Demographic Study of Cuban Freemasons: A Technical Discussion

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Abstract

Cuban Freemasons are one of the oldest, largest and geographically most widely spread organizations of Cuban civil society. We examine the evolution of Freemasons in Cuba, using annual membership data from the Grand Lodge, in Havana. Defining the equivalent of population at risk, a new Masonic indicator is derived. Using Immigration and Naturalization Service data, we estimate the number of Freemasons that left Cuba in the wake of Castro's revolution. Using United Nations data, we estimate deceased Masons. Using annual membership data, we estimate the number of Communist Party and administration officers that may have joined the Freemasons. We thus describe the evolution of members of the Grand Lodge, through the second half of the XX Century, and through the seven epochs of Cuban sociopolitical developments, that we have identified.

Key Words: demographic study, statistical modeling, time series, Freemasons

1. Introduction

We present a technical discussion of the statistical methods used in a Demographic Study of Cuban Freemasons, by Romeu and Pardo (2010a), submitted to the Grand Lodge of Cuba (GLC). Implications for the Cuban Freemasons (CF) are in Romeu (2011a). Implications on Cuban Civil Society are in Romeu (2010b and 2011b). Implications on Cuban political and historical perspectives, are in Romeu (2011c). These papers were presented at conferences in ASCE (Association for the Study of the Cuban Economy), UNAM, and Cuba Futures of Bildner Center/CUNY, in 2010 and 2011.

Romeu, the first author, is a Chartered Statistician Fellow of the Royal Statistical Society, a senior member of ASQ, and a member of ASA. He has taught statistics at Syracuse University and SUNY for 30 years, and he is responsible for the statistical analysis and the conclusions parts of this demographic research.

Pardo Valdés, the second author, is a 33rd Degree Mason, and President of the Academy of Higher Masonic Studies of the GLC, in Havana. He contributed the GLC data used.

The original demographic study was submitted to the GLC in the Spring of 2010. It was a lengthy (seven chapters) but simple statistical analysis of GLC annual membership time series (1945-2008), as well as of its provincial membership. In

addition, some initial considerations regarding the demographic impacts on the GLC organization, were also presented.

Romeu then expanded the research, including Immigration and Naturalization Service (INS) data, United Nations (UN) mortality rates, and Cuban population census data. To answer several research questions of interest Romeu used an approach similar to that of Minard (Tufte, 1980) in his analysis of the retreat of Napoleon's army from Russia, in 1808. Research questions included: (1) characterizing the CF and investigating how they evolved in time; (2) employing Minard's approach, identifying possible factors affecting GLC trajectory; and (3) developing statistical models that help explain GLC trajectory, and obtaining factor weights, significance levels, etc. As a result, a number of papers dealing with the different aspects of the problem under study, already mentioned above, have been written and presented to different forums.

In the rest of this paper we will provide an overview of CF. We will first summarize the demographic study results, discussing in detail the statistical considerations used in their development. Finally, we give some conclusions and discuss further work.

2. Background

In our research we only analyze data from the GLC: i.e. 1st, 2nd and 3rd degree, or *Blue Lodge* masons. We have not included in our analyses, data from Masonic organizations of the higher degrees (i.e., 4th to 33), or data of other Cuban para-Masonic organizations, such as Caballeros de la Luz and Odd-Fellows.

Masons define themselves as the "*organization of morality*", whose purpose is "*to make some good men, better*". Masons are independent of government, discourage discussions about politics or religion, and admit only adult men of good conduct and health. They claim to be tolerant, to do good works, and to practice brotherhood among their members. Perhaps because of these characteristics, men of the stature of Washington, Juarez, Bolivar and Marti, in the XIX Century, and of Salvador Allende, Lazaro Cardenas and Winston Churchill, in the XX Century, were attracted to, and have joined, the Freemasons.

We will not discuss the origins of Freemasons in this paper. Readers interested in their history are referred to Harwood (2007). For a history of CF, readers are referred to Miranda (1933). For contemporary developments of CF/GLC, readers are referred to Torres-Cuevas (2003).

