MACROECONOMIC PERFORMANCE OF SIXTEEN IBERO-AMERICAN COUNTRIES OVER THE PERIOD 1980-1991*

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ABSTRACT

The objective of this study is to analyze the macroeconomic performance of 16 Ibero-American countries over the period 1980-1991. Macroeconomic performance is defined as the ability of a country's macroeconomic managers to provide four welfare-enhancing economic services to their citizens: a high level of GDP per capita, a low rate of inflation, a low rate of unemployment, and a favorable trade balance. We use linear programming techniques to construct a best practice macroeconomic performance frontier, against which to measure the relative performance of each country in each year relative to all countries in all years. We then normalize the data in order to evaluate the quality of the macroeconomic management of each country.

Keywords: DEA, Efficiency, Macroeconomic Performance.

RESUMEN

El objetivo de este estudio es analizar el rendimiento macroeconómico en 16 países Iberoamericanos durante el período 1980-1991. Se define dicho rendimiento como la capacidad de sus gobernantes de proporcionar cuatro servicios económicos que aumenten el bienestar de sus habitantes: un alto nivel de GDP per cápita, una bajo coeficiente de inflación, un bajo coeficiente en la tasa de desempleo y una balanza comercial favorable. Se usan técnicas de programación lineal para construir la "mejor" frontera experimental de rendimiento macroeconómico, y ésta se usa para evaluar el rendimiento relativo de cada país en cada uno de los años estudiados respecto al conjunto formado por todos los paises durante todos los años. A continuación se normalizan los datos con el fin de evaluar la calidad de la administración macroeconómica de cada país.

Palabras Clave: DEA, Eficiencia, Rendimiento Macroeconómico.

1. INTRODUCTION

The objective of this paper is to construct and evaluate indices of the macroeconomic performance of a set of 16 Ibero-American countries during the turbulent period 1980-1991, a period that has been aptly described as the "lost decade" (Oxford Analytica,1991). The countries whose macroeconomic performance we evaluate include all countries in Central and South America except five.

This was not an easy period in which to manage the economies of the region, with political turmoil plaguing several of the countries, occupying the minds and much of the money of their governments. Governments changed frequently, from military to civilian, and from civilian to military. To make things worse, most of the Ibero-American countries began the decade in dire economic straits. Their situations varied, and can be traced in varying degrees to economic mismanagement and unfavorable external circumstances over which they had little control. Many of them had followed inward-looking, protectionist, import substitution industrialization policies well into the 1970s, and the various approaches they adopted toward stabilization and trade liberalization in the 1970s were largely unsuccessful. In addition, declining trends in the international prices of the primary commodities in which they specialized drastically reduced their export earnings, and at the same time rising trends in the international prices of the petroleum and energy-intensive industrial commodities they imported increased their import costs.

Thanks to the low international interest rates and the excessive international liquidity that prevailed in the late 1970s, and due also to pressing domestic needs exacerbated by their worsening terms of trade, all countries in the region borrowed heavily in the late 1970s and the early 1980s. Then came the inevitable debt crisis of 1982. The rest of the world went into recession after the second of the two oil price shocks in 1979. This led to depressed demand for the region's exports, and to rapidly increasing international interest rates, which in turn raised the cost of servicing the region's debt and diverted funds from pressing domestic needs. With export earnings falling, import costs rising and debt costs soaring, countries increasingly turned to printing presses to create the money needed to finance their domestic needs. The result in many countries was runaway inflation, high rates of unemployment and generally negative rates of growth . (For a comprehensive overview, see Cardoso and Helwege (1992).)

The situation deteriorated during the first half of the 1980s, and improved only marginally during the second half of the 1980s. Although some economic indicators trended upward in some of the countries for part or all of the period, most economic indicators exhibited a steady downward trend in most of the countries. If all indicators had trended in the same direction, performance evaluation would be easy, and there would be no need to develop a single aggregate performance measure. However this was not the case, and it is precisely when some economic indicators trend upward and others trend downward that an aggregate performance measure is most valuable. We develop two such measures, one of which we prefer, to evaluate the performance of each country in each year relative to all countries in all years.

The economic indicators which our two performance measures aggregate are the usual ones: the level of real GDP per capita, the rate of inflation, the unemployment rate, and the trade balance. They are contained in the set of economic indicators regularly reported by *The Economist* for a set of 15 industrialized nations. Two of them, the inflation rate and the unemployment rate, have gained popularity as the two components of Okun's "Misery Index." Another perverse index is the Calmfors Index, which subtracts the GDP-weighted trade balance from the unemployment rate. Variants of all four indicators comprise the vertices of the OECD's "Magic Diamond." However the Misery Index and the Calmfors Index are only two-dimensional, and so ignore two important features of macroeconomic performance. Moreover, all three indexes contain the same arbitrary and unrealistic weighting scheme with which to aggregate their respective indicators: by implicitly assigning a weight of unity to each component, each index treats its respective indicators as being equally important, in all countries and in all years. The performance measures used in this study do not suffer from either of these drawbacks. They contain all four indicators, they aggregate them into a single performance measure, and the weights they use to aggregate the four indicators are allowed to vary across countries and through time.

The technique we use to aggregate the four economic service indicators into a single aggregate performance measure is a linear programming methodology aptly known as Data Envelopment Analysis (DEA). The technique envelops the service indicators of every country in every year, creating a best-practice macroeconomic performance frontier relative to which the performance of each country in each year is evaluated. Performance is then measured in terms of the distance of each country in each year to the best practice frontier. It is the way in which distance is measured relative to the best-practice frontier that distinguishes our two performance measures. The first performance measure is obtained from a conventional DEA model, and measures distance radially in all service dimensions, and so can leave slacks

in all but one of the service dimensions. These slacks are not accounted for in the conventional DEA performance measure. The second performance measure is a new extension of the conventional DEA model which incorporates slacks directly into the performance measure. Since slacks include a source of inefficiency in service provision, in addition to the radial inefficiency captured by the conventional DEA model, we are led to a strong preference for the second performance measure whenever slacks are present in any substantial amounts. This being the case with the Ibero-American data, most of our analysis is based on the new extension of the conventional DEA model, which we refer to as the Global Efficiency Measure (GEM).

