

A COMPARISON OF MACROECONOMIC PERFORMANCE IN A CONTEXT OF CONFLICTING POLICY OBJECTIVES

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Abstract

This study seeks to assess macroeconomic performance under conflicting policy objectives. Given the availability of data for the period 2008-2011, we select 60 upper-middle and high income economies spanning several large geographical regions. The performance were analyzed by directional distance functions under DEA model. Supplementary analysis is performed in terms of pairwise dominance comparison. The analysis revealed that the average efficiency scores difference between European countries and non European countries seems to be not much difference. However, grouping European countries by four sub-regions, differences are observed: North and West economies are more efficient than South and East countries. Distinguishing the development economies, according to IMF classification, advanced countries are more efficient than the emerging. Public policy decisions often require the establishment of a balance between conflicting objectives. The research suggests that DEA and pairwise dominance comparison are useful tools to find the best balance and guide the policymakers to improve the effectiveness of the policies. This is the first paper that investigates a wide range of economies, evaluating, at the same step, conflicting objectives of macroeconomic policy inside a performance perspective.

Keywords: macroeconomic performance, efficiency, data envelopment analysis, dominant units

JEL Classification: C61, O11

1. Introduction

After the financial crisis of 2008/2009, fiscal austerity has become the new principle for public policy in Europe and the U.S. However, for government it is not easy to restore the fiscal balance, as it can trigger negative externalities such as a recession, rising unemployment, deflation and increasing poverty.

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Traditionally, the evaluation of macroeconomic performance has been based on four objectives: growth rate, inflation, unemployment and trade balance which are envisaged as the “magic diamonds” of the OECD (e.g., Economic Outlook, 1987). However, this procedure has two limitations: first, these dimensions are incomplete because they are not able to take into consideration all the policy demands. For example, the UK government pursues not only high and stable economic growth, low inflation, high employment, but also sustainable economic growth, in terms of social and environmental impacts and sound government finances.

Second, this measure contains an arbitrary and unrealistic weighting scheme to aggregate the respective indicators: implicitly, assigning a unit weight to each component, each index treats its respective indicators as being equally important, no matter how strong a macroeconomic tradeoff occurs between various policy instances.

Several studies have been undertaken for overcoming these limitations. We considered some. Lovell (1995) considers the four magic diamonds to assess macroeconomic performance of ten Asian economies for the period 1970-1988, using the output-oriented Free Disposal Hull approach (Deprins, Simar, Tulkens, 1984). Lovell, Pastor. and Turner (1995) examine the macroeconomic performance of 19 OECD countries over the period 1970-1990, adding two environmental disamenities (carbon and nitrogen emission) to the magic diamonds list and use the non-radial Slack-Based Measure, under Data Envelopment Analysis approach (Charnes, Cooper & Rhodes, 1978), to assign a performance score to each country. Somnath Chattopadhyay and Suchismita Bose (2015) adopt the Multiple Criteria Decision Making, including fiscal deficit and GDP per capita to the standard four indicators. Camelia Burja, Vasile Burja (2013), applying a DEA approach to a selection of new EU Member States to estimate their performances, use GDP as an output variable and the following indexes “Global Competitiveness Index”, the “Human Development Index” and the “Environmental Performance Index” as input variables.

The novelty of our study is twofold: first, we have added, to the four dashboard indicators, per capita GDP, fiscal balance, Carbon Dioxide Emissions and Human Development Index. In such way, we try to take into account, simultaneously, economic, social and environmental goals. Second, under the DEA frame, we have applied Directional Distance Functions (Chambers et al. 1996) to measure macroeconomic performance, because it provides an asymmetrical treatment of good and bad outputs.

Supplementary evaluation analysis is done in terms of pairwise dominance comparison among countries. This tool does not need a measure to assert if a country is performing better than another to pursue political goals.

The empirical analysis proposed is limited to “upper-middle” and “high income” economies. Given the availability of data for the period 2008-2011, we have selected 60 countries spanning several large geographical regions.

The layout of the paper is as follows: the next section provides the methodology used to evaluate economic performance. Section 3 presents the theoretical justification for the selection of variables in constructing a macroeconomic performance, data and results. A Summary and concluding notes are reported in the last section.

