

Benchmarking Privatization: The building of a Privatization Index using Fuzzy Logic

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SUMMARY

As with the S&P 500 or the Wilshire 5000 for traded companies, or even more recently the Sandhill Index for Venture Capital in non traded operations, indexes are helpful to benchmark the performance of a company. There is a huge activity worldwide in Privatization matters. The main sectors are water, gas distribution, power, telecom, airports, ports, banks, golf management, prisons, health, education, railways and toll roads. It is then easy to understand that the need for benchmarking this information could be high in order to compare sectors, opportunities or performance of companies. The instrument used to establish this index in this article is the Experton, a perfect tool set up by Kauffmann to capture the opinion of an expert on a matter. Gil Aluja in Spain was a developer of such instruments to the economic world.

Key words: Privatization, Privatization Index, Experton, Privatisation

1. Introduction.

1.1. From Zadeh to the Experton.

Zadeh opened the door to instruments able to manipulate with a new approach the imprecise thinking of the human's brain, starting the area of the fuzzy logic. The abandoning of the Boolean Logic with the introduction of the notion of "appartenance" not defined as 0 and 1 but as an interval $[0,1]$, that is a fuzzy set, was a breakthrough in 1965. In 1975, Sambuc introduced the concept of phi-fuzzy set in its thesis "Application of diagnostic in Thyroidian Pathology" mixing the above mentioned concept with the one defined by Moore based on intervals of confidence in 1966. At the same time, in 1976 and 1977, Féron and Hirota strongly stated the bases of the "Ensembles Aléatoires Flous" which are the Probabilistic Sets. It was then the mixing of these Probabilistic Sets with the Moore's interval concept that gave to Kaufmann in 1987 the key for the discovering of the Experton, a perfect tool to capture the opinion of an expert on a matter. Gil Aluja in Spain was a developer of such instruments to the economic world.

1.2. The need for Benchmarking Privatization.

There is a huge activity worldwide in Privatization matters. The main sectors are water, gas distribution, power, telecom, airports, ports, banks, golf management, prisons, health, education, railways and toll roads. For 10 of these sectors we have listed the top 10 companies leaders of these privatization processes. Out of more than 100 countries with privatization operations, the 40 top ones have been listed and basically selected as the top 10 for each of the 4 major continents. The consequence of these previous studies has been the establishment

of a database with more than 1000 operations enabling a good understanding of the privatization operations all around the world for any of these sectors. It is then easy to understand that the need for benchmarking this information could be high in order to compare sectors, opportunities or performance of companies.

2. Privatization Index

2.1 The criteria.

For the companies, a list a criteria that could be used adopting gray scales are: International presence in privatizations, revenue and size of the privatization businesses, statement and acting from the company, Public Private Partnership and Concession expertise and stability in concessioning. For the countries these criteria are: Sectors, type of privatization, stability and guaranty of the investment, size of the privatization and country predisposition vs. privatization.

2.2. The need for an Index.

As with the S&P 500 or the Wilshire 5000 for traded companies, or even more recently the Sandhill Index for Venture Capital in non traded operations, indexes are helpful to benchmark the performance of a company. In this case a country or a company specialized in privatization will be benchmarked versus a sector index or a country index, a geographic area index and so on.

2.3. The Index Building.

The instrument used to establish this index in this article is the Experton .

2.3.1. Sectors of Privatization: Presentation and Parameters.

Out of more than 20 original sectors involved in privatization, public-private partnerships and management contracts, we took 12 sectors between the more active, with 7 to 12 companies by sector , with a 6 criteria listing establishing a fuzzy scale.

2.3.1.1. Criterias for Sectors

The first step consists in defining a criteria list in order to give to the experts the possibility of valuating in a fuzzy way, in between an interval of confidence defined as Moore did, which will lead us then to the phi-fuzzy set defined as Sambuc. We will start by the sector valuation, then later the country valuation in order to compare the two approaches.

Companies criteria list

1	International Presence in Privatizations	Presence in all 4/5 continents	9
IP		Numerous countries & numerous cases of privatization, high activity	8
		Numerous countries & numerous cases of privatization, recently lower activity	7
		Numerous countries with cases of privatizations, continued activity	6
		Numerous countries with cases of privatizations, low activity	5
		Significant cases in some countries, continued development	4
		Significant cases in some countries no recent development	3
		Significant cases with some concentration in geographic areas	2
		Basically national cases of privatization	1
		Just some national cases of privatization	0
2	Revenue and size of the Privatization Business	Traded, top 2 revenues in its sector	9
RS		In the top 3-5 of its sector worldwide in revenue, going on in expansion	8
		In the top 3-5 of its sector worldwide in revenue, in restructuring	7
		Traded and Significant Revenue out of Concessions and PPP's	6
		Traded, Medium revenue in its sector	5
		Could be traded by its very sizeable revenue	4
		Medium revenue, mainly concessions, PPP, Privatizations	3
		Medium revenue, other businesses	2
		Not traded company, Medium revenue from privatization activity	1
		Not traded company, still low revenue from privatization activity	0
3	Statement and acting from the Company	Company wants to continue expanding with aggressivity	9
SA		Present in all continents	8
		Bidding over 80% of stake in privatizations	7
		Aggressive in selected markets	6
		Bidding largely under 50% of stake	5
		Only international privatizations with symbolic	4

