Arrested Development? Puerto Rico in an American Century*

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Summary

I consider Puerto Rican growth over the course of the twentieth century. Using a new GDP index, I show that modern economic growth for Puerto Rico begins with American rule. From 1900 to 1940, Puerto Rico does well relative to Latin America and Europe. Puerto Rico escaped the worst ravages of the great depression because of its access to the protected US markets for sugar and textiles and because of large federal transfers. The New Deal led to a fundamental divergence between living stands, as measured by consumption, and productivity as measured by Gross National Income (GNI). The literature concentrates on productivity where performance is mediocre. This is misleading as by 1975 Puerto Rico had achieved close to the highest living standard, as measured by consumption, among Spanish speaking societies.

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*****_Preliminary and incomplete. Comments welcome_

1. Introduction

If Puerto Rico were a US state, it would have the lowest income in the Union. The Puerto Rican record is disappointing given that Puerto Rico experienced rapid growth after the Second World War. Puerto Rican income per capita increased from seventeen percent of the US in 1950 to thirty four percent in 1971 leading Baumol and Wolff (1996) to claim Puerto Rico as an economic miracle on a par with East Asia. The growth spurt petered out in the early 1970's.

There are fundamental questions about the Puerto Rico experience. What explains rapid growth and convergence up to the 1970's? What explains the relative stagnation thereafter? The answers to these questions have obvious implications for Puerto Rico. They may also have lessons for our understanding of growth and convergence generally.

I do not answer the big questions.[1] Rather my goal is to put the Puerto Rican experience over the last century into sharper perspective. The paper has two contributions. The first contribution is to extend the Puerto Rican record backwards. The first four decades of American rule are a statistical dark age. There are no estimates of national income. There are no price or wage indices. These years are important as they saw the economic and social transformations that have shaped Puerto Rican society. To provide some quantitative background, I provide new estimates of GDP from 1900 to 1940. The standard view is that the pre New Deal era was one of stagnation. This appears to be mistaken. The GDP data show that modern economic growth begins with American rule in 1898 rather than the New Deal.

[1] See Bridgeman et al (2012).

The second contribution of the paper is to look at Puerto Rican growth in a broader perspective. The literature on Puerto Rico assumes, for the most part, that the US, and in particular the poorer Southern states, is the yardstick with which to gauge Puerto Rican progress. Put differently, Puerto Rico is the fifty first state. There is merit in this view. Puerto Ricans are, after all, American citizens. For over a century, they have shared a fixed exchange rate and a common monetary policy with the mainland. There is complete factor mobility and the Island receives large transfers from the Federal Government.

Yet the notion that Puerto Rico is the fifty first state is incomplete in many respects. The work in this area typically compares Puerto Rico with the US using income – either personal income or Gross National Income (GNI).[2] The reliance on income measures comes with a cost. There are large differences between productivity, as measured by GNI or personal income, and Puerto Rican living standards, as measured by consumption. The gap between the relative consumption and the income measures is often fifty percent or more in favor of Puerto Rico. The differences arise because Puerto Rican expenditures have exceeded income by a large margin for all years after the New Deal. The point to note here is that these differences do not exist for US states.

I show that ignoring the difference between relative income and consumption has created the mistaken impression of extreme poverty in Puerto Rico. This is not the case. By the 1970's Puerto Rican income was about one third of the US. In contrast, Puerto Rican consumption was already fifty percent of the US and has continued at a high level. Thus, Puerto Ricans are not as poor as standard calculations suggest.

[2] For Puerto Rico, GNI is preferable to the more usual GDP as a measure of income because GDP is distorted by the transfer pricing of US corporations operating in the island, see Bosworth and Collins (2006).

The second reason why state comparisons are incomplete is that Puerto Rico is not a US state. Puerto Ricans do not vote in US elections. The Commonwealth has a separate constitution. It has a different history and a different language. Its culture and its political and its legal system are those of Puerto Rico. Arguably, it shares as many commonalities with its Latin cousins as with the Southern states of the US.

The alternative view is that Puerto Rica is a small open economy with high levels of factor mobility along the lines of, say, Ireland. If Puerto Rico is indeed a separate society then the appropriate comparisons are not necessarily with the US. This matters as Puerto Rico does much better if we compare its living standards with other Spanish speaking societies. Drawing on the benchmark studies of the International Comparison Program, the ICP, I show that Puerto Rico since the 1970's has close to the highest consumption level of all Spanish speaking societies. Put differently, when we look at living standards and switch our focus away from the US towards other Latin societies, it is not obvious that Puerto Rico is a failure.

I proceed as follows. The next section presents a new GDP index covering 1900 to 1940. The concluding sections compare Puerto Rico first to the US and then to the wider world.

2. A Stricken Land? – Puerto Rico 1900-1940

This section provides a new GDP index covering 1900 to 1940. We owe to Daniel Creamer the first set of national income accounts for Puerto Rico see Creamer (1947).[3] His estimates cover 1940 to 1944. The Puerto Rican authorities carried on his work and we have a complete set of national account after 1940. The national accounts do not exist for any year before 1940.

The received wisdom is that economic progress before the 1940's is slow. Puerto Rico was a "stricken land" in the words of the last mainland governor Rexford Tugwell, see Tugwell (1946). Variants of this claim appear in such influential works as Perloff (1950) and Dietz (1986).[4] There is an equally widely held belief that Puerto Ricans suffered greatly during the great depression see Dietz (1986). As we shall see, the data so not support either claim.

The data necessary to produce Puerto Rican national accounts are relatively abundant after the American occupation. There is a rudimentary census in 1899. From 1910 onwards, Puerto Rico is part of the US census. In addition, trade data is very detailed.[5]

There is enough information for Puerto Rico to construct national income along expenditure or output lines. I use the output approach. It is easier to work from the output side, as the price data required to produce deflators for expenditure estimates is scarce.

[3] Creamer was an able national income accountant. He came to Puerto Rico from the National Income accounts section of the Commerce Department. Perhaps he is best remembered for his report on the US national accounts, often called the Creamer report see Cohen (1982).

[4] Diffie and Diffie (1930) provide an early pessimistic view of the economic consequences of US rule. Their work has proved remarkable popular among other social scientists.

[5] There is also a special 1935 census for Puerto Rico arising out of the New Deal.

The GDP index is a Laspayres quantity index with fixed 1940 prices. The index is given by equation (1)

$$(1) \qquad Q^t (x^{1940}, x^{1940\text{-}t}, \mathbf{p}^{1940}) = \sum \mathbf{p}^{1940} x^{1940} / \sum \mathbf{p}^{1940} x^t$$

I construct the output index by creating indices for the main sectors and then aggregating the sectors to form GDP. I aggregate sectors using their share in value added for 1940. Finally, I chose 1940 as it is the only year before the war with detailed data on sectoral value added.[6]

The sectoral weights are in Table One. The weights for the sub-indices are in the data appendix.

