A MODIFIED CROSS EVALUATION DEA MODEL FOR DMU RANKING: AN OLYMPIC CASE STUDY

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Abstract
There is no official method to establish a final ranking for the Olympic Games. The usual ranking is based on the Lexicographic Multicriteria Method with its main drawback that is to overvalue the gold medal. Besides, it ignores the results of the winter games. This paper proposes a method based on Data Envelopment Analysis (DEA), where the outputs are the number of three type medals that each country won in the Salt Lake City and Sydney games; a constant input is considered for all countries. Restrictions based on the importance of each medal are imposed in the model as the DEA method has an excessive degree of freedom for the weight assignment for each variable. In order to avoid different weights for each country, a weight average for each input is evaluated and is used, as the coefficient in the weighted sum that establishes the final ranking.
Keywords: Data Envelopment Analysis – Cross evaluation – Ranking.

Resumo
Não há método oficial para estabelecer uma classificação final para os jogos olímpicos. A classificação usualmente apresentada é baseada no método lexicográfico de multicritério, com o seu principal defeito: valorizar em excesso a medalha de ouro. Além disso, ignora os resultados dos jogos de inverno. Neste artigo é proposto um método baseado em Análise de Envoltória de Dados (DEA), onde os *outputs* são o número de medalhas dos três tipos que cada país conquistou nos jogos de Sydney e Salt Lake City; o *input* é constante e unitário para todos os países. Como DEA tem liberdade excessiva de atribuição de pesos a cada variável, são impostas restrições baseadas na importância de cada medalha e de cada conjunto de jogos. Para evitar ponderações diferentes para cada país, é calculada a média dos pesos de cada *output*, e esse valor é usado como peso na soma ponderada que estabelece a ponderação final.
Palavras-chave: Análise de Envoltória de Dados – Avaliação cruzada – Ordenação.

1. INTRODUCTION

The use of Operational Research models in sports is an all-inclusive theme (Klaassen and Magnus, 2003; Koning et al., 2003; Estellita Lins et al., 2003; Horner, 2001; Condon et al., 1999; Sueyoshi et al., 1999). In this paper we use Operational Research approaches to look into the analysis of the Sydney 2000 Olympic Games and Salt Lake City 2002 Winter Olympic Games results, as these events are the world's greatest festivals of athletic competition and international friendship (AAFLA, 2002).

The Olympic Games were born in ancient Greece and were designed for individual contests. However, the cities from where the winners originated would grant them numerous prerogatives, clearly showing that the city felt it had won as well. The modern Games, initiated in 1896 by Baron Coubertin, tried to keep the initial spirit of individual competition. The purpose clearly failed. Ever since the very first modern Games, it became usual to play the national anthem of the winner' s country. During the Cold War the national character of the contest became ever more noticeable, developing into a true battle between East and West. Even before that, the Third Reich had tried to show the supremacy of the Arian race in the Games of 1936 although the results were quite different from those Hitler had bargained for.

The Winter games were incorporated to the Olympic Games in 1908 with the artistic skating. In 1924, the first Winter Olympic Games were realised in Chamonix, France. Since 1994, the Winter Olympic Games have been organised in different years compared to Summer Olympic Games. Despite this national character, the Olympic Committee has never issued an official ranking that would allow pinpointing the country that was the overall Olympic winner. The media, however, did so in a way discussed below and which has become the quasi-official ranking (Estellita Lins et al., 2003).

In order to establish a general ranking for the Olympic Games we have to solve a few problems. The different competitions within the Games have to be valued and, within each competition, the positions obtained by each country in the summer and winter games have to be valued too. The first of these problems dealing with the popularity of each sport, or its Olympic tradition or even the number of athletes will not be analysed here since it is very subjective. All competitions within the same games are considered as equally important.

