Efficiency Analysis on Administrative Business Regulation in the G20 Economies

A comparison between mature and rapid growth markets

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Abstract— **The paper focuses on the G20 economies, split into mature and rapid growth markets. The aim is to evaluate their administrative business regulation efficiency in terms of two components: efficiency spread within each market group and differences between the best-practice frontiers of each market group. Data cover the period 2007–2012 and is acquired from World Bank database (Doing Business survey).**
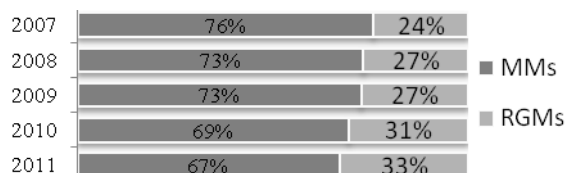
Keywords— Efficiency Analysis, Administrative business regulation, Market Classification, International comparisons.

I. INTRODUCTION

We focus the analysis of the G20 countries based on two market groups: Mature Markets (MMs)- Australia, Canada, France, Germany, Italy, Japan, South Korea, United Kingdom, United States; Rapid-Growth Markets (RGMs) - Argentina, Brazil, China, India, Indonesia, Mexico, Russia, Saudi Arabia, South Africa, Turkey. This split is based on the International Monetary Fund grouping of "advanced economies" and "emerging and developing economies[1].

To identify the economic profile between two markets and to contextualize data to the current international economic crisis period, we examine GDP (Gross Domestic Product), import/export and inflation that are considered important macroeconomic indicators to evaluate the competitiveness (fig.1).
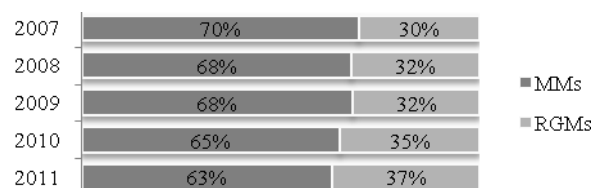
FIGURE 1

a. Source: our elaboration on World Bank data.

[1] http://www.imf.org/external/pubs/ft/weo/2011/01/weodata/groups.htm

Through a preliminary investigation of the dataset, from 2007 to 2011, we observe that the share of G20 GDP in global GDP remains stable (around 77%), even if the RGMs GDP increase significantly: from 24 to 33%.

The same tendency is roughly replicated by export (fig. 2): the share of G20 export in global export remains stable (around 64%), even if the RGMs export increase significantly: the value goes from 30 to 37%. The growing percentage of export in the last five years shows as RGMs have a great openness to trade, respect to US or to Euro area.
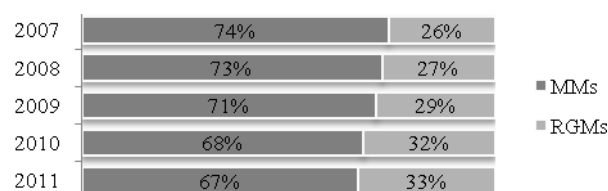
FIGURE 2

b. Source: our elaboration on World Bank data.

Also for import the trend is similar (fig. 3): the share of G20 import in global import remains stable (around 64%), even if the RGMs import increase appreciably, from 26 to 33%.
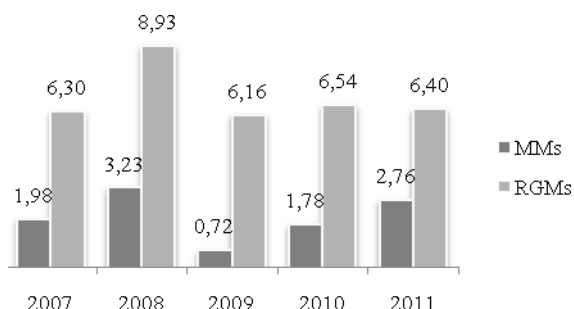
FIGURE 3

c. Source: our elaboration on World Bank data.

These data give a clear signal of competitiveness and growth prospect of RGMs, even if there is, on average, a moderate inflationary pressure between 2007 and 2011.

FIGURE 4

d. Source: our elaboration on World Bank data.

The market alone is not able to ensure a long-term process of economic growth: a regulatory policy is crucial but, if it is not well designed, it could damage the progress. Since the 2007–08 financial crises, it has become much more widely accepted that governments have a very substantial role to play in regulating, incentivizing and directing private sector activity.