DEA is widely used to evaluate the performance of *microeconomic* units, such as schools, hospitals, banks and the like. It is rarely used to evaluate the performance of *macroeconomic* units such as countries. We are aware of only five related studies.

Melyn and Moesen (1991) used two restricted types of DEA to evaluate the performance of a set of 14 OECD countries whose economic service indicators (the rate of growth of real GNP, the rate of change of the GNP deflator, the rate of unemployment, and the trade balance expressed as a percent of GNP) were averaged over the 1982-1989 period.

Färe, Grosskopf, Norris and Zhang (1994) used DEA to construct a Malmquist index of productivity change in 17 OECD countries over the period 1979-1988. They used one economic service indicator (the level of real GDP) and two resource indicators (the level of employment and the size of the real capital stock).

Golany and Thore (1994) used DEA to compare the performance of the G-7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States) over the period 1972-1992. They used three economic service indicators (percentage changes in the real standard of living, real exports of manufactured goods, and real manufacturing productivity) and three resource indicators (the percent change in real nonresidential investment, nondefense R&D as a share of GDP, and public expenditure on education as a share of GDP) to measure the competitiveness of each of the G-7 nations.

Lovell (1994a) used a non-convex version of DEA to evaluate the performance of 10 Asian countries over the period 1970-1988. He used four economic service indicators (the rate of growth of real GDP per capita, the employment rate, the reciprocal of the inflation rate, and the ratio of exports to imports).

Finally Lovell, Pastor and Turner (1995) used DEA to compare the macroeconomic performance of European and non-European OECD countries over the period 1970-1990. They used the same four economic service indicators as in this paper but resorting to an additive DEA model, and added two environmental indicators (emissions of carbon and nitrogen).

Several authors, including Førsund and Hearnes (1995[1989]), Kittelsen and Førsund (1992), Fried, Lovell and Vanden Eeckaut (1993), and Torgersen, Førsund and Kittelsen (1994) have incorporated slacks directly into a performance analysis by developing "variable-specific slack-adjusted" efficiency measures. However this paper and that of Lovell, Pastor and Turner (1995) appear to be the first to introduce and apply definitions of efficiency which incorporate slacks and which are global rather than variable-specific. This is also the first study to evaluate the macroeconomic performance of Ibero-American countries.

The paper is organized as follows. In Section 2 we describe the Ibero-American data that provide the foundation for our macroeconomic performance analysis. In Section 3 we provide a brief description of DEA, and we provide a detailed comparison of the DEA and GEM performance measures. The comparison is detailed because we have good reason to prefer our new GEM measure to the conventional DEA measure. Section 4 contains our empirical results. While the primary focus is on an inter-country and intertemporal comparison of macroeconomic performance, we also compare the behavior of the two performance measures themselves. The comparison lends considerable empirical support to our preference for our new GEM measure over the conventional DEA measure. We use our new GEM measure to analyze two characteristics of macroeconomic performance. The first characteristic describes the performance of economies in terms of their overall strength. The second characteristic describes the performance of economies in terms of how well they have been managed. Since relatively strong economies need not necessarily have been well managed, and since relatively weak economies need not necessarily have been poorly managed, the two exercises occasionally reach different conclusions. Section 5 contains the summary and conclusions of the study.

2. THE DATA

We study the macroeconomic performance of a set of 16 Ibero-American countries over the period 1980-1991. Our primary data source, the United Nations Economic Commission For Latin America and The Caribbean (CEPAL), reports information on four economic variables of interest for 19 countries over this period, but serious missing data problems forced us to eliminate three countries from the original data set. The deleted countries are The Dominican Republic, El Salvador and Haiti, and only the first two have an Iberian heritage. Thus when we measure macroeconomic performance we have $16 \cdot 12 = 192$ observations. Data for all countries in all years are available from the authors.

Each country has an apparatus for making macroeconomic decisions, a bureaucracy collectively referred to by Koopmans (1951) as the country's "helmsman". The helmsman makes decisions concerning all aspects of macroeconomic policy, from fiscal, monetary and trade policy to policy concerning how government revenues will be allocated among competing interests. We view this collective decision-making apparatus as a single resource, and since each country has it, we assign an equal value of this resource to all countries in all years. The logic underlying this view is that what ultimately matters is not the magnitude of this resource, the size of the economic decision making bureaucracy, but rather its performance, its ability to provide economic and social services to the citizens it serves. Having made such an assumption, it does no further damage to reality to normalize the resource to a value of unity for all countries in all years. Thus our model of macroeconomic performance includes a single resource, the helmsman, which has a value of unity in all countries in all years.

The helmsman is assumed to attempt to provide maximum amounts of four economic services to its citizens. The first economic service is the level of real GDP per capita, measured in 1980 US$ and based on current exchange rates. The second economic service is the urban employment rate. The third economic service is the reciprocal of the price level change, defined as $(CPI_t/CPI_{t-1})^{-1}$, where CPI is the consumer price index. The fourth economic service is the ratio of the value of exports to the value of imports, also measured in 1980 US$ and based on current exchange rates. Notice that the second and third economic services have been transformed from the usual unemployment rate and inflation rate so as to make them desirable economic services whose provision is to be expanded rather than contracted. Thus all four economic services are defined so that more is preferred to less.

