The Economic Impact of Migration of Puerto Rico: 2000-2017

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Introduction

According, to the Statistical Institute[1] through the decades with periods of more or less movement, the migration of Puerto Ricans between Puerto Rico and the United States have been a constant. The close political relationship between both destinations has facilitated the constant migratory flow that recorded since the beginning of the 20th century. Over time, the migratory movement has resulted in new generations born in the various jurisdictions of the United States that they identify themselves as Puerto Rican. At the beginning of the 21st century, the census 2000 decade exposed an approach regarding the size of the Puerto Rican population in Puerto Rico (3.6 million) and the United States (3.4 million). After a decade, the decennial census most recent in 2010 confirmed that the Puerto Rican population totaled close to 8.2 million people, with a majority in the United States (4.6 million) compared to Puerto Rico (3.6 million). In recent years, the growth pattern of the Puerto Rican population in the United States It has continued, this in turn accelerated by high emigration from Puerto Rico. Historically, this population is known for being located in the Northeast region of the United States. Nevertheless, in the last 13 years there has been a considerable increase in states in the southern region such as Florida and Texas. However, by contextualizing the Puerto Rican population with the total population A different demographic scenario emerges from each state. For example, in terms Proportional, Puerto Ricans have the largest presence in the state of Connecticut. Inclusively, the state of Hawaii turns out to be among the first ten states with the

[1] Statistical Institute of Puerto Rico, various years.

highest proportion Puerto Rican population. On the other hand, the state of Texas, even with the high volume of emigrants who have received from Puerto Rico in the last decade, the population identified as Puerto Rican does not reach one percent of its population.

The reduction in the population of Puerto Rico between the 2000 and 2010 and 2010 to 2017[2] makes it imperative that we study the migratory trends of Puerto Rico in the last two decades. The constant movement of people who enter and leave Puerto Rico for migratory reasons affects the way that the population, society and economy of Puerto Rico are transformed. This document presents a look at the migratory movement of Puerto Rico and its impact on the Puerto Rican economy in terms on output, employment, GNP components and income reduction. The information was mainly taken from the Statistical Institute[3] that in turn used as a source the U.S. Community Survey, Census Bureau, as well as U.S. air passenger movement data. Bureau of Transportation Statistics, and of the Puerto Rico Ports Authority.

According to the Community Survey, between 2005 and 2009 more than 300 a thousand people residing in Puerto Rico moved to the United States and just over 160 thousand people moved from the United States to Puerto Rico. This leaves us with a migratory balance with the United States of -144 thousand people in the last 5 years of decade 2000 to 2009, which represented almost 4 percent of the population of Puerto Rico in the last decade.

This migratory movement affects the quantity and quality of the human resources available in Puerto Rico. Therefore, the capacity to offer services and the need for services to serve the population evolve as migration causes changes in the population structure. Also, migration can drive or stop economic activity and economic growth in Puerto Rico. This was observed in the middle of the last century when the great migratory movements caused abrupt changes in the population, social and economic composition of Puerto Rico. A profile of emigration for this period shows that migration contributed to accelerate the aging of the population in the last 5 years of the decade and emigrants had a relatively higher educational level than immigrants, according to the Community Survey.

[2] Year 2017 was the last year the author could found information on migratory movement
[3] This work draw heavily on migration repots published annually by The Statistical Institute.

Migration 2010-2017

The emigration trend worsened, in the current decade (2010-2017), in net terms: 458 thousand people emigrated to the United States based on the Community Survey. The ten states with the highest emigration from Puerto Rico (2017) were Florida, Pennsylvania, Massachusetts, New York, Texas, New Jersey, Connecticut, Ohio, Georgia, and North Carolina. Between 2016 and 2017, the profile of the population that migrated between Puerto Rico and the United States changed in various ways according to data from the Community Survey. The median age of the migrant population increased slightly from 29.5 to 30.1 years, and immigrants were younger with a reduction in the median age from 29.9 to 29.1 years. The year 2017 was the first time, since 2010, that the emigrant population was older than the immigrant population. The percentage of the emigrant population with some post-secondary education had a slight reduction from 57% to 56%; This percentage of people for the immigrant population decreased from 48% to 38%. The percentage of the emigrant population that are outside the force (after migrating) increased from 38% to 43% and in immigrants it increased from 58% to 60%. The median income of immigrants and immigrants between Puerto Rico and the United States decreased by 11 and 2 percent, respectively. By 2017, 37% of emigrants and 50% of immigrants lived in poverty according to data from the Community Survey.