[6] There are index number problems arising from the use of late period weights. In simple terms, late period weights will likely understate growth. The next section provides a longer discussion.

Table One

Value added shares in the output index

	Weight
Agriculture	0.305
Manufacturing	0.114
Contract Construction	0.011
Transportation	0.059
Power and Gas	0.008
Communication	0.003
Trade	0.105
Banking and Insurance	0.014
Government	0.182
Services	0.089
Housing	0.093
GDP	1.000

Source: Creamer (1947), see also the data appendix.

As expected, the agricultural sector accounts for the largest share of GDP in 1940. Also noticeable is the high share of government. At eighteen percent, this is double the size of the government sector for the US mainland.

The quality of the sectoral indices varies. Agriculture and manufacturing rest on high quality census data and are likely accurate for census years. In contrast, the indices for the service sectors are of lower quality. The data appendix provides a complete account.

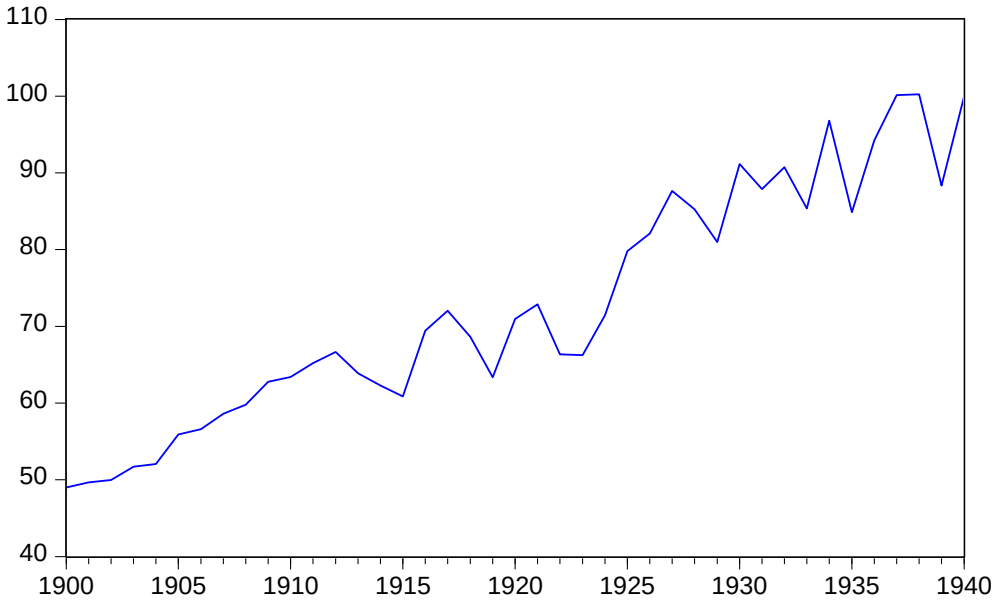
The results - GDP per capita for1900-1940

Figure One graphs the GDP per capita index from 1900 to 1940. The annual data are in the appendix.

Figure One

Output Per Capita

1940 = 100



Source: Author's calculations, see data appendix.

GDP per capita doubled from 1900 to 1940, representing an annual growth rate of 1.8 percent, over the first forty years of American rule.[7] As we shall see, this is a solid record by the standards of the time. The fact that Puerto Rican income grows in all periods suggests that Puerto Rico had begun modern economic growth in the Kuznets sense.[8]

[7] Overall GDP grew at a rate of 3.5 percent. The large differences between growth rates for GDP and GDP per capita are due to rapid population growth.

[8] There are no estimates of GDP prior to 1940. Smith (1943) provides estimates of nominal GDP from 1930 to 1940. We have no GDP deflator. But deflating his estimates by the import price index from Perloff (1950) we get broadly similar results to the output index.

Also noticeable from Figure One, is GDP instability. The instability is a function of the extraordinary swings in the external terms of trade due in turn to changes in the prices of the main export - sugar.[9]

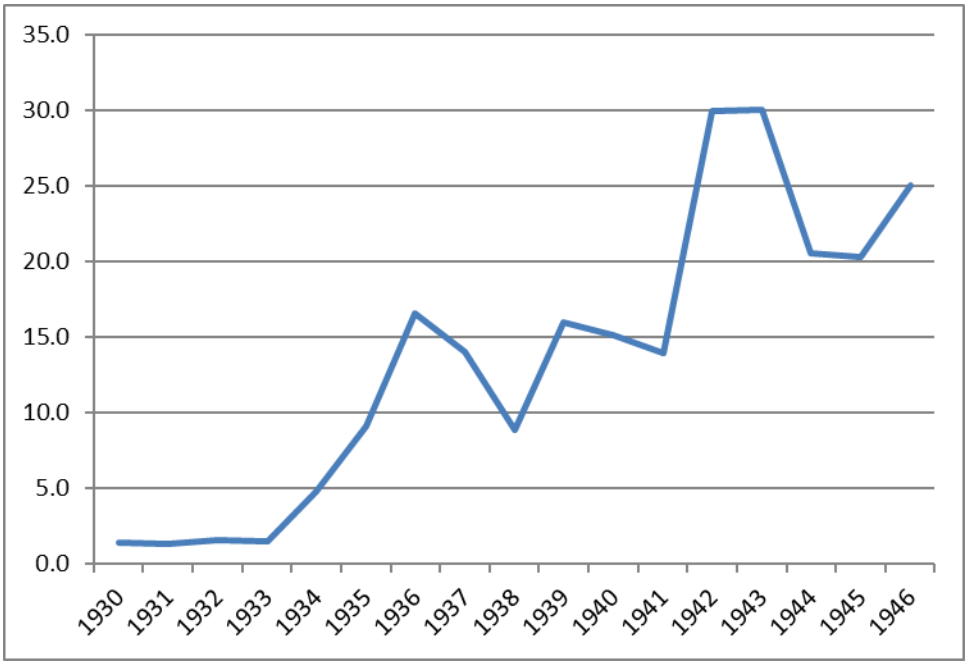
A surprising feature of Figure One is that despite the received wisdom Puerto Rico does relatively well during the depression. There is no large fall in GDP after 1930. Indeed, GDP per capita increases by ten percent from 1930 to 1940. There are three reasons why Puerto escapes the worst of the depression. First, sugar exports increased during the 1930's due to access to the protected US market. The volume of sugar actually doubles over the course of the 1930's. Second, there is a dramatic increase in textile exports also due to increased protection on US markets.