Summary statistics for each of the four services are tabulated in Tables 1 and 2. Columns 1,2 and 4 in each Table report the services as described above; column 3 in each Table replaces the reciprocal of the price level change with the price level change itself, defined as (CPI_t/CPI_{t-1}). Although the reciprocal of the price level change is used in the empirical analysis, the price level change itself is reported in the two Tables to provide an indication of the magnitude of the problem. Table 1 reports summary statistics by country, while Table 2 reports summary statistics by year. The overall averages listed at the bottom of both Tables provide evidence of the hard times these countries endured during the 1980s. The average level of real GDP per capita was less than $1700, the average urban employment rate was barely 90% and the average annual inflation rate was nearly 49%. The only bright sign was a favorable trade balance.

Table 1 Average Values of the Four Services, by Country, 1980-1991

Country	GDP/capita	Employment Rate	Price Level Change	Trade Ratio
Argentina	$3713	94.38	3.44	2.20
Bolivia	653	92.00	1.77	1.14
Brazil	1922	94.74	3.17	1.57
Chile	2312	88.89	1.21	1.21
Colombia	1308	93.27	1.24	1.17
Costa Rica	1414	87.38	1.24	1.33
Ecuador	1354	92.22	1.34	1.61
Guatemala	970	92.17	1.15	0.97
Honduras	631	90.60	1.10	0.95
Mexico	2521	95.85	1.54	1.67
Nicaragua	632	81.73	2.65	0.48
Panama	1729	85.38	1.03	1.17
Paraguay	1268	90.31	1.22	0.72
Peru	1055	92.61	2.60	1.12
Uruguay	2101	89.63	1.62	1.25
Venezuela	3520	89.90	1.23	1.74
Mean	1694	90.69	1.49	1.27

Table 2 Average Values of the Four Services, by Year, 1980-1991

Year	GDP/capita	Employment Rate	Price Level Change	Trade Ratio
1980	$1834	92.36	1.34	0.89
1981	1813	92.70	1.27	0.88
1982	1724	90.87	1.33	1.09
1983	1654	89.57	1.46	1.35
1984	1651	89.24	1.44	1.31
1985	1636	88.89	1.59	1.40
1986	1668	89.55	1.49	1.30
1987	1694	90.35	1.45	1.26
1988	1675	90.10	1.59	1.36
1989	1645	91.22	1.66	1.50
1990	1646	91.72	1.73	1.53
1991	1690	91.72	1.60	1.34
Mean	1694	90.69	1.49	1.27

Even though these countries are located in the same region and share a common political/economic heritage, it is clear from Table 1 that they have achieved greatly different levels of economic performance. To give but one example, the level of real GDP per capita in Argentina and Venezuela was about six times its level in Bolivia, Honduras and Nicaragua. Other disparities can be found in the data, particularly in the average rates of inflation experienced in different countries. Table 2 shows a general downward trend over time in most of the service indicators. From the beginning to the end of the sample period, real GDP per capita declined by nearly 10% in the sample, and declined in 14 of 16 countries. The employment rate declined marginally, and fell in 10 of 16 countries. The annual rate of inflation increased from just over 30% to 60%, and increased in 12 countries. The trade ratio, however, shows an upward trend overall, and in all countries but Nicaragua and Peru. These conflicting trends in individual indicators suggest the need for a single aggregate performance measure, to which we now turn.

3. THE TWO PERFORMANCE MEASURES: DEA AND GEM

The acronym DEA is used to describe a family of linear programming models intended to measure the relative performance of each member of a collection of decision making units (DMUs). It was originally developed for use in public sector performance analysis, in which (i) DMUs provide more than one service, and (ii) not all services are priced, making it impossible to use prices to aggregate the services into a single performance index. It is ideally suited for the task at hand, in which the DMUs are the helmsmen responsible for the conduct of macroeconomic policy in various countries through time. The helmsmen provide many services, four in our case, and these services are not priced on markets. (A recent summary of DEA is provided by Lovell (1994b).)

A conventional DEA model, due to Banker, Charnes and Cooper (1984), can be expressed as follows. Let $X_i = (X_{1i},\ldots,X_{Ni})$ denote an $N \cdot 1$ vector of resources used by DMU_i, $i = 1,\ldots,I$, and let $X = (X_1,\ldots,X_I)$ be an $N \cdot I$ matrix of resources used in the sample. Let $Y_i = (Y_{1i},\ldots,Y_{Mi})$ denote an $M \cdot 1$ vector of services provided by DMU_i, and let $Y = (Y_1,\ldots,Y_I)$ be an $M \cdot I$ matrix of services provided in the sample. Let $\Delta = (\Delta_1,\ldots,\Delta_I)$ denote an $I \cdot 1$ vector of weights satisfying $\Delta_i \geq 0$, $i = 1,\ldots,I$, and $\Sigma_i\Delta_i = 1$. Finally let the subscript "o" denote the DMU whose performance is being evaluated. Then the conventional DEA model can be written as

$$\max_{\text{Ø},\Delta_i} \quad \text{Ø} \qquad \text{subject to} \qquad \begin{aligned} Y\Delta - s^+ &= \text{Ø}Y_o \\ -X\Delta - s^- &= -X_o \\ \Delta_i &\geq 0,\ i = 1,\ldots o,\ldots,I \\ \Sigma_i\Delta_i &= 1 \\ s^+,\ s^- &\geq 0, \end{aligned} \tag{1}$$

where s^+ is an $M \cdot 1$ vector of service slack variables and s^- is an $N \cdot 1$ vector of resource excess variables.

