EFFICIENCY COMPARISON ON ADMINISTRATIVE BUSINESS REGULATION IN THE G20 ECONOMIES

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***Abstract*— The paper focuses on the G20 economies, split into mature and rapid growth markets. We evaluate performance in terms of "ease of doing business", limited to starting a business and trading across borders area regulations, which are related to some important economic profiles. Data cover the period 2007–2012 and are acquired from the World Bank database (Doing Business survey). Ease of doing business is a good concept to evaluate business regulations. Our contribution is to distinguish two aspects: first, to take into consideration intra group and inter group in the evaluation; the second one is to measure the ease of doing business using traditional frontier production analysis instead the measure proposed by the World Bank. In the second stage, we analyze the dependency of the performance specific to ICT environment.**

Keywords— Efficiency Analysis, Administrative business regulation, International comparisons.

I. INTRODUCTION

The challenge for government is to deliver effective and efficient regulation that is effective in addressing an identified problem and efficient in terms of minimizing compliance costs on the citizens and businesses while maximizing the benefits to society.

In recent years, an important insight to managers making operational decisions has shifted significantly towards empirical assessments of the policy through international comparisons. Supranational institutions have produced an internationally set of indicators that measure the performance of the policy.

Regarding business regulations, perhaps the best-known survey, produced at the international level, is the Doing Business by the World Bank. It offers an annual ranking of "ease of doing business". In the comparison, Doing Business assumes a common reference set for all countries. In reality, homogeneity is seldom present, however. If we assume that the performance of each country depends not only on the individual ability, but also on the technological environment in which a country operates, direct comparisons may be misleading.

To overcome this aspect, we propose to measure the "ease of doing business" using a production approach to calculate technical efficiency and to decompose it between inter and intra group components.

This efficiency decomposition is relevant for policy purposes and to guide performance improvements.

For the application, we select G20 countries focusing the analysis on two market groups: Mature Markets (MMs) and Rapid-Growth Markets (RGMs)[1]. The G20 countries covers more than 85% of the world economy. As such, G20 economic growth provides a proxy of global economic growth.

The article has the following structure: the data are described in section 2, Section 3 exposes the methodological approach adopted to measure the ease of doing business, and section 4 presents the results of the application, some concluding remarks are presented in section 5 and, finally, in the appendix are reported statistical data at a country level.

II. THE DATA

Doing Business considers ten topics, relating to regulation of the life cycle of businesses. Each of them consists of a set of indicators constructed by laws and regulations in 183 economies 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.

For the evaluation, we select "starting a business" and "trading across borders" (divided into import and export trade).
All data cover 19 countries over the period 2007-2012. For the purposes of analysis the data are pooled in order to have a reasonable number of observations to make a meaningful evaluation. The data, aggregated across countries and over time and distinguished by market groups, are summarized in table 1.

In general, it appears that the burden of compliance in MMs is lower than the G20 average even if for "starting a business" RGMs appear less expensive.

However, if an overall picture of "ease of doing business" is desired, it is necessary to aggregate the indicators into a single comprehensive performance measure.

Debreu (1951) and Farrell (1957) introduced a measure of technical efficiency. With an input requirement set, their measure is defined as (one minus) the maximum equiproportionate (i.e., radial) reduction in all inputs that is feasible with given technology and outputs.

We apply this measure to estimate the degree of "ease of doing business" and we take into account that the countries operate within the different technological environments.

TABLE 1 G20 DATA SUMMARY STATISTICS, 2007- 2012

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

Source: our elaboration on World Bank data

[1] This split is based on the International Monetary Fund grouping of "advanced economies" and "emerging and developing economies http://www.imf.org/external/pubs/ft/weo/2011/01/weodata/groups.htm

III. MATERIAL AND METHODS

Homogeneity is one of the important assumptions to make reliable comparisons in the context of productivity analysis. In our application the performance of each country depends not only on national institute responsibility to minimize the burden for firms, in the compliance of regulation, fixed regulation goals, but also on the characteristics of the environment in which they operate, such as technological and administrative organization.

If the homogeneity assumption is not satisfied, it is necessary to separate the two components of productive efficiency: intra-groups and inter-groups factors[2].

An illustrative example will help to clarify the procedures followed. The figure shows a set of decision making units (DMU) which use two inputs (x_1 and x_2) to produce a single output.

