Arrested Development? Puerto Rico in an American Century*

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Summary

This paper considers the Puerto Rican record from American annexation to the present. Puerto Rico became an American colony in 1898, achieving self-rule after the Great Depression. The standard narrative among American observers is that Puerto Rico was a stagnant society before the policy changes of the New Deal and that the island suffered greatly during the Great Depression. These claims are mistaken. Using a new GDP index for 1900 to 1940, I show that modern economic growth begins with American rule and that Puerto Rico escaped the worst ravages of the Great Depression. The New Deal is, however, the great watershed for the island as it led to a dis-connect between income as measured by Gross National Income (GNI) and living standards as measured by household consumption. Once we account for the difference, Puerto Rico is not so poor after all.

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1. Introduction

If Puerto Rico were a US state, it would have the lowest Gross National Income (GNI) per capita in the Union – by far. Yet Puerto Rico was a "miracle" economy once. Income per capita increased from seventeen percent of the US mainland in 1950 to thirty-three percent in 1971 leading Baumol and Wolff (1996) to claim the island as an economic "miracle" on a par with East Asia. The growth spurt faded in the early 1970's and the island lost ground relative to the mainland. Recent years have seen hard times with a default and a decline in population.

The economic history of Puerto Rico attracts little attention. Yet we cannot understand the island's current troubles without knowledge of its past. In addition, the Puerto Rican experience has relevance for important questions. Puerto Rico, along with the Philippines and Cuba, become a US colony after the Spanish American war. Arising out of the work of Engerman and Sokoloff (1997, 2002) and Acemoglu, Johnson and Robinson (2001, 2002) there is a large literature on the long run effects of colonization. The argument is that colonization produced different sets of institutions in the Americas and that the institutions have persisted over time largely determining long run patterns of development. Puerto Rico is an interesting case study as it went from Spanish to US rule. Did US colonial rule stimulate growth and institutional change for the island or did it retard progress? [1] After the Great Depression, Puerto Rico switched from the limited government of the colonial regime to a development state under home rule. Since then it has enjoyed seven decades of government sponsored

[1] The lliterature on US imperialism of the 1900's, for the most part, studies the effects on foreign investment and financial markets see, for example, Lebergott (1980), Mitchener and Weidenmier (2005) and Maurer (2013). There is less work on how US colonial rule changed institutions and property rights in places such as Cuba or Puerto Rico.

development efforts along with massive transfers from the mainland. All, it seems, to no avail.[2] Why was convergence so fast after 1950 and why did it stall in the early 1970's?

To date, however, there are few attempts to answer the "big' questions of Puerto Rican history – the effects of American colonial rule or the failure to converge to the mainland.[3] This paper shows that to grapple with these issues we must close two gaps in the economic history of the island. First, the early years of American colonial rule are a statistical dark age without national income measures or price/wage indices. Yet, these years are important as they witnessed the economic and social transformations that shaped Puerto Rican society to the present. Second, national accounts for the island have serious flaws, which mean that we have at best a blurred view of economic performance for recent decades.[4]

My goal is to close the gaps in the record and to put the Puerto Rican experience over the last century into sharper comparative perspective. I also provide some initial results on the effects of colonialism and the failure to converge. I have two contributions. First, I construct a GDP index for 1900 to 1940. Using the index, I argue that the standard mainland views– that the colonial era was one of stagnation and that Puerto Rico suffered greatly during the great

[2] The experience of the island is of general interest for three other reasons. First, Puerto Rico serves as a laboratory with which to study the effects of important US policies. For example, it is a setting where we can see clearly the effects of binding minimum wages see Castillo-Freeman and Freeman (1992). The Island also allows researchers to examine the effects of tax incentives promoting "foreign" in this case mainland investment. Second, since the classic work of Ingram (1962) Puerto Rico is a case of current account adjustment in a currency union. Finally, with increasing trade in intermediates and foreign ownership traditional measures of economic activity are becoming difficult to interpret. As will be clear, Puerto Rico is a prime example of such problems.

[3] The island is absent from work on convergence across US States, see Barro and Sala-i-Martin (2003), Mitchener and McLean (2003) and Turner *et al* (2007) for surveys. This means that the literature misses a particularly interesting case. After all, Puerto Rico is the one region of the US where convergence appears to have ceased at a low income. Bridgeman et al (2012) is one of the few papers to address the failure to converge.

[4] Without national accounts, we cannot study long run growth using modern quantitative growth models see Hansen and Ohanian (2016).

depression – are mistaken. Rather, modern economic growth begins with American rule. In addition, Puerto Rico did better during the Great Depression than the mainland or other Latin economies.

The second part of the paper clarifies crucial aspects of Puerto Rican growth after the New Deal. First, I document the conceptual flaws in the Puerto Rican national accounts for recent decades that make it difficult to compare Puerto Rican income levels or growth rates with the US or other economies. Next, I provide a solution to these problems by comparing income and consumption for the island with the US and other Latin economies using data from the International Comparison Program (ICP) of the World Bank. The results of this exercise provide a fresh and more positive perspective on the progress of the island.

For American observers, Puerto Rico is very poor. This is understandable given that its GNI and personal income per capita are shocking low relative to the mainland.[5] But income measures mislead where Puerto Rican living standards are concerned as the policy changes of the New Deal created a divergence between income, as measured by GNI or personal income, and living standards as measured by household consumption. Puerto Rico, as it turns out, fares better for consumption. This is hardly surprising. What is surprising, however, is the scale of the differences. Over the last seven decades, the gap ranges from thirty to fifty percent in favor of Puerto Rico. Take 1976. The ratio for income relative to the US was only thirty percent. The ratio for consumption was forty-six percent. Another way of making the point that Puerto Rico is not as poor as it sometimes seems is to compare Puerto Rico to Southern States. Before the

[5] Following the introduction of the 1993 UN system of national accounts, GNI has replaced the familiar GNP. The literature for Puerto Rico finds that GNI is preferable to GDP as a measure of economic activity for the island as GDP is distorted by the transfer pricing of US corporations operating in the island.

recent crisis, Puerto Rican consumption levels were sixty percent of the poor Southern States - hardly evidence of extreme poverty. The island does better in international comparisons. Currently, Puerto Rican consumption exceeds the rest of Latin America and is close to a country like Portugal or Korea. More generally, Puerto Rico has enjoyed the highest or the second highest consumption levels among Spanish speaking societies since the 1950's. Thus, only by ignoring the differences between income and consumption can we sustain the notion of extreme Puerto Rican poverty.

I proceed as follows. Section two presents a GDP for 1901 to 1940 and shows how this index change the received wisdom about US colonial rule. The next section discusses the oddities of Puerto Rican national accounting after 1950 and explains how they distort the Puerto Rican record. The final sections compare Puerto Rico to the US and then to other Latin economies using income and consumption measures taken from the International Comparison Program (ICP) of the World Bank.

To conclude, I argue that the US literature on Puerto Rico has neglected two of the central features of the Puerto Rican experience – that growth begins with American colonial rule and that the island has succeeded in ensuring a standard of living for its citizens that is the envy of most Latin societies. In sum, while Puerto Rico could have done better over its American century it is far from the abject failure that it is usually painted.

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

Puerto Rico became a US possession after the Spanish-American War of 1898. Initially, the Island had a governor selected by the US with a popularly elected lower house. The Jones act of 1917 extended US citizenship to Puerto Ricans but it was not until 1947 that they received the right to elect their governor. In 1948, Luis Muñoz Marín became the first elected governor from the island and self-rule began.

Puerto Rico had a small government before the New Deal dominated by colonial US administrators. The priorities were infrastructure, education and healthcare. There were few attempts to foster industrialization. For the most part, sugar dominated policy debates.[6] Everything changes in the early 1930's as the New Deal on the mainland ushered in a development state. Initially, the authorities introduced extensive land reform, increased government spending and created government enterprises to jump-start industrialization. Later the Island shifted to a more indirect approach that emphasized incentives designed to attract mainland investment – Operation Bootstrap.[7]

What were conditions like during the early decades of American rule?[8] Population growth increased after annexation and the island saw rapid improvements in life expectancy and improved infrastructure. The impact of direct colonial rule on living standards is, however, more difficult to decipher as there are no national income accounts or real wage indices.

[6] The Brooking Study (Clark (1930)) and Gayer, Homan and James (1938) are the best accounts of economic policy during direct colonial rule.

[7] Perloff (1950) is a classic account of policy during and after the New Deal. Dietz (1986) provides references on Operation Bootstrap. Bridgeman et al (2012) is a more recent account that re-interprets the effects of these policies on factor and goods markets.

[8] The quantitative evidence for the Island before American rule is scarce. There is every reason to believe that income and consumption were very low.

Among mainland observers, the received wisdom is that economic growth before the New Deal was slow or nonexistent. Puerto Rico was a "stricken land" in the words of the last mainland governor Rexford Tugwell, see Tugwell (1947), where rapid population growth overwhelmed all improvements.[9] A second staple of the mainland literature is the belief that Puerto Rico suffered greatly during the great depression, see Dietz (1986).

These views were deeply ingrained among US observers by the late 1950's.[10] Consider Werner Baer (1959) Page 645:

> "Until the 1940's the island of Puerto Rico was a typical example of a stagnant backward economy with no raw material base and a very low per capita income"……Although the development of the sugar industry increased the island's income and provided more job opportunities, this growth was not fast enough to keep up with the population explosion which was taking place…….In the 1930's the economy plunged into absolute despondence. Two hurricanes which destroyed most of the sugar crops of 1928 and 1932, followed by the depression which resulted in substantial curtailments of markets and low price levels, drastically slashed the island's income"

Are these claims correct? The obvious starting point is national income. We owe to Daniel Creamer (Creamer (1947)) the first set of Puerto Rican national income accounts.[11] The Puerto Rican authorities carried on his work and we have a complete set of national accounts from 1940 onwards. There are no estimates for years before 1940. To fill the gap, I provide a GDP index from 1900 to 1940. The construction of national accounts for Puerto Rico for the

[9] Variants of this claim appear in standard references such as Perloff (1950) and Dietz (1986). Diffie and Diffie (1931) provide an early pessimistic view of the economic consequences of US rule that has proved enduringly popular among US social scientists.

[10] I should note that Latinists tend to hold a more nuanced view of Puerto Rico that emphasizes the progress in literacy, infant mortality etc. For recent examples see Bulmer Thomas (2003) or Prados de la Escosura (2015).

[11] Creamer was an able technician. He came to Puerto Rico on secondment from the National Income accounts section of the Commerce Department, the great pioneers in the development of national income accounting. Creamer is remembered today for his report on the US national accounts, often called the Creamer report, see Cohen (1982).

early part of the twentieth century benefits from the fact that information for the island is abundant after American rule. There is a rudimentary census in 1899. From 1909 onwards, Puerto Rico is part of the US census. In addition, there are very detailed trade data.