The program seeks for DMU_o the maximum feasible equiproportionate expansion in all the services it provides, subject to the constraints imposed by best practice, that is that radially expanded services not exceed a convex combination of services provided in the sample and that resources utilized not fall short of a convex combination of resources utilized in the sample. The solution to the program contains an optimal value of the objective $\emptyset^*_o \geq 1$. If $\emptyset^*_o > 1$, then DMU_o is inefficient in its provision of services, and $100 \cdot (\emptyset^*_o - 1)$ provides a measure of the percent by which it can equiproportionately expand all services without exceeding best practice service provision observed in the sample. However it is conventional to measure the performance of DMU_o with $\Omega^*_o = (\emptyset^*_o)^{-1} \leq 1$. Thus $100 \cdot \Omega^*_o$ provides a measure of the percent of maximum feasible service provision DMU_o actually provides.

It is possible that $\Omega^*_o < 1$ with slacks $s^{+*} > 0$ and $s^{-*} > 0$ remaining in the optimal solution, in which case additional nonproportionate increases in service provision or reductions in resource usage are possible. Thus $\Omega^*_o < 1$ may actually overstate the efficiency of DMU_o. The optimal solution $\Omega^*_o = 1$ only if DMU_o is efficient in its provision of services, i.e., only if it is not possible for it to equiproportionately expand the services it provides with the resources at its disposal without violating best practice service provision observed in the sample. However it is also possible that $\Omega^*_o = 1$ with positive slacks remaining in the optimal solution, in which case nonproportionate service expansion or resource reduction remains possible even though $\Omega^*_o = 1$. This is why the condition $\Omega^*_o = 1$ is necessary, but not sufficient, for efficient service provision; it is also why $\Omega^*_o = 1$ may overstate the efficiency of DMU_o. Thus because it does not incorporate slacks, $\Omega^*_o \leq 1$ provides an upper bound to the true efficiency of DMU_o in its service provision.

The solution to the program also contains optimal values of the vector Δ, and the positive elements of Δ^* identify the DMUs which serve as role models for DMU_o. These role models are located at the vertices of the facet of the best practice frontier to which DMU_o is projected. Each of these role models has $\Omega^*_i = 1$, and so each may be efficient.

The DEA model used in this study is a simplification of the DEA model just introduced. It is a simplification because in the application at hand each DMU has only one resource, its helmsman, and every DMU has the same unitary value of this resource. In this case $X_i = [1]$, $i = 1,\ldots,I$, $X = [1,\ldots,1]$, and the DEA problem simplifies to

$$\max_{\Phi,\Delta_i} \quad \Phi \quad \text{subject to} \quad Y\Delta - s^+ = \Phi Y_o \qquad (2)$$

$$\Delta_i \geq 0,\ i = 1,\ldots,o,\ldots,I$$
$$\Sigma_i \Delta_i = 1$$
$$s^+ \geq 0.$$

Even though the underlying economic model has one resource, the assumption that the value of this resource is unity for all DMUs, in conjunction with the convexity constraint, causes the resource feasibility constraint to be redundant in the DEA problem. Optimal values of $\Omega = \Phi^{-1}$ and Δ are interpreted as before, as performance scores and role model identifiers, respectively. The fact also remains that service slacks in the optimal solution are not incorporated into the performance score, and so $\Omega^*_o \leq 1$ can overstate the true efficiency of DMU_o.

The DEA model (2) is illustrated in Figure 1, in which the helmsmen are assumed to provide two services, Y_1 and Y_2. The feasible set of services is the convex set 0ABCDE. Best practice service providers are labelled B, C and D. The helmsman providing service vector Y_F is inefficient, and is capable of an equiproportionate expansion $\Phi_F > 1$ in both services. The helmsman providing service vector Y_G is also inefficient, and is capable of an equiproportionate expansion $\Phi_G > 1$ in both services. The DEA performance evaluations for these two producers are thus $\Omega_F < 1$ and $\Omega_G < 1$. However the helmsman providing service vector Y_G is also capable of an additional expansion in service Y_2 in the amount s^+_{2G}. Thus the DEA performance measure Ω correctly evaluates the performance of the helmsman providing service vector Y_F, but it overstates the performance of the helmsman providing service vector Y_G because it ignores the slack component s^+_{2G}.

Our sole objection to the conventional DEA model is that it does not incorporate slacks into the performance evaluation. We now introduce our extension of the DEA model, which does incorporate slacks into the performance evaluation. Our GEM model is structured exactly as the conventional DEA model is. The modification involves evaluating performance not just by Ω, but by modifying Ω to incorporate any slacks that may remain in the optimal solution of the conventional DEA model. The GEM model is based on the DEA model (2). However instead of measuring performance using Ω and ignoring slacks, the GEM model measures performance with the following modification of Ω:

