

Claiming the Usefulness of Relative Welfare Indicators in General Equilibrium Analysis:

A Comprehensive Comparison of VAT Reforms.

Ana-Isabel Guerra

Department of International Economics
Universidad de Granada
Paseo de la Cartuja 7, 18071-Granada, Spain
anaisabelguerra@ugr.es

Abstract

The evaluation of welfare effects should be clear and presented in an easy to interpret manner. In this paper, we show that on these grounds the true index of cost of living, first introduced by Konüs (1939), is preferable to the standard absolute indicators when evaluating welfare effects in static applied general equilibrium models i.e. the equivalent and the compensated variations. In these applied models, it is customary to use linearly homogeneous utility functions such as Cobb-Douglas or the more general CES specification. Under this class of utilities, the Konüs index is independent of the reference level of utility. This makes this index an unambiguous cost of living indicator. Lastly, to show the convenience of using the Konüs index in empirical work, we have carried out an original exercise with a novel data set for the Spanish economy. We report the macroeconomic and welfare impacts of two alternative Value-Added Tax Reforms through the application of an original simulation strategy.

Keywords: Cost of living indices, applied general equilibrium analysis, tax reforms, fiscal policies.

JEL codes: D58, D69, E62

Acknowledgments

The author thanks the support of research project MICINN-ECO2017-83534P from the Ministry of Economy and Competitiveness of Spain and FEDER (EU)

I. Introduction

In the context of applied general equilibrium models (AGEM), the most widely used welfare indicators are the classical money metric welfare measures: the Hicksian Equivalent and Compensated Variations (EV and CV, respectively). However, in great contrast to the EV and the CV, the use of cost of living indices such as the Konüs Index (Konüs, 1939) is less common under AGEM. This is so even though these indices can be seen as sub-products of income welfare measures. For this reason, cost of living indices are also known as relative welfare indicators. Nevertheless, the use of this index in applied work has been subject of criticism because its dependence on the reference level of utility chosen for its calculation. There is a well-known situation where the Konüs index is homogenous of degree zero in utility and thus there is no objection for its use. This situation refers to the case of linearly homogeneous preferences (Layard and Walters, 1978), which are the most commonly employed in static applied general equilibrium analysis such as the constant elasticity of substitution (CES) utility functions. In addition, another interesting property of the Konüs index under linearly homogeneous preferences is that this index is equivalent to the ratio of the CV to the EV (Guerra et al. 2018).

In illustrating the usefulness of the Konüs index in this context we have carried out an original empirical exercise for the Spanish economy using a static applied general equilibrium model with a newly data set constructed by the authors from official data: A Social Accounting Matrix (SAM) for the year 2010. The empirical exercise consists in evaluating the macroeconomic and welfare effects of two value-added tax (VAT) reforms: the actual VAT reform enacted by the Spanish government in force since 2012 and an alternative VAT reform (Conde-Ruíz et al. 2015) that consists in introducing a single rate. Our results indicate that, in comparing these two VAT reforms consistently, the Konüs index indicates that their impacts in terms of welfare are quite similar. A conclusion that is not easy to draw when absolute welfare indicators are set side by side i.e. EV and CV.

II. Evaluating and Comparing the Impacts of VAT Reforms in Spain: A Comprehensive Approach.

We use a newly data set that consists in a Macroeconomic SAM for Spain for the year 2010. The SAM contemplates 34 sectors (See Table_A in the Annex), five institutional units that include corporations, the public administration, households and two foreign sectors. In the model, all markets are competitive and clear, with the exception of the labour market where the ‘classical’ assumption of perfect flexibility has been relaxed incorporating a wage curve i.e. negative relationship between the unemployment rate and the real wage. Agents behave rationally. We model private

consumption demand using a representative consumer with a Cobb-Douglas utility function, a particular case of the CES utility functions.

With the objective of giving evidence of the suitability of using the Konüs index we have opted to carry out an original analysis whose aim is to shed some light about both the macroeconomic and the average welfare impacts at an economy-wide level of two VAT tax reforms in the Spanish economy. The interest on this empirical analysis stems from the still ongoing debate about which should be the structure of this indirect tax to favour fiscal consolidation while maximizing its efficiency. This debate has opened up after some European Union (EU) Members have undertaken VAT reforms to avert a fiscal crisis that would have derived in uncontrolled increments in public deficits and thus in public debts.