The last and probably most important factor is that the New Deal led to large Federal transfers to Puerto Rico. To grasp the size of the transfers, Figure One gives the ratio of federal transfers to GDP from 1930 to 1944. I take the estimates of federal spending from Perloff (1950). The nominal GDP comes from Smith (1943) mentioned earlier. These are rough estimates. They are adequate, however, for our purposes.

[9] It also reflects weather shocks such as the hurricanes of 1928 and 1932.

Figure Two

Federal Spending as a share of GDP – 1930 to 1944



Source: Authors calculations see data appendix.

The sheer scale of the transfers that begin after the New Deal is remarkable. They average one and a half percent of GDP in the early 1930's. This climbs to five percent in 1934 and nine percent in 1935. By 1936, it is sixteen percent. The war years see yet higher expenditures associated with the war effort.

After 1934, Federal transfers become as important to Puerto Rico as sugar in previous decades.

Adjusting for changes in the external terms of trade

The GDP index measures the volume of output in 1940 prices. In an open economy, movements in the external terms of trade will alter command over real resources. To see why this matters for a small economy, assume that exports comprise forty percent of output. It is easy to show that increase in the world price of exports by twenty percent will increase real income by eight percent even if the volume of GDP does not change.

Equation (2) provides the standard GDP adjustment to reflect changes in the external terms of trade where p is an overall deflator, px and pm are the export and import price indices, x and m are volumes of exports and imports and T is the impact on the volume of GDP.

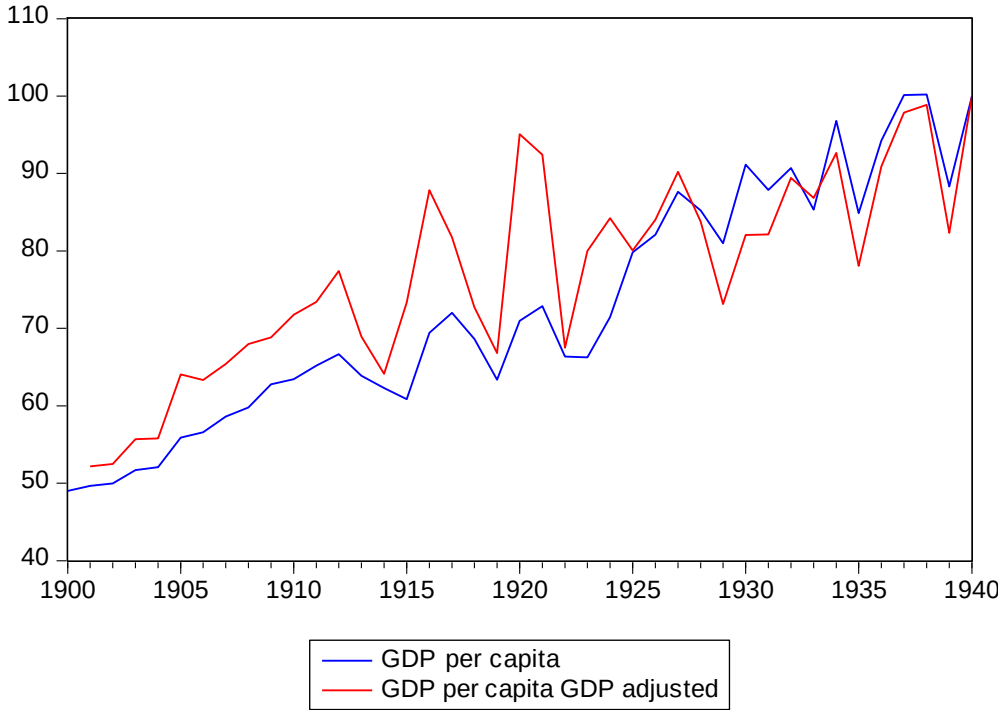
(1) T = effects on GDP of the terms of trade = $x\left(\frac{px}{p} - 1\right) + m(1 - \frac{pm}{p})$

Figure Three compares the volume measure of GDP with the terms of trade adjusted measure. Following the US accounts, I use the import price as the deflator.

Figure Three

Adjusting for changes in the external terms of trade

1940 = 100



Source: Author's calculations see data appendix.

The terms of trade adjustment is large. It greatly increases GDP during the sugar booms of the First World War and the early 1920's. For example, it raises GDP by thirty percent in 1920 reflecting the record sugar prices of this year. The terms of trade effect reduces income from 1929 to 1931 by about ten percent.

The terms of trade adjustment does not, however, change the findings that modern economic growth began after American rule or that Puerto Rico did relatively well during the great depression.

Summing up

By modern standards, growth rates of two percent are not impressive. Yet the Puerto Rican performance before 1940 has to be seen in the context its time. Maddison (2007) provides GDP data covering Europe and Latin America for the period. Table Two compares his estimates of growth with Puerto Rico.

Table Two

Comparing Growth Rates in GDP per capita: 1900 to 1938.

Western Europe	1.2
Latin America	1.4
USA	1.2
Puerto Rico	1.8

Source: Maddison (2007).

The Puerto Rican record compares favorably with Western Europe and Latin America.[10] The evidence therefore supports an optimistic appraisal of growth and living standards for the decades after American rule. The evidence does not suggest convergence with the US. To be sure, Puerto Rico grows at a faster rate than the US over the whole period. This is due to the 1930's where some special factors were at work.

[10] The high and sustained growth rates of miracle economies are a post World War Two phenomena.

3. Gerschenkron in the tropics

In the 1930's, Puerto Rico was a laboratory for the new deal. In the 1940's, Puerto Rico began its policies of state sponsored industrialization and the Puerto Rican "miracle" began. Puerto Rico then grew at fast rates to the early 1970's. However, it is hard to be more precise about the Puerto Rican record after the New Deal because of a fundamental flaw in the national accounts.

Stated simply, the problem is that Puerto Rico calculates national income using fixed 1954 prices. The reliance on a fixed set of unchanging prices over sixty years is peculiar. The standard practice is to change the prices at regular intervals. Some countries change prices every five years. The US now changes its prices every year.

The use of fixed prices over such a long period gives rise to an index number problem. The problem is the "Gerschenkron effect" named after the great economic historian Alexander Gerschenkron.[11] He showed that measuring output with a set of prices from an early period artificially inflates output growth. Using late period prices artificially reduces growth.[12]

The Gerschenkron effect arises because of the negative correlation between prices and quantities. A simple example will show why. Assume that an economy produces tradables and nontradables. Assume further that growth is faster in tradables and the relative price of tradables falls over time. It is easy to show that early period prices will produce a higher growth rate as compared to late period prices. Intuitively, by using early prices we value the faster growing sectors at higher prices.

[11] Gerschenkron (1947) discovered the effect in his study of Soviet growth.

[12] This is the case for the last section growth is measured with 1940 prices. Thus, the GDP index likely understates growth.