$$\Gamma = \Omega \cdot [1 - M^{-1}(\Sigma_i s^+_i / \hat{Y}_i)], \qquad (3)$$

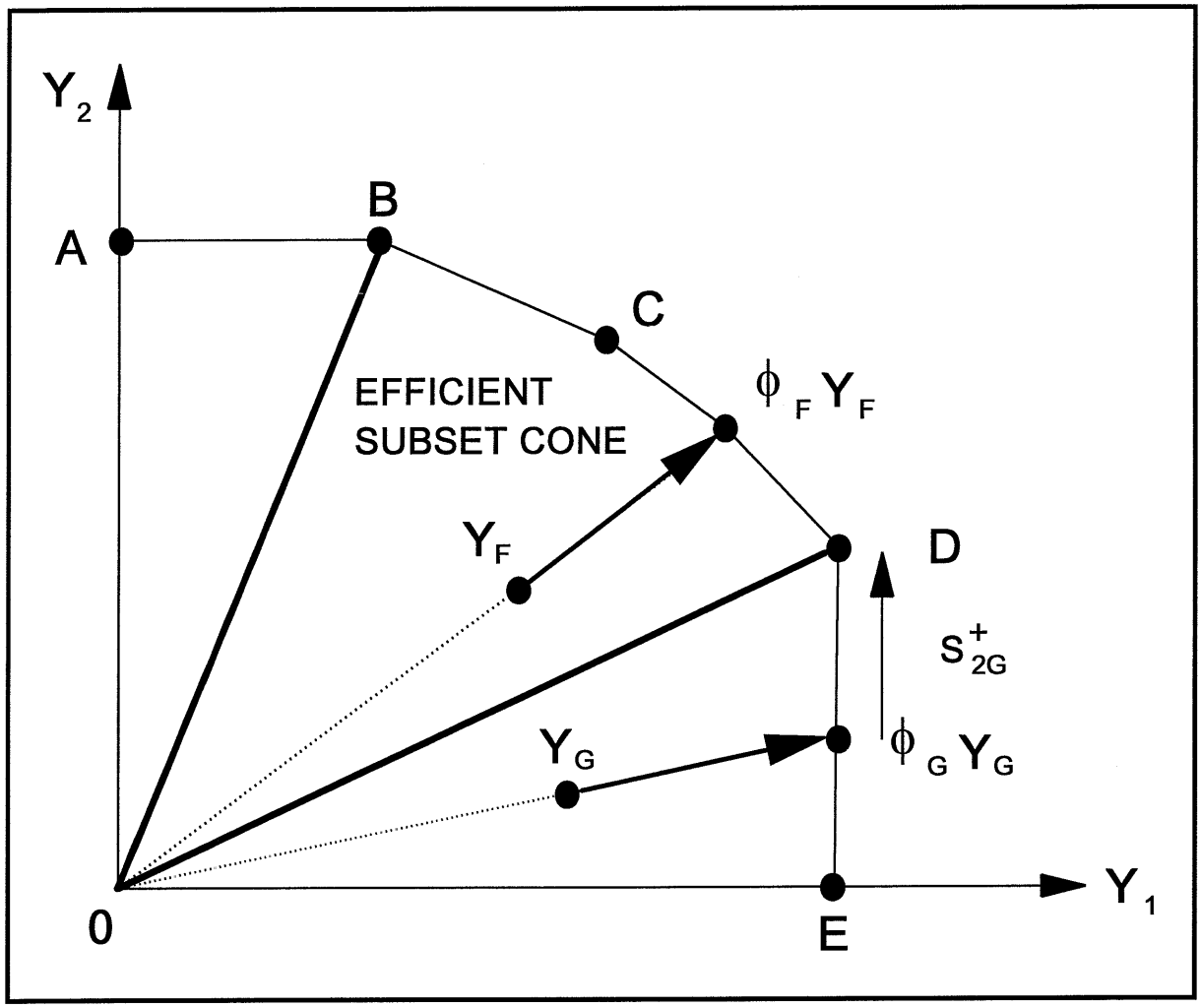

Figure 1. The Measurement of Macroeconomic Performance Using DEA and GEM.

where $\hat{Y}_i$ is the optimal projection of Y_{oi}. (In Figure 1 the optimal projection for Y_F occurs at $\emptyset_F Y_F$, and the optimal projection for Y_G occurs at D.) We know that $\Omega \leq 1$ provides a measure of radial efficiency, and that Ω overstates overall efficiency because it ignores slacks. Γ incorporates slacks into a single inclusive, or "global", efficiency measure, by adjusting Ω downward by a fraction equal to one minus the arithmetic mean of the variable-specific slacks expressed as a percent of the optimal values of those variables. Thus Γ provides a convenient scalar-valued aggregate of the variable-specific, slack-adjusted measures of Førsund and Hearnes (1995[1989]), Kittelsen and Førsund (1992), Fried, Lovell and Vanden Eeckaut (1993), and Torgersen, Førsund and Kittelsen (1994). It is easy to verify that Γ satisfies the following properties:

(i) $0 < \Gamma \leq \Omega \leq 1$,

(ii) $\Gamma = \Omega <=> s^+ = 0$,

(iii) $\Gamma = 1 <=> \{\Omega = 1 \text{ and } s^+ = 0\}$.

Thus Γ incorporates slacks, unlike Ω, and so is bounded above by Ω. The extent to which Γ falls short of Ω depends on both the number and the magnitude of positive slacks in the optimal solution. $\Gamma = \Omega$ if, and only if, all service slacks are zero at the optimal solution, and $\Gamma = 1$ if, and only if, $\Omega = 1$ and all service slacks are zero at the optimal solution. In terms of Figure 1, $\Gamma = \Omega$ for all observations such as Y_F contained in the efficient subset cone spanned by observations B, C and D. However $\Gamma < \Omega$ for all observations such as Y_G not contained in the cone. Whether or not this is an important distinction is an empirical matter to be determined by the nature of the data under investigation.

4. AN EMPIRICAL ANALYSIS OF MACROECONOMIC PERFORMANCE IN THE IBERO-AMERICAN COUNTRIES

Our empirical analysis of the macroeconomic performance of the 16 Ibero-American countries consists of two exercises. The first exercise examines macroeconomic performance over the entire 1980-1991 period, using the four economic service indicators whose values are summarized in Tables 1 and 2. The second exercise repeats the first exercise, but it is based on normalized data so that all helmsmen begin the decade with the same normalized values of each service. This exercise eliminates the inherent advantage enjoyed in the first exercise by the helmsmen in those countries whose previous helmsmen provided them with favorable values of the four economic service indicators at the beginning of the period. It is useful to think of the first exercise as providing an evaluation of the relative economic health of these countries, while the second exercise compares the quality of macroeconomic management in these same countries.

4.1 Macroeconomic Performance Analysis With Four Economic Service Indicators, 1980-1991

The first stage of our analysis involves all 16 countries over the entire sample period 1980-1991, and uses the four economic service indicators whose values are summarized in Tables 1 and 2. The analysis is based on both the DEA model (2) and the GEM extension (3) of the DEA model (2). Although the primary economic objective of the exercise is to compare the macroeconomic performance of the 16 economies over this period, an important secondary analytical objective is to compare the performance of the DEA model with that of the GEM extension of the DEA model. Summary results are collected in Tables 3 - 5.