		% equity	
		Signs of selling assets in International Privatizations	3
		Only punctual deals accepted with high return low risk	2
		Company centering in old traditional markets	1
		Company abandoning international activity	0
4	PPP , Privatization, Concession	Main reference as expert by World Bank or similar	9
PE	Expertise	Break through with innovation in PPP and new schemes	8
		PPP Expertise	6
		Concession expertise in number and years	5
		Concession expertise in number but recent in time	4
		Some concession expertise	3
		Just acquisitions (Privatization)	2
		Agressive in bidding but still not significant expertise in privatziations	1
		Some examples of bids, low activity in Privatization	0
5	Stability in Concessioning /Relation vs. Regulator	zero concessions abandoned	9
SC		stable contracts in general	8
		difficulties in countries, not affecting contract	7
		dificulties in country, renegotiation of tariff in order	6
		tense relations with one regulator	5
		tense relations with several regulators	4
		direct claim with one contract	3
		direct claim with several countries	2
		started international arbitrage	1
		lost international arbitrage	0
6	Profitability	10% Revenue and over	9
PR		8% Revenue	8
		6% Revenue	7
		4% Revenue	6
		2% Revenue	5
		0% Revenue	4
		minus 2% Revenue	3
		minus 4% Revenue	2
		minus 6% Revenue	1
		minus 8% Revenue and less	0

2.3.1.2. Valuation for Sectors

Once the valuation's criteria list is established and once the fuzziness of the criterias is defined, it is possible to define for each company a phi-fuzzy set using expert valuation:

A.1	Companies	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5		Criteria 6	
		IP		RS		SA		PE		SC		PR	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
A.1	Water												
A.1.1.	Veolia	9	9	9	9	3	7	5	9	1	6	1	5
A.1.2.	Ondeo - Suez Group	9	9	9	9	1	8	5	9	1	6	1	3
A.1.3.	Saur - Bouygues Group	8	8	7	8	6	6	5	5	8	8	5	6
A.1.4.	RWE - Thames Water	3	7	6	7	1	3	3	4	6	7	4	5
A.1.5.	Agbar	7	7	6	7	6	7	8	9	9	9	7	8
A.1.6.	Kelda	1	2	2	5	1	2	1	2	8	9	9	9
A.1.7.	AWG	9	9	6	6	3	3	3	4	8	9	2	6
A.1.8.	Severn Trent	6	6	6	6	5	6	4	4	8	8	5	6
A.1.9.	Bechtel-IW	3	3	3	4	3	3	2	4	5	6	2	5
A.1.10.	United Utilities	3	3	6	6	3	3	3	4	3	7	9	9
A.1.11.	Acea	1	1	5	6	0	5	0	3	7	7	0	6
A.2.	Solid Waste												
A.2.1.	Waste Management Inc.	9	9	9	9	3	7	2	2	5	8	2	7
A.2.2.	Allied Waste	1	1	5	7	0	1	0	0	7	8	2	4
A.2.3.	Republic Services	0	1	5	6	1	1	0	2	8	8	6	9
A.2.4.	Sita - Suez Group	8	9	8	8	8	9	6	9	6	8	0	5
A.2.5.	Onyx - Vivendi Group	8	9	7	8	8	9	5	5	7	8	0	6
A.2.6.	Safety Kleen	0	2	5	5	1	1	0	2	2	7	0	0
A.2.7.	FCC	8	8	5	6	6	9	5	6	5	8	6	7
A.2.8.	Cespa	1	3	3	6	2	7	4	5	5	6	6	6
A.2.9.	Urbaser - Dragados Group	4	4	5	6	6	6	5	5	5	6	6	6
A.2.10.	Shanks Group	1	1	2	2	2	2	2	3	8	8	4	5
A.3.	Gas												
A.3.1.	Duke	2	4	5	6	6	7	2	2	8	8	7	9
A.3.2.	Sempra Energy	0	2	5	5	1	2	0	0	8	8	8	9
A.3.3.	TXU	0	3	5	6	0	3	1	2	8	8	0	5
A.3.4.	Tractebel - Suez Group	8	9	8	8	6	8	2	3	7	9	3	6
A.3.5.	Ruhrigas	4	4	4	5	4	6	1	3	8	8	6	6
A.3.6.	GDF-Gaz de France	6	7	4	4	5	6	2	3	8	8	7	7
A.3.7.	Gazprom	4	6	8	9	5	6	1	2	8	8	9	9
A.3.8.	Gas Natural	6	6	5	6	6	7	3	4	5	7	9	9
A.3.9.	ENI	5	7	9	9	6	7	2	3	6	8	9	9
A.3.10.	Centrica (British Gas)	3	3	5	5	6	6	2	2	8	8	5	6
A.4.	Parkings												
A.4.1.	Central Parking Corp. CPC	2	4	9	9	8	8	5	5	8	8	4	5
A.4.2.	Interparking Group	0	3	0	1	6	6	3	3	8	8	8	9
A.4.3.	Vinci Park	8	8	5	6	8	8	5	6	8	8	5	6
A.4.4.	Cintra - Ferrovial	0	1	0	5	1	1	5	5	8	8	9	9
A.4.5.	APCOA - Standard Parking	8	8	9	9	6	7	2	4	8	8	3	4
A.4.6.	Tractebel - Suez Group	0	1	0	1	0	1	2	3	8	8	9	9
A.4.7.	Saba	1	2	1	2	5	7	5	5	8	8	9	9
A.4.8.	NCP - Sirven	0	1	0	0	1	1	2	5	8	8	9	9
A.4.9.	FCC	1	1	0	1	1	2	2	3	8	8	7	9
A.4.10.	Imperial Parking Corp.	1	1	5	5	1	1	2	3	8	8	5	5