By adopting a fixed set of early period prices, the national income accounts for Puerto Rico will exaggerate growth. The question is whether the constant prices distort our understanding of Puerto Rican growth? The answer appears to be yes.

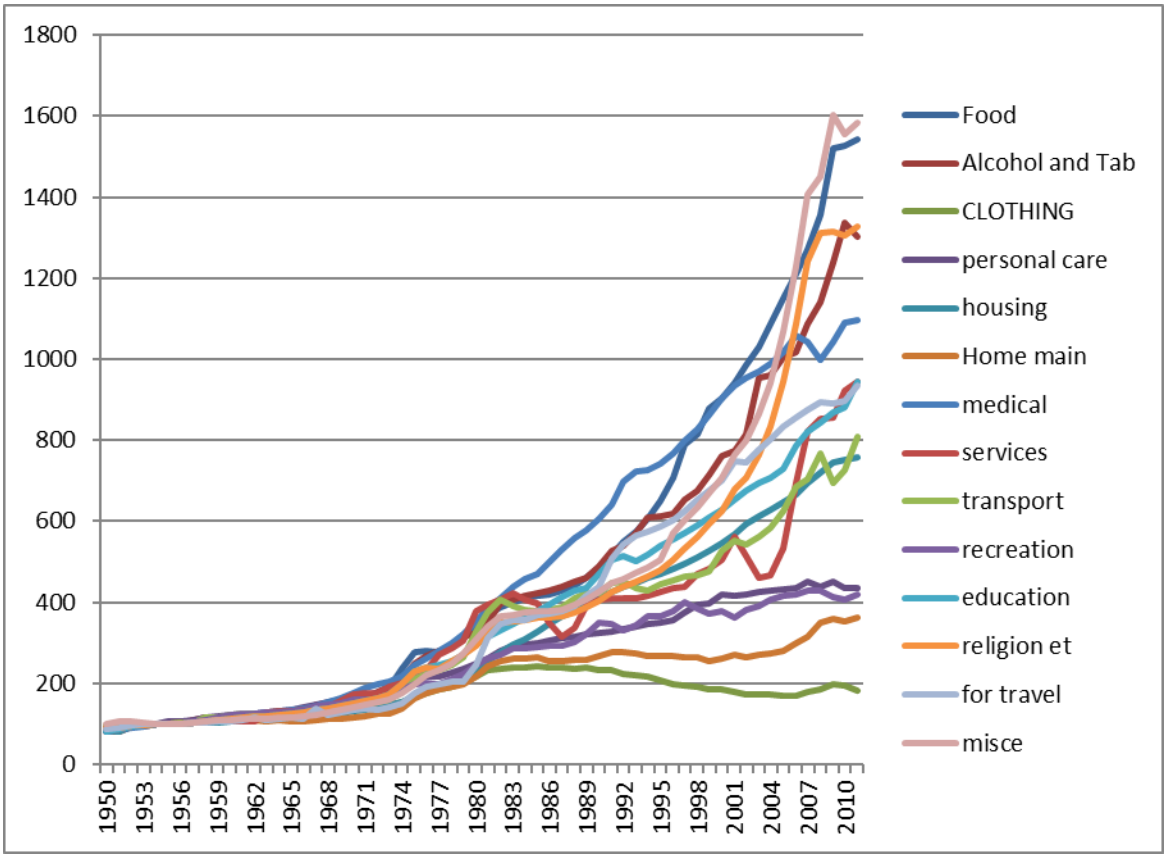
To see why, consider consumption. The national income accounts break consumption into fourteen categories. An examination of these data reveals that fixed prices have had a large influence. The first step calculates the implicit deflators for the various categories of consumption. Figure Four shows the results.

The overall consumption deflator increased from 100 in 1954 to 617 in 2011. This conceals sharp differences in inflation across sub-categories. The deflators for some items of consumption, such as clothing, merely doubled.[13] The deflators for other items such as medical care increased almost tenfold. As we might expect, Puerto Rico has experienced large changes in relative prices since 1954. This is the necessary condition for the Gerschenkron effect.

[13] Bosworth and Collins (2006) comment on the puzzling behavior of these deflators relative to the US.

Figure Four Consumption deflators

1954 = 100



Source: Authors calculations using data from Series históricas ('50-'11p) obtained at http://www.jp.gobierno.pr/Portal_JP/Default.aspx?tabid=316

The next step calculates consumption using different base year prices. Table Three compares consumption in 1954 and 2011 prices – the last year these data are available. The calculation takes into account changes in relative prices across sectors. It does not take into account changes in relative prices within sectors.

Table Three

Comparing consumption in different base year prices
1954 = 100

	1954 prices	2011 prices
1954	100	100
1960	133	126
1970	243	212
1980	303	257
1990	370	295
2000	512	353
2010	613	403

Source: Author's calculations using data from Series históricas ('50-'11p).

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The biases work in the expected directions as the early price base produces larger growth. The differences are remarkable. Using 1954 prices, consumption increases six-fold. Using 2011 prices, it increases fourfold. Keep in mind that Table Two understates the bias as it ignores changes in relative prices within consumption sub-groups.

The Puerto Rican national accounts overstate growth relative to the GDP measures used in other economies.[14] The overstatement makes comparisons of growth rates between Puerto Rico and other countries along the lines of Baumol and Wolfe (1996) problematical. It also makes it difficult to compare Puerto Rican growth rates over time or to calculate factor productivity, along the line of Bosworth and Collins (2006), in any meaningful way.

[14] I cannot rebase GNI as the breakdowns outside consumption are not disaggregated.

Fortunately, not all is lost! Puerto Rican nominal GNI is measured accurately and we can compare the Puerto Rico and the US (or US states) in nominal terms. The next section provides such comparisons. For the comparisons to make sense requires that the relative Puerto Rican/US price level is stable over time. As discussed in a later section, this appears to hold at for recent decades, at least approximately.