Table 3 lists macroeconomic performance scores and ranks for each country, averaged over the entire period, using both the DEA performance measure Ω and the GEM performance measure Γ. The two techniques agree on the identity, but not the ranking, of the four best performing countries: Venezuela, Mexico, Panama and Argentina have enjoyed the strongest economies over the sample period. The helmsmen in these four countries have succeeded in providing at least 98% (DEA) or 96% (GEM) of maximum feasible economic services to their citizens in the environment in which they have conducted macroeconomic policy. The two techniques also agree on the identity of the worst performing country: Nicaragua has had by far the weakest economy over the sample period. The helmsman in Nicaragua has provided only 85% (DEA) or 58% (GEM) of maximum feasible economic services to its citizens in the environment in which it operated.

However the two rankings of the remaining 11 countries are very different. Chile, for example, is ranked #12 by DEA and #5 by GEM, while Brazil is ranked #5 by DEA and #12 by GEM. The biggest disagreement concerns Uruguay, which is ranked #15 by DEA and #6 by GEM. The two techniques also disagree on the magnitude of the variation in macroeconomic performance across countries. The DEA analysis shows Nicaragua to have a score just 15% beneath that of the best DEA performer, Mexico, while the GEM analysis shows Nicaragua to have a score fully 40% beneath that of the best GEM performer, Venezuela. Without grounds for establishing a preference for DEA or GEM, one would be left with no clear picture of the relative macroeconomic performance of the 16 Ibero-American countries, or of the extent of variation in their performance. This in turn would put in jeopardy the validity of the methodology of macroeconomic performance evaluation. Fortunately such grounds exist, and they establish a strong preference for GEM.

Table 3 Average Macroeconomic Performance Scores, by Country, 1980-1991, Four Economic Services

Country	DEA Score	Rank	GEM Score	Rank
Argentina	0.993	2	0.962	4
Bolivia	0.947	10	0.741	15
Brazil	0.977	5	0.844	12
Chile	0.940	12	0.922	5
Colombia	0.958	8	0.904	7
Costa Rica	0.929	13	0.845	11
Ecuador	0.960	7	0.870	10
Guatemala	0.956	9	0.900	8
Honduras	0.961	6	0.843	13
Mexico	0.995	1	0.980	2
Nicaragua	0.846	16	0.578	16
Panama	0.988	3	0.974	3
Paraguay	0.926	14	0.881	9
Peru	0.945	11	0.776	14
Uruguay	0.921	15	0.907	6
Venezuela	0.981	4	0.981	1
Mean	0.951		0.873	

We have demonstrated that the DEA performance score Ω overstates efficiency in the presence of service slacks, whereas the GEM performance score Γ avoids this difficulty by incorporating service slacks directly into the performance measure. It turns out that 63% (120 of 192) of the observations in the data set exhibit service slack in at least one dimension in the DEA model (2). In terms of Figure 1, 63% of the observations lie outside the efficient subset cone spanned by observations B, C and D. Not only are service slacks pervasive, they are also frequently large. Table 4 provides summary evidence on the nature of service slacks in the DEA model. For example, slack appears in 30% (57 of 192) of the observations in the inflation dimension, and it is large on average, with mean magnitude 46% of the mean value of the inflation indicator. Slack also appears frequently, and with large

magnitude, in the GDP per capita and trade dimensions. The inescapable conclusion is that a substantial portion of overall inefficiency in macroeconomic performance is ignored by the DEA performance measure Ω. We therefore judge the macroeconomic performance story told by the DEA model to be unreliable, and henceforth we concentrate on the GEM version of the story.

Table 4 Service Slacks in DEA, 1980-1991, Four Economic Services

Economic Service	Number of Observations with $s^+_i > 0$	mean s^+_i / mean Y_i
GDP/capita	100/192 (52.09%)	34.47%
Employment Rate	3/192 (1.56%)	0.88%
Uninflation Rate	57/192 (29.69%)	46.45%
Trade Ratio	43/192 (22.40%)	14.13%

Returning to the GEM results in Table 3, they show Venezuela and Mexico to have enjoyed the best macroeconomic performance during the 1980s, followed closely by Panama, Argentina (despite having had the worst inflation of all countries in the sample) and Chile. Nicaragua suffered the worst macroeconomic performance, trailing far behind Bolivia and Peru. On average, the helmsmen in the 16 countries provided only 87% of the economic services to their citizens that they could have provided had they consistently kept up with the best practice standards established by their role models, in the admittedly difficult environments in which they operated.

Table 5 shows the trends in the performance of these countries through time. Performance was best during the first three years of the sample. Performance deteriorated continuously through 1985, and there is no apparent trend thereafter. Additional evidence

in support of the deteriorating performance identified by the GEM analysis comes from the role models identified by the nonzero elements of Δ obtained from the optimal solutions to the linear programs. Seventeen country-year observations appear as role models at least once in the 192 linear programming problems. Eight of those 17 role models come from the early period 1980-83. The most frequent role models are Guatemala (1981, 1982), Mexico (1987, 1989), Venezuela (1982, 1983) and Argentina (1980). The fact that most role models, apart from Mexico, come from the early period reinforces the conclusion that macroeconomic performance in most Ibero-American countries declined after 1983.