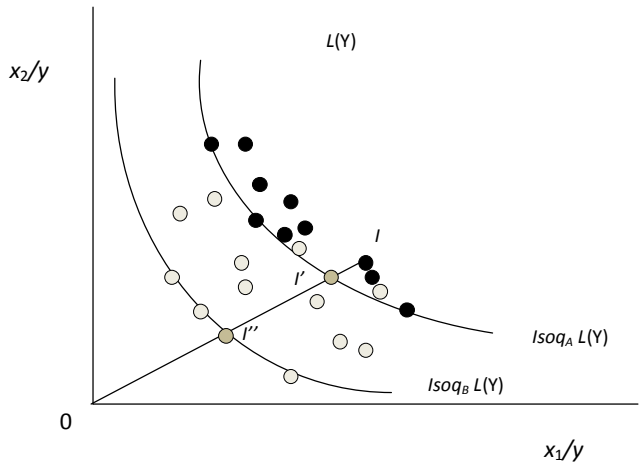
The DMUs operate under two different technological environment groups; those labeled with the black dot operate under the group *A*, while, those labeled with the white dot operate under the group *B*.

The technological frontier of each group is represented by a unit-isoquant and is constructed using the most efficient observations within that group.

Let us consider a DMU *I* and its frontier group *A* denoted by the surface *IsoqA*. The level of intra-group efficiency is defined as the ratio of $\|0I'\|/\|0I\|$, where *I'* is the projection point of *I* onto the *IsoqA*.

To appraise the component of efficiency which can be attributed to the inter-group, internal inefficiency needs to be eliminated. Thus, the original input levels have been replaced with the corresponding adjusted- values *I'*. So, for DMU *I,* the ratio of $\|0I''\|/\|0I'\|$ measures the intra-group efficiency which is attributable to the group *A* under which it operates.

FIGURE 1 THE INTRA AND INTER GROUP EFFICIENCY



[2] The method is initially proposed by Charnes (1981).

The overall productive efficiency is the product of inter and intra group components.

Thus, for DMU *I*: we have the following efficiency multiplicative decomposition.

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

To verify if the differences between groups is statistically significant we apply the Mann-Whitney rank- test (Brockett and Golany, 1996) and the independent samples *t*.

The basic model to estimate the degree of efficiency is:

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

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

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

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

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

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 peers for the producer *i*.

Convex hull provides the closest possible peers to inefficient DMUs and the solution can be expressed as a convex linear combination. Non convex hull requires first the knowledge of the set of dominating DMUs for each dominated DMU and then the selection of the one closest that should be used as the peer[3].

IV. EMPIRICAL ANALYSIS

Table 2 gives the average scores of inter and intra group of "ease of doing business" for starting a business regulation for MMs and RGMs market groups. The summaries are also distinct with respect to the reference envelopes used (convex and non convex hull).

TABLE 2 STARTING A BUSINESS - DECOMPOSITION OF PRODUCTIVE EFFICIENCY

Starting a business	Market group	Mean test				Rank test			
		Non convex		Convex		Non convex		Convex	
		Mean score	t	Mean score	t	Mean rank	Z	Mean rank	Z
Intra 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	
Inter 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	-9.1	75.6	-9.0
Overall efficiency	MM	54.4	6,0	49.4	5,7	42.5		41.2	
	RGM	27.1		23.3		31.7		31.3	

[3] Convex hull was proposed by Charnes, Cooper and Rhodes (1978). Non convex hull was first proposed by Deprins, Simar, and Tulkens (1984).

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 MMs performance to be worse than the RGMs.

However, considering inter group efficiency, we can assess that the productivity of the MMs is greater than the RGMs.

Looking at trading across borders, tables 3 and 4, the statistical test indicates the main difference between MMs and RGMs regarding the inter-group component while, the intra- group indicates that performance is rather homogenous between the two market groups:

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

TABLE 3 TRADING ACROSS BORDERS, EXPORT - DECOMPOSITION OF PRODUCTIVE EFFICIENCY

Export	Market group	Mean test				Rank test			
		Non convex		Convex		Non convex		Convex	
		Mean score	t	Mean score	t	Mean rank	Z	Mean rank	Z
Intra 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	
Inter 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	
Overall 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 TRADING ACROSS BORDERS, IMPORT - DECOMPOSITION OF PRODUCTIVE EFFICIENCY

Import	Market group	Mean test				Rank test			
		Non convex		Convex		Non convex		Convex	
		Mean score	t	Mean score	t	Mean rank	Z	Mean rank	Z
Intra 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	
Inter 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	
Overall 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 to explain the statistical inter-group difference is that MMs use information and communication technologies (ICTs) in public service delivery, while RGMs are more dependent on traditional technology.

To empirically evaluate it, we analyze additional data of the country offered by INSEAD and WIPO[4].

Namely, they collected data about four dimensions.

[4] INSEAD and WIPO co-publish The Global Innovation Index (GII) since 2012. http://www.globalinnovationindex.org/gii/index.html

- 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 the highest percentages of households with a computer and also of households with internet access, while ICT is not so widespread in RGMs.