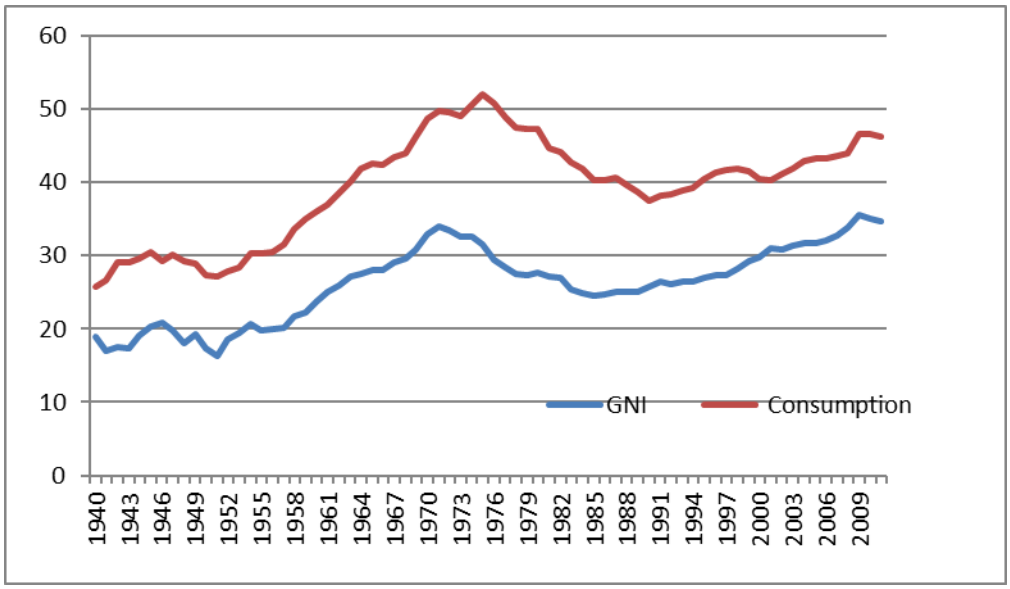
4. Puerto Rico in the American Mirror

Figure One compares GNI (Gross National Income) and consumption per capita for the US and Puerto Rico in current US dollars from 1940 to 2011. GNI measures relative output while consumption measure relative living standards. Following the convention in the international comparison literature, I define consumption as private consumption plus government provided education and healthcare services. The broader measure of consumption is necessary because private consumption provides a misleading measure of well being when there are differences in the extent of public provision of healthcare and education. The appendix provides the underlying series and discusses sources and methods.

Figure Five

Relative GNI and Consumption – Puerto Rico and the US 1940 to 1911

US = 100



Source: See data appendix.

The relative GNI series reveals familiar patterns. The ratio of Puerto Rican GNI per capita to the US rises from 0.17 in 1950 to 0.34 in 1970. It drops for the next two decades. In recent years, income regains its 1970's peak but the improvement occurs alongside an absolute decline in population of five percent between 2007 and 2012.

We see the same general trends in the series for consumption.[15] There is a fundamental difference - the level of consumption is higher for all years. The differences are between forty and sixty percent! The GNI comparison therefore provides a misleading measure

[15] The peak year for consumption occurs a little later than income in 1975/76 at fifty two percent. For recent years, the differential between productivity and living standards has narrowed. Income has regained and slightly exceeded its 1970's peak while consumption remains below its earlier peaks.

of relative living standards, though not productivity. Puerto Rico is not as poor as it often seems.

Two factors explain the different levels of income and consumption. First, personal consumption has a higher share of GNI for Puerto Rico. It averages about ninety percent. For the US, the ratio is sixty percent before 1980 rising to about sixty eight percent for recent years.[16] Second, Puerto Ricans obtain a greater portion of their education and health services through their government. For the US, the ratio of publicly provided education and health services to personal consumption is about ten percent after 1950. The ratio is eighteen percent for Puerto Rico.

Comparing Puerto Rico with US states using personal Income

Since Perloff (1950), the literature compares Puerto Rico to US states, and in particular to the poor Southern States, using personal income. [17] Personal income provides a useful measure of relative productivity for Puerto Rico. It will greatly understate Puerto Rican living standards as the ratio of consumption to personal income differs across Puerto Rico and US states because state governments provide lower amounts health and education.[18] In sum, by using personal income, we also understate how well Puerto Ricans live.

[16] This, in turn, reflects the fundamental fact that expenditures are much higher than income for all years in Puerto Rica as imports of goods and services greatly outweigh exports.

[17] Personal income is equal to employee compensation plus transfers plus proprietors' income less contributions to social security.

[18] For Puerto Rico, the ratio of consumption to personal income is close to one after 1950. For the US as a whole, the ratio averages seventy seven percent with an increase in recent years. We do not have data on public provision of education and medical services by states. Yet we have every reason to suppose that it is higher in Puerto Rico.

There is a fundamental difference between Puerto Rico and US states. The ratio of personal consumption to personal income is similar for all US states judging from BEA estimates state of consumption from 1997 to 2007 (see Awuku-Budu, Guci, Lucas, and Robbins (2013)) see also Lebergott (1996). Puerto Rico is the exception.

To summarize, Puerto Rico is not nearly as poor as it has seemed in many policy discussions. That said it should also be clear that while the switch to consumption changes our perceptions of Puerto Rican wellbeing, it does not change the standard narrative that Puerto Rico grows quickly to the mid 1970's and stagnates thereafter.

5. Puerto Rico in a Latin Mirror

The previous section compared Puerto Rico to the US. To complete the picture, I examine how Puerto Rico compares to other economies. There are two reference groups. The first is Iberia and Latin America. The relevance of these countries should be obvious – they share a common cultural and linguistic heritage. The second group is the developed market economies of Europe - Belgium, Demark, France, Germany, Italy, Netherlands, Norway and the United Kingdom. I include Ireland because of similarities in economic policies.

The last section assumed that relative price levels were constant over time for the US and Puerto. This assumption cannot be made for broader group of economies where economic growth and exchange rate changes lead to large differences in absolute price levels.

To compare Puerto Rico with the outside world therefore requires a measure of Puerto Rican relative price levels. The commonwealth has never participated in the International

Comparison Program (the ICP).[19] There is, however, evidence from other sources. The most important pointers come from the COLA program– more properly the Non Foreign Cost of Living Allowance –which seeks to compensate federal bureaucrats posted to Puerto Rico, Hawaii, Alaska and other outlying US areas for differences in the cost of living as compared to Washington DC.

The COLA program compares price levels in Washington DC and San Juan. COLA has published detailed results for the last two decades. The data appendix looks at the COLA studies in more detail. I argue that the COLA evidence is consistent with similar price levels across for the US and Puerto Rico. For recent decades, I compare Puerto Rico with the rest of the world by assuming that the Puerto Rican price level equals the US.

There remains the question of whether the assumption is a good approximation for the more distant past. To provide an anchor for an earlier comparison, the data appendix provides a direct 1950 price level comparison for the US and Puerto Rico. I compare cover food, lighting and clothing with price data from the International Labor Organization (ILO). For the other categories of expenditure, I use quantitative indicators along the lines pioneered by Gilbert and Kravis (1954). The complete details and sources are in the appendix.

