



Legacies of opportunity and economic integration: Path dependent labor force participation in Puerto Rico's development



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ABSTRACT

Using a large-scale sample of the working-age population drawn from U.S. decennial census microdata for Puerto Rico, this article evaluates whether theories of labor markets adequately explain labor force participation rates in developing countries that are highly integrated to more developed nations. Significant differences across labor cohorts in the likelihood of participation of men and women indicate that participation is conditioned by historical timing of entry into the work force. A two-equation model is used to estimate the exogenous effect of expected earnings. Cohort differences persist net of controls for education and earnings. This evidence suggests path-dependent participation rates associated to distinct stages of the economic development process, and is most consistent with institutionalist perspectives in the sociology of labor markets. Cohort participation-experience profiles are not consistent with the labor-leisure choice model or with the international division of labor theory.

1. Introduction

Sustained participation in the work force is a fundamental precondition for earnings and occupational attainment in developed and developing countries alike (Breen, 2005; Gangl, 2003; World Bank, 2013). Despite this generally acknowledged importance, how participation in developing countries is shaped by their integration to more developed ones, remains an open question. In this article, I extend current sociological perspectives on the interplay between economic development and inter-country integration by examining labor force participation during Puerto Rico's industrialization. Relying on labor cohorts to proxy timing of entry into the work force, I analyze whether phases of development associated to variation in economic opportunities generate cohort-specific participation trajectories. The estimated inter-cohort differences for men and women are then used to assess theoretical perspectives on economic integration and labor markets.

The supply of labor is defined as the sum of all those working or actively looking for work. When considered as a proportion of all adults, it measures the rate of labor force participation. The analysis of participation rates over time relying on micro-data has been extensively carried out for industrialized countries and their corresponding industrialization experience (Balleer, Gómez-Salvador, & Turunen, 2009; Clogg, 1982). These results indicate that greater economic integration does not necessarily produce convergent participation rates across countries, findings that allude to the importance and persistence of differences in labor market institutions (Kapsos, 2007). Comparable

insight into developing countries has remained limited owing to a focus on periods of insufficient length, or due to reliance on intra-country variation at a single point in time to gauge differences in levels of industrialization (Evans & Saraiva, 1993; Smith, 1981; Yu, 2005).

Puerto Rico provides a threefold methodological advantage for improving sociological knowledge about the relationship between labor market institutions and inter-country integration: First, Puerto Rico's high level of economic and political integration to the United States, typifies the conceptualization of high integration found in sociological perspectives concerned with its consequences for development. Puerto Rico's labor market can therefore provide a well-suited context for examining such perspectives. Secondly, since Puerto Rico's relationship to the United States resembles that of many developing countries with more industrialized nations, findings on Puerto Rico may speak to the experience of countries, territories, or provinces relying on integration for development. Such is the case with Ireland, Jamaica, and the Dutch and French Antilles, all of which have relied on export-based strategies and on out-migration to more industrialized partners (Byron & Condon, 1996; Mjøset, 1993; Peach, 1967). Finally, Puerto Rico's development trajectory, with fairly distinct economic development periods, can be differentiated by institutional and macro-economic characteristics.

I exploit variation in these characteristics to evaluate the presence of inter-cohort differences in labor force participation. For the purposes of my analysis, a labor cohort is defined as a set of individuals who, upon entering the work force for the first time, face similar labor market institutions and macro-economic conditions. Previous work,

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relying on this aspect of Puerto Rico's development, documented differences across historical periods in the relevance of labor cohorts for occupational status inequality (Toro, 2014). I improve on this research design by using information on English ability in Puerto Rico as a source of exogenous variation in a non-recursive estimation of the relationship between expected earnings and participation. This identification strategy enables disentangling the effect of cohort covariates from the net effect of earnings.