2.3.1.3. Index for Sectors

One short conclusion could be to go directly to an index for each company using simply a system of average.

		pilot projects	0
3	Stability and guaranty of the investment	zero concessions abandoned by companies	9
SG		stable contracts in general	8
		difficulties not affecting contract	7
		difficulties in country, renegotiation of tariff in order	6
		tense relations with one company	5
		tense relations between several regulators/companies	4
		direct claim with one contract	3
		direct claim with several contracts	2
		started international arbitration	1
		lost international arbitration	0
4	Size	all utilities and services privatized over 10 billion US\$ last 5 years, still strong activity	9
SZ		all utilities and services over 10 billion US\$ last 5 years, lowering activity	8
		all utilities privatized over 10 billion US\$ last 10 years	7
		all utilities privatized	6
		mainly all utilities privatized	5
		some utilities privatized	4
		significant cases in diversified cases	3
		significant cases in limited areas	2
		just some cases but strong privatization	1
		just some cases of partial privatization	0
5	Country Predisposition vs. Privatization	Privatization very welcome, World Bank helping process	9
CP		Long experience and tradition with no risk history	8
		Long experience and expertise with some problems	7
		Strong regulator, concessions with good relationship	6
		Strong regulator, some problems in relationship	5
		No regulator or limited, medium experience	4
		Recent legislation with more access to privatization	3
		Low in progress. Needing still progress	2
		Passive but not adverse, allow cases	1
		Recently changed its mind, stopping privatization	0

2.3.2.2. Valuation for Countries

Once again we ask experts the opinion for each country using the different criterias. In this example we are starting from a final result from experts but we could have construct an initial step with several experts, then come to a final result through expertons:

B.

	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5		
	NS		TP		SG		SZ		CP		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
B.1.	Americas										
B.1.1.	Argentina	9	9	7	9	1	6	6	8	5	7
B.1.2.	Brazil	9	9	3	6	6	7	3	4	0	5
B.1.3.	Mexico	9	9	8	8	8	8	4	4	3	4
B.1.4.	Colombia	9	9	6	8	7	8	4	5	6	7
B.1.5.	Venezuela	7	7	3	4	4	6	3	3	1	4
B.1.6.	Peru	6	6	3	4	6	7	1	1	0	4
B.1.7.	Chile	9	9	8	9	9	9	9	9	8	9
B.1.8.	Panama	4	4	3	4	8	8	1	1	0	4
B.1.9.	USA	9	9	9	9	9	9	5	9	5	8
B.1.10.	Canada	9	9	7	9	9	9	5	9	5	8
B.2.	Asia										
B.2.1.	Philippines	6	6	4	6	1	6	2	5	5	7
B.2.2.	Thailand	4	4	4	6	8	8	3	3	4	4
B.2.3.	China	7	7	6	6	8	8	3	3	1	4
B.2.4.	Japan	4	4	3	3	8	8	1	1	1	1
B.2.5.	South Korea	5	5	4	4	8	8	1	1	1	1
B.2.6.	Indonesia	5	5	3	4	1	6	3	5	3	5
B.2.7.	India	4	4	3	5	5	6	1	2	1	2
B.2.8.	Malaysia	6	6	3	4	8	8	2	4	4	4
B.2.9.	Taiwan	4	4	4	5	8	8	2	2	2	4
B.2.10.	Turkey	3	3	1	2	8	8	0	1	2	3
B.3.	Europe										
B.3.1.	Poland	5	5	2	3	7	8	4	4	3	4
B.3.2.	Romania	5	5	2	3	6	7	1	1	2	4
B.3.3.	Russia	3	3	0	3	7	7	0	4	2	4
B.3.4.	UK	9	9	9	9	6	9	9	9	5	5
B.3.5.	France	9	9	3	4	8	9	3	4	3	6
B.3.6.	Italy	9	9	4	6	6	7	4	5	4	6
B.3.7.	Spain	9	9	7	9	9	9	9	9	8	8
B.3.8.	Portugal	8	8	3	5	5	5	2	4	2	4
B.3.9.	Hungary	6	6	1	3	7	7	1	1	3	4
B.3.10.	Czech republic	6	6	3	4	7	8	1	3	3	9
B.4.	Africa-Oceania										
B.4.1.	Australia	9	9	5	5	8	8	2	4	6	6
B.4.2.	New Zealand	6	6	5	6	8	9	1	1	4	4
B.4.3.	Senegal	3	3	1	1	2	4	0	2	0	2
B.4.4.	South Africa	7	7	4	9	8	9	0	5	2	6
B.4.5.	Egypt	6	6	0	4	7	7	0	4	1	4
B.4.6.	Morocco	5	5	3	9	7	8	2	5	6	9
B.4.7.	Kenya	2	2	0	4	7	7	0	0	1	4
B.4.8.	Cameroon	5	5	3	4	5	7	2	4	2	4
B.4.9.	Tunisia	1	1	0	3	8	8	0	1	0	2
B.4.10.	Ivory Coast	6	6	1	3	1	6	0	4	0	2