The challenge for government is to deliver effective and efficient regulation: effective in addressing an identified problem and efficient in terms of reducing of business administrative burdens on the citizens and businesses while maximizing the benefits to society.

Regarding the administrative burdens for businesses restricted to expenditure on time and money in order to comply with regulation, there is a different story about competitiveness between MMs and RGMs. We assess it on the Doing Business[2] data, limited of two areas to evaluate administrative compliance for businesses: starting a business and trading across borders (divided in import and export components). The empirical analysis pooled the period from 2007-2012 in order to have a reasonable number of observations to make a meaningful evaluation (table 1).

On average, MMs show a 30% of extra cost. The gap is more than 68% for minimum capital. On the other hand, procedures and time requested to start a business are more burdensome for RGMs. Weaknesses are evident also in the across borders regulation.

TABLE 1

Area	Indicators	MMs	RGMs	G20
Starting a business	Procedures (number)	6	10	8
	Time (days)	10	38	25
	Cost	1.806	1.392	1.588
	Minimum capital	3.704	2.207	2.916
Trading across borders export	Documents (number)	4	7	5
	Time (days)	9	17	13
	Cost (per container)	1.043	1.212	1.132
Trading across borders import	Documents (days)	5	7	6
	Time (days)	10	22	16
	Cost (per container)	1.140	1.389	1.271

e. Source: our elaboration on World Bank data

However, the simple comparison of the average values for each indicator captures only marginal aspects. This allows us to go deeper into our analysis and assess performance in a more accurate way.

In this paper, we evaluate administrative compliance performance applying frontier production approach and decomposing efficiency score into efficiency spread in each market group and the efficiency differences between the best-practice frontiers of each market group.

The rest of the paper is organized as follows: section 2 develops the conceptual framework widely used to decompose efficiency and to measure it. Section 3 applies the methodology and discusses the results, while Section 4 presents the conclusions and derives regulatory policy implications.

II. ANALYTICAL FRAMEWORK

The methodology to assess group efficiency was initially proposed by Charnes (1981)[3]. Essentially, this approach distinguishes between internal efficiency, which assesses performance when producers are compared to the best observed practices within the group they belong to, and group efficiency, which identifies differences in the location of the best-practice frontiers between groups.

In our proposal, we denote efficiency the potential savings, involving reduced administrative compliance requirements at a national level.

Before addressing the mathematical formulas necessary to measure the efficiency of administrative business regulation in input orientation, an illustrative example, presented in figure 5, will help to illuminate what is involved. Consider an area of regulation and a sample of countries separated into two groups A and B, corresponding to the market economy system being analyzed. Each of them, indicates necessary requirements x_1 and x_2 (inputs) to obtain one business license y (output). Countries are assumed to have constant returns to scale. So, the inputs are normalized by the value of the output.

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[2] Doing Business is an initiative of World Bank. It provides objective measures of business regulations and their enforcement across 185 economies. It considers ten themes, relating to regulation of the life cycle of businesses. Each of them consists of a set of indicators constructed by laws and regulations in the world in accordance with: procedures to be undertaken, time needed, costs that enterprises must support and other composite indicators based on multiple parameters.

[3] It was later further developed by several authors, including Silva and Thanassoulis (2001) and O'Donnell (2008).

FIGURE 5
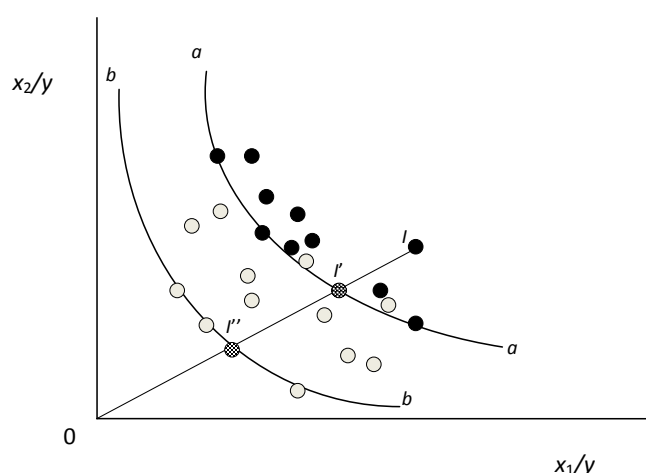
The targets defined for the country are based on internal benchmarking. This implies that each country is compared with another country within the same market group. The evaluation of the efficiency spread within the market groups gives an indication to how much the countries performance is homogeneous, that is, if all RGMs and MMs are equally close to the best-practice levels observed within their own group, or if in one group of countries is closer to the frontier than the other. Let us consider a country I and its bounded market group A represented by isoquant surface aa. The level of internal country efficiency is defined as the ratio of $\|0I'\|/\|I\|$, where I' is the projection point of I (indicated also with a grid dot) onto the boundary isoquant aa relative to which all countries belong market group A are being evaluated.