The study of the GLC is of importance because, with over 150 years, it is one of the oldest organizations of Cuban civil society. It is one of the largest, with about 30,000 members nation-wide, gathered in over 300 lodges, in every town and province. CF has traditionally admitted members of all races, social classes, political persuasions, and religions. Finally, CF has actively participated in Cuba's struggle for independence, and many of Cuba's founding fathers were freemasons, including Jose Marti.

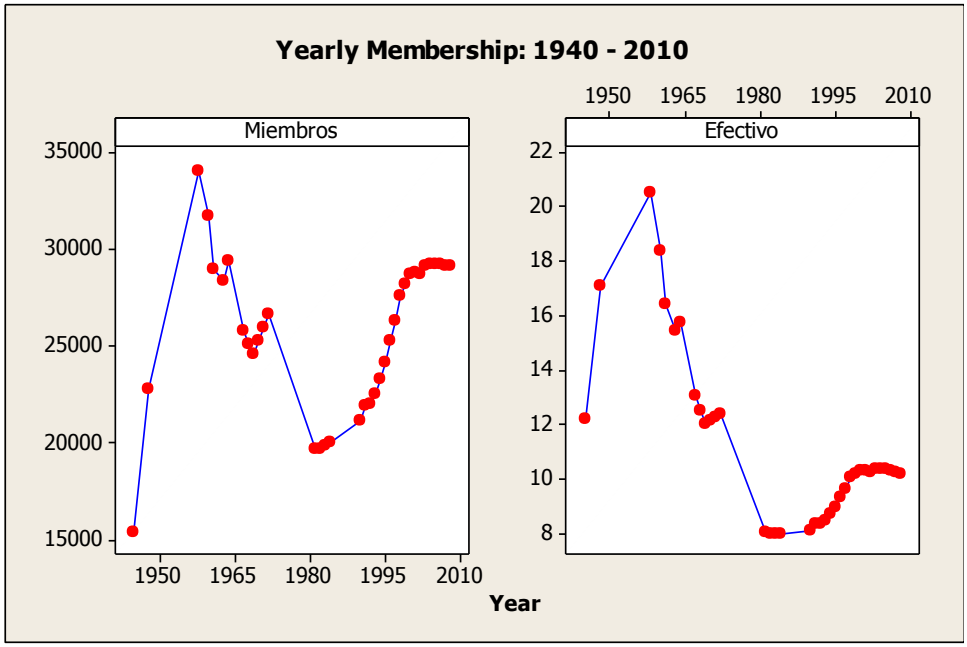
Therefore, due to its wide and diverse membership, GLC can be considered an important sub-population for studying Cuban socioeconomic and political issues.

This is especially important, given that there are few other independent groups of its size and diversity, with a complete membership dataset, starting before the 1959 revolution. For, other comparable civil society organizations either have no data, are too small, too regional, too specific or too narrowly designed.

3. Statistical Study Summary and Discussion

The annual GLC membership time series is shown in Figure 1. Part A (left) shows the annual members, in thousands. Part B (right) shows what we call annual *Effective Masons*.

Figure 1. Yearly GLC membership: A) Total Masons; B) Effective Masons.



Since women cannot join the Freemasons, neither men below the ages of 21, nor the sick, or those with criminal records, or very poor, this reduces the *population at risk* to approximately one-fourth of the total Cuban population (inter-census yearly results were obtained by linear interpolation). Such ratios yield the number of CF, per thousand men, eligible for belonging to the GLC. The *Effective Masons* indicator allows a fair comparison of GLC membership across regions, and across different time periods. For, the *Effective Masons* indicator considers the effect of population size and growth.

Freemasons have lost membership in many countries during the second half of the XX Century. For example (Morris, 2003) in 1960, of 180 million US citizens, there were 4.1 M Freemasons, yielding 91.5 *Effective Masons*. In 2000, such indicator had dropped to 25.6 per 1000 eligible: almost a four-fold reduction.

Table 1. Freemasons in Cuba and the US, in the 2nd Half of the XX Century

	Year	Population	Masons	/1000s	Effective
USA	1960	179,323,175	4,103,000	22.8	91.5
	2000	281,421,906	1,800,000	6.4	25.6
Cuba	1959	6000000	34000	5.7	22.8
	2000	11000000	29000	2.6	9.6

Besides the mentioned paper by Morris, and the two volumes by Ayala (1991, 1993), we have not found much other quantitative information or analyses, regarding Freemasons.