2.3.2.3. Index for Countries

We now may rank the countries with this index:

Indice de vitalidad de privatizaciones por país

Countries	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5		C1	C2	C3	C4	C5		
	NS		TP		SG		SZ		CP								
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.							
Americas																	
Argentina	9	9	7	9	1	6	6	8	5	7	9	8	3,5	7	6	67	
Brazil	9	9	3	6	6	7	3	4	0	5	9	4,5	6,5	3,5	2,5	52	
Mexico	9	9	8	8	8	8	4	4	3	4	9	8	8	4	3,5	65	
Colombia	9	9	6	8	7	8	4	5	6	7	9	7	7,5	4,5	6,5	69	
Venezuela	7	7	3	4	4	6	3	3	1	4	7	3,5	5	3	2,5	42	
Peru	6	6	3	4	6	7	1	1	0	4	6	3,5	6,5	1	2	38	
Chile	9	9	8	9	9	9	9	9	8	9	9	8,5	9	9	8,5	88	
Panama	4	4	3	4	8	8	1	1	0	4	4	3,5	8	1	2	37	
USA	9	9	9	9	9	9	5	9	5	8	9	9	9	7	6,5	81	
Canada	9	9	7	9	9	9	5	9	5	8	9	8	9	7	6,5	79	
																0	
Asia																	0
Philippines	6	6	4	6	1	6	2	5	5	7	6	5	3,5	3,5	6	48	
Thailand	4	4	4	6	8	8	3	3	4	4	4	5	8	3	4	48	
China	7	7	6	6	8	8	3	3	1	4	7	6	8	3	2,5	53	
Japan	4	4	3	3	8	8	1	1	1	1	4	3	8	1	1	34	
South Korea	5	5	4	4	8	8	1	1	1	1	5	4	8	1	1	38	
Indonesia	5	5	3	4	1	6	3	5	3	5	5	3,5	3,5	4	4	40	
India	4	4	3	5	5	6	1	2	1	2	4	4	5,5	1,5	1,5	33	
Malaysia	6	6	3	4	8	8	2	4	4	4	6	3,5	8	3	4	49	
Taiwan	4	4	4	5	8	8	2	2	2	4	4	4,5	8	2	3	43	
Turkey	3	3	1	2	8	8	0	1	2	3	3	1,5	8	0,5	2,5	31	
																0	
Europe																	0
Poland	5	5	2	3	7	8	4	4	3	4	5	2,5	7,5	4	3,5	45	
Romania	5	5	2	3	6	7	1	1	2	4	5	2,5	6,5	1	3	36	
Russia	3	3	0	3	7	7	0	4	2	4	3	1,5	7	2	3	33	
UK	9	9	9	9	6	9	9	9	5	5	9	9	7,5	9	5	79	
France	9	9	3	4	8	9	3	4	3	6	9	3,5	8,5	3,5	4,5	58	
Italy	9	9	4	6	6	7	4	5	4	6	9	5	6,5	4,5	5	60	
Spain	9	9	7	9	9	9	9	9	8	8	9	8	9	9	8	86	
Portugal	8	8	3	5	5	5	2	4	2	4	8	4	5	3	3	46	
Hungary	6	6	1	3	7	7	1	1	3	4	6	2	7	1	3,5	39	
Czech republic	6	6	3	4	7	8	1	3	3	9	6	3,5	7,5	2	6	50	
																0	
Africa-Oceania																	0
Australia	9	9	5	5	8	8	2	4	6	6	9	5	8	3	6	62	
New Zealand	6	6	5	6	8	9	1	1	4	4	6	5,5	8,5	1	4	50	
Senegal	3	3	1	1	2	4	0	2	0	2	3	1	3	1	1	18	
South Africa	7	7	4	9	8	9	0	5	2	6	7	6,5	8,5	2,5	4	57	
Egypt	6	6	0	4	7	7	0	4	1	4	6	2	7	2	2,5	39	
Morocco	5	5	3	9	7	8	2	5	6	9	5	6	7,5	3,5	7,5	59	
Kenya	2	2	0	4	7	7	0	0	1	4	2	2	7	0	2,5	27	
Cameroon	5	5	3	4	5	7	2	4	2	4	5	3,5	6	3	3	41	
Tunisia	1	1	0	3	8	8	0	1	0	2	1	1,5	8	0,5	1	24	
Ivory Coast	6	6	1	3	1	6	0	4	0	2	6	2	3,5	2	1	29	

2.3.3. The experton for the benchmarking by Sector and by Country.

Using information from 2.2.1 and 2.2.2, we define Privatization Indexes by sector, by country, and we can benchmark a company versus its sector, a country versus its continent, and use the Index for detecting privatization opportunities for example.