Economic historians, see Maddison (1995), use two approaches to form historical GDP indices – the industry of origin or output approach based on sectoral volume indices and expenditure (or commodity flow) measures in current prices deflated by appropriate price indices to yield real GDP. To apply the expenditure/commodity flow measures to Puerto Rico requires, in addition to the census and trade sources noted above, estimates of incomes in service activities along with mark ups for the wholesale and retail sectors. It also requires detailed price data for deflation. These data are not available before 1940 and it would require extensive archival research to obtain them. Due to these data limitations, I estimate GDP using an industry of origin measure.[12]

The GDP index, given by equation (1), is a Laspayres quantity index with fixed 1940 prices where **p** refers to prices and **X** to quantities.

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

[12] Maddison (1995) discusses the long tradition of sector of origin indices. One well known example is Feinstein (1972) for the UK. The sectoral approach also features in the old literature on the Soviet Union where price data were difficult to obtain, see Moorsteen and Powell (1966). More recently, Maddison and Wu (2008) use sector of origin GDP indices in their work on Chinese GDP. For the UK and the Soviet Union, the expenditure and income measures show similar long run trends but there are considerable differences in annual growth rates. This is also the case for China under central planning see Chen and Devereux (2017).

To construct GDP, I create sectoral output indices and then aggregate to form GDP using 1940 shares in value added as weights. I chose 1940 as the base because it is the first year with detailed data on sectoral value added.

Table One provides the sector weights. As expected, agriculture has the largest share of GDP. Also noticeable is the high share of government. At twenty percent of GDP, it is double the share for the mainland.

Table One

Value added shares

	Weight
Agriculture	0.343
Manufacturing	0.128
Contract Construction	0.013
Transportation	0.066
Power and Gas	0.009
Communication	0.004
Trade	0.118
Banking and Insurance	0.015
Government	0.205
Other Services	0.100
GDP	1.000

Source: Creamer (1947), see also Appendix two.

I provide the sectoral indices along with details of their construction in Appendix two. In brief, I construct indices using physical quantities – tons of sugar etc. When viewing the GDP index, the reader should keep in mind that the quality of the sectoral indices varies. Agriculture

and manufacturing rest on census data and are likely quite accurate. In contrast, some of the service sector indices assume that output moves in line with employment. The assumption, though common in historical sector of origin GDP estimates, is crude because it requires constant labor productivity.[13] The second drawback of the GDP index is that while I have annual series for manufacturing, agriculture and retail/wholesale trade but some of the other indices rely on interpolation between censuses.

There are other potential biases that should be borne in mind. First, by relying on physical quantities the sector of origin approach can miss quality change, see Usher (1976, 1980). For example, if we measured the output of autos by the number of autos produced then we miss quality change due to improved performance etc. Given the simple structure of the Puerto Rican economy during these years, this is probably not a serious problem. Second, the reliance on late period (1940) prices will reduce measured growth rates through the "Gerschenkron effect" discussed in the next section. This bias is potentially important as shown in later sections although it is difficult to quantify.

The GDP index is a first- generation measure. It can be improved upon though that likely requires extensive archival research. The index should reveal the long run evolution of GDP but the implied annual growth rates should be viewed cautiously. As we shall see, the long run trends revealed by the index are broadly consistent with other evidence.

[13] Maddison and Wu (2008), for example, make this assumption for China where it generated controversy see Wu (2014).

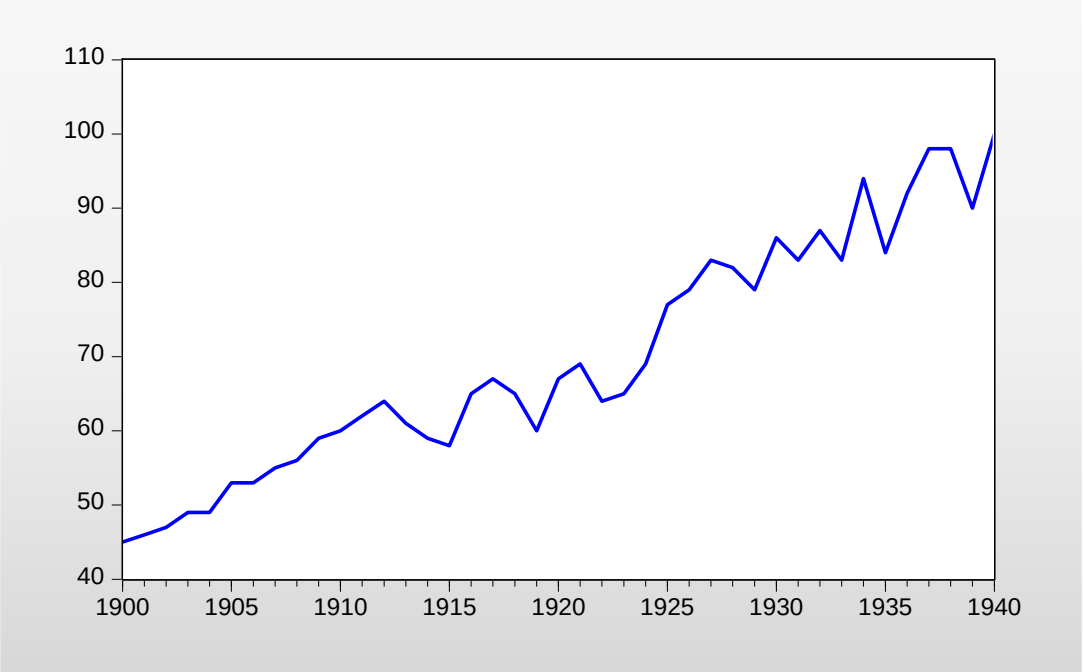
The results - GDP per capita 1900-1940

Figure One graphs GDP per capita in volume terms from 1900 to 1940. The annual data are in Appendix one.

Figure One

GDP per Capita 1900- 1940

1940 = 100



Source: Authors' calculations see Appendix one for the annual series.

Puerto Rican GDP per capita doubled from 1900 to 1940 representing an annual growth rate of 2.0 percent for the first forty years of American colonial rule.[14] Output per worker grows faster than income per capita at 2.6 percent. The difference between per capita and per worker growth arises because of a fall in the ratio of the labor force to population which drops

[14] As shown in the data appendix, overall GDP grew at a rate of 3.6 percent due to rapid population growth.

from 0.35 in 1910 to 0.27 in 1940 due to fast population growth and the resulting lower average age. As it turned out, the low ratio of the labor force to population became an enduring feature of the Puerto Rican economy.

The fact that income grows consistently during colonial rule counters the claims that Puerto Rico was a stagnant society. On the contrary, Puerto Rico begins modern economic growth in the Kuznets sense after annexation.[15] Also noticeable from Figure One is the instability of GDP. This is partly a function of the extraordinary swings in the Puerto Rican external terms of trade due, in turn, to changes in the price of the island's main export - sugar. The volatility also results from weather shocks such as the hurricanes of 1928 and 1932. Lastly, it partly reflects policy shocks such as the changes in sugar policy during the 1930's and the unexpected imposition of the US minimum wage on the island in 1938 - an event which devastated textile exports.

The second striking feature of the GDP series is that, counter to received wisdom, Puerto Rico does relatively well during the Great Depression. From Figure One there is no collapse in GDP after 1929. Indeed, GDP per capita increases from 81 in 1929 to 100 in 1940, albeit with great volatility.

I shall return to the depression years after describing the terms of trade adjustment to GDP.

[15] As mentioned, there are no estimates of real GDP for years before 1940. Dudley Smith, Smith (1943), provides a series from 1930 to 1940 that approximates nominal national income. Deflating his estimates by the import price index described in the data appendix we get broadly similar trends to the GDP index.

Adjusting for changes in the external terms of trade

The GDP index measures output using 1940 prices. For an open economy, such volume GDP measures can be a misleading indicator of living standards because movements in the external terms of trade alter command over real resources and hence living standards in ways not reflected in constant price GDP. National income accountants were aware of this problem early on and provided adjustments to make real GDP better reflect international considerations. To date, these adjustments have not attracted attention from economic historians.[16]

Figure Two provides uses the two good model of trade to provide a graphical treatment of the difficulties that changes in the external terms of trade pose for GDP in constant prices. The economy produces X_1 and X_2 and is small in world markets. Trade is balanced. Initially, the economy produces at point **a** and consumes at point **b** where X_2 is the export good. Suppose the external terms of trade improve. As shown in the figure, production shifts to **c** and consumption increases to **d** where welfare improves from U_0 to U_1.

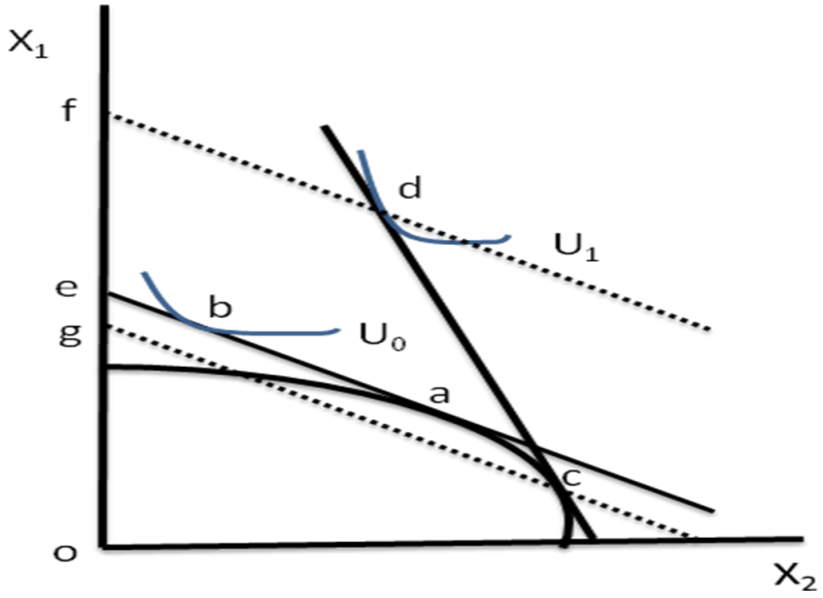
Let us measure consumption and GDP in initial prices. In terms of the figure, the increase in consumption in constant prices is the distance **ef** measured on the X_1 axis. Real consumption increases with an improvement in the external terms of trade. Paradoxically, real GDP falls! The decline in GDP is the distance **eg**.[17] In this case, the volume GDP index provides a misleading measure of command over resources.

[16] For the most part, economic historians have not adjusted GDP volumes for terms of trade gains/losses. Exceptions include Ward and Devereux (2012) and Stohr (2016).

[17] The intuition is straightforward. GDP for this case is equal to consumption plus exports minus imports. In constant base year prices consumption increases but the trade balance in constant prices is negative leading GDP in constant prices to fall.

Figure Two

GDP and the External Terms of Trade



The model is a simple one but the message that we must adjust GDP to reflect command over resources and hence real living standards carries over to more complex models see Kohli (2004).

Equation (2) provides the correction suggested by national income accountants to adjust GDP to reflect changes in the external terms of trade. Note that p is a trade deflator, px and pm are the export and import price indices and x and m are volumes of exports and imports. The adjustment yields a measure of real income called real Gross Domestic Income (GDI) in the UN system of national accounts where GDI = GDP + T.[18]

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

[18] Silver and Mahadavy (1989) provide a formal introduction to GDI and related concepts used in this paper.