In Cuba, however, and due to the political and economic changes brought in by the 1959 revolution, the situation developed differently. Membership first follows a stronger decay than abroad. Then, after 1990, the GLC recovers strongly (Figure 1). Highlights of such membership figures, by decade, for Total and *Effective Masons*, are in Table 2. They include Total and Effective members; percent of total and effective membership increase both, per the entire time period and its average per year. Bolded are two extreme figures in the membership series, occurring in 1958 (maximum) and in 1981 (minimum).

Table 2: Highlights of annual GLC membership, approximately every ten years.

			Total	Members	Miembros	Efectivos
KeyYear	Total	Effective	TotPrcTMbr	AvAnualTM	TotPrdMbEf	AvgAnualEf
1945	15361	12.17	*	*	*	*
1958	**34025**	**20.5**	**122.0%**	**9.0%**	**68.0%**	**5.0%**
1968	25824	12.47	-24.0%	-2.5%	-40.0%	-4.0%
1971	26659	12.28	3.0%	0.0%	-1.5%	0.0%
1981	**19690**	**7.98**	**-26.0%**	**-2.4%**	**-35.0%**	**-3.2%**
1991	21962	8.35	12.0%	1.3%	4.6%	0.5%
2000	29225	10.3	33.0%	3.6%	24.0%	2.6%
2008	29110	10.2	0.0%	0.0%	0.0%	0.0%

There is an accelerated membership growth between 1945 and 1958, followed by an accelerated decay, between 1959 and 1968. There is a second pronounced decay, from 1971 to 1980. Some growth occurs in the 1980s. Then, we observe a strong growth in the 1990s, followed by a period of stabilization, at about 30 thousand, from 2000 onwards.

To answer the research question "what happened" during these years, we paired the GLC time series with simultaneous Cuban historical events. Then, we used the series change-points to determine the start and end dates of specific epochs. Then, we obtained linear regressions on time, for the seven periods identified. Growth and decay segments were statistically significant. Trends for the short periods of transition were non significant. As a result of all this work, seven historical periods (Table 3), consistent with historical epochs, were established.

The *historical events*, in each of the seven epochs of Table 3, correspond to the most important political, economic, and social activities occurring in Cuba, at the time. The implications and meaning of such events on their periods lie outside

the present technical discussion. The interested reader is directed to the papers mentioned in the introduction. Their importance lie in that we were able to (1) establish coherent historical periods, based on the GLC time series, (2) to flag candidate events, that characterized each of these periods, as possible factors in their corresponding epochs, and (3) to validate the GLC data analyzed.

We will return to the GLC time series, when we discuss the derivation of statistical models that help explain such time series behavior.

Table 3. Historical periods derived from GLC annual membership time series:

Historical Epoch	**Years**	**Membership Trend**	**Relevant Events**
Before the revolution	1945-1958	Accelerated growth	Grau, Prío and the struggle against Batista
First Years after the revolution	1959-1969	Accelerated reduction	Emigration; B. Pigs; October Crisis; Revol. Ofensive; UMAP
Second Revolutionary Period	1970-1976	Slower reduction Missing Data.	Zafra de los 10 Millones; End of Legal Emigration
Third Revolutionary Period	1977-1980	Accelerated reduction	State Economy; Visits from “Community”; Mariel
Fourth Revolutionary Period	1981-1990	Slower growth Missing Data	Gorbachev;Disolution of USSR; Economic Liberalization after the Mariel Boatlift:
Fifth Revolutionary Period	1991-2000	Accelerated growth	IV Congress of PCC; Special Period; Rise of Tourism
Sixth Revolutionary Period	2001 to date	Stability	New Millenium; Tourism; Support from Venezuela

Slow reduction (1970-76) and slow growth (1981-90) periods can be appreciated better through the *Effective Masons* time series (Part B of Figure 1).