2.3.3.1. The Sectors' Experton and the second prder experton:

We are going to define an experton for the Sectors. In fact we may consider that the experience of every company in a sector is assimilated to an expert experience, so the

valuation of each company is considered as an expert valuation and is the base for the experton (See Kauffman for the Experton methodology):

First step, the valuation. Each company is considered an expert (in fact with real experience):

A.1	Companies	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5		Criteria 6	
		IP		RS		SA		PE		SC		PR	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
A.1	Water												
A.1.1.	Veolia	9	9	9	9	3	7	5	9	1	6	1	5
A.1.2.	Ondeo - Suez Group	9	9	9	9	1	8	5	9	1	6	1	3
A.1.3.	Saur - Bouygues Group	8	8	7	8	6	6	5	5	8	8	5	6
A.1.4.	RWE - Thames Water	3	7	6	7	1	3	3	4	6	7	4	5
A.1.5.	Agbar	7	7	6	7	6	7	8	9	9	9	7	8
A.1.6.	Kelda	1	2	2	5	1	2	1	2	8	9	9	9
A.1.7.	AWG	9	9	6	6	3	3	3	4	8	9	2	6
A.1.8.	Severn Trent	6	6	6	6	5	6	4	4	8	8	5	6
A.1.9.	Bechtel-IW	3	3	3	4	3	3	2	4	5	6	2	5
A.1.10.	United Utilities	3	3	6	6	3	3	3	4	3	7	9	9
A.1.11.	Acea	1	1	5	6	0	5	0	3	7	7	0	6

Second step: statistics of the valuations

	C1		C2		C3		C4		C5		C6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
0	0	0	0	0	1	0	1	0	0	0	1	0
1	2	1	0	0	3	0	1	0	2	0	2	0
2	0	1	1	0	0	1	1	1	0	0	2	0
3	3	2	1	0	4	4	3	1	1	0	0	1
4	0	0	0	1	0	0	1	5	0	0	1	0
5	0	0	1	1	1	1	3	1	1	0	2	3
6	1	1	5	4	2	2	0	0	1	3	0	4
7	1	2	1	2	0	2	0	0	1	3	1	0
8	1	1	0	1	0	1	1	0	4	2	0	1
9	3	3	2	2	0	0	0	3	1	3	2	2
	11	11	11	11	11	11	11	11	11	11	11	11

Third step: we extract the probabilities

	C1		C2		C3		C4		C5		C6	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
0	0	0	0	0	0,09	0	0,09	0	0	0	0,09	0
1	0,18	0,09	0	0	0,27	0	0,09	0	0,18	0	0,18	0
2	0	0,09	0,09	0	0	0,09	0,09	0,09	0	0	0,18	0
3	0,27	0,18	0,09	0	0,36	0,36	0,27	0,09	0,09	0	0	0,09
4	0	0	0	0,09	0	0	0,09	0,45	0	0	0,09	0
5	0	0	0,09	0,09	0,09	0,09	0,27	0,09	0,09	0	0,18	0,27
6	0,09	0,09	0,45	0,36	0,18	0,18	0	0	0,09	0,27	0	0,36
7	0,09	0,18	0,09	0,18	0	0,18	0	0	0,09	0,27	0,09	0
8	0,09	0,09	0	0,09	0	0,09	0,09	0	0,36	0,18	0	0,09
9	0,27	0,27	0,18	0,18	0	0	0	0,27	0,09	0,27	0,18	0,18
	1	1	1	1	1	1	1	1	1	1	1	1

Fourth step: we accumulate the probabilities in order to get the experton

	C1		C2		C3		C4		C5		C6		
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
0	1	1	1	1	1	1	1	1	1	1	1	1	
1	1	1	1	1	0,909	1	0,909	1	1	1	0,909	1	
2	0,82	0,909	1	1	0,636	1	0,818	1	0,818	1	0,727	1	
3	0,82	0,818	0,909	1	0,636	0,909	0,727	0,909	0,818	1	0,545	1	
4	0,55	0,636	0,818	1	0,273	0,545	0,455	0,818	0,727	1	0,545	0,909	
5	0,55	0,636	0,818	0,909	0,273	0,545	0,364	0,364	0,727	1	0,455	0,909	
6	0,55	0,636	0,727	0,818	0,182	0,455	0,091	0,273	0,636	1	0,273	0,636	
7	0,45	0,545	0,273	0,455	0	0,273	0,091	0,273	0,545	0,727	0,273	0,273	
8	0,36	0,364	0,182	0,273	0	0,091	0,091	0,273	0,455	0,455	0,182	0,273	
9	0,27	0,273	0,182	0,182	0	0	0	0,273	0,091	0,273	0,182	0,182	
	5,36	5,818	5,909	6,636	2,909	4,818	3,545	5,182	5,818	7,455	4,091	6,182	
	0,60	0,65	0,66	0,74	0,32	0,54	0,39	0,58	0,65	0,83	0,45	0,69	
	0,62		0,70		0,43		0,48		0,74		0,57	3,54	59

At the very end we get the mathematical expectation, eliminating the entropy by a simple average, which is giving us a Privatization Index for the water sector of 59.