In this work we will tried to offer and estimate of the economic impact of net migratory movements in term of it direct and indirect impacts on the different components of final demand (GNP components, specially consumption expenditures) output, employment and income (compensation to employees).

Source of Data and Methodology

Source of Data

The model and data used in this work mainly consist of the following sources:

1. Statistical Institute of Puerto Rico annual reports
2. Puerto Rico Planning Board, Economic Report to the Government (specially, data included in its statistical appendix)

Puerto Rico Planning Board, Input-Output Tables (mainly Tables for years 2002 and 2007).

Estimate by the author of an Input-Output Table for year 2012 (using NAICS industry classification).

Methodology

The methodology used in this work refers to economic impacts. I do not deal with discussions related to other types of impacts (sociological, political or other social).

Methodology and Source of Data

The following steps were used in our methodology. The principal sources of data for this work were the Statistical Appendixes (2000-2009 and 2010 -2017) to the Economic Report to the Government and the Input-Output tables published by The Puerto Rico Planning Board) and the publications of the of Statistical Institute of Puerto Rico. From table 2 of the Statistical Appendix, we took data on consumption expenditures disaggregated by its components, consumption of durable goods, non-durable goods and services. Other components of final (Investment, Government Expenditures and others) demand were also analyzed. All these components were expressed in per-capita terms (divided by population of each year). The procedure was done separately for two periods, 2000-2009 and 2010-2017 following data source available from the Statistical Institute of Puerto Rico. According to this Agency the of total net migration for the first period amounted to 144,000 persons. This figure was not published on per year basis, therefore an average per year was obtained by dividing the total 144,000 by each of the 10 years period to obtain an average (14,400) for each year. Once we estimated the net migrants average per year the results were multiplied by per capita consumption and other component of Gross National Product (GNP) to obtain the reduction in each component. Table1 illustrates the procedure and the direct[4] results for selected years.

[4] The direct and indirect impacts are obtained by solving the Input-Output model, shown later in this work.

TABLE 1				
ESTIMATION OF MONETARY LOSSES OF NET MIGRATION				
	2000	**2002**	**2005**	**2009**
Gross National Product (in million $)	**41,418.6**	**45,071.3**	**53,752.4**	**63,617.9**
Personal consumption expenditures	36,132.6	38,844.9	46,535.4	55,122.1
Durable goods	4,610.0	4,612.0	5,512.8	5,204.7
Nondurable goods	14,633.8	15,392.7	17,976.8	21,958.7
Services	16,888.8	18,840.2	23,045.9	27,958.7
Population	3,807,987	3,849,308	3,903,455	3,751,000
Per-Capita Consumption (in dollars)				
Personal consumption expenditures	9,489	10,091	11,922	14,695
Durable goods	1,211	1,198	1,412	1,388
Nondurable goods	3,843	3,999	4,605	5,854
Services	4,435	4,894	5,904	7,454
Migration: Average per Year	14,400	14,400	14,400	14,400
Monetary Loss (in million $)				
Personal consumption expenditures	136.6	145.3	171.7	211.6
Durable goods	17.4	17.3	20.3	20.0
Nondurable goods	55.3	57.6	66.3	84.3
Services	63.9	70.5	85.0	107.3

Table 2 shows the losses in consumption expenditures for each year from 2000 to 2007. As shown in the table, the total losses in consumption expenditures for the whole period amounted to $1,691.5 billions.

The same procedure, as above, was followed to analyze the second period of 2010 to 2017. Table 3 shows the same information but for selected years for period 2010-2917.