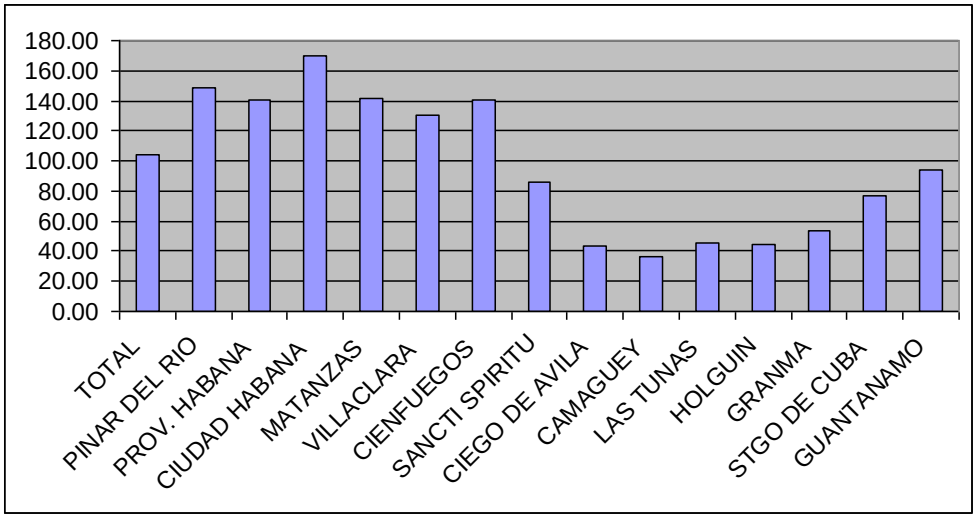
Another research question of interest deals with the nature and extent of the GLC membership. The Cuban territory is not homogeneous. The western part of the island is more urban, richer and more densely populated than the eastern part. To analyze such effect, we looked at the GLC *Effective Masons* data by provinces, circa 2007 (Table 4). For such indicator allows fair comparisons across regions. We noticed how the number of lodges and of CF, in the metropolitan area of Havana was 1/3 of the total. And for the combined western provinces (bolded), this result was over 70% of the total.

Table 4: Provincial annual membership data, circa 2007

PROVINCE	Lodges	Mmbrs	PctLodgs	PctMemb	Efective	Efec/000
TOTAL	316	29127	100	100	10.42	0.01042
PINAR del RIO	**17**	**2706**	**5.38**	**9.29**	**14.9**	**0.0149**
PROV. HABANA	**29**	**2494**	**9.18**	**8.56**	**14.03**	**0.01403**
CIUDAD HABANA	**111**	**9329**	**35.13**	**32.03**	**16.95**	**0.01695**
MATANZAS	**28**	**2370**	**8.86**	**8.14**	**14.14**	**0.01414**
VILLACLARA	**29**	**2667**	**9.18**	**9.16**	**13.05**	**0.01305**
CIENFUEGOS	**14**	**1387**	**4.43**	**4.76**	**14.04**	**0.01404**
SANCTI SPIRITU	11	991	3.48	3.4	8.61	0.00861
CIEGO DE AVILA	8	449	2.53	1.54	4.36	0.00436
CAMAGUEY	14	709	4.43	2.43	3.62	0.00362
LAS TUNAS	6	604	1.9	2.07	4.6	0.0046
HOLGUIN	12	1138	3.8	3.91	4.46	0.00446
GRANMA	10	1104	3.16	3.79	5.37	0.00537
STGO DE CUBA	19	1992	6.01	6.84	7.69	0.00769
GUANTANAMO	7	1187	2.22	4.08	9.36	0.00936

Comparing *Effective Masons* indicators per province (Figure 2) with their Total National Average (=102), we immediately verified the presence of two groups.

Figure 2: Effective Masons indicator (x1000), per province, circa 2007



The Contingency Table (Table 5) implemented shows how Cuba's geographical areas are associated with *Effective Masons*. Western provinces (P. del Rio, Havana, Havana Metro, Matanzas, Cienfuegos and Villaclara), with larger urban populations and stronger economic developments, have larger *Effective Masons* indicators and more lodges, in their more numerous urban centers. A much lower percentage of members and lodges can be found in the largely rural and more sparsely populated provinces of Cuba's Eastern provinces.

We concluded from such Contingency analysis, that CF tends to be an urban phenomenon. That is, CF are stronger in Eastern urban provinces where a higher educational and socioeconomic level prevails. However, in almost every town or village in Cuba, there is at least one Masonic lodge.

Table 5: Contingency table assessing geographical areas and Effective Masons.

