fish -0.073	Vegetables	Fruits -0.062	Other food items -0.061	
Product Cereals Milk and dairy products	Cereals -0.974 -0.123	Milk and dairy products 0.086 -0.818	Fat -0.264 -0.075	Meat 0.235 0.394	Fish -0.073 -0.083	Vegetables 0.000 -0.077	Fruits -0.062 -0.026	Other food items -0.061 -0.066	
Product Cereals Milk and dairy products Fat	Cereals -0.974 -0.123 -0.275	Milk and dairy products 0.086 -0.818 -0.189	Fat -0.264 -0.075 -0.329	Meat 0.235 0.394 0.232	Fish -0.073 -0.083 -0.354	Vegetables 0.000 -0.077 -0.108	Fruits -0.062 -0.026 -0.059	Other food items -0.061 -0.066 -0.048	
Product Cereals Milk and dairy products Fat Meat	Cereals -0.974 -0.123 -0.275 0.052	Milk and dairy products 0.086 -0.818 -0.189 0.045	Fat -0.264 -0.075 -0.329 0.001	Meat 0.235 0.394 0.232 -0.909	Fish -0.073 -0.083 -0.354 -0.145	Vegetables 0.000 -0.077 -0.108 -0.143	Fruits -0.062 -0.026 -0.059 -0.074	Other food items -0.061 -0.066 -0.048 0.057	
Product Cereals Milk and dairy products Fat Meat Fish	Cereals -0.974 -0.123 -0.275 0.052 -0.391	Milk and dairy products 0.086 -0.818 -0.189 0.045 -0.069	Fat -0.264 -0.075 -0.329 0.001 -0.001	Meat 0.235 0.394 0.232 -0.909 0.882	Fish -0.073 -0.083 -0.354 -0.145 -0.322	Vegetables 0.000 -0.077 -0.108 -0.143 -0.133	Fruits -0.062 -0.026 -0.059 -0.074 -0.091	Other food items -0.061 -0.066 -0.048 0.057 -0.064	
Product Cereals Milk and dairy products Fat Meat Fish Vegetables	Cereals -0.974 -0.123 -0.275 0.052 -0.391 -0.059	Milk and dairy products 0.086 -0.818 -0.189 0.045 -0.069 0.004	Fat -0.264 -0.075 -0.329 0.001 -0.001 -0.047	Meat 0.235 0.394 0.232 -0.909 0.882 0.126	Fish -0.073 -0.083 -0.354 -0.145 -0.322 0.292	Vegetables 0.000 -0.077 -0.108 -0.143 -0.133 -0.864	Fruits -0.062 -0.026 -0.059 -0.074 -0.091 -0.161	Other food items -0.061 -0.048 0.057 -0.064 -0.052	
Product Cereals Milk and dairy products Fat Meat Fish Vegetables Fruits	Cereals -0.974 -0.123 -0.275 0.052 -0.391 -0.059 -0.242	Milk and dairy products 0.086 -0.818 -0.189 0.045 -0.069 0.004	Fat -0.264 -0.075 -0.329 0.001 -0.001 -0.047 0.037	Meat 0.235 0.394 0.232 -0.909 0.882 0.126 0.527	Fish -0.073 -0.083 -0.354 -0.145 -0.322 0.292 -0.048	Vegetables 0.000 -0.077 -0.108 -0.143 -0.133 -0.864 -0.173	Fruits -0.062 -0.026 -0.059 -0.074 -0.091 -0.161 -0.770	Other food items -0.061 -0.066 -0.048 0.057 -0.064 -0.052 0.012	
Product Cereals Milk and dairy products Fat Meat Fish Vegetables Fruits Other food items	Cereals -0.974 -0.123 -0.275 0.052 -0.391 -0.059 -0.242 0.027	Milk and dairy products 0.086 -0.818 -0.189 0.045 -0.069 0.004 -0.020 -0.136	Fat -0.264 -0.075 -0.329 0.001 -0.001 -0.047 0.037 -0.044	Meat 0.235 0.394 0.232 -0.909 0.882 0.126 0.527 0.210	Fish -0.073 -0.083 -0.354 -0.145 -0.322 0.292 -0.048 -0.236	Vegetables 0.000 -0.077 -0.108 -0.143 -0.133 -0.864 -0.173 -0.093	Fruits -0.062 -0.026 -0.059 -0.074 -0.091 -0.161 -0.770 0.068	Other food items -0.061 -0.048 0.057 -0.064 -0.052 0.012 -1.002	