TABLE 2				
ESTIMATION OF MONETARY LOSSES OF NET MIGRATION				
Year	**2010**	**2012**	**2015**	**2017**
GROSS PRODUCT (in million $)	64,294.6	68,085.7	69,602.0	69,999.7
Personal consumption expenditures	56,783.8	60,897.0	61,640.5	62,768.2
Durable goods	5,368.5	6,107.3	5,658.8	5,815.4
Nondurable goods	22,924.6	24,793.9	24,663.2	24,846.3
Services	28,490.7	29,995.8	31,318.4	32,106.5
Population	3,731,000	3,657,000	3,504,000	3,366,000
In Per-Capita terms (in dollars)				
Personal consumption expenditures	14,774.1	15,902.3	17,665.4	18,269.9
Durable goods	1,395.0	1,552.4	1,665.2	1,663.2
Nondurable goods	5,885.5	6,468.6	7,034.4	7,126.1
Services	7,493.6	7,881.3	8,965.6	9,480.6
Migration: Average per Year	28,000	55,000	64,000	77,000
Monetary Loss (in million $)				
Personal consumption expenditures	413.67	874.63	1,130.58	1,406.78
Durable goods	39.06	85.38	106.58	128.06
Nondurable goods	164.79	355.77	450.20	548.71
Services	209.82	433.47	573.80	730.01

Table 4 show the losses in consumption expenditures per year for the period of 2010 to 2017. An analysis of the table shows that the whore period total consumption lost was 7,828.7 billion dollars. During this period two components of consumption were most impacted, durable goods and services.

Direct and Indirect Impact: Input-Output Model.

To estimate direct and indirect impact on output, employment and income we used an Input-output model. The input model was developed in the decade of the 30 by Wassily Leontief culminating in the publication, during 1941, of matrices of the United States for the

years 1919 and 1929. From this period on various countries began to develop the input-output accounting and models. In the case of Puerto Rico, Leontief personally estimated a input-output table for 1947 as part of a project sponsored by the Center for Social Research of the University of Puerto Rico. Henceforth matrices have been estimated for the years 1963, 1967, 1972, 1977, 1982, 1987 and 1992, 2002 and 2007. From 1963 to 2002 the system used to classify industry was the SIC system. The construction of I-O matrix for year 2007 used the NAICS system for the first time in the history of the island. In this work we used this I-O matrix to update the I-O accounts to 2012[5].

Input-Output model enables us to estimate impacts on output, employment and income (wages and salaries). To estimate the direct and indirect impact on output[6], employment and income we need to construct an Input-Output model whose components are the inverse of transaction matrix, the rectangular matrix of final demand and vectors of direct employment and income coefficients. The last Input-Output table published by the Puerto Rico Planning Board (the first using industry codes NAICS) was that for 2007. For this work I updated the whole Input-Output system to year 2012 using a method developed in the University of Cambridge, England [7](the system includes updating the I-O matrix, the value added vector the final demand rectangular matrix, etc. Using the final demand matrix for year 2009 and 2017.

Mathematical Model

One of the fundamental equations of W. Leontief model is as follows:

$$1.\ (I - A)^{-1} F = X$$

5 To Update of the matrix we used the RAS method developed in Cambridge, England. See Richard stone, John Bates y Michael Bacharach, A Programme for Growth (No.3): Input Relationship 1954-1966, Cambridge Department of Applied Economics, England (published in England by Chapman and Hall, Ldt., and in n United States, by M.I.T. Press).

6 Notice that the concept of output in Input–output model is different from the concepts of GNP or GDP.

7 Richard stone, John Bates y Michael Bacharach, A Programme for Growth (No.3): Input Relationship 1954-1966, Cambridge Department of Applied Economics, England (published in England by Chapman and Hall, Ldt., and in USA, by M.I.T. Press).

Where,

$(I - A)^{-1}$

is an inverse square matrix (direct and indirect technical coefficients), **F** is rectangular matrix of final demand (consumption expenditures, investment, Government consumption expenditures and net exports) and **X** is the output. In other words, the solution of the Leontief system is that output is the result of the final demand components multiplied by a matrix of technological coefficients symbolized by the inverse matrix.

In our case we used the vectors of consumption expenditures as our exogenous column vectors and Leontief inverse to obtain direct and indirect output losses and a vector of employment and income coefficients (wages and salaries) to obtain direct and indirect losses in employment and income.

Mathematically,

$$2. \frac{E}{X} = N$$

where E = employment, X = output and N = employment per million dollars of output (coefficient of direct employment requirements). To obtain the direct and indirect employment coefficients we used the following equation

$$3. N(I - A)^{-1} = \varepsilon$$

where ε is the direct and indirect employment coefficient $(I - A)^{-1}$ is the Leontief inverse.

To obtain the impact on wages and salaries (income) the same procedure was used.

Mathematically,

$$4. \frac{S}{X} = \omega$$

Where S = wages and salaries, X = output and ω is direct income coefficient.