To appraise the component of countries efficiency which can be attributed to the market group under which a country operates, internal inefficiency needs to eliminate. Thus, the original input levels of the country I, that is identified as inefficient within market group A, have been replaced with the corresponding adjusted-to-efficiency values I'. So, for country I, the ratio of $\|0I''\|/\|I\|$ measures the component of the efficiency which is attributable to the market group A under which it operates.

The value of this index quantifies the magnitude of the differences in the location of the best-practice frontiers.

The aggregate efficiency is the product of internal efficiency and group efficiency.

Thus, for example, we have the following efficiency multiplicative decomposition of country I:

$$\|0I''\|/\|0I\| = \|0I'\|/\|0I\| \times \|0I''\|/\|I\|$$

The hypothesis tests are used to verify if the differences between groups captured by the efficiency indices are statistically significant. One of the most frequently method used to perform a statistical test, to determine the significance of the differences in average program efficiency between the two groups of productive units, is the Mann-Whitney rank-test, because efficiency scores are bounded between zero and

one (Brockett and Golany, 1996). We test the null hypothesis that the distributions of efficiency rankings from each market group are the same. However, we report also the independent samples t, for statistical comparison of the mean efficiency scores of two groups.

To estimate efficiency scores we refer to nonparametric methods based on envelopment techniques[4]. These techniques use a sequence of linear programs to establish which of n producers determines the production-possibility boundary (frontier) and calculate efficiency measures relative to such reference set. The general mathematical formulation in input oriented problem (minimum used input, given attainable output and technology), can be expressed:

$$\min_{\lambda_i, z_h} \lambda_i$$

$$\text{s.t} \quad \sum_{h=1}^{n} z_h \left(x_{hk}/y_h \right) \le \lambda_i \left(x_{ik}/y_i \right), \quad k = 1, ..., q$$

$$z_h \ge 0 \qquad\qquad ; \quad \text{convex hull technology}$$

$$z_h \in \{0,1\} \qquad\quad ; \text{non convex hull technology}$$

$$\sum_{h=1}^{n} z_h = 1, \quad \forall h \in \{1, ..., n\}$$

where:

x_{hk} x_{ik} are the quantities of input k to produce a unit of output y, of producer h and i, respectively. The scalar value λ_i represents a proportional reduction in all inputs such that $0 \le \lambda_i \le 1$ and variable z_h identifies best practices for the producer i.

Convex hull technology allows a producer to be dominated by a convex combination of other producers. Non convex hull ensures that efficiency evaluations are effected from only observed dominant producers[5].

III.   EMPIRICAL ANALYSIS

Using the indicators characterizing the regulatory compliances illustrated in the section 1, we have evaluated performance for 19 countries by pooling data for the entire observation period. The aggregate efficiency is decomposed in two parts: the internal efficiency spread among the countries in each market group and the group efficiency that captures the difference between frontiers. All three measures are used in concert to guide performance improvement. The results are displayed in the tables below and include: mean score, mean ranks and statistical significance. Moreover, the results are distinct respect to reference technologies used (convex and non convex).

For starting a business, a summary of the technical efficiency results obtained in each group using the efficiency

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[4] Based on Farrell's approach (1957).

[5] Convex hull was proposed by Charnes, Cooper and Rhodes (1978). Non convex hull was first proposed by Deprins, Simar, and Tulkens (1984). Framework is explained in details in Tulkens and Vanden Eeckaut (1995), Coelli et al (2005).

decomposition and mathematical formulation proposed are presented in table 2.