		Milk and						Other
Product	Cereals	dairy	Fat	Meat	Fish	Vegetables	Fruits	food
		products						items
Cereals	-0.973	0.099	-0.190	0.183	-0.047	-0.028	-0.007	-0.042
Milk and dairy products	-0.079	-0.832	-0.057	0.356	-0.109	-0.099	-0.050	-0.064
Fat	-0.221	-0.140	-0.322	0.221	-0.460	-0.118	-0.168	-0.047
Meat	-0.014	0.006	-0.031	-0.815	-0.212	-0.096	-0.074	0.019
Fish	-0.308	-0.070	-0.051	0.807	-0.105	-0.121	-0.108	-0.130
Vegetables	-0.071	-0.048	-0.057	0.169	0.219	-0.859	-0.111	-0.057
Fruits	-0.182	-0.035	-0.022	0.497	-0.091	-0.148	-0.756	-0.016
Other food items	-0.029	-0.054	-0.011	0.192	-0.168	-0.076	0.123	-1.019

Upper average

Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Cereals	-0.932	0.111	-0.142	0.121	-0.094	0.001	-0.056	-0.038
Milk and dairy products	-0.008	-0.782	-0.114	0.241	-0.068	-0.080	-0.051	-0.048
Fat	-0.156	-0.165	-0.424	0.155	-0.238	-0.054	-0.103	-0.022
Meat	-0.049	-0.034	-0.112	-0.776	-0.092	-0.096	-0.053	0.026
Fish	-0.190	-0.044	-0.039	0.598	-0.184	-0.099	-0.121	-0.101
Vegetables	-0.034	-0.053	-0.007	0.148	0.020	-0.843	-0.097	-0.046
Fruits	-0.111	-0.025	-0.024	0.332	-0.092	-0.100	-0.817	0.006
Other food items	-0.001	-0.053	0.004	0.156	-0.216	-0.065	0.085	-1.011

Wealthy

Product	Cereals	Milk and dairy products	Fat	Meat	Fish	Vegetables	Fruits	Other food items
Cereals	-0.763	-0.011	-0.132	0.111	-0.193	-0.063	-0.011	-0.034
Milk and dairy products	-0.034	-0.790	-0.081	0.148	0.005	-0.057	-0.019	-0.047
Fat	-0.131	-0.094	-0.378	0.147	-0.239	0.052	-0.131	-0.069
Meat	-0.089	-0.128	-0.199	-0.641	-0.161	-0.083	-0.158	-0.006
Fish	-0.137	-0.020	-0.111	0.371	-0.142	-0.104	-0.055	-0.143
Vegetables	-0.064	-0.038	0.096	0.194	-0.088	-0.894	-0.030	-0.068
Fruits	-0.036	-0.012	-0.087	0.189	-0.022	-0.040	-0.793	-0.046
Other food items	-0.038	0.016	-0.006	0.114	-0.110	-0.023	0.048	-1.026

Role of Policies in Stimulating Renewable Energy in Arab Countries Sahar Aboud*

Abstract

Despite the abundance of literature on renewable energy (RE), studies about the role of policies in stimulating RE, especially for Arab countries, are still limited. This study aims at examining the role of RE policies as a key determinant of RE investment in 11 Arab countries using panel data covering the period 2010-2019 to identify areas for policy intervention to stimulate RE investment in Arab countries. The study uses RE share in total energy supply as a proxy for RE investments. The analysis finds there is heterogeneity among Arab countries concerning their efforts toward reaching an enabling environment for RE investment, but all of them are exhibiting an improvement. Results confirm the importance of policies, either using the RE policy index or its sub-indices in stimulating RE investment in Arab countries have low coefficients that reflect weakness in some sub-indices, particularly carbon pricing and greenhouse gas monitoring, incentives and regulatory support, attributes of financial and regulatory incentives, and counterparty risk. To boost RE investment, Arab countries need to work vigorously on these pillars.