The resulting Fisher Ideal comparisons show that the Puerto Rico price level was ninety percent of the US in 1950. As discussed in the appendix, the higher Puerto Rican prices for

[19] The ICP compares overall price levels by means of very large price surveys. The ICP price benchmarks underlie the Penn World Tables (PWT) and Maddison (2007).

imported goods were offset by lower prices for services and lower wholesale and retail margins.[20]

The results

I compare Puerto Rico for three years, 1955, 1980 and 2005. The data on income and consumption (personal consumption plus education and health care from the government) for 1980 and 2005 are from the benchmark studies of the International Comparison Program. I chose these years because of good coverage for Latin America. There are no ICP benchmarks before 1967. For, 1955, I use Braithwaite (1967) for the Latin economies. The European data are from Gilbert and Kravis (1954). [21]

There are some differences. The 1955 comparison is a Fisher Ideal bilateral comparison with a US base. The 1980 comparison is a multilateral comparison using 1980 "world prices" given the by Geary Khamis procedure. The 2005 benchmark uses a multilateral variant of the Fisher Ideal call the EKS (Elteto Koves and Szulc) index. I do not have all countries for each year. For instance, Cuba is in the 1955 sample but Ireland and Portugal are not.

The estimates are in the appendix. They are best seen graphically. Figure Six provides the 1955 comparison. The vertical axis measures consumption relative to the US while the horizontal axis compares income per capita relative to the US. I use GDP for all countries save for Puerto Rico and Ireland where GNI is the preferred measure.

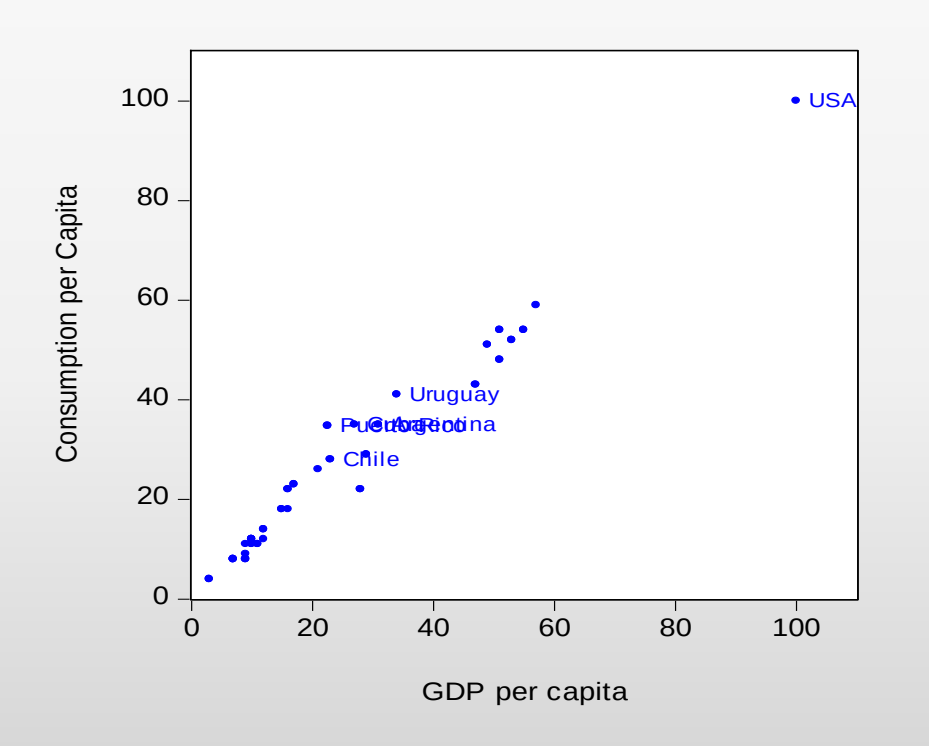
[20] The comparisons in the last section therefore understate the relative standing of Puerto Rico for 1940's and 1950's. The resulting error is small and it does not change any of the earlier conclusions.

[21] Ward and Devereux (2012) provide more detail on the 1955 comparisons.

The US had a commanding lead in terms of consumption and GDP per capita for 1955. The second group in the Figure is Western Europe where consumption and GDP are between fifty to sixty percent of US levels. After Western Europe, there is Italy and the middle income economies of Latin America – Argentina, Cuba and Uruguay. These economies have twenty five to thirty percent of US GDP per capita. They do better for consumption as they average thirty to thirty five percent of the US. The rest of Latin America brings up the rear.

Figure Six

Relative Income and consumption 1955



Where does Puerto Rico stand? As we have seen, there is large divergence between income and consumption for Puerto Rico after the New Deal. [22] The divide comes across clearly in the Figure. By 1955, Puerto Rico is a prosperous middle income economy for consumption. It has similar levels of consumption to Argentina, Cuba and Uruguay at thirty five percent of the US. This is above Italy and Spain in Europe. Relative income for Puerto Rico is just twenty three percent of the US compared to thirty one and thirty four percent for Argentina and Uruguay respectively. This is a fifty percent difference.

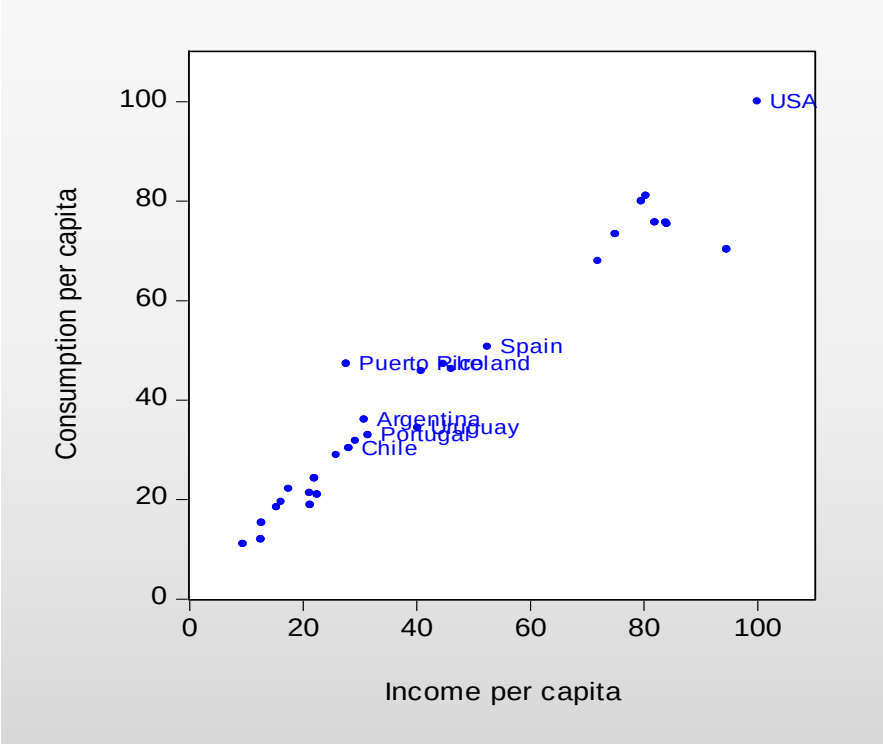
Figure Four repeats the exercise for 1980. I chose 1980, as it is the first ICP benchmark with wide coverage of Latin Economies.[23]

[22] The divergence appears to be a unique feature of Puerto Rico. I could find no similar example in the ICP benchmarks for other economies.