We do the same for the other 11 sectors and at the very end we establish the global valuation for all the sectors:

		C1		C2		C3		C4		C5		C6		
A.1	Water	0,596	0,646	0,657	0,737	0,323	0,535	0,394	0,576	0,646	0,828	0,455	0,687	
A.2	Solid Waste	0,444	0,522	0,600	0,700	0,411	0,578	0,322	0,433	0,644	0,833	0,356	0,611	
A.3	Gas	0,422	0,567	0,644	0,700	0,500	0,644	0,178	0,267	0,822	0,889	0,700	0,833	
A.4	Parkings	0,233	0,333	0,322	0,433	0,411	0,467	0,367	0,467	0,889	0,889	0,756	0,822	
A.5	Airport Management	0,478	0,633	0,622	0,689	0,633	0,822	0,333	0,433	0,811	0,833	0,744	0,856	
A.6	Electricity - Power	0,496	0,615	0,744	0,769	0,513	0,735	0,325	0,444	0,752	0,872	0,632	0,778	
A.7	Golf Management	0,317	0,365	0,540	0,556	0,429	0,524	0,317	0,476	0,857	0,889	0,206	0,476	
A.8	Prisons	0,400	0,467	0,522	0,611	0,556	0,622	0,400	0,556	0,811	0,856	0,478	0,578	
A.9	Toll Roads	0,486	0,583	0,681	0,708	0,542	0,694	0,431	0,528	0,819	0,889	0,944	0,958	
A.10	Education	0,192	0,253	0,505	0,556	0,242	0,283	0,202	0,384	0,879	0,889	0,434	0,687	
A.11	Health Management	0,242	0,273	0,657	0,687	0,303	0,364	0,283	0,434	0,848	0,889	0,545	0,596	
A.12	Telecoms	0,688	0,750	0,757	0,778	0,583	0,736	0,271	0,444	0,826	0,882	0,243	0,458	

If we simplify we can assimilate all these experton results to a matrix which is by itself a base for another experton, an experton from 12 expertons, that is a second degree experton:

		C1		C2		C3		C4		C5		C6		
A.1	Water	0,6	0,6	0,7	0,7	0,3	0,5	0,4	0,6	0,6	0,8	0,5	0,7	
A.2	Solid Waste	0,4	0,5	0,6	0,7	0,4	0,6	0,3	0,4	0,6	0,8	0,4	0,6	
A.3	Gas	0,4	0,6	0,6	0,7	0,5	0,6	0,2	0,3	0,8	0,9	0,7	0,8	
A.4	Parkings	0,2	0,3	0,3	0,4	0,4	0,5	0,4	0,5	0,9	0,9	0,8	0,8	
A.5	Airport Management	0,5	0,6	0,6	0,7	0,6	0,8	0,3	0,4	0,8	0,8	0,7	0,9	
A.6	Electricity - Power	0,5	0,6	0,7	0,8	0,5	0,7	0,3	0,4	0,8	0,9	0,6	0,8	
A.7	Golf Management	0,3	0,4	0,5	0,6	0,4	0,5	0,3	0,5	0,9	0,9	0,2	0,5	
A.8	Prisons	0,4	0,5	0,5	0,6	0,6	0,6	0,4	0,6	0,8	0,9	0,5	0,6	
A.9	Toll Roads	0,5	0,6	0,7	0,7	0,5	0,7	0,4	0,5	0,8	0,9	0,9	1,0	
A.10	Education	0,2	0,3	0,5	0,6	0,2	0,3	0,2	0,4	0,9	0,9	0,4	0,7	
A.11	Health Management	0,2	0,3	0,7	0,7	0,3	0,4	0,3	0,4	0,8	0,9	0,5	0,6	
A.12	Telecoms	0,7	0,8	0,8	0,8	0,6	0,7	0,3	0,4	0,8	0,9	0,2	0,5	

Again, we construct the statistics:

	C1		C2		C3		C4		C5		C6	
0	0	0	0	0	0	0	0	0	0	0	0	0
.1	0	0	0	0	0	0	0	0	0	0	0	0
.2	3	0	0	0	1	0	2	0	0	0	2	0
.3	1	3	1	0	2	1	6	1	0	0	0	0
.4	3	1	0	1	3	1	4	6	0	0	2	0
.5	3	2	3	0	3	3	0	3	0	0	3	2
.6	1	5	3	3	3	3	0	2	2	0	1	3
.7	1	0	4	6	0	3	0	0	0	0	2	2
.8	0	1	1	2	0	1	0	0	7	3	1	3
.9	0	0	0	0	0	0	0	0	3	9	1	1
1	0	0	0	0	0	0	0	0	0	0	0	1
	12	12	12	12	12	12	12	12	12	12	12	12

Then the probabilities:

	C1		C2		C3		C4		C5		C6	
0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
.1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
.2	0,25	0,00	0,00	0,00	0,08	0,00	0,17	0,00	0,00	0,00	0,17	0,00
.3	0,08	0,25	0,08	0,00	0,17	0,08	0,50	0,08	0,00	0,00	0,00	0,00
.4	0,25	0,08	0,00	0,08	0,25	0,08	0,33	0,50	0,00	0,00	0,17	0,00
.5	0,25	0,17	0,25	0,00	0,25	0,25	0,00	0,25	0,00	0,00	0,25	0,17
.6	0,08	0,42	0,25	0,25	0,25	0,25	0,00	0,17	0,17	0,00	0,08	0,25
.7	0,08	0,00	0,33	0,50	0,00	0,25	0,00	0,00	0,00	0,00	0,17	0,17
.8	0,00	0,08	0,08	0,17	0,00	0,08	0,00	0,00	0,58	0,25	0,08	0,25
.9	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,25	0,75	0,08	0,08
1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,08
	1	1	1	1	1	1	1	1	1	1	1	1