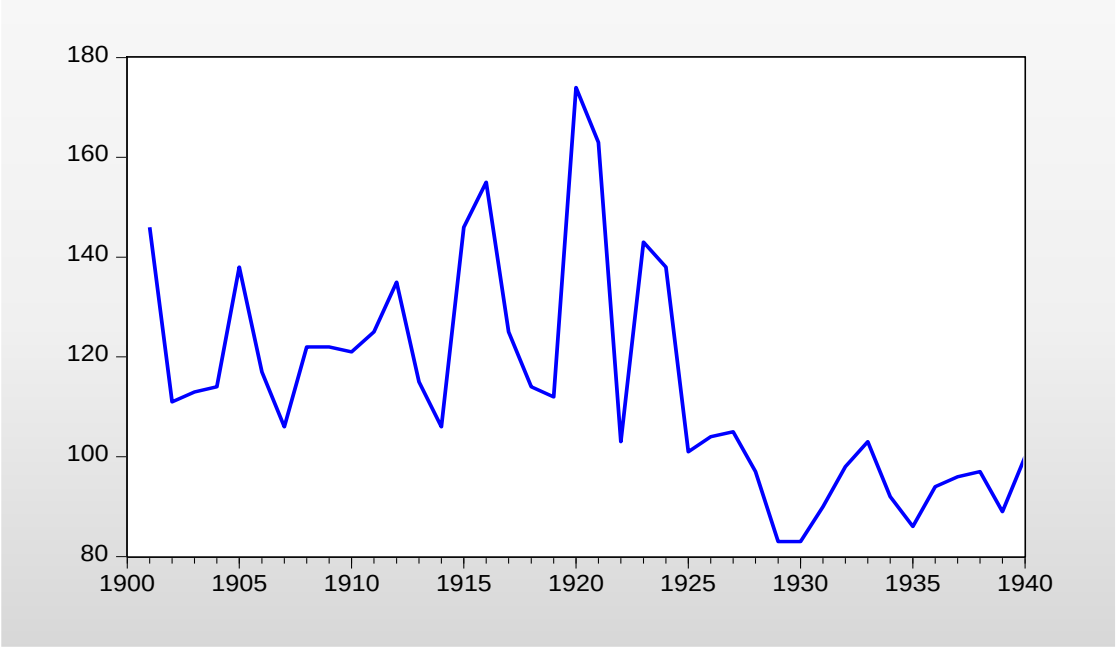
Following the convention in the US national accounts, I use the import price index as the trade deflator.[19] This yields the "command" measure of GDP.

There are big swings in the external terms of trade for the island for these years. To show this, Figure Three gives the external terms of trade from 1901 to 1940. Appendix one provides the annual data and Appendix two explains how I construct these series.

Figure Three

The External Terms of Trade

1940 = 100



Source: Authors calculations see Appendix for annual series.

Driven largely by sugar prices, the terms of trade were remarkably volatile before the 1930's. Sugar prices peak during the sugar boom of the First World War and its aftermath. The

[19] There is a long debate on the correct deflator for trade. An influential school recommends the overall expenditure deflator, see Kohli (2004) as the trade deflator. The expenditure deflator is not an option for Puerto Rico as it does not exist before 1940.

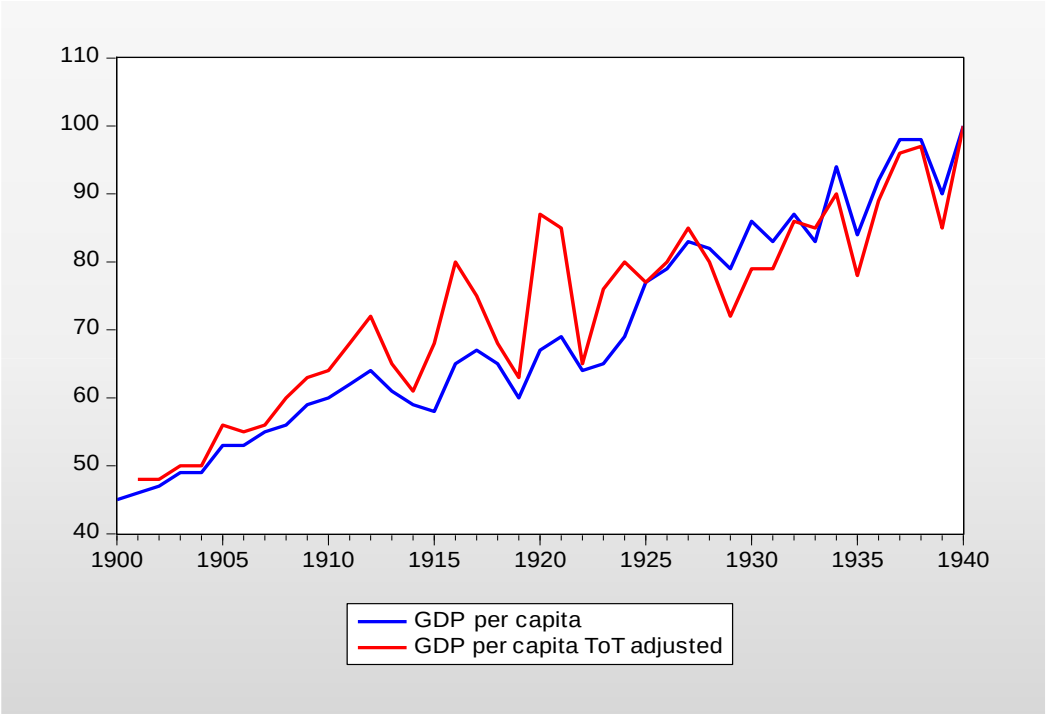
terms of trade declines from the late 1920's onwards but volatility also falls as sugar prices are partly insulated from world markets by US sugar programs.

Figure Four compares the GDP volume measure to the terms of trade adjusted measure of GDP calculated using equation (2). The underlying data are in Appendix one.

Figure Four

Adjusting GDP per capita for changes in the external terms of trade

1940 = 100



Source: Authors' calculations see data appendix.

As shown, the terms of trade adjustment to GDP is often large. Most notably, it increases GDP during the sugar booms of the First World War and the early 1920's. The record sugar prices of 1920 raise GDP by ten percent but it increases the terms of trade adjusted real GDP by a remarkable *thirty percent*!

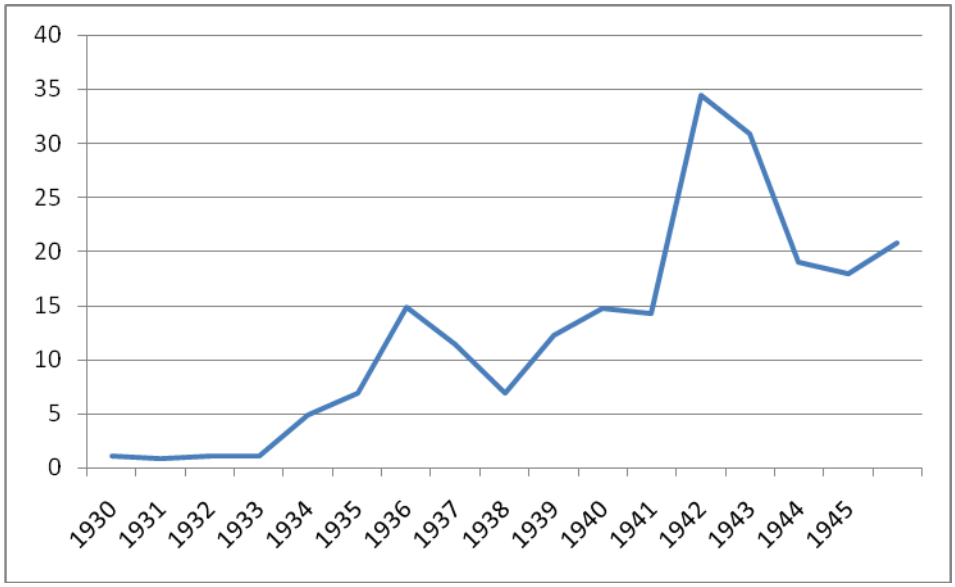
Does the result that Puerto Rico escapes the worst of the Great Depression continue to hold after we adjust for changes in the terms of trade? Before answering this question, I first examine why the volume of GDP holds up during the 1930's. A closer look at the components of GDP shows the island's strong showing during the 1930's occurs for three reasons. First, sugar exports increase due to Puerto Rican access to the protected US market. The volume of sugar production increased by seventy percent from 1929 to 1940 albeit with large year-to - year swings. The sugar effect is most marked for the first part of the 1930's. From 1928 to 1934, agricultural output increased by twenty-five percent largely due to sugar. Compare this to the mainland where agricultural output fell by twelve percent over the same period see Kendrick (1961). Second, there is a large increase in textile exports to the US during the first part of the 1930's again due to increased US protection. The index of textile production increases from 43 in 1928 to 98 in 1934, where 1940 = 100. Between 1928 and 1934, overall manufacturing output, driven by textiles and sugar, increases by fifty percent whereas US manufacturing output *falls* by thirty percent see Kendrick (1961).

The third reason why the volume of GDP held up during the depression is increased Federal transfers from the New Deal during the second half of the 1930's. To illustrate the size of the transfers, Figure Five gives the ratio of federal spending to nominal GDP from 1930 to 1944.[20]

[20] The Figure understates the federal contribution to the island since a complete accounting requires that we also consider transfers working through the tax system that partly funded domestic spending. Particularly important here are excise rebates swollen by the Second World War.

Figure Five

Federal Spending as a share of GDP – 1930 to 1945



Source: Authors' calculations. I take nominal federal spending from Perloff (1950). After 1940, nominal GDP (then termed Gross Insular Product) is from Perloff (1950). I form an index of nominal GDP before 1940 by reflating the GDP index in 1940 prices described in the text by the import price index described later. The results are similar if I use Smith's (1943) nominal income estimates.

The scale of Federal spending after the New Deal is remarkable. It averages one and a half percent of income during the early 1930's. It climbs to seven percent in 1934. By 1935, it is fifteen percent. The war years see yet higher expenditures associated with the war effort. In sum, after 1934 federal spending becomes as important as sugar to Puerto Rico. [21]

[21] The increase in government spending may have had additional effects on income through multiplier effects. Recent research by Fishback and Kachanovskaya (2015) considers the effects of government spending on economic activity (the multiplier) during the New Deal without including Puerto Rico. Fishback and Kachanovskaya (2015) and Nakamura and Steinsson (2014) show that the effects of government spending depends on the type of government spending and on whether it consists of transfers, loans or direct government spending. This is potentially important for Puerto Rico as the type of Federal spending changes across the 1930's. There is hurricane relief in the early 1930's. Work relief and agricultural loans start in 1934. Finally, there is a big increase in spending on goods and services associated with the war effort starting in 1940, see Perloff (1950) for a complete breakdown.

Do the terms of trade effects change how we view the 1930's? From Figure Two, the terms of trade declines from 1928 to 1931. This reduces income from 1929 to 1931 by about ten percent so these years saw hardship. The terms of trade also decline in 1934 but this is short lived. Thus, even after taking account of changes in the external terms of trade, it remains the case that the Island did better than the mainland during the 1930's.