2. Methodology

Following Koopmans 1951, Lovell, Pastor and Turner 1995, the macroeconomic decision-making apparatus of a country is formulated by its bureaucracy, called helmsman. The relative performance of a country is evaluated with reference to the outputs produced or the services provided, without reference to the resources consumed in the process. So, each country uses exactly one helmsman and a single constant input, with the value equal to one.

Under the assumption of constant return to scale in assessing the macroeconomic performance, we adopt the following mathematical programming formulation:

$$\max \left\{ \beta: \sum_{j=1}^k \lambda_j p_{jm} \geq p_{om} + \beta |p_{om}| \quad (r = 0, \dots, m), \right. \\ \left. \sum_{j=1}^k \lambda_j q_{jn} \leq q_{on} - \beta |q_{on}| \quad (s = 0, \dots, n), \right. \\ \left. \sum_{j=1}^k \lambda_j \geq 0, \quad \beta \geq 0, \quad \lambda_j \geq 0 \quad (j = 1, \dots, k) \right\}$$

where:

- country is indexed as $i = 1, \dots, o, \dots, k$
- good outputs vector p is indexed as $r = 0, \dots, m$
- bad outputs vector q is indexed as $s = 0, \dots, n$
- λ is a $k \times 1$ vector of intensity of variables.

Absolute values of p and q vectors are a simple alternative to handle negative data as well, (Kristiaan Kerstens, Ignace Van de Woestyne, 2011).

Additional analysis is proposed to evaluate macroeconomic performance. Here, the only constraints considered are expressed by an inequality assertion.

For each pair of countries (h_o, h_d) , h_o dominates h_d for which $(p_d' - q_d) \leq (p_o' - q_o)$, with at least one element of the vector inequality strict. Conversely, h_d is dominated by h_o .

Undominated countries, that never are dominated by other observations, are aptly called “efficient by default”.

This criterion has the virtue of providing, for countries dominated, the comparable dominant best practices to emulate.

3. Data, discussions and results

To take into account economic, social and environmental components, we consider the following indicators, distinguishing between good and bad outputs.

Good outputs:

1. Rate of growth of GDP (GGDP), as a proxy for economic growth (source World Bank).
2. Per capita GDP (PGDP) as a measure of the average wealth of the population of a nation (source World Bank).
3. Fiscal surplus/deficit as a proportion of GDP (FSDGDP) that captures the fiscal rectitude of a government and consists of keeping the national debt under control (source World Bank).
4. Current account balance as a proportion of GDP (CABGDP), which captures a country's external economic performance, whereas a deficit is regarded as a bad signal for the economy (source World Bank).
5. Human Development Index (HDI) is a composite indicator used to measure the social sustainability dimension of a country (source United Nations).

Bad outputs:

1. Unemployment rate is the proportion of the “economically active” population who are not working, as a signal of overall economic health (source World Bank).
2. Inflation or deflation rampage rate as a signal of price stability (Consumer Price Index data is available from World Bank). We assume that negative or positive deviations

from this threshold (2% as indicated by the European Central Bank) are detrimental for the economy.

3. The rate of Total Carbon Dioxide Emissions from the Consumption of Energy (source International Energy Statistics) on the Energy use (source World Bank) catches the national pollution concentration (TCDE).

We have restricted the evaluation to upper-middle and high income (World Bank definition) assuming homogeneity of behaviours across countries; however, the results produced by any performance assessment, should be handled with caution.

Due to missing data, the final sample used for analysis consists of 60 countries, listed in Appendix 1, according to their economic attributes and regional locations.

Countries span several large geographical regions: Europe accounts for three – fifths of the sample, nine countries are grouped in the East, eleven in the North, ten in the South and the remaining in the West. The high income countries are forty-one, thirty are OECD members, and twenty-seven are located in Europe. The advanced Economies are thirty-three and twenty-four countries are concentrated in Europe.

Table 1 provides a statistical overview of the data used in the analysis distinct by geographic region, income groups and economic classification.