	Western / Exp	Eastern / Exp	Totals
EffMasons < 10.4	0 / 3.43	8 / 4.57	8
EffMasons > 10.4	6 / 2.57	0 / 3.43	6
Totals	6	8	14

To help explain the annual membership development of the GLC, we developed a time series model that describes the membership flow in any organization:

Members CurrentYear = Members PreviousYear – Losses + Gains

In the case of the GLC we break down such Losses and Gains into:

Gains = New members (affiliations) + Re-affiliations
Losses = Withdrawals + Deaths + Politically_Motivated

Withdrawals refer to those members who become disillusioned with, and leave, their organization. *Politically motivated* losses include: (1) emigration due to the revolution; (2) left (or never joined) the GLC due to adverse government policies toward CF; (3) left (or never joined) the GLC because the revolutionary ideology was more attractive to them, than Freemasonry.

Our Forecast is based on Equation (1) below:

$$x_t = x_{t-1} - \alpha_{1;t-1} y_{t-1} / 4 - \alpha_2 x_{t-1} - \alpha_3 x_{t-1} + \alpha_4 x_{t-1} + \varepsilon_t \quad (1)$$

Where x_t represents *membership* in the GLC for Year t, $\alpha_{1;t}$ represents *Effective Masons coefficient* for year t, y_t represents the yearly *immigrants* to the USA for year t (divided by four because half are women, and of the remaining half, still one half is composed of males who are either too young, too old, have criminal records, physical, or mental problems, to become masons). The remaining coefficients are: α_2 *deaths*; α_3 *politically-related* (adverse and positive) withdrawals; α_4 and *new affiliations*. Finally, ε_t is the model *white noise*, distributed normally.

Using statistical model (1) we obtained the numerical results in Table 6, where x_t is represented by (**TotMason**) and y_t is represented by (**TotEmig**).

The model's annual E*ffective Masons* coefficient $\alpha_{1;t} = 1.5$ is 50% higher than the corresponding average annual E*ffective Masons* coefficient. We use such value because a majority of those who emigrated, in the 1960s, were mainly from the middle class and from Cuba's *urban western provinces*. Recall, from Table 4,

how Western provinces have a 50% larger E*ffective Masons* coefficient than the national average. The annual coefficient of mortality used (α_2) is 1%, which is also 50% larger than the mortality reported by the UN for Cuba in the year 2000. We use this value because freemasons tend to be older men, and UN mortality rates reported, are for the general population.

Membership drops ($\alpha_{3,1}$) result from the sum of: 0.67% membership drops due to preferring the new ideology, and another 0.67% ($\alpha_{3,2}$) membership drops due to concerns about government (political or economic) reprisals against CF. We use another 0.67% for defections ($\alpha_{3,3}$) due to finding that the organization is not of their liking. Hence, $\alpha_3 = 0.2 = 3*0.0067$. Finally, $\alpha_4 = 0.007$ are new affiliations.

The (α_i) coefficient values are based on the following mathematical relation:

For an established time series growth or decay rate *K*, we have: $\sum_{j=1,4} \alpha_j = K$ (2)

Mortality and emigration values are established from hard data. However, coefficients α_3 and α_4 need to be established by judgment and experience. Hence, other values α_3, α_4 could also have been used, as long as they fulfill equation (2).