To sum up, annual GDP growth rates during the colonial rule and the New Deal often tell us little about what happened to living standards since this also depends on the external terms of trade. The terms of trade adjustments are important for Puerto Rico especially when looking at year to year changes in GDP but they do not change earlier findings - that modern economic growth began after American rule and that Puerto Rico did relatively well during the Great Depression.[22]

Further Evidence

Working from the output side, I do not have a measure of consumption. There is evidence from clothing and food consumption, however, to suggest that consumption increased in tandem with income. Before the 1950's Puerto Rico imported almost all of its clothing. Thus, I measure clothing consumption by clothing imports. In addition, I measure food consumption by adding food imports to the components of the agricultural production

[22] The depression for Puerto Rico would have been much worse outside the US. As we have seen, the Federal government directly benefitted Puerto Rico through its various programs and their possible multiplier effects. The Island gained as exports prices for sugar and textiles were above prices on world markets. Of course, import prices were also higher through the Jones act where all imports came on US ships but these effects are small relative to the effects on export prices. To see how Puerto Rico would have fared outside the US, consider Cuba. Ward and Devereux (2012) find that after adjusting for changes in the external terms of trade Cuban income per capita for 1932 was forty-four percent of its 1920 level – an income catastrophe equivalent to that suffered by the losing combatants in the Second World War.

index described earlier. The resulting indices for clothing and food are crude. They serve, however, as useful cross-checks for the GDP measure.

Appendix two provides per capita quantity indices for clothing and food along with a food import index for 1901 to 1940. The indices provide independent evidence of a significant improvement in living standards. For example, per capita clothing consumption doubled from the mid 1900's to 1940. Food consumption increases from 60 in the early 1900's to 100 in 1940. Accordingly, it seems safe to conclude that consumption increased along with GDP per capita. Puerto Ricans were better off in material terms after American colonial rule although by 1940 they were still very poor compared to the mainland.

Summing up

By the standards of recent decades, growth rates for income per capita of two percent are not spectacular. We should, however, see the Puerto Rican performance in the context of its time. Maddison (2007) provides GDP data for Europe and Latin America that allows us to compare Puerto Rican growth rates with the rest of the world. The results are in Table Two. From the Table, Puerto Rican growth rates compare favorably with Western Europe and Latin America. The differences in favor of Puerto Rico for the 1930's are particularly striking. The GDP data therefore support an optimistic appraisal of economic performance after annexation.

Table Two

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

	1900-1914	1914-1929	1929-1938	1900-1938
Western Europe	0.7	1.7	0.9	1.1
Latin America	1.6	2.2	0.3	1.5
United States	1.1	2.4	-1.3	1.1
Puerto Rico	1.9	1.9	2.4	2.0

Source: Maddison (2007) as updated by the Maddison project at http://www.ggdc.net/maddison/maddison-project/data.htm. Maddison does not provide growth measures that adjust for changes in the terms of trade.

The results also imply some income convergence to the US mainland given that Puerto Rico grows at a faster rate. To be sure, this is partly due to the 1930's where special factors were at work. On the other hand, there is stronger evidence that output per worker converges. As noted earlier, output per worker increased at a rate of 2.6 percent per year from 1900 to 1938. For the mainland, the growth rate in output per worker for this period is only 1.3 percent (Kendrick (1961).

As discussed later, the reliance on 1940 prices likely understates Puerto Rican growth through the "Gerschenkron effect" suggesting that convergence was stronger than suggested by Table Two. In sum, the first four decades of American rule saw the beginning of modern economic growth with some convergence to the mainland.

3. Gerschenkron in the tropics

The previous section provides GDP for 1900 to 1940. After 1940, we have the official national accounts. Recall that GDP is the market value of goods and services produced within a country's borders while GNI is the market value of goods and services produced by labor and the other factors supplied by domestic residents. Recent decades have seen large differences between GDP and GNI for Puerto Rico. By the middle 2000's, the ratio of GNI to GDP for the Island was only two thirds. The scale of the difference is unique among developed economies as, outside of Puerto Rico, only Ireland shows a significant gap. For 2014, the latest year where data is available, the World Bank Development indictor (WDI) database put this ratio at 0.85 for Ireland and 0.65 for Puerto Rico.

Economists typically prefer GDP to GNI because GDP is the relevant measure when looking at total factor productivity etc. The prevailing view for Puerto Rico is that GNI is superior as a measure of economic activity. The differences between GDP and GNI for the island are due to repatriated earnings from US firms and specifically to repatriated earnings from firms in the pharmaceutical and medical device industries who partly locate to Puerto Rico to avail of differential tax treatment. Part of the differences between GNI and GDP reflect returns to foreign owned factors of production. A large but unknown portion is the result of transfer pricing where US firms overstate the profits of their subsidiaries in Puerto Rico.[23] In

[23] Bosworth and Collins (2006) provide compelling evidence that GDP is overstated in this fashion. A simpler way to grasp the large size of the measurement error is to look at the official data on manufacturing value added. Puerto Rico shows a ratio of value added in manufacturing to GDP of 0.47 in 2014. This is, by far, the highest ratio in the world. For comparison, the next highest ratios, for China and Korea, show a manufacturing share of 0.3 see the 2016 World Development Indicators. Bosworth and Collins (2006) also provide some rough adjustments to obtain "true" GDP.

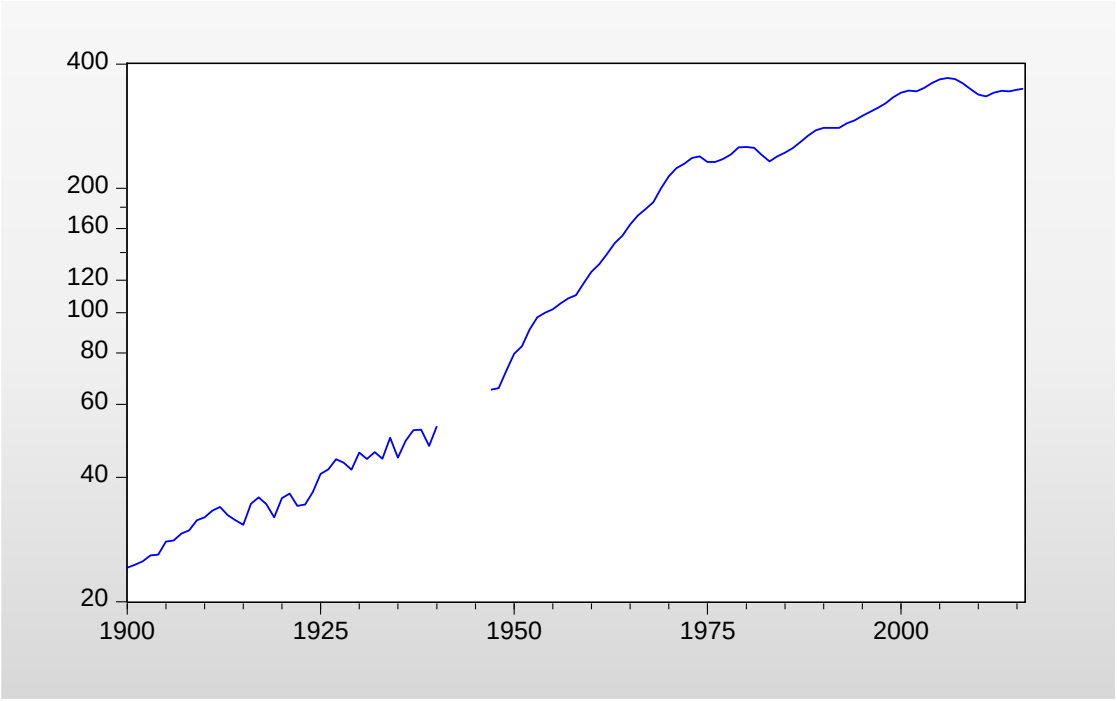
what follows, I concentrate on GNI, as it is a better measure of income. Therefore, I focus on the income rather than output or productivity.[24]

How well has Puerto Rico done over the very long run in terms of income growth? Figure Six traces real GNI per capita from 1900 to 2016.

Figure Six

Real GNI per capita - 1900-2016

1954 = 100



Sources: I assume that the growth in GNI equals that of GDP for 1900-1940. The estimates for 1940 and 1947 to 1950 are from Anuario Estadístico, (1955) page 150. There are no estimates of real GNI for the war years. The series from 1950 to date are from Series históricas ('50-'11p) obtained at http://www.jp.gobierno.pr/Portal_JP/Default.aspx?tabid=316 to 2011 and Economic Report for the Governor and Legislative Assembly thereafter. The annual series underlying the Figure are in Appendix two.

[24] Transfer pricing has other effects on the national accounts. As shown in the appendix it can also change the GNI/GDP deflators.

The graph uses a log scale to capture the three epochs of Puerto Rican growth. As we have seen, modern economic growth begins with American colonial rule. Real income per capita grows at a respectable 2.0 per annum to 1940. The second phase begins with the policy changes of the New Deal. After Operation Bootstrap, the island grew at fast rates to the early 1970's – the convergence boom. Indeed, real GNI per capita grows at an annual average of 4.9 percent between 1950 and 1970! During these years, the island grew at similar rates to the miracle economies of Asia. After the first oil crisis, Puerto Rico experiences a severe recession. Growth falters and measured real GNI per capita grows at an average rate of only one percent from 1970 to 2016 - well below growth rates the mainland. Moreover, GNI per capita falls after 2006. Thus, the last four decades would seem to be worst period for growth since annexation.

The stagnation of income over the last four decades in the national accounts is usually taken as evidence of Puerto Rican failure see Abel et al (2012) page 2. As it turns out, there are serious problems with Puerto Rican national accounts for recent decades that call into question this conclusion.

The first problem is Puerto Rico does not adjust for changes in the external terms of trade. As a result, the national accounts has greatly understated GNI/GDP growth rates. Once we adjust for this distortion, the Island appears in a much better light.