With the accumulation of probabilities we get the experton:

	C1		C2		C3		C4		C5		C6	
0	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
.1	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
.2	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
.3	0,75	1,00	1,00	1,00	0,92	1,00	0,83	1,00	1,00	1,00	0,83	1,00
.4	0,67	0,75	0,92	1,00	0,75	0,92	0,33	0,92	1,00	1,00	0,83	1,00
.5	0,42	0,67	0,92	0,92	0,50	0,83	0,00	0,42	1,00	1,00	0,67	1,00
.6	0,17	0,50	0,67	0,92	0,25	0,58	0,00	0,17	1,00	1,00	0,42	0,83
.7	0,08	0,08	0,42	0,67	0,00	0,33	0,00	0,00	0,83	1,00	0,33	0,58
.8	0,00	0,08	0,08	0,17	0,00	0,08	0,00	0,00	0,83	1,00	0,17	0,42
.9	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,25	0,75	0,08	0,17
1	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,08
	4,08	5,08	6,00	6,67	4,42	5,75	3,17	4,50	7,92	8,75	5,33	7,08
	0,41	0,51	0,6	0,667	0,442	0,575	0,317	0,45	0,792	0,875	0,533	0,708
		0,46		0,63		0,51		0,38		0,83		0,62

We take out the entropy coming with the final result of 57 which is the Privatization index all sectors together.

2.3.3.2. The Countries' Experton

For the countries we build directly the opinion of experts for the 40 countries:

B.	Countries	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5	
		NS		TP		SG		SZ		CP	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1 B.1.1.	Argentina	9	9	7	9	1	6	6	8	5	7
2 B.1.2.	Brazil	9	9	3	6	6	7	3	4	0	5
3 B.1.3.	Mexico	9	9	8	8	8	8	4	4	3	4
4 B.1.4.	Colombia	9	9	6	8	7	8	4	5	6	7
5 B.1.5.	Venezuela	7	7	3	4	4	6	3	3	1	4
6 B.1.6.	Peru	6	6	3	4	6	7	1	1	0	4
7 B.1.7.	Chile	9	9	8	9	9	9	9	9	8	9
8 B.1.8.	Panama	4	4	3	4	8	8	1	1	0	4
9 B.1.9.	USA	9	9	9	9	9	9	5	9	5	8
10 B.1.10.	Canada	9	9	7	9	9	9	5	9	5	8
11 B.2.1.	Philippines	6	6	4	6	1	6	2	5	5	7
12 B.2.2.	Thailand	4	4	4	6	8	8	3	3	4	4
13 B.2.3.	China	7	7	6	6	8	8	3	3	1	4
14 B.2.4.	Japan	4	4	3	3	8	8	1	1	1	1
15 B.2.5.	South Korea	5	5	4	4	8	8	1	1	1	1
16 B.2.6.	Indonesia	5	5	3	4	1	6	3	5	3	5
17 B.2.7.	India	4	4	3	5	5	6	1	2	1	2
18 B.2.8.	Malaysia	6	6	3	4	8	8	2	4	4	4
19 B.2.9.	Taiwan	4	4	4	5	8	8	2	2	2	4
20 B.2.10.	Turkey	3	3	1	2	8	8	0	1	2	3
21 B.3.1.	Poland	5	5	2	3	7	8	4	4	3	4
22 B.3.2.	Romania	5	5	2	3	6	7	1	1	2	4
23 B.3.3.	Russia	3	3	0	3	7	7	0	4	2	4
24 B.3.4.	UK	9	9	9	9	6	9	9	9	5	5
25 B.3.5.	France	9	9	3	4	8	9	3	4	3	6
26 B.3.6.	Italy	9	9	4	6	6	7	4	5	4	6
27 B.3.7.	Spain	9	9	7	9	9	9	9	9	8	8
28 B.3.8.	Portugal	8	8	3	5	5	5	2	4	2	4
29 B.3.9.	Hungary	6	6	1	3	7	7	1	1	3	4
30 B.3.10.	Czech republic	6	6	3	4	7	8	1	3	3	9
31 B.4.1.	Australia	9	9	5	5	8	8	2	4	6	6
32 B.4.2.	New Zealand	6	6	5	6	8	9	1	1	4	4
33 B.4.3.	Senegal	3	3	1	1	2	4	0	2	0	2
34 B.4.4.	South Africa	7	7	4	9	8	9	0	5	2	6
35 B.4.5.	Egypt	6	6	0	4	7	7	0	4	1	4
36 B.4.6.	Morocco	5	5	3	9	7	8	2	5	6	9
37 B.4.7.	Kenya	2	2	0	4	7	7	0	0	1	4
38 B.4.8.	Cameroon	5	5	3	4	5	7	2	4	2	4
39 B.4.9.	Tunisia	1	1	0	3	8	8	0	1	0	2
40 B.4.10.	Ivory Coast	6	6	1	3	1	6	0	4	0	2

The we are going to define the Experton for Countries, doing first of all the statistics, then the probabilities, then the accumulated probabilities giving the Experton:

	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5	
	NS		TP		SG		SZ		CP	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0	0	0	4	0	0	0	8	1	6	0
1	1	1	4	1	4	0	9	9	7	2
2	1	1	2	1	1	0	7	3	7	4
3	3	3	13	7	0	0	6	4	6	1
4	5	5	6	11	1	1	4	11	4	17
5	6	6	2	4	3	1	2	6	5	3
6	8	8	2	6	5	6	1	0	3	4
7	3	3	3	0	8	9	0	0	0	3
8	1	1	2	2	14	15	0	1	2	3
9	12	12	2	8	4	8	3	5	0	3
	40	40	40	40	40	40	40	40	40	40

	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5	
	NS		TP		SG		SZ		CP	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0	0	0	4	0	0	0	8	1	6	0
1	1	1	4	1	4	0	9	9	7	2
2	1	1	2	1	1	0	7	3	7	4
3	3	3	13	7	0	0	6	4	6	1
4	5	5	6	11	1	1	4	11	4	17
5	6	6	2	4	3	1	2	6	5	3
6	8	8	2	6	5	6	1	0	3	4
7	3	3	3	0	8	9	0	0	0	3
8	1	1	2	2	14	15	0	1	2	3
9	12	12	2	8	4	8	3	5	0	3
	40	40	40	40	40	40	40	40	40	40

	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5	
	NS		TP		SG		SZ		CP	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0	0	0	0,1	0	0	0	0,2	0,025	0,15	0
1	0,025	0,025	0,1	0,025	0,1	0	0,225	0,225	0,175	0,05
2	0,025	0,025	0,05	0,025	0,025	0	0,175	0,075	0,175	0,1
3	0,075	0,075	0,325	0,175	0	0	0,15	0,1	0,15	0,025
4	0,125	0,125	0,15	0,275	0,025	0,025	0,1	0,275	0,1	0,425
5	0,15	0,15	0,05	0,1	0,075	0,025	0,05	0,15	0,125	0,075
6	0,2	0,2	0,05	0,15	0,125	0,15	0,025	0	0,075	0,1
7	0,075	0,075	0,075	0	0,2	0,225	0	0	0	0,075
8	0,025	0,025	0,05	0,05	0,35	0,375	0	0,025	0,05	0,075
9	0,3	0,3	0,05	0,2	0,1	0,2	0,075	0,125	0	0,075
	1	1	1	1	1	1	1	1	1	1

	Criteria 1		Criteria 2		Criteria 3		Criteria 4		Criteria 5	
	NS		TP		SG		SZ		CP	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0	1	1	1	1	1	1	1	1	1	1
1	1	1	0,9	1	1	1	0,8	0,975	0,85	1
2	0,975	0,975	0,8	0,975	0,9	1	0,575	0,75	0,675	0,95
3	0,95	0,95	0,75	0,95	0,875	1	0,4	0,675	0,5	0,85
4	0,875	0,875	0,425	0,775	0,875	1	0,25	0,575	0,35	0,825
5	0,75	0,75	0,275	0,5	0,85	0,975	0,15	0,3	0,25	0,4
6	0,6	0,6	0,225	0,4	0,775	0,95	0,1	0,15	0,125	0,325
7	0,4	0,4	0,175	0,25	0,65	0,8	0,075	0,15	0,05	0,225
8	0,325	0,325	0,1	0,25	0,45	0,575	0,075	0,15	0,05	0,15
9	0,3	0,3	0,05	0,2	0,1	0,2	0,075	0,125	0	0,075

6,175 6,175 3,7 5,3 6,475 7,5 2,5 3,85 2,85 4,8
0,686 0,686 0,411 0,589 0,719 0,833 0,278 0,428 0,317 0,533
0,686 0,5 0,776 0,353 0,425

2,74

The final result once we take out the entropy by doing the mathematical expectation is that the Privatization Index for Countries is 55.

2.4. The Privatization Index resulting from the Sectors' Experton and the Countries' Second Degree Experton

The Privatization Index with a Sector approach is: 57

The Privatization Index with a Country approach is: 55

Then, for the 2004 study, the privatization index is: 56

Due to the simplicity of the results we can determine the combined Privatization Index by average. We could have taken the Experton of Privatization Index for Countries, The Experton of the Sector Privatization Index, then combined both in one Experton.

Regarding the two indexes, we see that the two approaches are very similar. The market (that is the countries) seem to be "less receptive to privatization" as the companies intention or capacity is (57 vs. 55) which is generally normal. The companies enter the market always a little bit less than their original expectation.

3. Conclusion:

We have defined a methodology using Expertons built with Fuzzy Logics to define a Privatization Index for Countries and Sectors which may give a sense of the opportunities of the markets in privatization matters, and also of capacity of operators in the managerial field as well as the receptivity and confidence of the different countries for such operations in terms of privatizations and public-private partnerships.

As a first analysis by countries, we see that Chile is very active but also countries as USA or UK. This is due to the fact that sectors as Prisons or Airport Management are active in Privatizations. South America in general is still well ranked due to Utilities Privatizations, but values as European countries are coming up as Italy and Spain. In companies, Agbar in Water, Sita in Solid Waste, ADP or the Australian Macquarie in Airports, EDF in Power, Wackhenut in Prisons, Vinci in Toll Roads and Verizon in Telecoms are some of the most interesting companies for their potential and their action in Privatizations or Public-Private Partnerships.

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