In the specific context of Spain, the central government undertook an increase in VAT rates, first in 2010 and later on in 2012, as a first measure to return the public deficit to a sustainable path. The 2012 reform consisted in increasing both the reduced and the standard VAT rates from 8 and 18 percent to 10 and 21 percent, respectively. An alternative proposal put forth by Conde-Ruiz et al. (2015) would contemplate the homogenization of all VAT rates to a single and common rate of 21 percent. These authors justified their proposal stressing that their VAT reform would increase the tax collection capacity of the VAT and would be less distorting since it would minimize the potential substitution effects¹. However, the question that may arise is the following: is this statement still true when we compare the possible economy-wide impacts of these two VAT reforms in a comprehensive manner?

In order to provide a first answer to this question, we have evaluated their potential effects on the Konüs index under the two aforementioned alternative VAT reforms along with other macroeconomic impacts and the classical absolute welfare indicators. We recall now that the Konüs index measures the so-called true cost of living. It is defined as the ratio of the consumer's expenditure functions in two different equilibrium states identified here by the equilibrium price vectors p^0 (benchmark prices) and p^1 (counterfactual prices):

$$\kappa = \frac{e(p^1, u)}{e(p^0, u)} \quad (1)$$

When $\kappa > 1$, the consumer is said to be worse off since more expenditure is required in the counterfactual to achieve the same welfare level as in the benchmark. On the other hand, $\kappa < 1$ indicates that the consumer is better off.

We enable a comprehensive comparison of the effects of the actual and proposed VAT reforms by implementing a two-step simulation strategy. In the first step, we evaluate using an AGEM for Spain the actual VAT reform implemented by the Spanish government (Scenario_1). In the second one, we introduce the structure of the alternative VAT reform (Scenario_2) in such a way that the change in the VAT

¹ Differently to our approach, the empirical analysis of these authors relied on a simulation technique using fiscal data from the VAT in Spain.

rates would yield exactly the same amount of public deficit (in real terms) obtained under Scenario_1. By endogenously determining the common VAT rate that would equate it with the same public deficit resulting from the actual VAT reform, we control for the size of the deficit, which makes the comparison of the results to be more sensible.

III. Results and Conclusions.

We present in Table 1 the main macroeconomic and welfare effects in real terms for the two simulated VAT reforms. We see in the table that the alternative single VAT tax rate, once we control for the size of the public deficit, would amount to 15.77 percent, down from the nominal 21 percent. The macroeconomic results shown down the two last columns of Table 1 clearly indicate that, for the same public deficit reduction (-24.482 percent), the two VAT reforms imply a decline in real aggregated income and thus in employment levels. Nevertheless, these negative effects are slightly more intense in the case of the alternative VAT reform vindicated by Conde-Ruíz et al. (2015). Hence, on these grounds and in line with the AGEM assumptions (in contrast to what these authors stated in their work), it turns out that even though the actual VAT reform enacted by the Spanish government is preferred, the differences of these two VAT reforms when compared in a comprehensive way are not remarkably large. The same applies regarding the figures and the indicators on the evaluated changes in VAT revenues.

Table 1. Impacts of Actual and Alternative VAT Reforms in Real Terms for an Equivalent Reduction on the Public Deficit: AGEM Spain 2010.			
	Benchmark Equilibrium Values	Scenario_1: Actual VAT Reform	Scenario_2: Alternative VAT Reform
		Super-reduced: 4 % Reduced: 10 % Standard: 21 %	Super-reduced: 0 % Reduced: 0 % Standard: 15.77 %
Macroeconomic Impacts			
Unemployment Rate	20.300 %	21.015%	21.048%
% Change in GDP	-	-0.4859%	-0.5279%
% Change in Public Deficit/Surplus		-24.482%	-24.482%
% Share of Public Deficit/Surplus over GDP	-3.634%	-2.758%	-2.759%
Impacts on VAT Revenues			
% Change in VAT revenues	-	22.921%	23.501%
% Share of VAT Revenues over GDP	5.440%	6.720%	6.755%
Absolute and Relative Welfare Indicators			
CV in real terms (millions of 2010 euros)	-	-20,804.468	-19,750.431
EV in real terms (millions of 2010 euros)	-	-20,443.472	-19,449.273
Konüs Index	-	1.0176	1.0155

Source: Own elaboration.