I find evidence of inter-cohort differences in labor force participation. Specifically, the relative odds of men who entered the work force in the 1950s and 1960s, during the most dynamic period of Puerto Rico's industrialization, are higher when observed 11–20 years after their initial entry into the work force, than those of comparably experienced labor cohorts, whose initial entry into Puerto Rico's work force took place in the 1970s and 1980s. At higher levels of experience, industrial-era labor cohorts reflect a lower likelihood than preceding cohorts. Inter-cohort differences among women resemble those documented for men, but are mostly significant upon controlling for expected earnings. These results are best viewed as path-dependent participation profiles determined by changes in the institutional make-up of Puerto Rico's labor market throughout its industrial development. Expected earnings are an important mechanism that channels differences in economic opportunities that result from changes in the institutions of Puerto Rico's labor market. More generally, evidence from Puerto Rico suggests the need for sociological perspectives focused on development and social stratification to formulate explicitly how the institutional context of labor markets in developing countries interacts with economic integration.

2. Labor force participation and inter-country integration

Three theoretical perspectives address the dynamics of labor force participation under economic development: the labor-leisure framework; the institutionalist perspective in the sociology of labor markets; and the international division of labor theory, itself a specification of world systems theory and the dependency school to account for the characteristics of labor markets in developing countries. Each of these three perspectives has distinct implications for the likelihood of participation by labor cohort under conditions of high inter-country integration. My discussion specifies for each theory gender-specific hypotheses for cohort differences.

2.1. Integration and the labor-leisure trade-off

The nineteen fifties and sixties witnessed the apogee of modernization theory, which argued that development is determined by the adoption of institutions similar to those of industrialized nations (Moore, 1951). A similar formulation by various theories of globalization considers that trade, and flows of information across countries, lead less developed countries to adopt the institutions of Western countries (Guillen, 2001). In this view, integration is expected to germinate institutional convergence, a likely outcome in countries that see a high level of legitimacy in the practices and institutions of the more developed country (Herkenrath, König, Scholtz, & Volken, 2005). High levels of institutional convergence make it possible for economic actors to base their actions on the calculation of trade-offs. The labor-leisure choice framework conceptualizes labor force participation in terms of this decision-making process. A potential labor market entrant is more likely to enter and stay in the work force if he/she can expect to earn a wage or salary that is higher than the value placed on leisure-time, child-care, and household-related production (Heckman, 1980; Mincer, 1962). Concomitantly, as merit and performance become key markers of expected productivity, employers make hiring and pay decisions based on the education and experience of applicants. Research on industrialization in the United States has documented changes in the elasticity of earnings consistent with this interpretation,

suggesting that earnings became a more important predictor of participation with economic change (Blau & Kahn, 2007).

This perspective suggests that inter-cohort differences are channeled through differences in expected earnings. Potential entrants into the labor force in the early stages of development face distinctly less attractive trade-offs owing to lower earnings, lower diversity of occupational opportunities, and to the incipient institutionalization of meritocratic criteria. This implies that early cohorts are likely to participate at lower rates than more recent ones. As development proceeds, subsequent labor cohorts encounter more favorable conditions upon first entering the work force, leading them to participate at higher rates. These inter-cohort differences should be present net of education since comparably educated workers in more recent cohorts are faced with better earnings and employment prospects.

Early formulations of the labor-leisure choice perspective, based on an invariant conception of gender roles, expected development to induce a reduction of women's labor force participation as rising earnings in manufacturing were expected to stimulate male participation, enabling families to sustain consumption levels with fewer workers (Mincer, 1962). Despite this expectation, the labor-leisure framework is consistent with the view that development leads to rising women's participation. Through the combined effect of growing "gender-appropriate" service sector jobs, and prospects of higher earnings owing to rising educational attainment, development can induce rising participation rates among women. Together with declining fertility and lower marriage rates—social changes commonly associated to development—women experience a reduced opportunity cost of work. Research examining the relationship between participation and GDP per capita has documented a U-shaped pattern consistent with these expectations (Rau & Wazienski, 1999). The labor-leisure framework implies that inter-cohort differences among women will be strongly channeled by expected earnings since women are disproportionately affected by the trade-offs between work and family obligations. Consequently, in the multivariate analysis, I examine cohort differences, net of controls for marriage and number of children. All hypotheses presented below are formulated conditional on these controls.