Adjusting for the External Terms of Trade

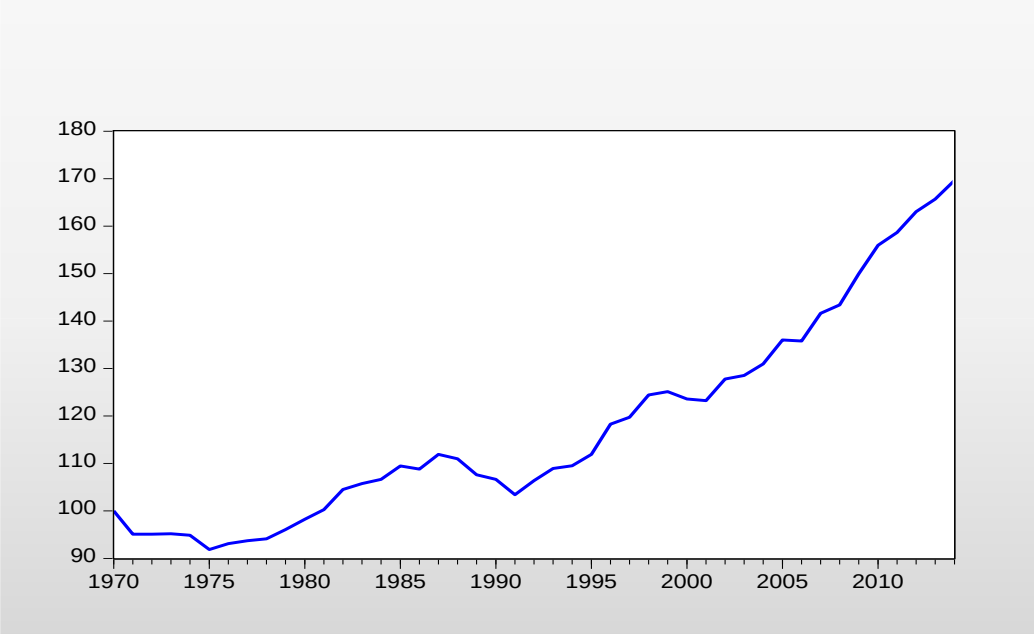
The literature on Puerto Rico ignores the terms of trade adjustments to GNI/GDP. The adjustment does not appear in the national accounts, in the Brookings volume of Collins *et al* (2006), the Federal Reserve report of Abel *et al* (2012), or in the influential policy report

Krueger *et al* (2015) etc. The neglect is surprising. First, Puerto Rico is one of the most open economies in the world. The ratio of measured imports plus exports of goods and services to nominal GNI has increased from 1.2 in 1970 to close to 2.0 for recent years. Second, Puerto Rico has experienced a large appreciation in its measured external terms of trade.[25] To show this, Figure Seven traces the external terms after 1970.

Figure Seven

The External Terms of Trade, 1970-2015

1970 = 100



Sources: United Nations National Accounts national account database. I measure the terms of trade as the ratio of the implicit deflator for exports of goods and services to the implicit deflator for the imports of goods and services.

The terms of trade improves from 1990 to date. During this period, the terms of trade rose by sixty percent - close to that experienced by Australia or Canada during their resource

[25] I say measured external terms of trade. As explained in the data appendix, the observed improvement in the external of trade may be a statistical artifact of transfer pricing.

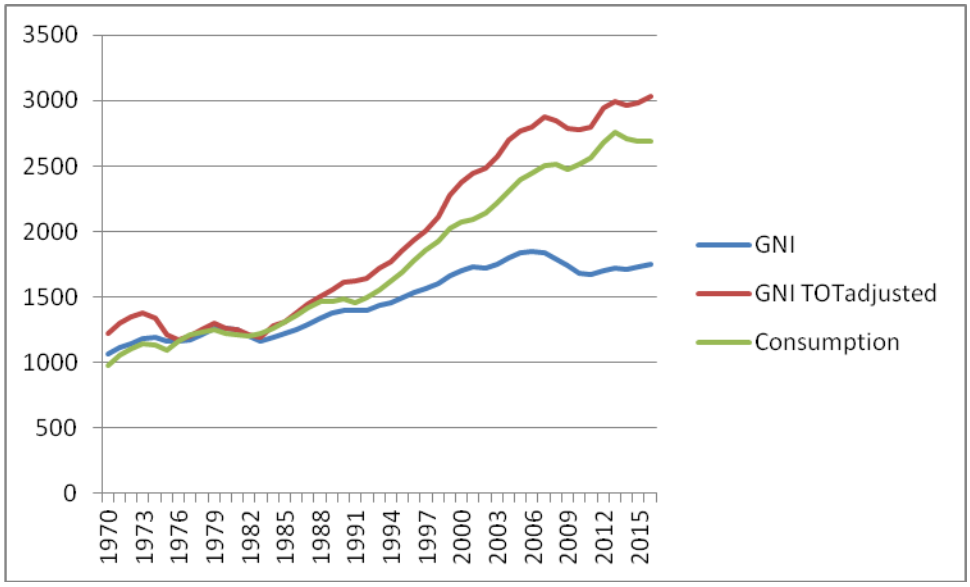
booms. In these circumstances, GNI/GDP will understate the real resources available to Puerto Ricans.

I adjust GNI using equation (2). For the earlier period, I deflated trade by the import price index due to unavailability of other domestic deflators. After 1950, I use the consumption deflator to adjust trade for reasons outlined in the data appendix.

Figure eight provides GNI per capita and the terms of trade adjusted GNI after 1970. The data appendix gives the results from 1950 to 2016.

Figure Eight

Adjusting GNI for changes in the external terms of trade – consumption and GNI per capita in constant 1954 prices



Sources: The GNI and consumption series series from 1970 to date are from Series históricas ('50-'11p) obtained at http://www.jp.gobierno.pr/Portal_JP/Default.aspx?tabid=316 to 2011 and Economic Report for the Governor and Legislative Assembly thereafter. GNI I is the terms of trade adjusted series explained in Appendix two.

I provide three series. The first is GNI per capita in constant prices from the national accounts. As seen earlier, the official series shows modest growth after 1970. Indeed, the ratio

of GNI for 2016 to 1970 is 1.63 reflecting an annual growth rate of just one percent. The second series, GNI TOTAdjusted, incorporates the terms of trade adjustment. The terms of trade adjusted GNI series diverges from GNI in the early 1990's reflecting the measured improvement in the external terms of trade. The ratio of adjusted GNI for 2016 to 1970 is 2.48 reflecting an average annual growth rate of two percent – double the official series and close to the growth rate of the US mainland. The standard GNI series therefore exaggerates the growth slowdown for the Island. Put differently, it would seem that the Puerto Rican economy has done better over recent decades than is appreciated in the policy literature.

One way to confirm these results is to look at consumption, also provided in Figure Eight. As noted earlier, the volume series for consumption are immune to terms of trade distortions. From Figure Eight, consumption closely tracks adjusted GNI and it also grows at a rate of two percent.

Should we conclude that Puerto Rico has kept pace with the mainland after all? Alas, it turns out to be more complicated. The problem is that the Puerto Rican national accounts suffer from a second, and more serious, flaw that overstates growth. As shown above, I can adjust GNI/GDP for changes in the external terms of trade. For the second problem, however, adjustment is very difficult indeed.

The Gerschenkron effect

Puerto Rico calculates real GNI/GDP for the entire period after 1940 with fixed 1954 prices.[26] The reliance on a fixed set of unchanging prices over seven decades is unique for the modern era as the standard practice is to change the prices used to value income at regular intervals. Most countries change prices every five years or so. The US changes prices every year. The use of fixed prices during a long period rapid economic change gives rise to a classic index number problem – the "Gerschenkron effect" named after the economic historian Alexander Gerschenkron.[27] The Gerschenkron effect states that measuring GDP with prices from an early year inflates growth while using prices from a late year reduces growth.[28]

The Gerschenkron effect arises because of the generally negative correlation between prices and quantities. A simple example illustrates the underlying mechanisms. Assume that the economy produces tradables and nontradables. Assume further that growth is faster in tradables and that the relative price of tradables falls over time. It is easy to show that early period prices will produce a higher measured growth rate as compared to late period prices.

[26] I could find no other country that uses fixed early prices for the post war era. The use of fixed prices over long time spans is more common, however, for the historical national accounts for the nineteenth and early twentieth centuries. These studies, for the most part, used late period prices. For example, Kendrick (1961) uses 1929 prices for 1889 to 1929. Feinstein (1971) uses 1900 prices for 1870 to 1910 and so on.

[27] Gerschenkron (1947) discovered this effect in his study of Soviet growth as the Soviets measured growth using 1929 prices hence overstating growth. The use of early period prices over long spans creates other difficulties too. For instance, it is difficult to incorporate new goods using early period prices. How do we value an I-phone in 1954 prices? This problem does not arise with late period prices.

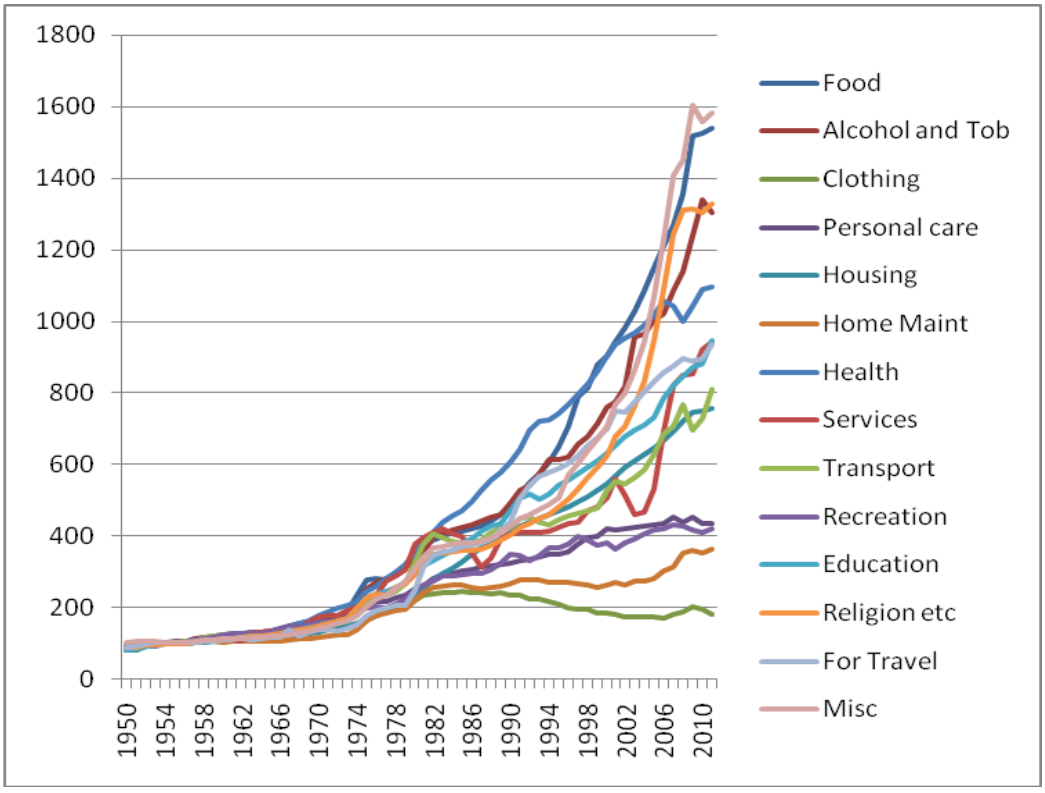
[28] As mentioned, using late period prices over long periods artificially reduces measured growth. This means that the Puerto Rican GDP index of the last section will understate growth. Appendix two considers the issue in more detail. In brief, I cannot form GDP indices using early year prices because of data constraints. I can, however, form indices for manufacturing and agriculture in 1909 and 1940 prices. As shown in the appendix, growth rates are indeed higher with 1909 prices. The fact that the GDP index of the last section understates growth to some unknown degree reinforces the claim that Puerto Rico experienced modern economic growth during the first decades of American rule. It also strengthens the conclusion that some convergence in income and labor productivity occurred with the mainland.

Intuitively, this occurs because by using early prices we value the faster growing sectors at higher prices. Thus, the national income accounts for Puerto Rico are potentially flawed. Is the resulting bias large enough to distort our understanding of the Puerto Rican record? The evidence suggests that it does. To best way to see the distortion resulting from fixed prices is with consumption. The national accounts break consumption for Puerto Rico into fourteen categories. An examination of these data reveals that the choice of base year largely determines the pace of consumption growth. To support this claim, I first calculate implicit deflators for the various categories of consumption from 1950 to 2011.