Table 1. Average of indicators by geographical and economic regions

Groups	GGDP	PGDP	FSDGDP	CABGDP	HDI	Unemployment rate	Inflation rate (*)	TDCE
East Asia & Pacific	102.62	36,724.19	-1.21	5.23	0.87	4.28	2.70	3.23
Europe & Central Asia	100.19	30,037.22	-3.23	-2.13	0.84	9.93	4.13	2.32
Latin America & Caribbean	103.67	11,362.88	-2.87	-5.03	0.73	8.97	6.89	2.20
Middle East & North Africa	102.94	39,861.34	1.37	9.40	0.80	6.82	4.09	3.65
North America	100.68	44,222.04	-4.78	-2.78	0.90	7.96	1.95	2.35
Sub-Saharan Africa	102.81	10,866.50	-5.05	-2.25	0.64	23.41	7.75	2.53
High income	100.65	36,562.01	-2.52	0.93	0.86	7.59	3.19	2.55
Upper middle income	102.57	12,757.60	-2.99	-3.92	0.72	13.79	7.06	2.52
Advanced Economies	100.26	37,297.93	-3.14	-0.07	0.88	7.49	2.65	2.57

Emerging Market and Developing Economies	102.49	18,911.31	-2.09	-1.26	0.75	12.07	6.57	2.51
Gran Total	101.26	29,023.95	-2.67	-0.61	0.82	9.55	4.41	2.54

^(*)For the evaluation we use the deviation from the ECB's 2% target rate.

Source: own work.

Sub-Saharan Africa shows an inferior condition with respect to other geographical areas. Comparing emerging economies with advanced ones, the first performs worse on all indicators with the exception of GGDP and TCDE.

In appendix II, for each country, there is reported the mean performance of four-years and the dominance occurrences within the observations set. Countries are ranked with respect to the score and the number of dominating relationships. Scores vary from 0 (best) to 0.55 (worst). The top performers are: Iceland, Kuwait and Norway. However, in terms of number of times that a country dominates others, Norway stands out (199 times), followed by Kuwait (14 times) and Iceland (10 times).

Table 2. Average of indicators by best performers

Country	GGDP	PGDP	FSDGDP	CABGDP	HDI	Unemployment rate	Inflation rate	TDCE
Norway	100.06	59,068.68	14.51	13.37	0.94	3.17	2.41	1.43
Iceland	98.80	38,084.04	-9.03	-12.51	0.89	6.22	8.52	0.64
Kuwait	100.81	85,367.31	17.51	35.82	0.81	1.60	5.83	2.81

Source: own work.

On the other side, the worst performers are Bosnia and Herzegovina, Greece, Jamaica, Serbia and South Africa. Ranking in terms of the number of times that a country is dominated by others. The worst hit is Jamaica (352 times) followed by Greece (175 times), Serbia (156 times) South Africa (119 times) and Bosnia and Herzegovina (90 times).

Table 3. Average of indicators by worst performers

Country	GGDP	PGDP	FSDGDP	CABGDP	HDI	Unemployment rate	Inflation rate	TDCE
Bosnia and Herzegovina	101.04	8,716.29	-2.34	-9.16	0.73	25.70	3.22	3.58
South Africa	102.21	11,439.27	-3.56	-3.91	0.63	23.95	7.05	3.34
Serbia	101.06	11,429.14	-3.24	-10.64	0.74	17.13	9.45	3.07

Greece	95.21	28,723.95	-11.46	-11.34	0.86	11.85	3.35	3.42
Jamaica	98.77	8,390.79	-6.73	-12.77	0.71	11.77	12.93	3.13

Source: own work.

Evaluating performances for homogeneous groups, East Asia & Pacific performs better than other geographic areas. The Sub-Saharan Africa performs the worst. European and non-European countries show similar score averages. However, grouping European countries by four sub-regions, more differences are revealed: the North and the West economies are more efficient than the South and the East. With respect to dominance relationships, the differences are much more pronounced. The North has 7.49 times the probability to dominate other countries with respect to the South, the West 7.83 times and the East 3.27 times. Distinguishing economies between advanced and emerging, the advanced ones are more efficient. A difference has also been found between high income and upper middle income – the first group performs better than the second.

Table 4. Summary of results

Group	No. of countries	Mean score	Number of Dominated	Number of Dominating
East Asia & Pacific	6	0.18	21	190
Europe & Central Asia	36	0.27	1,071	1,249
Latin America & Caribbean	7	0.30	441	113
Middle East & North Africa	6	0.26	40	114
North America	2	0.27	17	101
Sub-Saharan Africa	3	0.47	178	1
Non Europe	24	0.28	697	519
Europe & Central Asia	36	0.27	1,071	1,249
Eastern Europe	9	0.34	225	125
Northern Europe	11	0.17	87	672
Southern Europe	10	0.37	718	65
Western Europe	6	0.16	41	387
High income	41	0.23	647	1,611
Upper middle income	19	0.37	1,121	157
Advanced Economies	33	0.23	584	1,443
Emerging Market and Developing Economies	27	0.37	1,184	325
Grand Total	60	0.27	1,768	1,768

Source: own work.