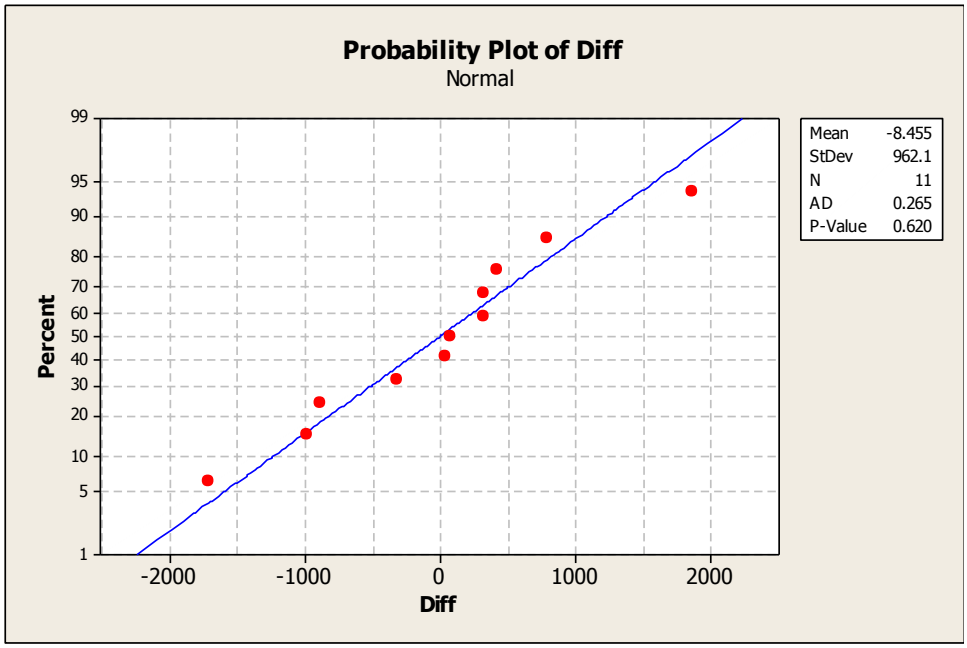
Model (1) appears reasonably acceptable. Anderson Darling test for its residuals (Figure 3) yields a p-value = 0.62 (maybe some serial correlation still remains). Therefore, we assume that the four factors identified are also reasonable and help better explain the problem at hand.

Table 6: GLC 1959-1969 time series model estimations using model (1).

	Initial	Members	1958: 34025	
Year	TotEmig	TotMason	Effective	Eq. (1)
1959	62,800	32889	0.02051	33780
1960	60,781	31753	0.01836	31714
1961	50,857	28992	0.01643	30709
1962	73,632	28663.5	0.01643	27872
1963	15,535	28335	0.01544	27914
1964	15,045	29446	0.01575	27594
1965	25,366	27635	0.01575	28619
1966	55,422	26353.5	0.01575	26672
1967	49,756	25824	0.01308	25503
1968	50,182	25072	0.01247	24995
1969	49,415	24589	0.01202	24273

We then studied the time series and historical events in the decade of the 1970s, where for several years there are no membership data available. This provides yet another measure of the very difficult times through which the GLC went through. Such missing data had to be estimated (in red). Results are given in Table 7.

Figure 3: Anderson-Darling GoF Test Result for model (1):



In 1971 *Freedom Flights* ended. As Portes (1987) says: *by the early 1970s, the middle-class emigration from Cuba had ceased*. The Cuban government had taken over almost all the country's economic activity. Hence, during that decade the GLC membership decline came mostly from attrition and deaths, which were uncompensated –due to political concerns- by new affiliations.

In 1977, relationships between Cuba and the USA improved following the new Human Rights policy introduced by American President Jimmy Carter. Meetings between the Cuban government and a Committee of Cuban émigrés in the USA were held in Havana, and some agreements were obtained.

As a result, hundreds of political prisoners were freed, and allowed to leave with their families. The reunification of families was also permitted, whereby several thousand others left the country. Finally, visits to Cuba from émigrés in the US, were allowed. And tens of thousand of them poured into the island.