[23] Strictly speaking, the Geary Khamis comparisons for 1980 are not comparable to either 1955 or 2005. In practice, the Geary Khamis measures give similar results to the Fisher Ideal for developed economies. It will, however, overstate income for poorer economies. The next version of the paper will provide Fisher Ideal results for 1980.

Figure Seven

Relative Income and consumption for1980



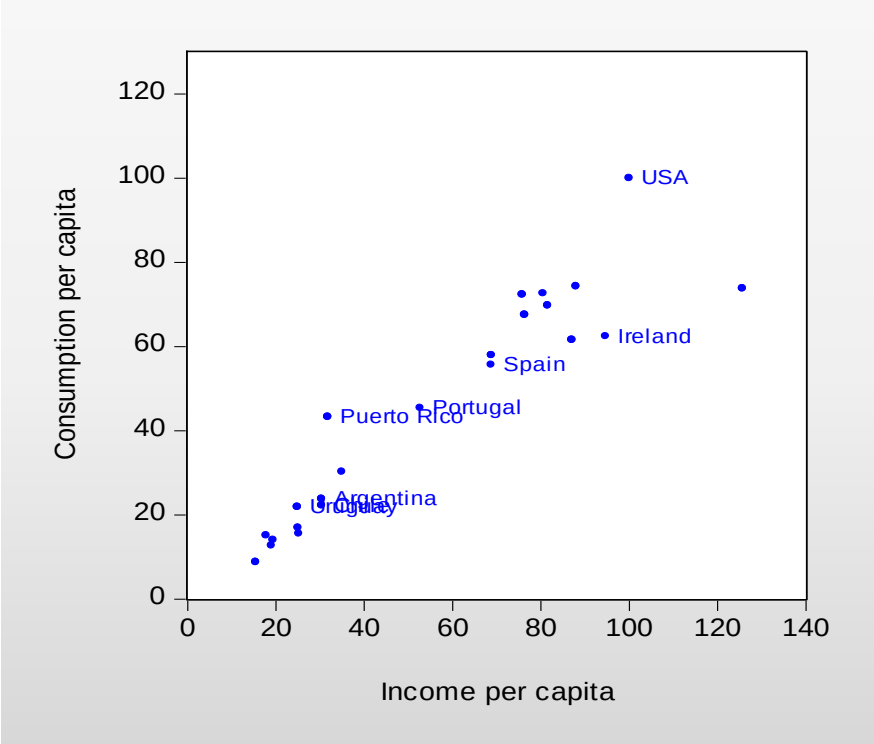
By 1980, Western Europe is closer to the US. Their average income per capita has increased to eighty percent of the US while their consumption is seventy four percent. Italy has now joined the rich economies.

Spain has also moved up the world income distribution and Spanish consumption is slightly ahead of Puerto Rico. Ireland and Puerto Rico are equal at forty seven percent of US levels. For 1980, Puerto Rico can claim the second highest standard of living of any Spanish speaking society. The standing of Puerto Rico is less impressive for income per capita. At twenty seven percent of the US, Puerto Rico is below the Argentina and Uruguay.

The final Figure brings us up to date with 2005.

Figure Eight

Relative income and consumption 2005



The US leads in consumption - Norway leads in income. The European economies have slipped a little relative by 2005. Spain and Ireland are now closer to the Western European frontier. Finally, the Figure shows Puerto Rico has fallen behind Spain and it is similar to Portugal. It is well ahead of everybody else in Latin America.

The contrast of consumption and income remains for Puerto Rico. In terms of income, Puerto Rico is stuck at the level of Argentina.

Conclusions

The first part of the paper provides a new index of national income for 1900 to 1940. It shows Puerto Rico was not a stagnant society in the early decades of American rule. Its growth rates during these years compare favorably with Western Europe. Modern economic growth begins before the policy changes of New Deal.

A fundamental change occurred sometime around the New Deal where it becomes crucial to distinguish between productivity as measured by output per capita and living standards as measured by consumption.

We can sum up the Puerto Rican experience after the New Deal as follows. First, the results for income per capita are depressing. After seven decades of government sponsored development efforts, a benign macro environment compared to the rest of Latin America, and massive transfers from the mainland, GNI per capita remains at Uruguayan or Argentinian levels

Second, Puerto Rico does much better using consumption. Consumption reached fifty-two percent of the US in the early 1970's and is forty seven percent now. This is well above Latin America and is equivalent to living standards in a country like Portugal. Puerto Rico has succeeded in ensuring a standard of living for its citizens largely divorced from the productivity of its workers. This is a paradox worth exploring.

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Appendix

Relative income and consumption per capita – 1955, 1980, 2005
US = 100

	Income per capita			Consumption per capita		
country	1955	1980	2005	1955	1980	2005
Belgium	53	80	82	52	81	70
Denmark	51	82	87	54	76	62
France	49	84	76	51	75	68
Germany FR	51	84	76	48	76	72
Italy	29	75	69	29	73	58
Netherlands	47	80	88	43	80	74
Norway	55	95	126	54	70	74
United Kingdom	57	72	81	59	68	73
Argentina	31	31	30	35	36	24
Bolivia	7	13	15	8	12	9
Brazil	9	29	25	9	32	17
Chile	23	28	30	28	30	22
Colombia	12	22	19	14	24	14
Costa Rica	16	26		18	29	
Cuba	27			35		
Dominican Republic	9	15		8	18	
Ecuador	11	21	19	11	19	13
El Salvador	10	13		11	15	
Guatemala	10	17		12	22	
Honduras	7	9		8	11	
Mexico	17	41	35	23	46	30
Nicaragua	10			12		
Panama	15	23		18	21	
Paraguay	9	16		11	19	
Puerto Rico	**23**	**28**	**32**	**35**	**47**	**43**
Peru	12	21	18	12	21	15
Uruguay	34	40	25	41	34	22
Venezuela	28	46	25	22	46	16
Portugal	16	31	53	22	33	45
Spain	21	52	69	26	51	56
Ireland		45	95		47	62
USA	100	100	100	100	100	100

Appendix
GDP per capita 1900-1940

Year	GDP cap	GDP cap TOT adjusted
1900	49	
1901	50	52
1902	50	52
1903	52	56
1904	52	56
1905	56	64
1906	57	63
1907	59	65
1908	60	68
1909	63	69
1910	63	72
1911	65	73
1912	67	77
1913	64	69
1914	62	64
1915	61	73
1916	69	88
1917	72	82
1918	69	73
1919	63	67
1920	71	95
1921	73	92
1922	66	67
1923	66	80
1924	71	84
1925	80	80
1926	82	84
1927	88	90
1928	85	84
1929	81	73
1930	91	82
1931	88	82
1932	91	89
1933	85	87
1934	97	93
1935	85	78
1936	94	91
1937	100	98
1938	100	99
1939	88	82
1940	100	100

Data Appendix

I first outline the output index and the terms of trade adjustment to GDP. Next, I consider the COLA price level comparisons. I close with the 1950 Puerto Rico/US price level benchmark.