We now move to comment on the absolute and relative welfare impacts of these two VAT Reforms. The negative signs of the CV and the EV indicate an erosion of households' welfare levels. However, in contrast with the macroeconomic effects, the alternative VAT reform (Scenario_2) generates a lower decline in welfare levels. The reason relies upon the fact that while under Scenario_1 VAT rates raise in all sectors, this is not the case under Scenario_2 (See Table_ A in the Annex). Observe, for instance, the values of the CV. To return households' to their benchmark utility levels would require an additional income compensation of 1,054.037 million of 2010 Euros, under Scenario_1. This difference in CVs seems quite large. However, the reported figures of the Konüs index, computed as the ratio of the CV to the EV under linearly homogeneous preferences, indicate that the dissimilarities between the two VAT reforms in terms of welfare impacts are rather small. The reduction of the public deficit by 24.482 percent increases the cost of living standards by 1.76 percent and 1.55 percent under Scenario_1 and Scenario_2, respectively—an additional 0.21 percent.

Table 2. Impacts of Actual and Alternative VAT Reforms in Real Terms for an Equivalent Reduction on Public Deficit. Sensitivity Analysis with respect to relevant elasticity values. AGEM Spain 2010.				
	50 % Increase from Benchmark Values		50 % Decrease from Benchmark Values	
	Wage Curve Elasticity.		Wage Curve Elasticity.	
	Scenario_1	Scenario_2 Standard VAT=15.778%	Scenario_1	Scenario_2 Standard VAT=15.755%
Konüs Index	1.0181	1.01606	1.0168	1.01456
%Change in GDP	-0.5754	-0.6231	-0.3422	-0.3767
% Change in VAT	22.754	23.402	23.188	23.675
% Share of VAT in GDP	6.7177	6.756	6.725	6.754
% Change in Public Deficit/Surplus	-22.787	-22.787	-27.196	-27.196
	Capital-Labour Elasticity		Capital-Labour Elasticity	
	Scenario_1	Scenario_2 Standard VAT=15.778%	Scenario_1	Scenario_2 Standard VAT=15.755%
Konüs Index	1.0185	1.0164	1.0163	1.0139
%Change in GDP	-0.6106	-0.6609	-0.2876	-0.3184
% Change in VAT	22.7633	23.409	23.171	23.6684
% Share of VAT in GDP	6.7200	6.759	6.721	6.7503
% Change in Public Deficit/Surplus	23.0041	23.0041	-26.832	-26.832
	Armington Elasticities		Armington Elasticities	
	Scenario_1	Scenario_2 Standard VAT=15.764%	Scenario_1	Scenario_2 Standard VAT=15.77%
Konüs Index	1.0176	1.0154	1.0176	1.0155
%Change in GDP	-0.4884	-0.5281	-0.4834	-0.5278
% Change in VAT	22.893	23.444	22.948	23.561
% Share of VAT in GDP	6.7190	6.7523	6.7221	6.758
% Change in Public Deficit/Surplus	-24.4410	-24.4410	-24.521	-24.521

Source: Own Elaboration.

In Table 2, we assess the sensitivity of the results to changes in some relevant elasticity values. We explore the effects of a ± 50 percent change in the elasticities governing the wage-curve, the substitution between labour and capital and the Armington substitution between domestic output and imports. We then re-run the two VAT simulations. The sensitivity analysis shows the consistency of the previous conclusions. Since VAT collections are associated to households' demand functions and in the AGEM model these functions are given by a unitary elasticity Cobb-Douglas utility function, this assumption may turn out be the most relevant to ascertain the most likely effects of tax reform affecting private demand. However, there is a lack of updated substitution elasticities estimates for consumption demand, which prevents at this stage a more refined sensitivity analysis. We plan to overcome this restrictive setup and initiate a future line of research to appraise the consequences of changing this assumption.