How to use the results that were obtained is the very essence of the remaining problems. Olympic rankings for each game are traditionally published under the shape of a table in which countries are ranked according to the number of gold, silver and bronze medals their athletes have won. This type of ranking is typical of the Lexicographic Multicriteria Method (Pomerol and Barba-Romero, 2000; Soares de Mello et al., 2003), which, in this particular case, has the disadvantage to overvalue the gold medal. In other words, countries that won a high number of silver and bronze medals but none of gold, such as Brazil and Georgia, are ranked below countries that have won a single gold medal and none of the others, e.g. Cameroon. This method starts from the assumption that the decision-maker is capable of ranking criteria according to their importance. In such a case an alternative is preferable to another if its performance is better according to the most important criterion, independently of all the other criteria. In the case of equal performances, a comparison according to second most important criterion is made. Should a new tie obtain, recourse is had for the third criterion and so on until all alternatives are ranked. In the case of the Olympic medal results, countries are ranked according to the number of gold medals they have won. If there is a tie, they are ranked by silver medals. Should a new tie appear, the new criterion is the number of bronze medals.

We propose an Olympic Ranking ranking based on Data Envelopment Analysis (DEA) that uses the results of the Sydney 2000 Olympic Games and the Salt Lake City 2002 Winter Olympic Games. The first games were the greatest ones yet organised, with 10,651 athletes, from 199 nations, competing in 300 events. In the Salt Lake City Games we saw the expansion of the Olympic programme to 78 events and the participation of 2,399 athletes from 77 nations. Athletes from 18 nations earned gold medals. Naturally, these figures point out that Winter

Olympic Games are not so influent in global public opinion as traditional games are. This fact must be taken into account in the mathematical model that will be carried out.

In the proposed DEA model the outputs are the number of the three type medals that each country won in both games and a constant input is considered for all countries. A well-known property of DEA models is that they allow an excessive degree of freedom for the weights assigned for each variable. In order to avoid such freedom, restrictions based on the importance of each medal are incorporated in the model.

On the other hand a ranking based on different weights for each country is not easily acceptable by the general public. In order to prevent this situation we present a final ranking based on a weighted sum in which we use the average of the weights assigned by the DEA model for each variable.

2. MODELLING WITH DEA

2.1. Fundamentals

The aim of DEA (Cooper et al., 2000) is to compare a certain number of production units usually named Decision Making Units (DMUs), that perform similar tasks but use a different level of inputs to achieve different level of outputs (Biondi Neto et al., 2004). Besides identifying efficient DMUs, DEA models allow inefficiencies to be measured and diagnosed. Efficient DMUs define a piece-wise linear borderline usually named efficient frontier.

Let us recall that DEA models allow each DMU to choose in complete freedom the weight for each variable. This may mean that some DMUs will overvalue the silver or bronze medals and in some cases they can even ignore the gold medals in order to achieve their efficiency score.

This situation usually leads to a greater number of ties among DMUs. In order to avoid this lack of discrimination among efficient DMUs there are several approaches (Angulo-Meza and Estellita Lins, 2002). We will use two of them to propose an Olympic ranking. The first one is the weight restrictions for which there are two main possibilities: Cone Ratio and the restriction to the importance of each variable. The last one uses the concept of virtual variables and requires more information from the decision-maker. Such a method is very subjective and may force a multicriteria approach in the evaluation of each weight (Soares de Mello et al., 2002b). This considerations lead to the use of the first possibility, the Cone Ratio.

The second technique we will use to increase the discrimination among DMUs is the cross evaluation method (Sexton et al., 1986), with the improvements proposed by Estellita Lins et al. (2003).

2.2. DEA modelling details: case study

The aim of the proposed DEA model is to rank the Sydney 2000 Olympic Games and Salt Lake City 2002 Olympic Games participant countries. The DMUs are defined as the countries that earned medals in at least one of those games (80 nations). The objective of each country is to obtain the largest possible number of medals. As there are two games and three types of medals we have six outputs for each DMU: the number of gold, silver and bronze medals that each country earned in Sydney and Salt Lake City games.

No input should be considered because our goal is to order the countries only by its results. However that leads to mathematical inconsistencies (Lovell and Pastor, 1999). In order to avoid such inconsistencies and to keep the idea of only considering the results it was assumed that the existence of each DMU is its own input. In other words, we considered a unit constant input for all DMUs in a framework similar to the one used by Soares de Mello et al. (2000).