To obtain the direct plus indirect income the following equation was used

$$\omega(I - A)^{-1} = \gamma$$

Where, γ is the vector of direct and indirect income coefficients and $(I - A)^{-1}$ is the inverse matrix.

Summarizing,

The model used for the estimation to obtain direct and indirect output losses by emigration looks as follows,

$$5.\ (I - A)^{-1} C_m = X_m$$

Where, C_m is direct direct consumption losses due to emigration, X_m are the direct and indirect losses in output due to emigration and $(I - A)^{-1}$ the inverse matrix,

$$6.\ X_m (N) = L_m$$

Where, L_m are direct and indirect losses in in employment

$$7.\ X_m (\omega) = S_m$$

Where, S_m are direct and indirect losses in income (wages and salaries) due to emigration.

The model was run twice (for period 2000-2009 and 2010-2017)

Results

In this section results are showed. As we told before the results are the of direct impacts using national accounts and direct plus indirect impacts using the Input-Output model.

Impact On Final Accounts

Impact in Consumer Expenditures 2000-2009

Table 2 bellow shows the direct impact on consumption expenditure due to net migration during the years 2000-2009

TABLE 3

CONSUMER EXPENDITURE LOSSES DUE TO NET MIGRATION, 2000-2009

Year	Total Consumer Ecpenditure	Durable Goods	Non-Durable Goods	Sevices
2000	136,636.4	17,433.0	55,338.0	63,865.5
2001	141,410.9	16,861.6	57,867.1	66,682.3
2002	145,316.0	17,253.0	57,583.0	70,479.9
2003	152,511.7	17,174.7	59,736.6	75,600.4
2004	160,780.0	17,589.2	62,077.5	81,113.2
2005	171,671.1	20,336.9	66,317.0	85,017.2
2006	182,428.5	20,756.3	71,391.8	90,280.4
2007	190,125.1	19,893.2	75,845.6	94,386.2
2008	199,019.3	18,953.3	79,854.6	100,211.4
2009	211,612.4	19,980.7	84,298.9	107,332.8
Total	**1,691,511.3**	**186,232.1**	**670,310.0**	**834,969.2**

A look at table 2 shows that losses in consumption due to net migration amounted to 1,681.4 millions of dollars, 2.64% of GNP for year 2009. The service sector was the more negatively impacted following by the non-durables category of consumption.

Impact in Consumer Expenditures 2010-2019

Table 4 shows the same information for years 2010 to 2019 period (in million dollarar).

TABLE 4

CONSUMER EXPENDITURE LOSSES DUE TO NET MIGRATION, 2010-2017

Year	Total Consumer Ecpenditure	Durable Goods	Non-Durable Goods	Sevices
2010	413,674.3	39,059.7	164,793.2	209,821.4
2011	767,348.6	72,547.3	309,791.9	385,009.5
2012	874,627.8	85,384.6	355,771.9	433,471.3
2013	825,664.9	82,805.1	336,165.2	406,694.6
2014	1,121,932.2	116,649.2	457,499.4	547,783.6
2015	1,130,582.6	106,575.3	450,204.6	573,800.9
2016	1,200,556.3	110,215.0	480,358.8	609,980.5
2017	1,406,785.0	128,063.4	548,713.1	730,008.5
Total	**7,741,171.8**	**741,299.6**	**3,103,298.2**	**3,896,570.2**

A glance at table 4 shows a substantial increase in consumption losses over the first period. Losses in consumption expenditures amounted to 7,741.2 million dollars, 11.06% of 2107 GNP. Historically GNP growth rate from 2010 to 2017 was 1.07%, without net migration the rate growth it would have been 1.24%.

The table 4 shows also that the consumer categories more impacted were the consumption of services and durable goods.

Direct and Indirect Impact on Output, Employment and Income

As mentioned before, to estimate the direct and indirect impact losses in output, employment and income due to emigration we used an Input-output model developed in the decade of the 30's by Wassily Leontief. In the case of Puerto Rico, Leontief personally estimated a input-output table for 1947 as part of a project sponsored by the Center for Social Research of the University of Puerto Rico. Henceforth matrices have been estimated for the years 1963, 1967, 1972, 1977, 1982, 1987 and 1992, 2002 and 2007. From 1963 to 2002 the system used to classify industry was the SIC system. The construction of I-O matrix for year 2007 used the NAICS system for the first time in the history of the island. In this work we used this I-O matrix to update the I-O accounts to 2012[8].