TABLE 5 ICT DIMENSION, 2011

		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		0.74	0.35

Our elaboration on INSEAD and WIPO data.

With respect to the indicators developed by INSEAD and WIPO, we added also Internet secure servers per 1.000.000 inhabitants by the World Bank that reflect the level of ICT security: secure servers are servers using encryption technology in internet transactions.[5] In RGMs the percentage is much lower than in MMs and this could be a signal that, despite ICT's diffusion, few people access the internet for business transactions.

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

[5] An effective security system assures that personal data is protected and not visible to other internet users.

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 effectively 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 developing a 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.

V. METHODOLOGICAL AND SUBSTANTIVE CONSIDERATIONS.

In recent years, various organizations have collected data on state level regulation and have made international and cross-state comparisons.

The most relevant survey, on an international level, is the World Bank Doing Business, which collects data in business regulations. The survey refers to a set of indicators in 185 economies in the world assuming a uniform regulatory environment in which businesses operate.

In this paper, it has been asserted that the performance evaluation of any country should be measured by comparison with all its own group, and also be compared with all members of other groups (inter-group, intra-group).

Focusing on G20 countries, based on two market groups, the application of efficiency analysis tools shows remarkable differentiation between them.

Exploring ICT infrastructure, we found that MMs invest more in technology equipment. The diversity of regulatory process to provide support service for, delivering compliance activities to regulated businesses explains part of the inter group market disparities. Therefore, there is a crucial link between the diffusion of ICT and the efficiency of the regulatory process. Further analysis needs to be done.

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Appendix

Starting a business: convex model, data summary statistics, 2007- 2012

Country	Intra efficiency	Inter efficiency	Overall efficiency
AUS	100.00	100.00	100.00
CAN	98.15	100.00	98.15
DEU	18.42	99.98	18.42
FRA	56.34	99.99	56.34
GRB	56.92	90.55	51.45
ITA	29.52	100.00	29.52
JPN	17.02	100.00	17.02
KOR	24.81	100.00	24.81
USA	48.68	99.99	48.68
ARG	46.37	26.88	12.47
BRA	35.60	43.68	15.60
CHN	48.64	60.29	29.53
IDN	49.71	23.71	11.87
IND	44.46	26.85	11.94
MEX	82.24	28.03	23.46
RUS	67.83	40.75	27.44
SAU	67.46	27.22	18.44
TUR	100.00	33.33	33.33
ZAF	85.83	53.03	48.73

Starting a business: non convex model, data summary statistics, 2007- 2012

Country	Intra efficiency	Inter efficiency	Overall efficiency
AUS	100.00	100.00	100.00
CAN	100.00	100.00	100.00
DEU	22.22	100.00	22.22
FRA	71.03	100.00	71.03
GRB	56.92	100.00	56.92
ITA	31.48	100.00	31.48
JPN	21.74	100.00	21.74
KOR	28.33	99.99	28.33
USA	58.12	100.00	58.12
ARG	63.43	23.81	14.99
BRA	35.60	57.21	20.47
CHN	51.37	82.50	42.56
IDN	49.71	24.72	12.40
IND	63.06	25.37	15.99
MEX	89.24	29.73	26.90
RUS	71.27	45.74	31.98
SAU	85.32	27.88	23.51
TUR	100.00	33.33	33.33
ZAF	86.93	53.36	49.24

Export: convex model, data summary statistics, 2007- 2012

Country	Intra efficiency	Inter efficiency	Overall efficiency
AUS	73.36	99.99	73.36
CAN	100.00	100.00	100.00
DEU	93.95	100.00	93.95
FRA	95.17	100.00	95.17
GRB	83.92	100.00	83.92
ITA	66.33	100.00	66.33
JPN	90.30	100.00	90.30
KOR	94.42	99.39	93.87
USA	100.00	100.00	100.00
ARG	89.98	56.54	50.73
BRA	91.13	62.80	56.58
CHN	91.37	98.18	89.74
IDN	100.00	96.48	96.48
IND	78.44	77.48	60.76
MEX	98.72	58.55	57.81
RUS	59.05	58.64	34.64
SAU	97.31	82.37	80.18
TUR	95.35	69.00	65.70
ZAF	61.65	74.17	45.15