Due to the existence of a single constant input, we use Constant Returns to Scale DEA model (DEA CCR) (Charnes et al., 1978). In (I) we can see the mathematical formulation for

DEA CCR model where h_0 is the DMU_0 efficiency; y_{jk} is the j-th output of the k-th DMU; x_{ik} is the i-th input of the k-th DMU; μ_j and v_i are the output and the input weights, respectively.

$$
\begin{aligned}
&\text{Maximize } h_0 = \sum_{j=1}^{s} \mu_j y_{j0} \\
&\text{subject to} \\
&\sum_{i=1}^{r} v_i x_{i0} = 1 \\
&\sum_{j=1}^{s} \mu_j y_{jk} - \sum_{i=1}^{r} v_i x_{ik} \le 0, \quad k = 1,\dots,n \\
&u_j, v_i \ge 0 \quad \forall\, j,i
\end{aligned}
\qquad \text{(I)}
$$

Obviously the earned medals do not have the same importance. This fact forces the incorporation of weight restrictions in the DEA model. In order to model these restrictions we can use the fact that a gold medal is for sure more important than a silver one and that one is more important than a bronze medal. However, the difference in importance among these sort of medals is not equivalent. In opposition of Baron Coubertin ideals, the victory is the main goal of the competitors. So the difference in importance between the gold and the silver medals is larger than the difference between the silver and the bronze ones.

We can also consider that a medal earned in the winter games has less impact than an equivalent medal earned in the traditional Olympic games.

The DEA model with these considerations and the simplifications due to the fact that a unit input was adopted for all DMUs is present in (II).

$$
\begin{aligned}
&\text{Maximize } h_0 = \sum_{j=1}^{6} \mu_j y_{j0} \\
&\text{subject to} \\
&\sum_{j=1}^{6} \mu_j y_{jk} \le 1, \quad k = 1,\dots,80 \\
&\mu_{gS} \ge \mu_{sS} \\
&\mu_{sS} \ge \mu_{bS} \\
&\mu_{gS} - \mu_{sS} \ge \mu_{sS} - \mu_{bS} \\
&\mu_{gSl} \ge \mu_{sSL} \\
&\mu_{sSL} \ge \mu_{bSL} \\
&\mu_{gSL} - \mu_{sSL} \ge \mu_{sSL} - \mu_{bSL} \\
&\mu_{gS} \ge \mu_{gSL} \\
&\mu_{sS} \ge \mu_{sSL} \\
&\mu_{bS} \ge \mu_{bSL} \\
&\mu_j \ge 0, \forall j
\end{aligned}
\qquad \text{(II)}
$$

where h_0 is the efficiency of the DMU_0 under consideration and μ_j is the weight for a r type medal (g = gold, s =silver, b = bronze) in p competition (S = Sydney 2000 Olympic Games, SL = Salt Lake City 2002 Winter Olympic Games).

The complete data set used to implement the Olympic ranking model is shown in Appendices 1.

3. RESULTS AND DISCUSSION

Appendices 2 shows the obtained efficiencies and the weights for each variable using model (II), evaluated by SIAD software (Angulo-Meza et al., 2003).

As can be seen, the first country in the classification considering model (II) is still the United States. In the same model, countries that earned a single gold medal, such as Cameroon and Mozambique, achieved a worst classification than the one obtained using the lexicographic method (popular ranking). The top of the table presents no important differences between the results from the proposed DEA model and the lexicographic method.

It can be observed that even using the weight restrictions, a significant number of DMUs assigned zero weights to some medals ignoring the results of these medals.

Sexton et al. (1986) proposed a cross evaluation method that avoids this problem. In such model, each DMU, besides being self evaluated as in the classical DEA models, is evaluated by all other DMUs. In other words, an average efficiency is performed based in the weights assigned to each variable by the complete set of DMUs. Such an approach has a drawback: the existence of multiple results, since the obtained weights are not unique for the extreme efficient DMUs.

For those DMUs, the Linear Programming Problem of the multipliers classic DEA model yields multiple optimal solutions. This property derives from the fact that DEA frontier has the characteristic of being non-differentiable in some points of its domain since the efficient frontier is a piece-wise linear one (Rosen et al., 1998).

Doyle and Green (1995) proposed two linear models carrying two unique solutions each one. In the first model, each DMU choose its weights not only to maximise its efficiency but also to decrease the other ones efficiencies (aggressive formulation). The second model enables each DMU to maximise not only its efficiency but as well as the efficiencies of all the other DMUs (benevolent formulation).