The implications for gender-specific rates suggest the following hypotheses:

Hypothesis 1. (men's participation). Development induces a monotonic rise in participation across cohorts as recent labor cohorts participate at higher rates than preceding ones. But, net of expected earnings and education, male inter-cohort differences in participation should be non-significant.

Hypothesis 2. (women's participation). Net of education and experience, recent labor cohorts participate at higher rates than pre-industrial and industrial labor cohorts. Inter-cohort differences should become non-significant upon controlling for expected earnings.

2.2. Comparative institutionalism and path dependence

The institutionalist perspective on labor markets has emphasized how variation in employment systems across countries affects the degree of uncertainty faced by workers (DiPrete, Goux, Maurin, & Quesnell-Vallee, 2006; Fligstein 2001; Kalleberg, 1988). Employment systems refer to the combined array of social policies that provide social security and training for the work force (Breen, 2005; Wolbers, 2007). This perspective shares with institutionalist perspectives in the sociology of economic development an interest in how variation in regulations induces differences in economic opportunities (Evans, 2005; Hall 2008; Hicks & Kenworthy, 1998; Portes & Smith, 2012). For example, development may depend as much on merit-based selection, as on institutionalizing employment systems and regulations that facilitate long-term employment security, and viable retirement

(Evans, 1995; Deaton & Paxon, 1994). If variation in such regulations is coupled to specific moments in the course of economic development, then development can generate path dependence in cohort participation-experience profiles. Evidence consistent with this image of labor market institutions has found that variation in old-age protection policies induces differences across birth cohorts in participation-experience profiles, as well as in participation among women and older men (Costa, 1998; Esping-Andersen, 1990; Fischer & Hout, 2006; Mandel & Semyonov, 2006).

The foregoing discussion suggests that development may lead to inter-cohort differences in participation, but not of the sort expected under the labor-leisure choice model. Adults who enter the work force at a time when economic change brings about improvement in the quality of occupations and expansive old-age protection policy, would participate at higher rates early in their careers, but reflect lower rates subsequently. Conversely, labor cohorts who upon entering the work force encounter low quality employment opportunities and weak or limited social policies oriented to old-age protection might participate at a higher rate for a longer time over their life-course. Net of earnings, cohort covariates partially capture the direct effect of changes in employment systems associated to economic development. An implication of this perspective is that cohort effects are not completely channeled through expected earnings.

Social security policies and old-age protection are ostensibly gender neutral in their application (even if not in the resulting distribution of benefits), but country differences in child-care and family-leave policies play out most strongly as differences across countries in women's participation (Pettit & Hook, 2009). These findings imply for both men and women non-monotonic cohort participation patterns. In the case of Puerto Rico, the institutionalist perspective suggests that net of education and expected earnings, inter-cohort differences may emerge contingent on the complex interaction of employment opportunities, family/parental leave policy, and retirement systems.

This suggests the following hypotheses:

Hypothesis 3. (men's participation). Institutional change associated to economic development does not induce systematic inter-cohort differences in men's participation rates.

Hypothesis 4. (women's participation). Institutional change associated to economic development does not induce systematic inter-cohort differences in women's participation rates.

2.3. Labor flexibility and the international division of labor

The international division of labor perspective (IDL) has emphasized the importance of inter-country integration and dependence to explain differences between countries in economic development. Economic integration refers to the degree of ease of capital and product flows between countries (Hall, 1986). Dependence is defined by a developing country's reliance on technology, capital, and trade from more developed countries. Highly integrated dependent countries are likely to have little leverage in trade, often times acquiescing to highly unfavorable terms, and experiencing an erosion of political control over their economies. For such countries, foreign direct investment might stimulate labor force participation through expanded employment in the modern sector of the economy, but most jobs are low-wage and low-skill (Fröbel, Heinrichs, & Kreye, 1980). These jobs come to dominate the labor market owing to the success of foreign firms in obtaining lax labor market regulations, and lax supervision of the conditions of employment (Benería, 2001). The IDL perspective implies that integration affects the labor market by limiting improvement in the quality of employment opportunities, and by limiting the implementation of policies that reduce uncertainty of employment over the life cycle. Since the movement of capital and of employment opportunities across countries and regions exacerbate these consequences, highly integrated

developing countries should be characterized by extreme labor market uncertainty (Standing, 1999a, 2011). The prevalence of weaker states and weaker labor market regulations should also affect the provision of old-age protection and retirement savings.