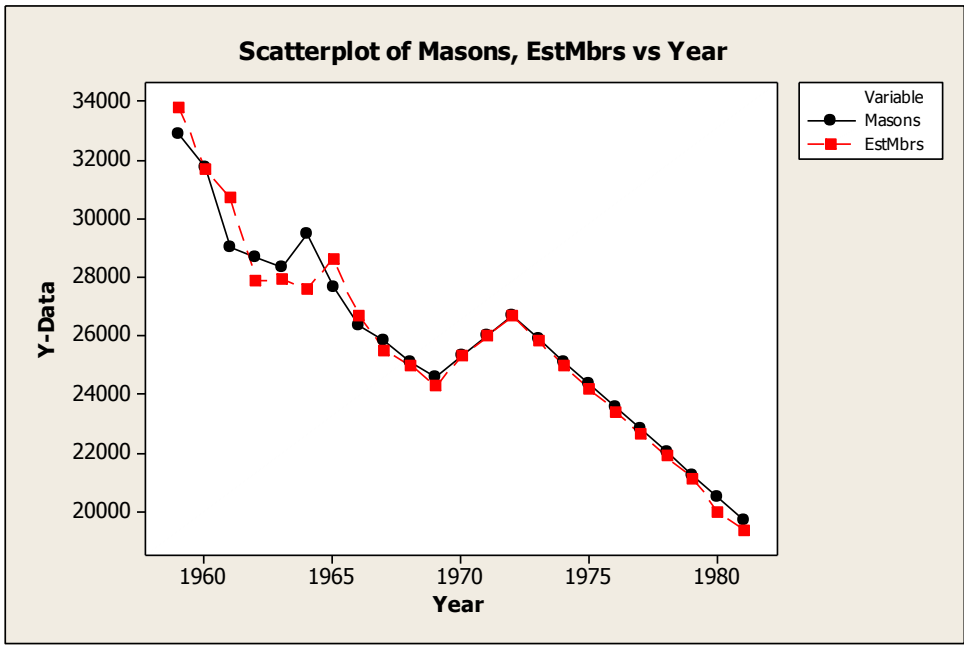
The commotion of these events revived the desires of many to leave the country, leading to the entrance of ten thousand into the Peruvian Embassy, and to the exodus of over 120 thousand more, during the Mariel Boatlift, in 1970. The result of all this activity, on the GLC membership, is reported in Table 7.

Tabla 7: GLC real and estimated membership in the decade of 1971-1980

Year	Members	Population	Emigration	Effective	Eq. (1)
1970	25295	8321400	49220	0.0122	22828
1971	25968	8461670	43323	0.0122	24288
1972	26659	8601940	11489	0.0122	25085
1973	25885	8742210	0	0.0120	25806
1974	25110	8882480	0	0.0115	24980
1975	24336	9022750	0	0.0110	24181
1976	23562	9163020	0	0.0105	23407
1977	22787	9303290	0	0.0100	22658
1978	22013	9443560	15000	0.0095	21879
1979	21239	9583830	15000	0.0090	21129
1980	20464	9724100	145000	0.0085	19990
1981	19690	9864370	0	0.0080	19351

The 1970s are analyzed using equation (1), in Table 7. Since there are no GLC membership reports from 1973 to 1980, decreasing *Effective Masons* coefficients were obtained by judgment. Due to the decade intense political environment, $\alpha_{3,1}$ and $\alpha_{3,2}$ were increased to 0.1, and α_4 decreased to 0.5. For completion, we also obtained linear estimations for the GLC missing annual membership (in red). The real and estimated data, for the period 1960 to 1980, are plotted in Figure 4.

Figure 4: Graphical comparison of real and estimated GLC membership 1960-80.



The graphs for the GLC reported membership, and its estimation via (1), for the period 1960-80, are close. This shows how Equation (1) fits. Also notice how, after 1972, there are six consecutive years without reported data. Finally, in 1981, GLC membership reported is 19,690; the lowest for the entire period analyzed.

We summarize the regression analyses results of the growth, decay and stable trends of these seven epochs, in Table 8. **Coef/Reg** denotes the regression coefficients, for annual GLC total membership data on year, with their statistical significance and R2. For periods 1970-76 and 1977-80, where there was no GLC reported data, we estimated the total yearly membership via (1). Regression trends agree with our qualitative analyses and interpretations.

Table 8: Regression analysis summary, for the seven historical epochs

Year	Trend	Coef/Reg	p-val	R^2
1945-58	Growth	1430.6	0.025	0.95
1959-69	Decay	-712.1	0.001	0.89
1970-76*	SlowDecay	-389.9	0.048	0.57
1977-80*	Decay	-782.5	0.001	0.98
1981-91	SlowGrowth	184.3	0.001	0.99
1992-00	Growth	907.9	0.001	0.97
2001-08	Stable	58.3	0.078	0.42

Another research question of interest consisted in exploring the extraordinary growth that the GLC experimented during the 1990s, and in determining possible reasons for such growth. Estimations for this decade (Table 9) were obtained via two different growth rates: before (0.021) and after (0.03) 1992.