The Doyle and Green method forces the decision-maker to choose one of the formulations. This fact contradicts the main characteristic of the cross evaluation method that is to minimise the interference of the decision-maker in the efficiency calculation process.

A DEA model that assigns single weights to the extreme efficient DMUs was proposed by Soares de Mello et al. (2002a) through the use of a smoothed DEA frontier. However, this technique has two requirements: the existence of at least three efficient DMUs and the use of the BCC model (Banker et al., 1984). As we are using the CCR model with only one efficient DMU, this approach does not applies to the present study.

An alternative approach is the one proposed by Estellita Lins et al. (2003). Anderson et al. (2002) present the theoretical foundations and prove that the cross evaluation method is equivalent to a fixed weights sum. Using this fact, Estellita Lins et al. (2003) evaluate the average weights for each variable and, in sequence, the efficiency of each DMU with these weights. For a small number of efficient DMUs the effect of multiple solutions existence causes small impact on the final results.

We now propose an improvement on the Estellita Lins et al. (2003) method. It consists to remove the extreme efficient DMUs from the set of DMUs used to calculate the average weight. This means the removal of the United States DMU from the set of DMUs used to calculate the average weight for the Olympic medals. This method eliminates the imprecision due to the existence of multiple solutions in the extreme efficient DMUs.

An important feature present both in the present model as well in the Estellita Lins et al. (2003) one is that an average efficiency is calculated jointly with the weight restrictions. As a consequence, there is an increase of the discrimination in the obtained ranking.

The average weights obtained for each medal are depicted in Table 1.

Table 1. Average weights.

	Weight
g-S	0,013503
s-S	0,008281
b-S	0,007081
g-SL	0,001911
s-SL	0,000748
b-SL	0,000598

We observe that the imposed restrictions to the individual weights were evidently satisfied by the average weights. On the other hand, it is important to verify that the weights for the medals in the Salt Lake City Games were much smaller than the ones obtained in the Sydney Games. These results are due to the imposed restrictions and to the fact that few countries earned medals in the Salt Lake City Games.

The final result is obtained with the use of an average weight of the earned medals weighted by the average weights shown in Table 2.

Table 2. Final Olympic ranking obtained with average weights.

DMU	*Weighted sum*	*DMU*	*Weighted sum*	*DMU*	*Weighted sum*
United States	1,0000	Kazakhstan	0,0736	Slovenia	0,0276
Russia	0,8788	Kenya	0,0660	Croatia	0,0271
China	0,6214	Denmark	0,0589	Nigeria	0,0248
Germany	0,5511	Jamaica	0,0544	Bahamas	0,0218
Australia	0,5473	Indonesia	0,0525	Saudi Arabia	0,0154
France	0,3819	Finland	0,0521	Moldavia	0,0154
Italy	0,3435	Mexico	0,0513	Trinidad and Tobago	0,0154
Cuba	0,2892	Lithuania	0,0482	Costa Rica	0,0142
United Kingdom	0,2840	Austria	0,0481	Portugal	0,0142
Netherlands	0,2744	Iran	0,0476	Cameroon	0,0135
South Korea	0,2650	Turkey	0,0476	Colombia	0,0135
Romania	0,2619	Slovakia	0,0454	Mozambique	0,0135
Ukraine	0,1941	Algeria	0,0430	Ireland	0,0083
Hungary	0,1790	Georgia	0,0425	Uruguay	0,0083
Japan	0,1705	South Africa	0,0378	Vietnam	0,0083
Poland	0,1450	Belgium	0,0378	India	0,0071
Byelorussia	0,1438	Morocco	0,0366	Armenia	0,0071
Canada	0,1340	Taiwan	0,0366	Barbados	0,0071
Bulgaria	0,1333	Uzbekistan	0,0359	Chile	0,0071
Norway	0,1287	New Zealand	0,0347	Iceland	0,0071
Greece	0,1249	Azerbaijan	0,0341	Israel	0,0071
Sweden	0,1205	Estonia	0,0308	Kuwait	0,0071
Spain	0,1065	Argentina	0,0307	Qatar	0,0071
Brazil	0,0922	North Korea	0,0295	Kirguistan	0,0071
Switzerland	0,0882	Yugoslavia	0,0289	Macedonian Republic	0,0071
Ethiopia	0,0835	Leetonia	0,0289	Sri Lanka	0,0071
Czech Republic	0,0756	Thailand	0,0277		

4. CONCLUSIONS

The results obtained with the evaluation model proposed in this paper are fairer than those obtained using the traditional model, the Lexicographic Multicriteria Method, because it considers simultaneously all medals.