Under such circumstances inter-cohort differentiation should be small or absent since development under integration is not associated to higher earnings or to improved labor market conditions. While development may lead men to move from employment in agriculture to industry and services, this need not be associated to higher earnings. Since men are traditionally in the work force, this implies that male labor cohorts should reflect small or no inter-cohort differences. Regarding women's labor force participation, the IDL perspective has suggested that foreign manufacturing firms might prefer employing young female workers in peripheral regions of the world economy (Safa, 1995). While the process of integration may stimulate women's labor force participation, it does so partly by eroding traditional forms of household production (Fernández-Kelly, 1983; Standing, 1999b). This dynamic is likely to generate cohort differences in participation-experience profiles since women entering the work force should participate at higher rates over time than women from previous labor cohorts who had alternative sources of income and sustenance from agricultural or artisanal production.

This discussion suggests the following hypotheses:

Hypothesis 5. (men's participation). Economic development through economic integration should lead to low or non-existent inter-cohort differences in participation among men. This pattern should be present regardless of the inclusion of expected earnings as a covariate.

Hypothesis 6. (women's participation). Economic development should be associated with lower participation for pre-industrial labor cohorts than for industrial and post-industrial female cohorts.

The aforementioned hypotheses can be viewed as competing expectations regarding inter-cohort differences in participation. Whereas **Hypothesis 1** predicts that male inter-cohort differences become non-significant net of expected earnings, **Hypothesis 5** predicts no male cohort differences regardless of including a control for expected earnings. **Hypothesis 3** straddles a middle ground that suggests the possibility of inter-cohort differences but not associated to the trajectory of economic development. Predictions regarding women subsumed under **Hypothesis 2** and **Hypothesis 6**, predict similar inter-cohort trends, but with different implications for the effect of expected earnings. While **Hypothesis 2** predicts conditionally higher participation rates for women belonging to industrial and post-industrial cohorts, this depends on whether the inducement effect of expected earnings intensifies with modernization. Net of expected earnings, inter-cohort differences among women are expected to disappear. **Hypothesis 6** predicts higher participation among industrial and post-industrial cohorts even after controlling for expected earnings. **Hypothesis 4** specifies no relationship between development and inter-cohort differences in female-specific rates.

3. Puerto Rico's political economy

Puerto Rico's economic transformation in the post-war era can be delineated analytically in terms of two dimensions: a changing opportunity structure, and changes in regulations that provide security in employment. These changes can be subsumed under three historical periods, which I discuss below. The interpretation of cohort patterns documented in the quantitative analysis hinges on this discussion. Puerto Rico underwent a diversification of its occupational and industrial structure, with a simultaneous expansion of the regulations that undergird stable careers and predictable labor markets. In a previous article, I have explained the former dimension of change (Toro, 2014). In this instance, I emphasize the latter, its interaction with the occupational structure, as well as differences by gender in the

experience of industrialization. Throughout these periods, Puerto Rico has remained highly integrated to the United States, with most of its commercial and financial flows taking place bilaterally.¹

3.1. Incipient industrialization (1930s–1948)

From the mid-thirties until the late forties, Puerto Rico's government ushered in economic development by expanding employment in public utilities, health, and education, and through the creation of agencies focused on policy and planning such as the Puerto Rico Development Company (PRIDCO), the Government Development Bank (GDB), and the Puerto Rico Planning Board (Wells, 1969). New laws and regulatory bodies, such as a minimum wage law, and the Minimum Wage Board (1941 and 1942), stabilized wages in the private sector. Nonetheless, the predominance of agriculture implied low-income prospects for labor market entrants (Dietz, 1986). Additionally, supplementary income and pensions for the elderly were largely restricted to workers in the public sector, wherein partial coverage was guaranteed under pension funds, the origins of which predated industrialization: the teacher's pension fund (1917), the police's retirement fund (1921), and a savings plan for employees of the insular government (1921). Several forms of need-based supplemental income for mothers (1941), as well as enacted paid maternity leave (1942), could imply that women who entered the work force during this time had distinctive participation rates relative to women who entered during subsequent development periods. But, owing to Puerto Rico's industrial composition, and to the absence of a policy framework guaranteeing old-age protection, labor market entrants during the forties were likely to remain in the work force well into old age (Rohrlich, 1978).