Figure Nine

Consumption deflators

1954 = 100



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

Figure Nine shows the results. The overall consumption deflator increased from 100 in 1954 to 630 in 2011. This average conceals large differences across consumption sub-indices. The deflators for some items, such as clothing, merely doubled.[29] At the other end of the spectrum, the deflator for medical care increased tenfold. In sum, Puerto Rico experienced large changes in relative prices after 1954. This is the necessary condition for the Gerschenkron effect. The second step calculates real consumption per capita using different base year prices. The results are in Table Three which provides consumption in 1954 and 2011 prices for selected years.

Table Three

Comparing consumption per capita 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: authors' calculations using data from Series históricas ('50-'11p).

[29] The US national accounts also show large changes in relative prices. Unfortunately, the US and Puerto Rico use somewhat different classifications of spending so it is difficult to compare the changes in consumption deflators.

The Gerschenkron effect is present in these data as the early base produces higher growth rates. Using 1954 prices consumption per capita increases six-fold. Using 2011 prices it increases fourfold. Moreover, these calculations understate the bias arising from fixed prices because they ignore the effects of changes in relative prices that occur within the sub-categories of consumption. It follows that the estimates in the table are a lower bound for the true effects.[30]

To summarize, the Puerto Rican national accounts overstate consumption growth relative to the measures used by the US and other economies.[31] The scale of overstatement is unknown but is possibly large. The more general point is that a reliance on fixed early prices will bias measured GNI/GDP growth rates. The solution to this impasse requires that the Puerto Rican statistical authorities change their base year prices at regular intervals and, equally important, to publish retrospective series for earlier years. The BEA (2011) makes proposals along these lines. So far, however, progress seems to be slow with little prospect of retrospective accounts any time soon.

Previously, we have seen that the neglect of changes in the external terms of trade has biased GNI downwards. This problem is correctable. On the other hand, the use of fixed prices has biased GNI upwards and this is difficult to correct. The flaws in the national accounts,

[30] I get similar results from the US national accounts. The US calculates consumption using a chained index. The chained index shows that per capita consumption increases by 364 percent from 1954 to 2014. Using the finest degree of disaggregation available, I find that calculating growth in fixed 1954 prices yields an increase of 568 percent.

[31] The shortcomings of the Puerto Rican national accounts and in particular the reliance on fixed prices have received little attention in the literature. The sole exception appears to be BEA (2011).

transfer pricing, the neglect of the external terms of trade, fixed 1954 prices, therefore make comparisons of growth rates between Puerto Rico and other countries, as in the classic work of Baumol and Wolfe (1996), a fraught exercise. They also make it difficult to calculate GDP and hence factor productivity for Puerto Rico even if we could adjust for transfer pricing, along the lines of Bosworth and Collins (2006), in any meaningful way. In short, we are largely in the dark concerning the Puerto Rican performance after the slowdown in the early 1970's.

Are there alternatives to the current GNI/GDP series? As we have seen, we can adjust for the effects of changes in the external terms of trade. The problem is with fixed prices. One possibility is to form an alternative index by revising the GNI deflator. Appendix Two considers the various alternatives. None, as it turns out, is appealing.

The remaining sections of the paper explore a simple but informative route to measuring the comparative performance of the island.

4. An American Mirror

Figure Ten compares Puerto Rican GNI and household consumption per capita from 1940 to 2016 to the US in current US dollars.[32] For the comparison is to make sense, relative Puerto Rican/US price levels must be equal.[33] As shown in the next section, the assumption holds, at least approximately, for recent decades.

[32] I assume that nominal GNI is measured accurately. The informal sector is large for the Island see Bosworth and Collins (2006) who put it at around twenty five percent of the economy. It is not known how this affects measured economic activity.

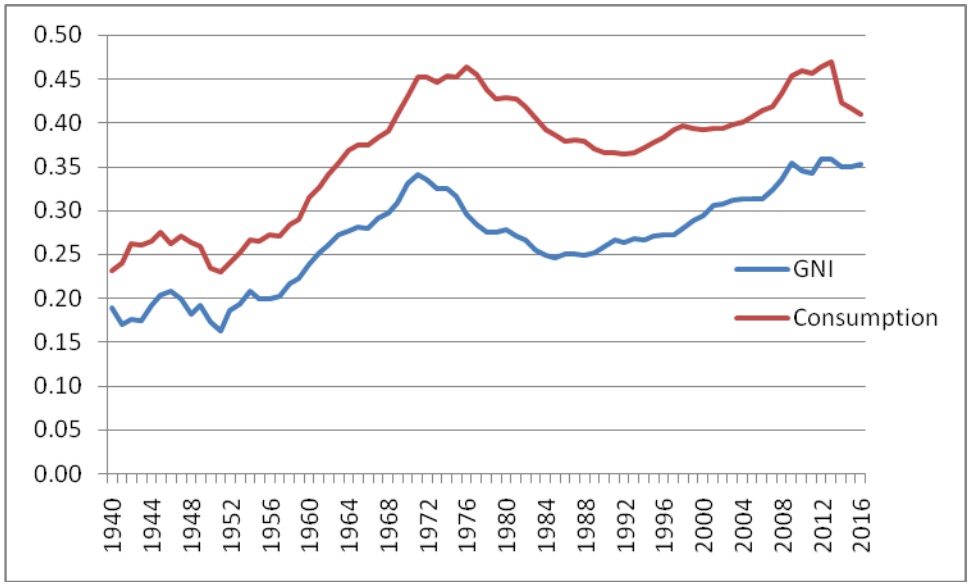
[33] More formally, I assume that the gross domestic expenditure deflators are approximately equal for Puerto Rico and the mainland. If that is the case, then the ratio of Puerto Rican to US nominal GNI is equivalent to the terms of trade-adjusted measure of relative GNI defined earlier.

Earlier, we have seen convergence to the US between 1900 and 1940. The figure shows that convergence ceases in the 1940's as ratio of GNI per capita in nominal terms is constant until 1950. The ratio then doubles from 0.17 in 1950 to 0.34 in 1971 – the convergence boom. It drops for the next decade as Puerto Rico loses ground relative to the mainland after the first oil crisis. In recent years, relative GNI regains the 1970's peaks but the improvement after 2004 occurs alongside an absolute decline in population. While Puerto Rico has not converged to the US for income after 1970, it has not fallen behind either.

Figure Ten

Relative GNI and Consumption per capita – Puerto Rico and the US from 1940 to 2016

US = 100



Source: Authors' calculations using Pico and Perloff (1951) for 1940 to 1950 and Series Históricas ('50-'11p) to 2011 and after 2011 the Economic Report for the Governor and Legislative Assembly for Puerto Rico. The US estimates are from the BEA national accounts. I add government spending on education and healthcare by using data from the underlying spreadsheets of the Penn World Tables (PWT) Version 7.1 - the last version of the PWT to include these data. PWT Version 7.1 adds government spending on healthcare and education to form private consumption. I assume that the 1950 ratio of personal consumption to overall consumption from the PWT holds between 1940 and 1950 for both economies and the 2008 ratios hold after 2008.

For our purposes, GNI measures income per person while consumption measures living standards. To compare consumption, I follow the convention in the International Comparison Program (the ICP) by defining household consumption as private consumption from the national accounts (NIPA consumption) plus government provided education and healthcare services. I term this measure ICP consumption. The broader measure of consumption is necessary because any difference in the public provision of healthcare and education across the US and Puerto Rico will distort comparisons.

Figure Ten shows a sizeable gap between relative income and ICP consumption with consumption higher for all years. The difference after 1940 ranges between thirty and sixty percent with the largest gap for the 1970's. Puerto Rico starts in the early 1940's with consumption at twenty-five percent of US levels as compared to twenty percent for income.[34] The consumption ratio increases to forty-six percent in 1976 – well above the GNI ratio.[35] The relative standing of Puerto Rico in terms of consumption falls from the mid 1970's but there is a recovery after 2000. By 2013, consumption is forty-seven percent of US levels dropping for recent years. In sum, the consumption series provides a more positive perspective on the progress of the island suggesting that Puerto Rico is not nearly as poor as it often seems in policy discussions.

[34] When do the differences between income and consumption begin? I cannot date this change without a proper series for consumption before 1940.

[35] The peak year for consumption occurs later than for income. For recent years the differential between income and consumption has narrowed.

The differences between consumption and income reflect the fact that NIPA consumption (that is excluding government spending on health and education) averages ninety percent of nominal GNI for Puerto Rico. For the US, the ratio is sixty percent before 1980 rising to around sixty-eight percent for recent years.[36] At a deeper level, the divergence between GNI and household consumption reflects the flow of resources from the mainland to the island that allows expenditure to exceed income.[37] During this long period, remittances, government and private borrowing and, most importantly, Federal transfers to individuals and the Puerto Rican government have financed an excess of spending over income.[38]

Comparing Puerto Rico to US states

The BEA provides data on GNI and consumption for US states after 1997.[39] The BEA state consumption data do not include government provided services so I compare NIPA consumption. As we might expect, the ratio of Puerto Rican NIPA consumption is higher than for GNI. Consider 2011- before the deep recession that grips the island. The ratio of GNI per capita to the US is 0.37 while the ratio for personal consumption is 0.46. For the poorer

[36] Perhaps surprisingly, the PWT data do not show that Puerto Ricans obtain a greater portion of their education and health services from the government as compared to the mainland.

[37] The patterns have, however, changed over time. In particular, the importance of federal transfers fell from the early 1950's to the middle 1970's with a rapid rebound thereafter. The changes in how consumption is financed do not alter how consumption or GNI is measured.

[38] For Puerto Rico, the appropriate income concept for consumption is arguably GNI plus net current transfers. This is called Gross National Disposable Income (GNDI) in the UN system of national accounts. For recent years, the ratio of consumption to GNDI averages about seventy-five percent.

[39] These data are available at: http://www.bea.gov/regional/histdata/releases/1215pce/index.cfm

Southern States, however, the consumption ratios are considerably higher – in the case of Mississippi and Arkansas they are close to sixty percent.[40]

After Perloff (1950), an important strand of the literature compares Puerto Rico to US states, particularly Southern states, using personal income.[41] The advantage of personal income is that allows comparisons over very long time spans.[42] The drawback is that personal income comparisons give a misleading picture of Puerto Rican living standards, which are best measured by consumption.[43]

To summarize, Puerto Rico living standards, as measured by household consumption, are higher than is generally understood. Nonetheless, consumption is still well below the mainland. Suppose, however, that Puerto Rico does not behave like a US state. Suppose instead that the Island is best understood as a separate Latin society albeit one receiving large

[40] The assumption of equal price levels is not a good one for some US states. If Puerto Rican prices are approximately equal to the mainland then Puerto Rican prices will be above price levels in poorer US states.