4. Conclusion

Macroeconomic performance is a complex and multidimensional relationship. No one government is able to fit all policy goals simultaneously because, very often, these are conflicting

interests. To understand how priorities could change under conflictive political instances, we use DEA mathematical programming. It allows for unequal weighting, reflecting the political priority assumed by the policy maker. In that framework, we apply the directional distance function because it handles good and bad economic objects asymmetrically.

Additional analysis is done in terms of dominance relationships. What is important in this criterion is the frequency: for a country it is more worthy of attention to dominate many other countries rather than a few, as it is more worrying to be dominated by many others than by a few.

Final remarks may suggest a fruitful avenue for future research. An examination of the shadow prices may provide some useful information on policy impacts to ensure sustainable development. Shadow prices, in fact, measure the marginal sacrifice needed, in terms of lower growth in GDP to comply with some environmental and social restrictions. This information also allows us to compare the impact on diverse country systems with different regulatory systems.

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Appendices

Table 1. Selected countries according to categories and locations

Country	Region	EU	Income group	Economies
Iceland	Europe & Central Asia	N	High income: OECD	Advanced Economies
Kuwait	Middle East & North Africa		High income: non OECD	Emerging Market and Developing Economies
Norway	Europe & Central Asia	N	High income: OECD	Advanced Economies
Sweden	Europe & Central Asia	N	High income: OECD	Advanced Economies
Switzerland	Europe & Central Asia	N	High income: OECD	Advanced Economies
Malaysia	East Asia & Pacific		Upper middle income	Emerging Market and Developing Economies
Luxembourg	Europe & Central Asia	W	High income: OECD	Advanced Economies
France	Europe & Central Asia	W	High income: OECD	Advanced Economies
Estonia	Europe & Central Asia	N	High income: OECD	Advanced Economies
Netherlands	Europe & Central Asia	W	High income: OECD	Advanced Economies
Korea, Rep.	East Asia & Pacific		High income: OECD	Advanced Economies
Austria	Europe & Central Asia	W	High income: OECD	Advanced Economies
Peru	Latin America & Caribbean		Upper middle income	Emerging Market and Developing Economies
Finland	Europe & Central Asia	N	High income: OECD	Advanced Economies
New Zealand	East Asia & Pacific		High income: OECD	Advanced Economies
Czech Republic	Europe & Central Asia	E	High income: OECD	Advanced Economies
Singapore	East Asia & Pacific		High income: non OECD	Advanced Economies
Slovenia	Europe & Central Asia	S	High income: OECD	Advanced Economies
Germany	Europe & Central Asia	W	High income: OECD	Advanced Economies
Costa Rica	Latin America & Caribbean		Upper middle income	Emerging Market and Developing Economies
Canada	North America		High income: OECD	Advanced Economies
Australia	East Asia & Pacific		High income: OECD	Advanced Economies
Brazil	Latin America & Caribbean		Upper middle income	Emerging Market and Developing Economies