3.2. Expansion of employment and public sector retirement systems (1948–1970s)

The decade of the fifties witnessed changes in policy that led to a re-composition of employment opportunities on the one hand, and to opportunities for retirement on the other. Through an export-led development strategy labeled Operation Bootstrap, Puerto Rico's government provided infrastructure to foreign (primarily U.S.) corporations, and articulated insular tax incentives to federal ones to stimulate foreign direct investment (Pantojas-García, 1990). This policy framework is generally credited with enabling aggregate growth through exports and low-wage employment in light manufacturing. Changes in the nature of production and in the quality of occupational opportunities may have led to higher expected earnings and better quality jobs.

The extension to Puerto Rico in 1951 of the Old Age and Disability components of the Federal Social Security Law (Kollmann & Solomon-Fears, 2001), along with the creation of the Public Employees Retirement System (Laws of Puerto Rico, 2015), and the Chauffeurs Insurance (Law 428), provided a foundation for retirement earnings. These retirement systems plausibly induced cohort effects by benefiting the least those who had been in the work force the longest at the time of their implementation. Low accumulated retirement savings should imply higher participation rates for those entering the work force prior to the decade of the fifties.

3.3. Industrial take-off (1955–1959)

Employment became increasingly diversified during the second half of the fifties. While agriculture's share of employment declined from

¹ Exports and imports to and from the United States have oscillated above 80% of GDP since 1948, the earliest year of available data for Puerto Rico's GDP, indicating Puerto Rico's high degree of dependence on the United States (CEPAL, 2004; Weisskoff and Wolff, 1975). The U.S. monetary and financial system encompasses Puerto Rico's economy.

approximately 30% to 23%, other economic sectors increased their relative share. For example, employment grew in a range of "modern" sectors: in transport and communication by 7%, in services by 14%, and in low-skill garment and textiles by 8%.² However, since expanding sectors were insufficient to absorb displaced agricultural labor, Puerto Rico witnessed accelerated migration to the United States (Bogue & Vazquez, 1985). Low inflation, together with rising productivity and investment, constituted a virtuous combination of macro-economic conditions that sustained annualized five percent growth in GDP per capita. Employment seasonality, typical of agrarian economies, declined, thereby contributing to an overall increase in household earnings (Curet Cuevas, 1986; De Jesús Toro, 1982).

3.4. Peak industrialization (1960–1973)

The decade of the sixties constitutes the zenith of Puerto Rico's industrialization. Production in the manufacturing sector rose to 300% of its value between 1947 and 1962.³ Employment became increasingly diversified, with government and service-related jobs rising from 45 to 54% of all employment between 1960 and 1970.⁴ Public employees' retirement savings were facilitated by the creation in 1966 of the Commonwealth Public Employees Association (Asociación de Empleados del Estado Libre Asociado), a compulsory savings plan. Economic growth, diversification of the occupational structure, social security inclusion, and pension systems for public sector employees, constituted an alteration of the institutional structure of Puerto Rico's labor market that may have led entrants during this period to have participation-experience profiles distinct from those of preceding labor cohorts.

3.5. Crisis and welfare benefits (1974–1983)

During the second half of the seventies, Puerto Rico experienced a shift in key aspects of the social and economic characteristics previously associated with growth and diversification. The worldwide recession induced an economic contraction that was compounded by the irreversible re-structuring of employment across sectors. Employment in agriculture continued its descent, contracting by approximately 45% between 1960 and 1970.⁵ Employment in goods production declined due to reduced competitiveness in garment and textiles. The reduction in employment was arguably exacerbated by the extension of full coverage under federal minimum wage levels (Castillo-Freeman & Freeman, 1991; De Jesús Toro, 1982). The extension in 1971 of the U.S. Food Stamps Program to Puerto Rico improved levels of non-earned income among the poor, thus raising their reservation wage. However this need not be a cohort-specific effect since individuals with reservation wages close to their expected market wage are present across cohorts.