The proposed model classified better countries having few gold medals but with a considerable number of silver and bronze medals. In the model with fixed weights we notice that Salt Lake City 2002 Winter Olympic Games results has little influence due to the low average weight assigned to the medals earned in these games. As a consequence, countries, particularly Norway, ended up in a best position with the use of the first model that allows each DMU to optimise its weights. An interesting question is if the winter games are of little importance as implied in the results of our model.

Concerning theoretical aspects, we can point out that the withdrawal of an efficient DMU from the set the DMUs used to calculate the average weights leads to a model with unique solutions, without the complexity of the classical cross-evaluation approach. Furthermore the use of weight restrictions altogether with average weights avoids the problem of unreal weights mentioned by Anderson et al (2002).

For future works, we suggest to carry on the developments of smoothed frontiers in order to deal with DEA models used in this paper. It will be also interesting to study the importance of each competition within the same games.

Appendices 1. Outputs for the proposed DEA model.

DMU	***g-S***	***s-S***	***b-S***	***g-SL***	***s-SL***	***b-SL***
Algeria	1	1	3	0	0	0
Argentina	0	2	2	0	0	0
Armenia	0	0	1	0	0	0
Australia	16	25	17	2	0	0
Austria	2	1	0	2	4	10
Azerbaijan	2	0	1	0	0	0
Bahamas	1	1	0	0	0	0
Barbados	0	0	1	0	0	0
Belgium	0	2	3	0	0	0
Brazil	0	6	6	0	0	0
Bulgaria	5	6	2	0	1	2
Byelorussia	3	3	11	0	0	1
Cameroon	1	0	0	0	0	0
Canada	3	3	8	3	2	8
Chile	0	0	1	0	0	0
China	28	16	15	1	2	2
Colombia	1	0	0	0	0	0
Costa Rica	0	0	2	0	0	0
Croatia	1	0	1	3	1	0
Cuba	11	11	7	0	0	0
Czech Republic	2	3	3	1	0	1
Denmark	2	3	1	0	0	0
Estonia	1	0	2	1	0	2
Ethiopia	4	1	3	0	0	0
Finland	2	1	1	4	2	1
France	13	14	11	4	5	2
Georgia	0	0	6	0	0	0
Germany	14	17	26	11	16	7
Greece	4	6	3	0	0	0
Holland	12	9	4	3	5	0
Hungary	8	6	3	0	0	0
Iceland	0	0	1	0	0	0
India	0	0	1	0	0	0
Indonesia	1	3	2	0	0	0
Iran	3	0	1	0	0	0
Ireland	0	1	0	0	0	0
Israel	0	0	1	0	0	0
Italy	13	8	13	3	2	4
Jamaica	0	4	3	0	0	0
Japan	5	8	5	0	1	1
Kazakhstan	3	4	0	0	0	0
Kenya	2	3	2	0	0	0
Kirguistan	0	0	1	0	0	0
Kuwait	0	0	1	0	0	0
Leetonia	1	1	1	0	0	0
Lithuania	2	0	3	0	0	0
Macedonia Republic	0	0	1	0	0	0
Mexico	1	2	3	0	0	0
Moldavia	0	1	1	0	0	0
Morocco	0	1	4	0	0	0
Mozambique	1	0	0	0	0	0