Table 5 shows the Input-Output results for period 2000 to 2009

8 To Update of the matrix we used the RAS method developed in Cambridge, England. See Richard stone, John Bates y Michael Bacharach, A Programme for Growth (No.3): Input Relationship 1954-1966, Cambridge Department of Applied Economics, England (published in England by Chapman and Hall, Ldt., and in n United States, by M.I.T. Press).

TABLE 5

ESTIMATES OF DIRECT AND INDIRECT LOSSES IN OUTPUT, EMPLOYMENT AND INCOME DUE TO NET MIGRATION, PUERTO RICO 2000-2009, (MONETARY FIGURES IN MILLION $)

Final demand Components	Final Demand	Direct and Indirect Output	Direct and Indirect Employment	Direct and Indirect Income
Personal consumption expendit	1,692.2	3,514.9	3,263	401.7
Durable goods	186.3	415.8	1,911	43.9
Nondurable goods	670.5	1,504.6	151	150.6
Services	835.4	1,594.5	1,201	207.2
Other Final Demand	3,219.6	6,380.9	3,263	749.9
TOTAL	**4,911.8**	**9,895.8**	**6,525**	**1,151.6**

A look at the table shows that the net migration of 144,000 cost an average estimate losses of $4,911.6 in final demand (GNP), and direct and indirect output of $9,895.8 million of output, 6,525 employment and $1,151.6 million in income.

Table 6 shows the same information for period covering years 2010 to 2017. During the period of 2010 to 2017 net migration was estimated as 454,000. Table 6 shows the same information for period covering years 2010 to 2017.

TABLE 6

ESTIMATES OF DIRECT AND INDIRECT LOSSES IN OUTPUT, EMPLOYMENT AND INCOME DUE TO NET MIGRATION, PUERTO RICO 2010-2017, (MONETARY FIGURES IN MILLION $)

Final demand Components	Final Demand	Direct and Indirect Ouput	Direct and Indirect Employment	Direct and Indirect Income
Personal consumption expenditures	8,466.1	18,677.9	98,413	980.8
Durable goods	784.4	1,880.3	9,430	82.9
Nondurable goods	3,351.2	7,762.8	38,563	335.4
Services	4,330.5	9,034.9	50,420	562.5
Other Final Demand	11,777.8	24,812.3	118,933	1,214.5
TOTAL	**20,243.8**	**43,490.2**	**217,346**	**2,195.2**

During this period, losses in final demand were estimated to be $20,243.8 million dollars. The direct and indirect losses in output, employment and income are estimated in $43,490, 217,346 and $2,192.3 respectively.

Finally the following table summarize the whole period from 2000 to 2017.

TABLE 7

ESTIMATES OF DIRECT AND INDIRECT LOSSES IN OUTPUT, EMPLOYMENT AND INCOME DUE TO NET MIGRATION, PUERTO RICO 2000-2017, (MONETARY FIGURES IN MILLION $)

Final demand Components	Final Demand	Direct and Indirect Ouput	Direct and Indirect Employment	Direct and Indirect Salary Income
Personal consumption expenditures	10,158.3	22,192.8	101,676	1,382.5
Durable goods	970.7	2,296.1	11,341	126.8
Nondurable goods	4,021.7	9,267.4	38,714	485.9
Services	5,165.9	10,629.4	51,621	769.7
Other Final Demand	14,997.4	31,193.2	122,195	1,964.3
TOTAL	**25,155.6**	**53,386.0**	**223,871**	**3,346.8**

Summarizing

Table 7 shows that from 2000 to 2017 the total net migration of the island was an estimate of 598,000 according to the Statistical Institute. This net migration has an important negative result on our economy. In this work it has been estimated that we lost $25,157.6 million in GNP, direct and indirect output $53,386.0 million, 223,871 jobs and 3,346.8 million in worker compensation. To express these results in more simple terms, for the whole period of 2000 to 2017 the island net migration amounted to 598,000. In economic terms, other things equal, by 2017 the gross domestic product would have been $25,156.6 million higher. In terms of direct and indirect impacts the island employment woud have been 223,871 higher and wages and salaries would have been $3,346.8, more than historical figure of 24,435.4 for that year.

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NOTE: The Excel tables available upon request.