Export: non convex model, data summary statistics, 2007- 2012

Country	Intra efficiency	Inter efficiency	Overall efficiency
AUS	77.78	100.00	77.78
CAN	100.00	100.00	100.00
DEU	100.00	100.00	100.00
FRA	95.83	100.00	95.83
GRB	88.89	100.00	88.89
ITA	75.00	100.00	75.00
JPN	100.00	100.00	100.00
KOR	96.13	100.00	96.13
USA	100.00	100.00	100.00
ARG	92.89	57.43	53.24
BRA	92.19	67.25	61.45
CHN	99.63	100.00	99.63
IDN	100.00	100.00	100.00
IND	80.70	83.57	67.50
MEX	100.00	60.00	60.00
RUS	61.31	58.05	35.59
SAU	100.00	85.35	85.35
TUR	97.62	71.28	69.38
ZAF	65.97	73.34	47.92

Import: convex model, data summary statistics, 2007- 2012

Country	Intra efficiency	Inter efficiency	Overall efficiency
AUS	77.45	100.00	77.45
CAN	70.37	100.00	70.37
DEU	91.95	100.00	91.95
FRA	93.42	99.96	93.40
GRB	91.67	100.00	91.67
ITA	68.62	100.00	68.62
JPN	72.14	98.22	70.86
KOR	97.40	99.14	96.59
USA	100.00	100.00	100.00
ARG	73.08	55.94	40.63
BRA	76.48	59.88	45.81
CHN	98.74	96.54	95.34
IDN	81.72	93.19	76.12
IND	79.62	72.18	57.50
MEX	100.00	63.00	63.00
RUS	43.37	65.03	28.26
SAU	97.44	75.08	73.23
TUR	98.62	62.55	61.69
ZAF	59.34	68.88	40.88

Import: non convex model, data summary statistics, 2007- 2012

Country	Intra efficiency	Inter efficiency	Overall efficiency
AUS	86.97	100.00	86.97
CAN	75.00	100.00	75.00
DEU	100.00	100.00	100.00
FRA	93.42	100.00	93.42
GRB	93.75	100.00	93.75
ITA	75.00	100.00	75.00
JPN	72.14	100.00	72.14
KOR	97.72	100.00	97.72
USA	100.00	100.00	100.00
ARG	88.52	47.26	41.29
BRA	83.00	58.17	48.22
CHN	100.00	100.00	100.00
IDN	90.74	100.00	90.74
IND	86.69	74.02	64.19
MEX	100.00	70.88	70.88
RUS	47.68	62.37	29.80
SAU	100.00	80.17	80.17
TUR	100.00	64.40	64.40
ZAF	64.40	66.78	42.84

ICT access dimension - 2011

	Fixed-telephone subscriptions per 100 inhabitants	Mobile-cellular subscriptions per 100 inhabitants	International Internet bandwidth Bit/s per Internet user	Percentage of households with computer	Percentage of households with Internet access	Internet secure servers per 1.000.000 inhabitants
AUS	47	108	50396	83	79	2003
CAN	48	75	70150	86	83	1369
DEU	63	132	74786	90	83	1023
FRA	56	105	78590	81	76	354
GRB	53	131	166073	84	85	1593
ITA	35	152	60820	66	62	191
JPN	51	103	23111	86	84	744
KOR	61	109	17170	82	97	2496
USA	48	106	47174	77	76	1563
ARG	25	135	25712	50	38	34
BRA	22	123	29041	45	38	54
CHN	21	73	2692	38	31	2
IDN	3	72	5423	7	6	3
IND	16	98	7196	12	7	3
MEX	17	82	8743	32	28	27
RUS	31	179	31911	57	46	27
SAU	17	191	32985	63	61	22
TUR	21	89	33938	49	43	143
ZAF	8	127	18874	20	10	74

ICT use dimension - 2011

	Internet users per 100 inhabitants	Fixed (wired)-broadband subscriptions per 100 inhabitants	Active mobile broadband subscriptions per 100 inhabitants
AUS	79	24	43
CAN	83	32	33
DEU	83	33	35
FRA	80	36	44
GRB	82	33	62
ITA	57	23	31
JPN	80	27	94
KOR	84	37	105
USA	78	29	66
ARG	48	11	12
BRA	45	9	21
CHN	38	12	10
IDN	10	1	2
IND	18	1	22
MEX	36	11	5
RUS	49	12	48
SAU	48	6	40
TUR	42	10	9
ZAF	21	2	20

E-Government dimensions - 2011

	Online Service	E-participation index
AUS	0.86	0.76
CAN	0.89	0.68
DEU	0.75	0.58
FRA	0.88	0.76
GRB	0.97	1.00
ITA	0.58	0.92
JPN	0.86	0.26
KOR	1.00	0.74
USA	1.00	0.92
ARG	0.53	0.29
BRA	0.67	0.50
CHN	0.53	0.21
IDN	0.54	0.18
IND	0.50	0.21
MEX	0.73	0.58
RUS	0.66	0.66
SAU	0.80	0.63
TUR	0.46	0.16
ZAF	0.46	0.05