[41] There are no comparisons in the literature to other outlying US areas – Hawaii and Alaska. At first glance, this might seem odd as there are clear similarities at least with Hawaii. They are both sugar producers and so on. The explanation appears to be that Alaska and Hawaii are high income areas and this is the case for a long time. We have personal income from BEA sources for Alaska from 1950. For Hawaii, there are estimates that stretch back to 1939 see Schmitt (1977, Table 6.3). For all years, personal income is well above the US average in the case of Alaska and close to the US average with Hawaii. Historically, these outlying areas also scored higher than Puerto Rico on indices such as education, infant mortality etc.

[42] Bridgeman et al (2012) provides an extensive discussion along these lines. If we use measured GDP to generate output per worker, then Puerto Rico approaches GDP per worker for poor Southern states.

[43] The ratio of consumption to personal income for Puerto Rico is close to one for all years after 1950. This marks an important difference as compared to the US where the ratio of household consumption to personal income since 1940 averages seventy-seven percent with an increase in recent years. Puerto Rico stands out in this regard as the ratio of personal consumption to personal income is similar across US states judging from BEA estimates of state consumption and income from 1997 to 2007, see Awuku-Budu, Guci, Lucas, and Robbins (2013)). The similarity also holds for earlier years, see Lebergott (1996).

transfers from the mainland. Then the relevant comparison for Puerto Rico is not with the US mainland but rather with other Latin economies.[44]

5. A Latin Mirror

There are two reference groups for the international comparisons. The first is Iberia and Latin America. The relevance of these countries is obvious – they share a common cultural and linguistic heritage. The second reference group covers the rich market economies of Europe - Belgium, Demark, France, Germany, Italy, Ireland, the Netherlands, Norway and the United Kingdom, countries to which Puerto Rico might aspire.

The last section rests on the assumption that relative price levels are equal for the US and Puerto Rico. The claim is difficult to verify, as the island has not participated in the International Comparison Program (the ICP).[45] There is, however, evidence on relative price levels from other sources. The most important pointers come from the price comparisons of the COLA program – more properly the Non-Foreign Cost of Living Allowance – that seeks to compensate federal bureaucrats posted to Puerto Rico, Hawaii, Alaska and other outlying areas for differences in the cost of living.

COLA uses price surveys to compare price levels between Washington DC and San Juan. The program has published detailed results for the last two decades. Appendix two looks at the

[44] Along similar lines, Prados De la Escosura (2007) argues that the US is not always the relevant comparison for Latin societies.

[45] The ICP compares overall price levels by means of large sophisticated price surveys. Their benchmarks underlie the Penn World Tables (PWT) and Maddison (2007). The ICP and the Penn World Tables also estimate price levels for countries without ICP price data, such as Puerto Rico, using a short cut regression procedure see Prados De la Escosura (2000) for a discussion. I consider the short cut estimates for Puerto Rico later in this section.

most recent studies. I show that the COLA evidence is consistent with roughly similar price levels for the US and Puerto Rico. This is a useful finding since it means that we can compare Puerto Rico to the rest of the world through the ICP – the International Comparison Program of the World Bank.

There remains the question of whether the assumption of similar price levels is a good approximation for the more distant past. To provide an anchor for the earlier comparisons, Appendix two provides a direct 1950 income comparison for the US and Puerto Rico along the lines pioneered by Gilbert and Kravis (1954) – the forerunner to the ICP.

The comparison covers forty-six categories of consumption, five categories of investment and three categories of government spending. Details and sources are in the Appendix. The results imply a Puerto Rican price level that is two thirds of the US in 1950. The approach of the last section therefore understates Puerto Rican income and living standards for early years relative to the US.

The Comparisons

I compare Puerto Rico for three years, 1955, 1980 and 2011. The data on income and consumption (I use ICP consumption that is NIPA consumption plus education and health care from the government) for 1980 and 2011 come from ICP benchmark comparisons that adjust for price level differences. I chose these years because of good coverage for Latin America. There are no ICP benchmarks before 1967 and I rely on pre- ICP comparisons. For 1955, I use Braithwaite (1968) for the Latin economies. The European data are from Gilbert and Kravis (1958). For Puerto Rico, I project the Puerto Rican/ US price levels estimates 1950 estimates

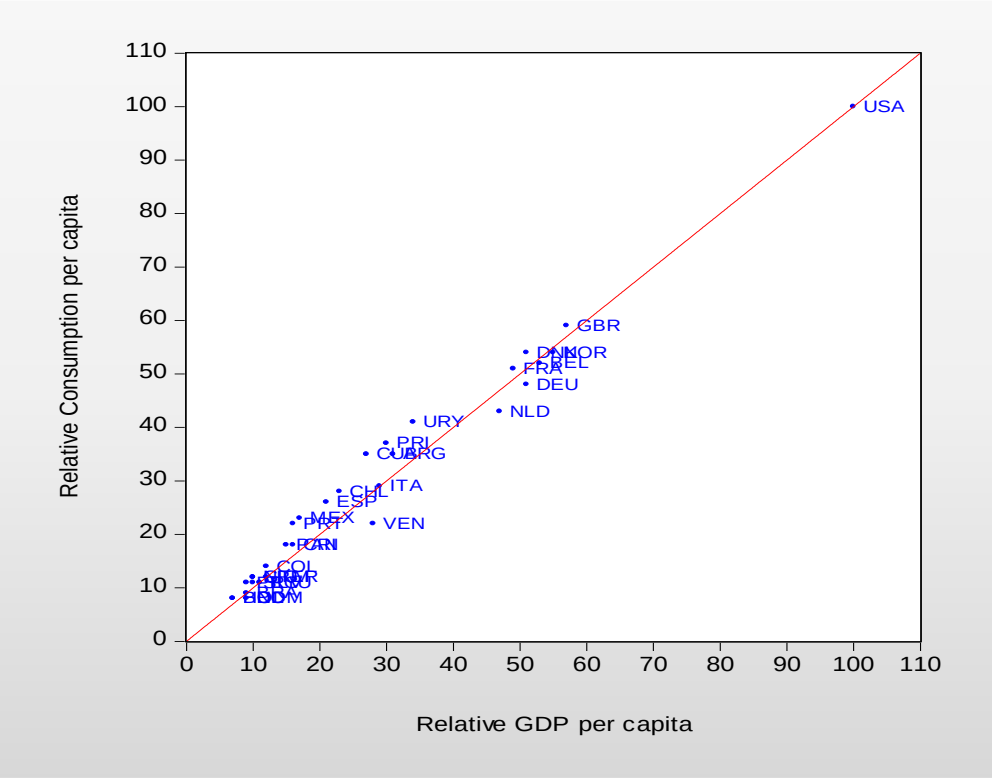
from the appendix to 1955 using the national accounts.[46] Finally, I include rough 1955 estimates for Portugal and Spain taken from Ward and Devereux (2012). The estimates of relative income per capita and ICP consumption per capita are in Appendix one.[47] The results are best seen graphically. Figure Eleven provides the 1955 comparison.

[46] The 1955 comparison is a Fisher Ideal bilateral comparison with a US base. The 1980 comparison also uses a Fisher Ideal measure with a US base which I calculate from the detailed ICP price and expenditure data described in Appendix two. To date, the ICP has not made available the price and expenditure data required to calculate Fisher Ideal indices for 2011. I therefore rely on the 2011 ICP benchmark which uses a multilateral variant of the Fisher Ideal called the EKS (Elteto Koves and Szulc) index. The estimates using the Fisher Ideal and the EKS are generally close.

[47] The comparisons in this section compare real income and consumption using prices from the comparisons years. For example, I use 1980 prices to compare income and consumption for 1980 and so on. Consequently, the income comparisons do not equal those of Maddison (2007) as he compares income for all years with 1990 prices. The estimates in the Figures are consistent, however, with the latest version of the Penn World Tables. Over its lifetime, the Penn World Tables has adopted various approaches to comparing income. The latest edition, version 9.0, compares income using the prices from the nearest ICP benchmark see Feenstra et al (2015). In this regard, the PWT has followed the example of economic historians such as Prados De la Escosura (2000). Finally, the literature has not found a way to reconcile the ICP benchmarks with the underlying NIPA growth rates see Feenstra et al (2015). Thus, even though we know the US growth rates we cannot recover those of Puerto Rico from the ICP benchmarks.

Figure Eleven

Relative Income and consumption for 1955



Sources: See Appendix one.

The vertical axis measures consumption per capita relative to the US while the horizontal axis compares income. I use GDP for all countries save for Puerto Rico and Ireland where GNI is my preferred measure.[48] The figure also provides a forty-five-degree line. Along the line, relative consumption and relative income are equal.

As shown by Figure Eleven, the US had a commanding lead in income and consumption in 1955. The second group of economies in the Figure is Western Europe where consumption and GDP per capita averages fifty to sixty percent of US levels. After Western Europe, we find

[48] I could also compare labor productivity as measured by GNI (or even GDP). On these measures, Puerto Rico performs much better.

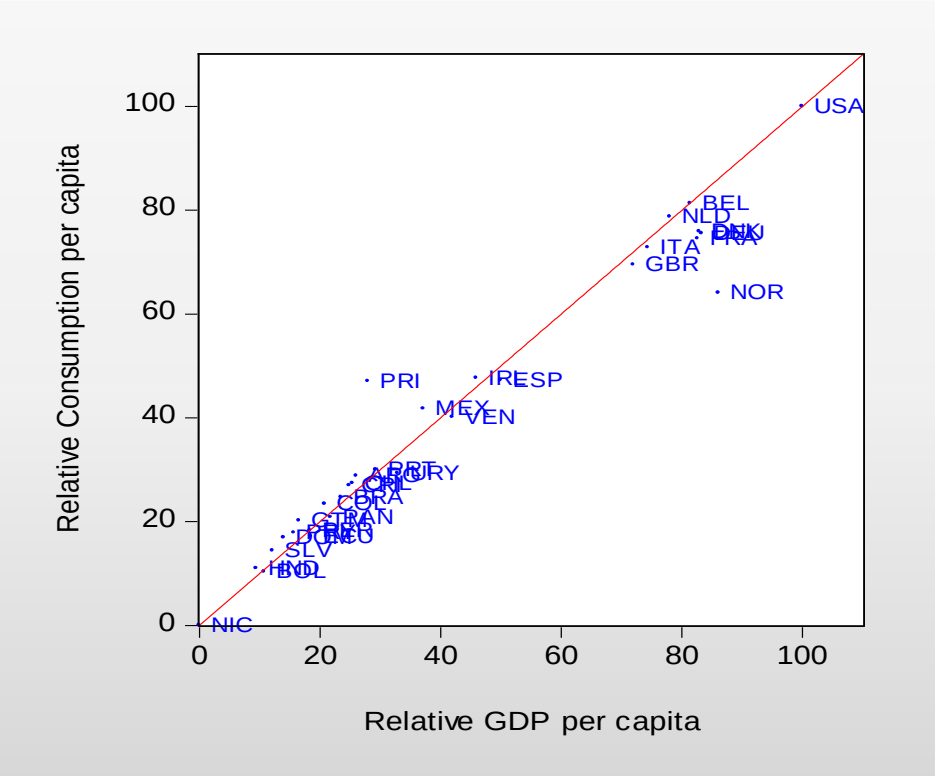
Italy and the middle-income economies of Latin America – Argentina, Cuba and Uruguay. These economies average twenty-five to thirty percent of US GDP per capita. They do better for consumption where they average thirty to thirty-five percent of the US. The rest of Latin America brings up the rear.