New Zealand	1	0	3	0	0	0
Nigeria	0	3	0	0	0	0
North Korea	0	1	3	0	0	0
Norway	4	3	3	11	7	4
Poland	6	5	3	0	1	1
Portugal	0	0	2	0	0	0
Qatar	0	0	1	0	0	0
Romania	11	6	9	0	0	0
Russia	32	28	28	5	7	3
Saudi Arabia	0	1	1	0	0	0
Slovakia	1	3	1	0	0	0
Slovenia	2	0	0	0	0	1
South Africa	0	2	3	0	0	0
South Korea	8	9	11	2	1	0
Spain	3	3	5	3	0	0
Sri Lanka	0	0	1	0	0	0
Sweden	4	5	3	0	2	4
Switzerland	1	6	2	3	2	6
Taiwan	0	1	4	0	0	0
Thailand	1	0	2	0	0	0
Trinidad and Tobago	0	1	1	0	0	0
Turkey	3	0	1	0	0	0
Ukraine	3	10	10	0	0	0
United Kingdom	11	10	7	1	0	2
United States	39	25	33	10	11	9
Uruguay	0	1	0	0	0	0
Uzbekistan	1	1	2	0	0	0
Vietnam	0	1	0	0	0	0
Yugoslavia	1	1	1	0	0	0

Appendices 2. Efficiencies and variables weights.

DMU	*Efficiency*	*Weight*					
		g-S	*s-S*	*b-S*	*g-SL*	*s-SL*	*b-SL*
Algeria	0,0516	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Argentina	0,0412	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Armenia	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Australia	0,5979	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Austria	0,1496	0,0079	0,0079	0,0079	0,0079	0,0079	0,0079
Azerbaijan	0,0513	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Bahamas	0,0291	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
Barbados	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Belgium	0,0516	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Brazil	0,1237	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Bulgaria	0,1553	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
Byelorussia	0,1753	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Cameroon	0,0256	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Canada	0,2126	0,0079	0,0079	0,0079	0,0079	0,0079	0,0079
Chile	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
China	0,7180	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Colombia	0,0256	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Costa Rica	0,0206	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Croatia	0,0816	0,0204	0,0000	0,0000	0,0204	0,0000	0,0000
Cuba	0,3204	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
Czech Republic	0,0841	0,0094	0,0094	0,0094	0,0094	0,0000	0,0000
Denmark	0,0680	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
Estonia	0,0472	0,0079	0,0079	0,0079	0,0079	0,0079	0,0079
Ethiopia	0,1026	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Finland	0,1225	0,0204	0,0000	0,0000	0,0204	0,0000	0,0000
France	0,3956	0,0089	0,0089	0,0089	0,0089	0,0044	0,0000
Georgia	0,0619	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Germany	0,7165	0,0079	0,0079	0,0079	0,0079	0,0079	0,0079
Greece	0,1359	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
Hungary	0,2136	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
Iceland	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
India	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Indonesia	0,0619	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Iran	0,0769	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Ireland	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Israel	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Italy	0,3505	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Jamaica	0,0722	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Japan	0,1856	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Kazakhstan	0,0971	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
Kenya	0,0722	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Kirguistan	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Kuwait	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Leetonia	0,0309	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Lithuania	0,0516	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Macedonia Republic	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Mexico	0,0619	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Moldavia	0,0206	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Morocco	0,0516	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Mozambique	0,0256	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000

Netherlands	0,3284	0,0149	0,0075	0,0000	0,0149	0,0075	0,0000
New Zealand	0,0412	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Nigeria	0,0309	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
North Korea	0,0412	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Norway	0,3061	0,0204	0,0000	0,0000	0,0204	0,0000	0,0000
Poland	0,1651	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
Portugal	0,0206	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Qatar	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Rumania	0,2821	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Russia	0,9072	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Saudi Arabia	0,0206	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Slovakia	0,0516	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Slovenia	0,0513	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
South Africa	0,0516	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
South Korea	0,2887	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Spain	0,1308	0,0094	0,0094	0,0094	0,0094	0,0000	0,0000
Sri Lanka	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Sweden	0,1417	0,0079	0,0079	0,0079	0,0079	0,0079	0,0079
Switzerland	0,1575	0,0079	0,0079	0,0079	0,0079	0,0079	0,0079
Taiwan	0,0516	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Thailand	0,0309	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Trinidad and Tobago	0,0206	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Turkey	0,0769	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Ukraine	0,2371	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
United Kingdom	0,3107	0,0194	0,0097	0,0000	0,0000	0,0000	0,0000
United States	1,0000	0,0256	0,0000	0,0000	0,0000	0,0000	0,0000
Uruguay	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Uzbekistan	0,0412	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Vietnam	0,0103	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000
Yugoslavia	0,0309	0,0103	0,0103	0,0103	0,0000	0,0000	0,0000

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