Japan	East Asia & Pacific		High income: OECD	Advanced Economies
Denmark	Europe & Central Asia	N	High income: OECD	Advanced Economies
Uruguay	Latin America & Caribbean		High income: non OECD	Emerging Market and Developing Economies
Slovak Republic	Europe & Central Asia	E	High income: OECD	Advanced Economies
Croatia	Europe & Central Asia	S	High income: non OECD	Emerging Market and Developing Economies
Bahrain	Middle East & North Africa		High income: non OECD	Emerging Market and Developing Economies
Belgium	Europe & Central Asia	W	High income: OECD	Advanced Economies
Lithuania	Europe & Central Asia	N	High income: non OECD	Emerging Market and Developing Economies
United Kingdom	Europe & Central Asia	N	High income: OECD	Advanced Economies
Malta	Middle East & North Africa		High income: non OECD	Advanced Economies
Colombia	Latin America & Caribbean		Upper middle income	Emerging Market and Developing Economies
Italy	Europe & Central Asia	S	High income: OECD	Advanced Economies
Portugal	Europe & Central Asia	S	High income: OECD	Advanced Economies
United States	North America		High income: OECD	Advanced Economies
Oman	Middle East & North Africa		High income: non OECD	Emerging Market and Developing Economies
Cyprus	Europe & Central Asia	S	High income: non OECD	Advanced Economies
Romania	Europe & Central Asia	E	Upper middle income	Emerging Market and Developing Economies
Latvia	Europe & Central Asia	N	High income: non OECD	Advanced Economies
Israel	Middle East & North Africa		High income: OECD	Advanced Economies
Hungary	Europe & Central Asia	E	Upper middle income	Emerging Market and Developing Economies
Bulgaria	Europe & Central Asia	E	Upper middle income	Emerging Market and Developing Economies
Spain	Europe & Central Asia	S	High income: OECD	Advanced Economies
Russian Federation	Europe & Central Asia	E	High income: non OECD	Emerging Market and Developing Economies
Poland	Europe & Central Asia	E	High income: OECD	Emerging Market and Developing Economies
Belarus	Europe & Central Asia	E	Upper middle income	Emerging Market and Developing Economies
Ireland	Europe & Central Asia	N	High income: OECD	Advanced Economies
Namibia	Sub-Saharan Africa		Upper middle income	Emerging Market and Developing Economies
Algeria	Middle East & North Africa		Upper middle income	Emerging Market and Developing Economies
Dominican Republic	Latin America & Caribbean		Upper middle income	Emerging Market and Developing Economies
Turkey	Europe & Central Asia	E	Upper middle income	Emerging Market and

				Developing Economies
Macedonia, FYR	Europe & Central Asia	S	Upper middle income	Emerging Market and Developing Economies
Greece	Europe & Central Asia	S	High income: OECD	Advanced Economies
Botswana	Sub-Saharan Africa		Upper middle income	Emerging Market and Developing Economies
Bosnia and Herzegovina	Europe & Central Asia	S	Upper middle income	Emerging Market and Developing Economies
Jamaica	Latin America & Caribbean		Upper middle income	Emerging Market and Developing Economies
Serbia	Europe & Central Asia	S	Upper middle income	Emerging Market and Developing Economies
South Africa	Sub-Saharan Africa		Upper middle income	Emerging Market and Developing Economies

Table 2. Efficiency scores and dominance relationship

Country	Mean score	Number of Dominated	Number of Dominating	Country	Mean score	Number of Dominated	Number of Dominating
Norway	0.00	0	199	Italy	0.30	27	31
Kuwait	0.00	0	14	Latvia	0.30	23	6
Iceland	0.00	0	10	Portugal	0.30	73	1
Sweden	0.02	0	116	United States	0.31	11	12
Estonia	0.08	0	25	Cyprus	0.33	42	0
Switzerland	0.09	4	176	Romania	0.33	46	6
Malaysia	0.10	0	20	Israel	0.34	9	19
Luxembourg	0.10	0	55	Hungary	0.34	31	23
France	0.11	10	44	Bulgaria	0.34	20	15
Netherlands	0.12	3	43	Russian Federation	0.34	12	18
Korea, Rep.	0.12	1	90	Spain	0.36	70	3
Austria	0.15	4	104	Algeria	0.37	19	10
Peru	0.16	2	18	Poland	0.37	15	11
Finland	0.17	7	76	Belarus	0.40	8	4
New Zealand	0.17	5	57	Ireland	0.40	22	2
Czech Republic	0.18	7	27	Namibia	0.40	6	0
Singapore	0.19	2	2	Dominican Republic	0.42	53	1
Slovenia	0.20	6	21	Turkey	0.44	77	6
Costa Rica	0.22	6	18	Botswana	0.45	53	1
Germany	0.22	4	92	Macedonia, FYR	0.46	56	2
Canada	0.23	6	89	Greece	0.46	175	0
Australia	0.24	0	7	Bosnia and Herzegovina	0.48	90	0

Brazil	0.24	10	30		Jamaica	0.51	352	0
Japan	0.24	13	14		Serbia	0.53	156	0
Denmark	0.25	6	46		South Africa	0.55	119	0
Uruguay	0.27	1	43					
Lithuania	0.27	9	4					
Slovak Republic	0.27	9	15					
Croatia	0.28	23	7					
Bahrain	0.28	3	23					
Belgium	0.28	20	49					
Oman	0.28	0	48					
United Kingdom	0.29	16	12					
Malta	0.29	9	0					
Colombia	0.30	17	3					