Where does Puerto Rico (PRI) stand? Judging by income and consumption, Puerto Rico is a prosperous middle-income economy. At thirty-seven percent of the US, consumption is close to Argentina, pre-Castro Cuba and Uruguay. It is above Italy and Spain in Europe. Puerto Rico therefore shares with the Southern Cone the highest living standard among Spanish speaking societies. Income per capita is thirty percent of the US - similar to Argentina and the rest of the Southern Cone. The higher levels of consumption relative to income for the Southern Cone reflect their low levels of government spending and investment relative to the US. For Puerto Rico, however, the higher relative level of consumption reflects high levels of expenditure relative to income financed by transfers and borrowing from the mainland.

Figure Twelve repeats the exercise for 1980 where I assume Puerto Rican and US price levels are the same. This is the first ICP benchmark with wide coverage of the Latin Economies. By 1980, Western Europe has edged closer to the US frontier and average income per capita has increased to eighty percent of the US. Average consumption is seventy-four percent of the US. Italy has joined the rich economies and Spain has moved up the world income distribution. Puerto Rican consumption at forty-four percent of the US is a little below Spain and Ireland but it is well ahead of other Latin economies. Along with Spain, Puerto Rico can claim the highest consumption level of any Spanish speaking society.

Figure Twelve

Relative Income and consumption for 1980

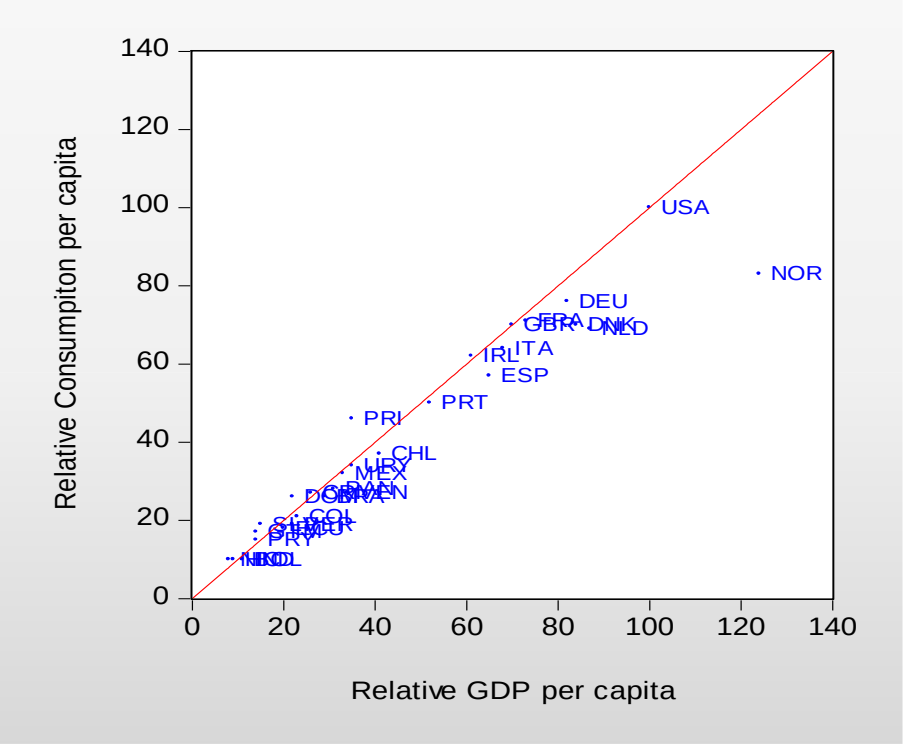


Sources: See Appendix one.

The standing of Puerto Rico for income is less impressive. At twenty-eight percent of the US, it is below Uruguay and Venezuela. For Puerto Rico, the consumption ratio is fifty-five percent higher than for income. The difference is larger than for any other economy in the Figure and reflects the large transfers from the Federal government.

The last Figure brings us up to date with 2011.

Figure Thirteen
Relative income and consumption for 2011



Sources: See Appendix one.

The US leads in consumption for 2011 - Norway leads in income. The Western European economies have slipped a little relative to 1980 but Spain and Ireland are closer to the Western European frontier. For consumption, Puerto Rico has fallen behind Spain and Ireland and to a lesser extent Portugal. Yet the island remains well ahead of the rest of Latin America. The next Latin economy is Chile where consumption is thirty-seven percent of the US compared to forty-six percent for Puerto Rico. Thus, Puerto Rico is a prosperous country by the standards of other Latin Societies. More generally, Puerto Rican consumption is at about the level of Korea and a little below Israel - hardly impoverished nations. The contrast of consumption with income

remains as using income, Puerto Rico is stuck at the level of Uruguay and Venezuela –well below Chile.

These estimates may understate Puerto Rican achievements. The ICP, the World Economic Outlook of the IMF and previous versions of the PWT estimate the Puerto Rican price level using short cut regression procedures, described in Appendix Two, which yield Puerto Rican price levels well below US levels. For example, the latest round of the ICP provides a short cut price level estimate of 0.798 relative to the US (World Bank (2014) page 77). The appendix argues against the short cut estimates for Puerto Rico. The essential point here if the short cut estimates are closer to the truth then Puerto Rican living standards are well above those suggested by this paper. Figure Thirteen puts Puerto Rican consumption at forty-six percent of the US. Using the ICP short cut price level estimates brings consumption to fifty-six percent of US level.[49] This puts Puerto Rican above Portugal and Korea, at the same level as Spain and close to Ireland! If the results of this paper err, they will thus err on the side of understating Puerto Rican consumption levels.

[49] I assume that the overall price level is approximately equal to that for consumption.

6. Concluding Comments

Puerto Rico is a remarkable case - it is a Spanish speaking society that for some purposes can be considered as a US state. The first part of the paper provides, for the first time, a GDP index for Puerto Rico during direct US colonial rule. The index counters the claims that Puerto Rico was a stagnant society before the New Deal. In fact, modern economic growth began with annexation and long before the policy changes of the New Deal. Nor, as is widely believed, did Puerto Rico suffer disproportionately during the Great Depression. On the contrary, it did better than the mainland.

Nonetheless, the New Deal is the great Puerto Rican watershed. First, it led to the creation of a development state that has persisted to the present. Second, after the New Deal it becomes crucial to distinguish between income, as measured by GNI, and living standards as measured by household consumption. To be sure, the results for income are disappointing. On the other hand, the island fares better for consumption. Consumption is sixty percent of the poorer Southern States. It is well above the rest of Latin America and is close to a country like Portugal or Korea. Seen in this light, Puerto Rico might have done better but it is not a disaster either.

The more general point is that any evaluation of the Puerto Rico record over the last century depends on how we view Puerto Rico. The view from the mainland sees Puerto Rico as a de-facto US state albeit speaking Spanish. Puerto Ricans, or so the argument goes, are Americans sharing a fixed exchange rate and a common monetary policy with the mainland and receiving large transfers from the Federal Government. It follows that we should judge Puerto Rico as we would a southern state, say South Carolina. There is merit is this view. Against it is

the fact that Puerto Rico has a different history and a different language. Its culture and its political and legal systems are those of Puerto Rico not the US. Most importantly, Puerto Rican elites see themselves as Puerto Ricans rather than as American and they have acted accordingly. A century of American rule has not changed these realities. If Puerto Rico is a separate society, then it is not obvious that it is a failure. The island has, after all, a standard of living that is the envy of other Latin societies. A standard, moreover, that is largely divorced from the income of its citizens. This, to be sure, is a Puerto Rican paradox worth exploring.

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Appendix - Table 1

Relative GDP and consumption per capita – 1955, 1980 and 2011
US = 100

	GDP per capita			Consumption per capita		
	1955	1980	2011	1955	1980	2011
Belgium	53	80	81	52	81	70
Denmark	51	82	84	54	76	70
France	49	84	73	51	75	71
Germany FR	51	84	82	48	76	76
Italy	29	75	68	29	73	64
Netherlands	47	80	87	43	80	69
Norway	55	95	124	54	70	83
United Kingdom	57	72	70	59	68	70
Argentina	31	31		35	36	
Bolivia	7	13	11	8	12	10
Brazil	9	29	29	9	32	26
Chile	23	28	41	28	30	37
Colombia	12	22	23	14	24	21
Costa Rica	16	26	26	18	29	27
Cuba	27			35		
Dominican Republic	9	15	22	8	18	26
Ecuador	11	21	20	11	19	18
El Salvador	10	13	15	11	15	19
Guatemala	10	17	14	12	22	17
Honduras	7	9	9	8	11	10
Mexico	17	41	33	23	46	32
Nicaragua	10		8	12		10
Panama	15	23	31	18	21	28
Paraguay	9	16	14	11	19	15
Peru	12	21	22	12	21	19
Puerto Rico	**30**	**28**	**34**	**37**	**43**	**46**
Uruguay	34	40	35	41	34	34
Venezuela	28	46	34	22	46	27
Portugal	16	31	52	22	33	50
Spain	21	52	65	26	51	57
Ireland		45	72		47	62
USA	100	100	100	100	100	100

Notes: For Ireland and Puerto Rico, GDP is replaced by GNI. The 1955 and 1980 comparisons are Fisher Ideal benchmarks while 2011 is a multilateral generalization of the Fisher Ideal Index called the Elteto Koves and Szulc (EKS) index. The 1955 benchmarks are from Ward and Devereux (2012) except for Puerto Rico where I use the 1950 US/Puerto Rico benchmark described in Appendix two projected to 1955. I construct the 1980 comparisons from detailed ICP price and expenditure data at http://www.rug.nl/research/ggdc/data/pwt/pwt-9.0. Finally, I take the 2011 results from http://siteresources.worldbank.org/ICPEXT/Resources/ICP_2011.html. The data necessary to calculate the Fisher Ideal for 2011 are not yet available from the ICP.

Appendix
Table 2
GDP per capita and the External Terms of Trade 1900-1940
1940 = 100

Year	GDP per capita	GDP per capita ToT adjusted	TOT
1900	45		
1901	46	48	146
1902	47	48	111
1903	49	50	113
1904	49	50	114
1905	53	56	138
1906	53	55	117
1907	55	56	106
1908	56	60	122
1909	59	63	122
1910	60	64	121
1911	62	68	125
1912	64	72	135
1913	61	65	115
1914	59	61	106
1915	58	68	146
1916	65	80	155
1917	67	75	125
1918	65	68	114
1919	60	63	112
1920	67	87	174
1921	69	85	163
1922	64	65	103
1923	65	76	143
1924	69	80	138
1925	77	77	101
1926	79	80	104
1927	83	85	105
1928	82	80	97
1929	79	72	83
1930	86	79	83
1931	83	79	90
1932	87	86	98
1933	83	85	103
1934	94	90	92
1935	84	78	86
1936	92	89	94
1937	98	96	96
1938	98	97	97
1939	90	85	89
1940	100	100	100

Notes: See Appendix two for methods and sources. GDP per capita for 1940 in 1940 prices is $139. Total exports for 1940 are $107.03 million and total imports are $92.35 million.