TABLE 2

Starting a business	Market group	Mean test				Rank test			
		No convex		Convex		No convex		Convex	
		Mean score	t	Mean score	t	Mean rank	Z	Mean rank	Z
Internal efficiency	MM	54.4	-3,1	50.0	-2,6	48.6	-2.7	48.4	-2.9
	RGM	69.6		62.8		65.6		65.7	
Group efficiency	MM	100.0	19,6	98.9	27,6	86.2	-5.1	86.7	-5.6
	RGM	40.4		36.4		74.2		75.6	
Aggregate efficiency	MM	54.4	6,0	49.4	5,7	42.5	-9.1	41.2	-9.0
	RGM	27.1		23.3		31.7		31.3	

Irrespective of which technology is assumed, the hypothesis test indicates that there is a significant difference in the efficiency spreads within groups. This reveals a worst performance of MMs compared with RGMs group.

However, considering at the group efficiency, we can assess that the productivity of the MMs frontier is greater than the productivity of the RGMs. In fact, the *t* test is statistical significant.

Looking at the trade across borders, tables 3 and 4, the test indicates that only the difference in the relative position of the frontiers is statistically significant, while, the internal efficiency in each group indicates that country performance is rather homogenous:

These comparisons suggest the existence of no-neutral technical progress in the business regulatory environments.

TABLE 3

Export	Market group	Mean test				Rank test			
		No convex		Convex		No convex		Convex	
		Mean score	t	Mean score	t	Mean rank	Z	Mean rank	Z
Internal efficiency	MM	92.6	1,5	88.6	0,9	62.3	-1.634	59.8	-0.7
	RGM	89.0		86.3		53.2		55.4	
Group efficiency	MM	100.0	10,4	99.9	12,2	81.0	-6.382	86.3	-6.6
	RGM	75.6		73.4		36.4		31.6	
Aggregate efficiency	MM	92.6	7,7	88.5	8,1	77.6	-8.070	78.8	-9.2
	RGM	68.0		63.8		39.5		38.3	

TABLE 4

Import	Market group	Mean test				Rank test			
		No convex		Convex		No convex		Convex	
		Mean score	t	Mean score	t	Mean rank	Z	Mean rank	Z
Internal efficiency	MM	88.2	0,7	84.8	1,3	57.7	-0.1	59.1	-0.5
	RGM	86.1		80.8		57.3		56.1	
Group efficiency	MM	100.0	11,4	99.7	15,1	80.9	-6,0	86.8	-6.9
	RGM	72.4		71.2		36.5		31.1	
Aggregate efficiency	MM	88.2	7,2	84.5	8,3	76.8	-8,0	79.7	-9.2
	RGM	63.3		58.2		40.1		37.5	

One hypothesis of this group efficiency tendency is that MMs use information and communication technologies (ICTs) in public service delivery, while RGMs are more depended on the traditional technology.

To empirically evaluate it, we analyze additional data of the country offered by World Bank. Regard on-line support, all MMs and RGMs have provided with the exception of Turkey, while 5/9 of MMs has instituted the business one stop shop, respect to 4/10 of RGMs. If we consider trade facilitation, such as electronic submission and single window linking customs, data reveals a considerable homogeneity between RGMs and MMs groups: all economies, with the exception of India, provide electronic trade documentation, while, for single window linking, all import and export 7/9 of MM_S ensures services respect to 7/10 of RGMs.

On the base of these results, the presence of technological equipment doesn't give enough information of the quality of this supports. For instance, the information could be static with the fewest options for users. The internet support provided to users should be depicted taking into account the readiness and the intensity. More useful details on the quality of technological equipment come from International and Telecommunication Union[6].

Namely, they collected data about four dimensions.

- Access dimension that captures ICT readiness and includes five infrastructure and access indicators (fixed-telephone subscriptions, mobile cellular telephone subscriptions, international internet bandwidth per internet user, percentage of households with a computer, and percentage of households with internet access).

- Use dimension that captures ICT intensity and includes three ICT intensity and usage indicators (percentage of internet users, fixed (wired)-broadband subscriptions, and active mobile broadband subscriptions).

- E-government service dimension, by United Nations E Government Survey, is a composite indicator that gives a measure of 'how much' the governments are putting online .

- E-participation dimension, by United Nations E Government Survey, focuses on the following components: use of the internet to facilitate provision of information by governments to citizens ("e-information sharing"), interaction with stakeholders ("e-consultation"), and engagement in decision-making processes ("e-decision making").

These dimensions are presented in table 5.

Looking at the first ICT dimension, we observe a significant difference between MMs and RGMs, except for the mobile cellular subscriptions. MMs have highest percentages of households with a computer and also of households with internet access, while ICT are not so widespread in RGMs.