Table 5 Average Macroeconomic Performance Scores, by Year, 1980-1991, Four Economic Services

Year	GEM score	Rank
1980	0.911	1
1981	0.906	2
1982	0.897	3
1983	0.868	5
1984	0.856	11
1985	0.842	12
1986	0.860	8
1987	0.883	4
1988	0.868	6
1989	0.858	9
1990	0.863	7
1991	0.858	10
Mean	0.873	

4.2 Macroeconomic Performance Analysis With Four Normalized Economic Service Indicators, 1980-1991

If the objective of the analysis is to evaluate the macroeconomic performance of the 16 countries over the 1980-1991 period, the preceding analysis suffices. However it should be noted that the helmsmen in some countries started out with an advantage; they inherited jobs in countries with relatively favorable values of one or more of the economic service indicators. Other helmsmen inherited jobs managing economies that were left in relatively poor shape by their predecessors. It may be considered unfair to evaluate the macroeconomic performance of the helmsmen in countries such as Nicaragua and Bolivia against the macroeconomic performance of the helmsmen in countries such as Mexico and Venezuela, when the latter began the decade with such an advantage. One way of addressing this issue is to normalize the four economic service indicators in such a way that all helmsmen start out on an equal footing in 1980. The objective of the exercise conducted in this section is to reanalyze the performance of the 16 helmsmen, using normalized data. To do so, we begin by dividing the four economic service indicators in every nation in every year by their respective 1980 values. Thus in 1980 every country has service vector Y_i = [1,1,1,1]. In this exercise all helmsmen inherit the same economy in 1980, and their macroeconomic performance is evaluated by seeing where they guide their respective economies. We use the GEM extension of the DEA model to conduct the analysis.

Results are summarized in Table 6. They tell a story which in some respects is similar to the story told by Table 3, which is based on raw data, and in other respects is quite different. Mexico and Argentina remain near the top of the list, and so eliminating the inherent advantage they enjoyed in 1980 has not damaged their good reputations. It appears that the relatively high rankings they earned in Table 3 were not due solely to the fact that they began the decade with relatively favorable values of the economic service indicators. Similarly Peru, Bolivia and Nicaragua remain at the bottom of the list, and so eliminating the inherent disadvantage they suffered in 1980 has done nothing to inspire confidence in their macroeconomic management. We conclude that the relatively low rankings they earned in Table 3 were not due solely to the relatively unfavorable values of the economic service indicators with which they began the decade.

Table 6 Average Macroeconomic Performance Scores, by Country, 1980-1991, Four Economic Services, Normalized Data

Country	GEM Score	Rank	Change from Table 3
Argentina	0.956	3	+1
Bolivia	0.815	14	+1
Brazil	0.939	4	+8
Chile	0.925	7	-2
Colombia	0.966	1	+6
Costa Rica	0.927	6	+5
Ecuador	0.925	7	+3
Guatemala	0.871	13	-5
Honduras	0.923	9	+4
Mexico	0.964	2	0
Nicaragua	0.815	14	+2
Panam	0.903	10	-7
Paraguay	0.897	11	-2
Peru	0.803	16	-2
Uruguay	0.939	4	+2
Venezuela	0.892	12	-11
Mean	0.904		

However our ranking of countries in positions 3-13 has been substantially upset by this exercise. On the basis of the results reported in Table 3 we concluded that Venezuela and Panama were relatively healthy economies. However on the basis of the results reported in Table 6 we conclude that they were also relatively poorly managed economies. It appears that our previous praise for the helmsmen in these countries may have been unjustified, and that their relatively strong performances were due in large part to the fact that they began the decade with relatively strong economies to manage. When they are put on equal footing with the other economies in this exercise, their relative performance deteriorates badly, with Venezuela falling 11 positions in the ranking and Panama falling seven positions in the

ranking. We reach just the opposite conclusion with regard to Brazil, Colombia and Costa Rica. Our previous denigration of their relative performances now seems less than fully justified, and we now conclude that their relatively strong performances were due less to the fact that they inherited relatively strong economies than to the fact that they managed the economies they inherited relatively well. When they are put on equal footing with the other economies in this exercise, their relative performances improve considerably, and they rise by eight, six and five positions respectively.

We conclude this section by paraphrasing a statement with which we began this section. We are confident in our ability to correctly identify the strongest and weakest economies in the Ibero-American data set over the 1980-1991 period. Table 3 identifies Venezuela and Mexico as having had the strongest economies, and Nicaragua, Bolivia and Peru as having had the weakest economies. We are also confident in our ability to identify those economies that were managed the best and the worst over the 1980-1991 period, given the shapes in which they began the decade. Table 6 identifies the best-managed economies as those of Colombia, Mexico and Argentina, and the worst-managed economies as those of Peru, Bolivia and Nicaragua. Two of the three strongest economies also enjoyed relatively strong macroeconomic management, as did an economy of average health, Colombia. However unfortunately for their citizens, it happens that the three weakest economies also suffered the worst macroeconomic management. This suggests that the gap between the healthiest and the weakest economies widened during the decade, a fact that is supported by the average GEM scores reported in Table 5.

5. SUMMARY AND CONCLUSIONS

We have conducted two types of analyses evaluating the relative macroeconomic performance of 16 Ibero-American countries over the period 1980-1991. The evaluation has been based on the ability of those responsible for macroeconomic management in these countries to provide four fundamental economic services to their citizens. As a result of these analyses we are prepared to draw several conclusions.

Most of the countries began the 1980s with weak and deteriorating economies, and their economies continued to deteriorate during the next five years. In terms of economic

health, the nadir was reached in 1985. As a group, the economies picked up some in 1986, but showed little improvement thereafter. The overall performance of virtually every economy declined through 1985. After 1985 some economies continued to deteriorate, while others improved. Venezuela and Mexico have had the strongest economies during the period, followed closely by Panama, Argentina and Chile. Nicaragua, Bolivia and Peru had by far the weakest economies during the period.

When attention shifts from the strength or weakness of economies to the quality of their macroeconomic management, our evaluation is slightly modified. The best managed economies were those of Colombia and Mexico, followed by Argentina, Brazil and Uruguay. The macroeconomic managers of Colombia and Uruguay succeeded in strengthening otherwise relatively weak economies, while those in Mexico and especially Argentina succeeded in keeping relatively strong economies from falling in our ranking.