3.6. Post-industrialization (1980s–2000)

The enactment in the late seventies of tax exemptions for revenues of U.S. corporations operating in Puerto Rico, amendments to Puerto Rico's industrial incentives Act, and the passage of Law 28 in 1978—granting exemptions to service sector firms—induced concentrated employment growth in finance, retail, and to a lesser extent, in

² Calculations based on data reported in the Economic Report to the Governor, Puerto Rico Planning Board, 1956, 1961.

³ Author's calculations based on data from: Table 9: "Gross Product and Gross Domestic Product by Industrial Sector; (fiscal years)." Puerto Rico Planning Board (1974, 1989, 1999, 2002).

⁴ Author's calculations based on data reported in the Economic Report to the Governor, Puerto Rico Planning Board, 1975.

⁵ Agriculture declined from 124,000 to 68,000 workers between 1960 and 1970 (Puerto Rico Planning Board, 1960 (Table 22) and 1975 (Table 25); "Employed Persons by Industry; (fiscal years)."

government (Pantojas-Garcia, 2001; U.S. General Accounting Office, 1997). Between 1980 and 2000, employment in government and in services rose from 63 to 72% of all employed. The phase-out of Federal incentives during the mid-nineties, and the adverse effects of NAFTA on low-skill manufacturing, accelerated this trend (U.S. General Accounting Office, 1996). The growth of finance coincided with the declining availability of defined-benefit pensions, with the growth of defined-contribution plans, and with the rising adoption by businesses of individual retirement accounts. While these changes could have stimulated savings, and thereby lowered participation in old age for post-industrial cohorts, the shift toward defined contribution plans could have lengthened participation over time. Nonetheless, dampened productivity growth, and stagnation of economic prospects during this period could have contributed to lower participation rates for recent cohorts (Bosworth & Collins, 2006).

3.7. The division of labor and cohort differentiation by gender

The transformation of Puerto Rico's economy generated employment opportunities differentiated by gender that are potentially cohort-specific. In the forties and fifties, women were concentrated in home needlework, and increasingly in factory-based garment manufacturing (Acevedo, 1990; Hernandez-Angueira, 1995; Milagros González, 1995; Rivera-Batiz & Santiago, 1996). As manufacturing became more predominant throughout the fifties, men increasingly took the new jobs, a pattern intensified with the rise of capital-intensive sectors such as electronics, chemicals, and pharmaceuticals. Women encountered better quality employment prospects than those available to women during the first half of the 20th century (Acevedo, 1990). By 1980, approximately 19% of employed women were professionals, up from 6% in 1940 (Acevedo, 1990: 241). Women's participation trends are consistent with this image, rising consistently since the sixties from about 25% to approximately 40% in the 1990s (Enchautegui & Freeman, 2006; Presser & Kishor, 1991). Men's participation trends reflect greater discontinuity, declining from about 71% in the 1950s, to a trough of 55% in the 1980s, but rising slightly in the 1990s to approximately 60%; a pattern also potentially associated to economic opportunities differentiated across labor cohorts (Enchautegui & Freeman, 2006; Rivera-Batiz & Santiago, 1996).

4. Data, variables, and methods

I restrict the analysis to individuals living in Puerto Rico, twenty to sixty-six years of age. The sample is drawn from the [Public Use Micro-data Samples \(PUMS\) for 1970](#) (one percent sample), 1980, 1990, and 2000 (five percent samples) of the U.S. decennial census (U.S. Department of Commerce 1970, 1980–2000).⁶ I retain 10,998, 73,054, 84,562, and 96,578 observations for the 1970, 1980, 1990, and 2000 censuses respectively, for a total of 265,192 observations. All samples exclude farmers, institutionalized civilians, and adults enrolled in school.⁷

Labor force participation: The outcome of interest is whether a person is in the labor force. I operationalize participation with a dichotomous variable coded as 1 for those who reported being employed or looking for work.