The output Index

The index is a weighted quantity index where the weights are the base year shares in valued added. The weights are in Table One in the text. I form the sectoral output indices as follows:

(i) Agriculture

The agricultural weights are in Table 1a. They are the shares of the products in gross agricultural output for 1940.

Table 1a
Agricultural Weights

Sugar Cane	0.517
Tobacco	0.051
Coffee	0.050
Milk	0.133
Eggs	0.016
Beef	0.062
Pork	0.035
Poultry	0.036
Pineapples	0.009
Coconuts	0.009
Other	0.009
Grapefruit	0.009
Plantains	0.032
Bananas	0.032
	1.000

There is data for all items, save meat, for census years. Data on production outside the census years is available for sugar, tobacco and coffee. There is also data on fruit production from the trade accounts. For other items, I interpolate between census benchmarks. Meat poses special difficulties. The production of meat is available from the 1930's. I make rough adjustments to allow for an increase in meat production per animal over time.

(ii) Other sectors

Sugar Manufacturing: Sugar output is from the agricultural index.

Non-Sugar Manufacturing. From the US census reports. Non-sugar manufacturing consisted largely of tobacco, food processing and beverages. I construct the manufacturing index with 1940 weights from Creamer (1947). The output data is taken mainly from the reports of the Governor of Puerto Rico.

Power and Gas: From Mitchell (1993) and reports of the Governor of Puerto Rico and the US census.

Construction: I used an index composed of inputs such as cement etc taken from the trade accounts.

Transportation: The index covers railway and road transportation as well as port and shipping services. I proxy road transportation using data on vehicle numbers. Rail transportation is from standard sources. Finally, I assume that shipping and port services are proportional to the real volume of exports and imports described later.

Wholesale and Retail Trade: I assume that non-sugar manufacturing output and imports move through the wholesale and retail sectors. I use the non-sugar manufacturing while the

quantum of imports is discussed later. I combine the indices with information taken from the 1939 wholesale/retail census.

Banking and Finance: I assume that the output of the financial sector is proportional to the real value of deposits in the banking system. The data on deposits is the Reports of the Governor of Puerto Rico. I deflate deposits using the import price index described later. This index is the only price index available.

Communications: I form an index from the data in the Report of the Governor and Mitchell (1993) on mail sent, total telegraphs and phone ownership.

Services: I divide services into household domestic services and all other services. I form indices using employment. This is standard but it imposes an assumption of zero productivity growth.

Government: I use insular and federal spending to form indices. I deflate both by the import price index.

Housing: I calculate a housing index using census data. I adjust for quality using the number of rooms per house and some rough adjustment for other factors.

Adjusting GDP for terms of trade changes

The TOT adjustment requires price indices for impors and exports. I take these indices from Perloff (1950). Perloff stops at 1913. I extend his indices backwards using his methods. I use equation (1), given in the text, to measure the effects of changes in the external terms of trade on GDP.

COLA Evidence on the Puerto Rican/US price level

The COLA studies compare relative price levels for San Juan and Washington using Washington weights. The first row of Table 2a provides COLA estimates for five recent years. For all years, save one, San Juan prices exceed Washington. The difference is six percent in 1997 and nine percent in 1999. The exception is 2002 where COLA finds San Juan below Washington.[24]

Table 2a

Relative Puerto Rico/US Price Levels for consumption

	1994	1996	1997	1999	2002
		Washington weights			
San Juan/DC	103	101	106	109	97
San Juan/US	112	110	116	119	105
Puerto Rico/US	104	102	107	110	97
		Puerto Rican Weights			
Puerto Rico/US	88	87	91	94	82
		Fisher Ideal			
Puerto Rico/US	96	94	99	101	89

Source: The COLA estimates in row one are from Federal Register various issues. The adjustments are described in the text.

To compare price levels between the US and Puerto Rico, I adjust the San Juan and Washington prices to Puerto Rican and US levels respectively.

The second row in Table 2a adjusts the Washington DC prices to a US level using a recent BEA study that compares price levels in Washington DC to the overall US for 2005 see

[24] The 2002 survey is superior on methodological grounds to the earlier studies.

Aten, Bettina and D'Souza (2008) Table 2 page 68. The BEA finds the Washington price level exceeds the overall US price level by nine percent. I use the 2005 adjustment factor for all years in Table 2a. The resulting San Juan price level is above US levels by a considerable margin. For 1997, the difference is twenty percent.

I next adjust San Juan to a Puerto Rican price level. It is widely held in Puerto Rico that San Juan price levels exceed those for the rest of the Island. I do not have much quantitative evidence, however, on which to base an adjustment. For 1994, COLA surveyed Mayaguez finding that its prices were ninety percent of San Juan. I reduce San Juan prices by seven and a half percent to approximate Puerto Rico as a whole. The lower adjustment factor reflects the share of San Juan in the overall population of the island. The resulting estimates of the Puerto Rican/US price level are in the third row.

Finally, I adjust to Puerto Rican weights. Given a negative correlation between prices and quantities, the price level with Puerto Rican Weights will be lower. The adjustment requires knowledge of the Paasche – Laspayres spread for Puerto Rico and the US. Following the usual terminology, Paasche is the result with Puerto Rican weights and Laspayres is the result with US weights.

I do not have the Paasche – Laspayres spread for Puerto Rico and the US. On the other hand, we know a lot about the ratio from the various rounds of the International Comparison Program. The spread depends on the similarity of consumption patterns. For the 2005 round of the ICP, the lowest spread for US comparisons is 0.95 - for Ireland, see Deaton and Heston (2010) Table One page 8. For Latin economies, the spread is lower. For example, the spread for Brazil in 2005 is 0.66. To adjust to Puerto Rican weights, I assume that the Paasche – Laspayres

spread is 0.85 – a little higher than for the US and Spain but well below other Latin Economies. With Puerto Rican weights, the price level is below the US. The final row provides the Fisher Idea – the geometric average of the Puerto Rican and US weights. I conclude that US and Puerto Rican Price levels are similar at least for recent decades.

The estimates in Table 1a are no more than educated guesses – controlled conjectures. They suggest that the nominal comparisons in the text are not likely to be too far off the mark, at least for recent years.

Comparing US and Puerto Rican Price levels for 1950

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