The economies that suffered the least competent macroeconomic management were those of Peru, Bolivia and Nicaragua. The macroeconomic managers in these countries succeeded in keeping their economies from overcoming the weaknesses they exhibited at the beginning of the period. In addition, the macroeconomic managers in Venezuela performed so poorly that Venezuela's ranking dropped from #1 in terms of overall strength to #12 in terms of the quality of its management. Venezuela's current economic plight bears eloquent testimony to the poor job its economic managers have done.

The analytical technique we have employed has enabled us to identify the strongest and weakest economies, and the best and worst managed economies, during the period. However it is necessary to add three concluding qualifications to our analysis.

An underlying assumption of the analytical technique we have used is that if two outcomes are feasible, so is any convex combination of those outcomes. In the context of macroeconomic policy-making, this assumption implies that, for example, Peru could have achieved some mix of what Colombia and Mexico achieved, had Peru's macroeconomic management been equally competent. However, feasibility of convex combinations of outcomes may be questionable, and desirability of convex combinations may be even more questionable. We have faith in feasibility. We have little or no faith in desirability, since different countries have different political and economic preferences, and operate in different environments. This is why we have specified a multivariate performance evaluation model. Empirical evidence of preference diversity is provided by the fact that countries arrange themselves into groups, each group having a different set of role models.

Second, our analysis has been conducted using four economic indicators. It is possible to argue that other indicators, such as a poverty indicator or an indicator of the inequality of the distribution of income, might be at least as important as the indicators we have used, and should be added to the analysis. Unfortunately our data source does not contain economic indicators other than those we have used. It is also possible to argue that our trade balance indicator is less important than the other three economic indicators, and should be deleted from the analysis. We do not subscribe to this belief, but we have repeated the analysis of Table 3, deleting the trade indicator from the set of economic indicators. Dropping the trade indicator makes little but substantial difference in the ranking; the biggest change corresponds to Argentina dropping out of the top four, falling from #4 to #11. The identities of the top three countries and the bottom three countries remain unchanged.

The third qualification concerns the environments in which these countries conducted macroeconomic policy during the period. We have acknowledged that these countries began the 1980s in generally poor economic shape, making macroeconomic management a difficult task during the period. In addition, several countries pursued noneconomic objectives during part or all of the period, which of course severely constrained the ability of their macroeconomic managers to achieve the goals they pursued. Unfortunately it is not feasible to incorporate such noneconomic considerations into the evaluation of the relative macroeconomic performance of each and every one of the Ibero-American countries. Most of these environmental characteristics are not quantifiable, and those that are quantifiable are not recorded for all countries over the entire period. Nonetheless an awareness of these noneconomic environmental conditions can and should be used to qualify our findings. (It is worth mentioning the point of view of Scully (1992), who states the influence of the constitutional environment in a country on that country's economic development.)

Our quantitative analyis certainly has its limitations, but it has the real virtue of providing a framework for the aggregation of disparate quantifiable economic indicators into a single macroeconomic performance measure for each country in each year. We view it as a reliable starting point for further discussion.

REFERENCES

Banker, R. D., A. Charnes and W. W. Cooper (1984), "Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis," *Management Science* 30:9 (September), 1078-1092.

Cardoso, E., and A. Helwege (1992), *Latin America's Economy: Diversity, Trends and Conflicts*. Cambridge and London: The MIT Press.

Färe, R., S. Grosskopf, M. Norris and Z. Zhang (1994), "Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries," *American Economic Review* 84:1 (March), 66-83.

Førsund, F.R. and E.Hearnes (1995[1989]), "Ferry Transport in Norway: An Application of DEA Analysis", in A. Charnes, W.W. Cooper, A.Y. Lewin and L.M. Seiford, eds., *Data Envelopment Analysis: Theory, Methodology and Applications.* Boston: Kluwer Academic Publishers.

Fried, H.O., C.A.K. Lovell and P. Vanden Eeckaut (1993), "Evaluating the Performance of US Credit Unions", *Journal of Banking and Finance* 17:2/3 (April), 251-265.

Golany, B., and S. Thore (1994), "The Competitiveness of Nations," Working Paper #94-05-03, The IC^2 Institute, The University of Texas, Austin, TX 78705-3596, USA; forthcoming in *IMPACT: How IC^2 Research Affects Public Policy and Business Markets.*

Kittelsen, S.A.C. and F.R. Førsund (1992), "Efficiency Analysis of Norwegian District Courts", *Journal of Productivity Analysis* 3:3 (September), 277-306.

Koopmans, T. C. (1951), "Analysis of Production as an Efficient Combination of Activities," in T. C. Koopmans, ed., *Activity Analysis of Production and Allocation.* New York: John Wiley & Sons.

Lovell, C. A. K. (1994a), "Measuring the Macroeconomic Performance of the Taiwanese Economy," *International Journal of Production Economics*, forthcoming.

Lovell, C. A. K. (1994b), "Linear Programming Approaches to the Measurement and Analysis of Productive Efficiency," *Top*, 2:2 (December), 175-224.

Lovell, C.A.K., J.T. Pastor and J.A. Turner (1995), "Measuring Macroeconomic Performance in the OECD: A Comparison of European and Non-European Countries", *European Journal of Operational Research*, forthcoming.

Melyn, W., and W. Moesen (1991), "Towards a Synthetic Indicator of Macroeconomic Performance: Unequal Weighting When Limited Information is Available," Public Economics Research Paper Nr. 17, Center for Economic Studies, Katholieke Universiteit Leuven, E. Van Evenstraat 2B, B-3000 Leuven, Belgium.

Oxford Analytica, Ltd. (1991), *Latin America in Perspective.* Boston: Houghton-Mifflin Company.

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