TABLE 5

		Market groups	
		MMs	RGMs
ICT access dimension	Fixed-telephone subscriptions per 100 inhabitants	51.23	17.99
	Mobile-cellular subscriptions per 100 inhabitants	113.4	116.94
	International Internet bandwidth Bit/s per Internet user	65363.33	19651.5
	Percentage of households with computer	81.66	37.21
	Percentage of households with Internet access	80.58	30.64
	Internet secure servers per 1.000.000 inhabitants	1245	12
ICT use dimension	Internet users per 100 inhabitants	78	35
	Fixed (wired)-broadband subscriptions per 100 inhabitants	30	7
	Active mobile broadband subscriptions per 100 inhabitants	57	19
Online service component		0.71	0.59
E-participation index		0.35	0.74

Respect to the indicators developed by International and Telecommunication Union, we added also Internet secure servers per 1.000.000 inhabitants by World Bank that reflect the level of ICT security: secure servers are servers using encryption technology in internet transactions. In fact, an effective security system assures that personal data is protected and not visible to other internet users. In RGMs the percentage is much lower than in MMs and this could be a signal that, despite of ICT's diffusion, few people access to internet for business transaction.

If we regard the second dimension, ICT use, the gap between MMs and RGMs is relevant. A low percentage uses internet in RGMs respect to MMs, but, when do it, use more mobile than fixed services. This reflects the great diffusion of smartphone and other mobile equipments.

For the third and fourth dimensions, we consider two composite indicators: online service component and e-participation. The first measures the willingness and capacity of national administrations to use information and communication technology to deliver public services, while the second reflects how useful these features are and how well they have been deployed by the government compared to all other countries. On average, we note that there is a considerable difference between the markets.

These statistics provide evidence of barriers to develop high level of ICT adoption as far as the core services of public administration. In other words, not all RGMs are equally prone to get involved into e-government.

IV. CONCLUSION

This article aims to assess performance on business regulation in G20 countries divided in mature and rapid-growth markets about two business regulations: starting a business and trade across borders.

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[6] http://www.globalinnovationindex.org/gii/index.html

We measure an overall performance index, decomposing it into two parts: the first that compare the efficiency spread between the countries in each market group, the second that captures the difference between market groups (which is determined by the context where the countries are required to operate and reflects differences on regulatory and administrative barriers). This efficiency decomposition is relevant for policy purposes and to guide performance improvements.

The empirical results suggest two broad conclusions. In terms of within-market group, seems that RGMs exhibit a small dispersion of efficiency spreads of levels among countries respect to MMs at least for starting a business. This is likely to be a result of internal ability to reduce business administrative burdens. However, the group efficiency component is the major determinant of performance in business regulation that makes differences between two market groups.

Exploring ICT infrastructure, statistics suggest that mature markets are more active in keeping up with new technologies rather than exploiting their existing production potential.

Rapid growth markets should invest more and in the technology equipment and, perhaps, in the administrative process reengineering to improve administrative efficiency and to provide better and swifter service for the business.

REFERENCES

[1] Brockett, P. L., & Golany B., 1996. Using Rank Statistics for Determining Programmatic Efficiency Differences in Data Envelopment Analysis. Management Science 42 (3): 466 – 472.

[2] Charnes, A., Cooper, W.W., Rhodes, E., 1981. Evaluating program and managerial efficiency: an application of data envelopment analysis to program follow through, Management Science, 27, 668-697.

[3] Charnes, A., W.W. Cooper, and E. Rhodes, 1978, Measuring the efficiency of decision making units, European Journal of Operational Research 2, 429-444.

[4] Coelli, T., Rao, D.S P., O'Donell, C.J. and Battese, G.E. 2005. An introduction to Efficiency and Productivity Analysis, New York: Springer.

[5] Deprins, D., Simar, L., and Tulkens, H. 1984. Measuring Labor Inefficiency in Post Offices, in Marchand, M., Pestieau, P. and Tulkens, H. (eds.) The Performance of Public Enterprizes: Concepts and Measurements, 243-267.

[6] Farrell, M. J. I. 1957. The Measurement of Productivity Efficiency, Journal of the Royal Statistical Society, Ser. A 120, 253-281.

[7] O'Donnell, C., Rao, D., Battese, G., 2008. Metafrontier frameworks for the study of firm-level efficiencies and technology ratios. Empirical Economics, 34, 231–255.

[8] Silva, M., Thanassoulis, E., 2001. Decomposing school and school type efficiencies. European Journal of Operational Research, 38, 357-373.