IV. References.

Conde-Ruiz, José Ignacio., Díaz, Manuel, Marín, Carmen and Juan Rubio Ramírez. (2015). *Una Reforma Fiscal para España* [A Fiscal Reform for Spain]. Fedea Policy Papers-2015/02. <http://documentos.fedea.net/pubs/fpp/2015/02/FPP2015-02.pdf>

Guerra, A-I., A. Manresa and F. Sancho (2018). “Measuring the true index of cost of living under general equilibrium: the numéraire matters”. *Economics Letters* (forthcoming).

Konüs, A.A. (1939). The problem of the true index of the cost of living. *Econometrica* 7 (1): 10-29.

Layard, P.R.G and A.A. Walters (1978). *Microeconomic Theory*, New York: McGraw-Hill.

Spanish Institute of Fiscal Studies. 1997. Data Set BADESPE. Available at: <http://www.estadief.meh.es/>

Annex

Table_A: VAT Reforms for an Equivalent Reduction on Public Deficit. Description of Simulation Strategy.								
	Benchmark Values		Scenario_1			Scenario_2		
CPA_2018 Codes	VAT Rates	Average VAT Rates	New VAT Rates	New Average VAT Rates	Evaluated Changes VAT Rates	New VAT Rates	New Average VAT Rates	Evaluated Changes VAT Rates
01,02, 03	4,7.5,17	9.5	4, 10, 21	11.666	22.807	15.77	15.77	66.00
05, 09	17	17	21	21	23.529	15.77	15.77	-7.235
10,11,12	4,7.5,17	9.5	4, 10, 21	11.666	22.807	15.77	15.77	66.00
13,14,15	17	17	21	21	23.529	15.77	15.77	-7.235
16,17,18	17	17	21	21	23.529	15.77	15.77	-7.235
19	17	17	21	21	23.529	15.77	15.77	-7.235
20,21	4,7.5,17	9.5	4,10,21	11.666	22.807	15.77	15.77	66.00
22	7.5,17	12.250	10,21	15.5	26.530	15.77	15.77	28.734
23	17	17	21	21	23.529	15.77	15.77	-7.235
24	17	17	21	21	23.529	15.77	15.77	-7.235
25	17	17	21	21	23.529	15.77	15.77	-7.235
26,27	17	17	21	21	23.529	15.77	15.77	-7.235
28	17	17	21	21	23.529	15.77	15.77	-7.235
29	17	17	21	21	23.529	15.77	15.77	-7.235
30	17	17	21	21	23.529	15.77	15.77	-7.235
31,32	17	17	21	21	23.529	15.77	15.77	-7.235
33,95	17	17	21	21	23.529	15.77	15.77	-7.235
35	7.5,17	12.250	10,21	15.5	26.530	15.77	15.77	28.734
36	7.5	7.5	10	10	33.333	15.77	15.77	110.266
37,38,39	7.5	7.5	10	10	33.333	15.77	15.77	110.266
41,42,23	7.5,17	12.25	10,21	15.5	26.530	15.77	15.77	28.734
45,46,47,48,49,50, 51,52	4,7.5,17	9.5	4,10,21	11.666	22.807	15.77	15.77	66.00
53,59,60,61,62,63	0,17	8.5	0,21	10.5	23.529	15.77	15.77	85.529
55,56	7.5	7.5	10	10	33.333	15.77	15.77	110.226
64,65,66	0,17	8.5	0,21	10.500	23.529	0,15.77	7.885	-7.235
68	7.5,17	12.250	10,21	15.5	26.530	15.77	15.77	28.734
69,70,78	7.5,17	12.250	10,21	15.5	26.530	15.77	15.77	28.734
77	17	17	21	21	23.529	15.77	15.77	-7.235
79	0,7.5,17	8.166	0,10,21	10.333	26.540	0,15.77	7.885	-3.441
80,81,82	17	17	21	21	23.529	15.77	15.77	-7.235
84					0.000			
85	0,17	8.500	0,21	10.500	23.529	0,15.77	7.885	-7.235
86,87,88	0,7.5	3.75	0,10	5	33.333	0,15.77	7.885	110.266
90,91,92,93,94,96,97,98,99	17	17	21	21	23.529	15.77	15.77	-7.235

Source: Own Elaboration and the data set on VAT rates per sector provided by BADESPE (Spanish Institute of Fiscal Studies, 1997)