Table 9: Cuban population, GLC members, and growth rates in the 1990s

Year	Population	Members	Effective	IV.PCC	Before.91	Diff.
1990	10433000	21153	8.1100	**0.03**	**0.021**	*
1991	10574800	21918	8.3466	21788	21597	190
1992	10645700	21962	8.3073	22441	22051	390
1993	10716600	22539	8.4688	23114	22514	601
1994	10787500	23321	8.7046	23808	22987	821
1995	10858400	24169	8.9619	24522	23469	1053
1996	10929300	25301	9.3203	25258	23962	1296
1997	11000200	26344	9.6416	26016	24465	1550
1998	11071100	27635	10.0489	26796	24979	1817
1999	11142000	28173	10.1789	27600	25504	2096
2000	11176406	28689	10.2994	28428	26039	2389

During the 1990s, two important national events took place. First, the 1992 Communist Party Congress allowed its members, as well as government officials, to join churches and the CF, and vice-versa. Second, the dissolution of the Soviet Union caused the worse economic crisis in contemporary Cuba. The government, to alleviate the crisis, promoted international tourism. New joint ventures with international hotel consortiums were formed. The new economic activity made working independent of the government -up to then practically the sole national employer- again possible. This created a larger degree of individual freedom.

As a result, three new groups of people became interested in joining the GLC: communist party *members*, government *officials*, and ordinary Cuban *citizens*, up to then *concerned* with enduring governmental economic or political reprisals, due to such CF membership.

We estimated *new members*, due to the above stated new national conditions, using the difference between the growth rates of the 1980's (0.021**),** before the PCC Congress and the beginning of international tourism, and the 1990s (0.03), after these events occurred. Both estimates, as well as their Difference (a point estimate of such *new* affiliations for the year) appear in Table 8.

For example, in the year 2000, of a total of n = 28689 members of the GLC, there were $\sum X = 2389$ such *new members*. Hence, a point estimator of such proportion in the total membership is $p = \sum X/n = 0.083$. A crude 95% confidence interval for such proportion is: (0.0801, 0.0865). Hence, we can state with 95% confidence that, out of the 28428 GLC members in year 2000, anywhere from 2297 to 2481 were new members from the three groups mentioned.

4. Conclusions

This is an on-going research and we have just described, due to lack of space, a small part of it. Therefore, in subsequent papers we will continue with these analyses and pursue additional avenues. These will include estimations of current growth and attrition rates, and the extension of model (1) beyond 1980.

However, comparing relevant historical events with trends detected we identify some factors that appear to have impacted the GLC membership throughout these times, and that are discussed in detail in the papers mentioned in the Introduction. We summarize these factors, below:

1. A free economy that allows independent employment (from government), enhances GLC membership. Such occurs in the epochs of (1945-1958) and (1990s onward).
2. Less dependence from government political supervision enhances GLC membership. Such occurs in the epochs of (1945-1958) and (1990s onward).
3. When emigration is an option, the GLC membership decreases. Such occurs in the epochs of (1959-1970) and (1977-1980).

Statistical considerations in model (1) include the following. First, our use of the *Effective Masons* indicator, in lieu of Total Members, is a relevant result. It has allowed us to compare, on fair grounds, GLC membership data from over half a century, as well as between very different provinces, and even between Cuba and the USA. This is possible because *Effective Masons* considers total population effect. Clearly, it is not the same to have ten thousand masons in a population of one million, than in a population of ten million.

The total and provincial Cuban population obtained from Census data, has been interpolated linearly, to account for yearly data. Death rates have been taken from UN tables, adjusted using judgment, to reflect CF older membership. Emigration data was taken from the INS. These are hard data.

Our estimation of Effective Masons as 1.5 times the average *Effective Masons* is based on two facts. First, most CF are in the Western, more urban and developed provinces. Then, not all Cubans immigrate to the USA. Many have emigrated to Latin America, Spain, and other European countries. Hence, even when taken as 1.5 times the average yearly *Effective Masons*, CF abroad is still a Lower Bound for emigration figures. The coefficients for GLC politically motivated desertions and affiliations have been assigned by judgment and experience.

Finally, model (1), developed to describe the time series of GLC membership, shows a good fit for the 1960-1970 decade. In addition, it is able to rationally recuperate missing data from the 1971-1980 decade. Finally, our use of the *Differential* to estimate the proportion and number of new elements that joined the GLC in the 1990-2000 decade is also rationally justified.

Acknowledgements

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