دور السياسات في تحفيز الطاقة المتجددة في البلدان العربية سحر عبود ملخص

بالرغم من وفرة الأدبيات الاقتصادية عن الطاقة المتجددة، فإن الدراسات مازالت محدودة حول دور السياسات في تحفيز الاستثمار في الطاقة المتجددة خاصة للبلدان النامية ومنها البلدان العربية. تتناول هذه الدراسة بالتحليل دور السياسات كأحد المحددات الأساسية للاستثمار في الطاقة المتجددة في 11 بلدًا عربيًا باستخدام السلاسل الزمنية المقطعية للفترة 2010-2019 لتحديد المجالات التي من شأن تدخل السياسات فيها أن يشجع الاستثمار في الطاقة المتجددة في البلدان العربية. وتستخدم الدراسة نصيب الطاقة المتجددة من إجمالي عرض الطاقة كمؤشر بديل للاستثمار في الطاقة المتحددة. ورغم ما يظهره التحليل من تباين جهود البلدان العربية فيما يتعلق بتهيئة البيئة الداعمة لاستثمار في الطاقة المتجددة. ورغم ما يظهره التحليل من تباين جهود البلدان العربية فيما يتعلق بتهيئة البيئة الداعمة لاستثمار في الطاقة المتجددة. إلا أن كافة البلدان العربية تشهد تحسنًا في هذا الصدد. وتؤكد النتائج أهمية السياسات في تحفيز الاستثمار في الطاقة المتجددة في البلدان العربية من معنوية المعنوى المؤشر الإجمالي للسياسات أو مكوناته الفرعية وجاءت المتجددة، إلا أن كافة البلدان العربية تشهد تحسنًا في هذا الصدد. وتؤكد النتائج أهمية السياسات في تحفيز الاستثمار في الطاقة المتجددة في البلدان العربية سواء على مستوى المؤشر الإجمالي للسياسات أو مكوناته الفرعية وجاءت المتجدرة، إلا أن كافة البلدان العربية سواء على مستوى المؤشر الإجمالي للسياسات أو مكوناته الفرعية وجاءت المتجددة التجدية إحصانيًا. وبالرغم من معنوية المتغيرات، فإن تواضع معاملاتها يعكس الضعف في بعض المؤشرات والفرعية وتحديدا تسعير الكربون ومتابعة الغازات الدفيئة، والحوافر والدعم التنظيمي، والحوافر المالية والتنظيمية، والمخاطر المرتبطة باحتمالية عدم الالتزام. وعليه، من أجل دفع عجلة الاستثمار في الطاقة المتجددة، يلزم على البلدان

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1. Introduction

Renewable energy (RE) can be a powerful engine for economic recovery from the ongoing coronavirus crisis through creating new opportunities for sustainable economic growth and employment. In addition, RE can be a cornerstone in achieving the 2030 Agenda for Sustainable Development and meeting the commitments made under the 2015 Paris Agreement, which seeks to "hold the increase in the global average temperature to well below 2°C above pre-industrial levels". (UNFCCC 2015; Article 2)

There is an upward trend in global investment in RE. A total of \$2.7 trillion have been invested in RE during 2010-2019 (excluding large hydro), which is more than triple the amount invested over the past decade (UNEP 2019).

Despite this increase, it is still significantly lower than the investment needed to meet the commitment under the Paris Agreement. The International Energy Agency (IEA) estimates that more than \$6 trillion in cumulative investments in renewable power until 2040 are required to meet this goal (IEA 2016).

There is consensus concerning the role of policies in stimulating RE investment. This role can be achieved by designing stronger and more coherent climate mitigation policies, which stimulate both the demand and supply of RE using different tools. These policies include carbon pricing, fiscal and financial incentives, the phasing-out of fossil fuel subsidies and R&D support OECD (2016).

There is a notable increase in supportive governmental intervention all over the world, with around 80 percent of high-and upper-middle-income countries adopting supportive RE policies (Polzin et al. 2019)

In 2018, around 111 countries have applied the feed-in tariff, at least 48 countries applied RE auctions, and about 66 countries implemented net consumption policies (REN21 2019).

Most studies have demonstrated the importance of policies in supporting investment in RE over the past decade, and this pivotal policy role is expected to continue.

The policy mix used by each country is subject to a variety of variables, including the nature of the market, the development of RE technologies, and policy priorities.

During the past decade, many Arab countries have made significant progress toward a sustainable energy future, through developing enabling policy frameworks for RE with ambitious targets and financial incentives.

These efforts resulted in a huge increase in accumulative investments in RE (excluding hydro) in the Arab region to be around \$15 billion during the past decade compared to only \$1.2 billion in 2008 (RECREEE and UNDP 2019).

However, with this shift, the share of Arab countries in global investment in RE is still limited and far from the value needed to achieve their targets, so the need to mobilize investments in RE is essential.

Despite the abundance of literature on RE, studies about the role of policies in RE investments, especially for developing countries including Arab countries, are still limited.

Therefore, the study aims at examining the role of RE policies as a key determinant of RE investment in 13 Arab countries using panel data covering the period 2009-2019 to identify areas for policy intervention to stimulate RE investment in Arab countries.⁽¹⁾ The countries are Jordan, United Arab Emirates, Egypt, Morocco, Tunisia, Algeria, Sudan, Iraq, Oman, Kuwait, Lebanon, Libya, and Saudi Arabia.

This research paper is organized as follows: Section I reviews the existing literature on the role of policies in stimulating RE investment. Section II briefly presents some stylized facts about RE investments in Arab countries. Section III describes the methodology and data used and discusses the results. The final section concludes with some policy implications.

⁽¹⁾ Due to the unavailability of data, the final sample is composed of 11 Arab countries: Algeria, Egypt, Jordan, Lebanon, Morocco, Saudi Arabia, Tunisia, Kuwait, the United Arab Emirates, Oman, and Sudan for the period 2010-2019.