⁶ Each of the data files used in this analysis refers to a micro-data sample containing answers to the long-form questionnaire administered to 20% of all households interviewed in the U.S. decennial census. From this sub-set of respondents, the U.S. census bureau generates a data set for public use. The sub-sample for 1970 corresponds to a sampling rate of 1 in 100 or 1% and contains 27,212 observations for Puerto Rico. In 1980 and subsequently each micro-data sub-sample corresponds to 5% of the entire population. The PUMS samples for Puerto Rico for 1980, 1990 and 2000 contain 160,219 174,724, and 189,828 observations respectively.

⁷ Models controlling for farm-related employment did not suggest significant differences from the main conclusions reported below. I find significant farmer-cohort interactions in the cross-sectional estimates, but no distinct array of inter-cohort differences for either males or females (results available upon request).

Labor cohorts: Labor cohorts are operationalized with nine ten-year cohorts by assigning an age at which individuals become available to enter the labor force, itself hypothesized from years of reported education. For adults who reported completing 8th grade or less, I assigned 14 years. For each additional year of education up to high school completion, the age assigned increases by one year. For those with some college education but without a degree, I assigned 19 years. I assigned 20 years for those completing an associated degree, and 22 years for college-educated adults. To those with a masters degree, I assigned 23 years, and to those with professional or doctoral degrees, I assigned 24 years.

Age of entry into the labor force is added to a person's birth year to produce a worker's entry year, which I grouped to obtain labor cohorts ranging from 1920 to 29 to 1990-99.⁸ Of these cohorts, the 1940-49, the 1950-59, and the 1960-69, can be observed throughout the entire period. The 1930-39, and 1970-79 labor cohorts can be observed three times; the 1920-29, and the 1980-89 labor cohorts can be observed twice. Those belonging to entry years prior to 1920, or to the 1990-99 labor cohort, can only be observed once.⁹ While not strictly matching the periodization of Puerto Rico's economic development described in Section 3, this segmentation of the cohort variable has the advantage that comparisons of cohort effects can be carried out at consistent experience thresholds.

Imputed experience: I ascribe a hypothetical level of experience corresponding to the difference between the year of entry into the work force and each census year in which a cohort can be observed. The distribution of years of experience is then segmented into ten-year groups. This variable is interpretable as a level of labor market exposure. Since cohorts are not all observable in each census year, the observed range of labor market exposure varies across cohorts.

Education: I code education with four separate dummy variables: 8th grade or less, 9th to 11th grade, high school, and college or more.

Expected earnings: Expected earnings refer to the log of predicted annual earnings, adjusted for inflation to U.S. dollar values in 1999. The estimates are based on the sub-set of observations with reported earnings. To simplify the presentation of results, the expected earnings covariate is included as a control, re-centered at the mean annual earnings for those with 8th grade or less in each census year.

Unearned income: Labor force participation is commonly affected by unearned income. I therefore include two control variables that subsume non-earned income sources reported in the census: Personal unearned income (PUI) sums all non-wage income sources—dividends, welfare payments, farm income, and retirement income—that accrue directly to the person of interest. Other household income (OHI) sums similar sources accruing to other household members plus their earnings. Both measures are adjusted for inflation and logged to capture non-linear effects.

Marriage and number of children: Since participation may vary depending on marital status and on the number and age of children in the household, models include controls for these characteristics. I have coded a dummy variable equal to one for respondents who reported being married. The number of children is coded with three separate variables: one for the number of children zero to five years of age, a variable for the number of children six to eleven, and a variable for the number of children twelve to seventeen.

Urban residence and place of birth: Since by 1953 most industrial employment had been created within less than 507 square kilometers from Puerto Rico's capital, San Juan, I have included a dummy control for residence in San Juan to account for this potential skew in economic opportunities (Severino, 1999). Place of birth could be a relevant

⁸ Results from a supplementary analysis using five-year labor cohorts are consistent with the ten-year estimates reported in Tables 3 and 5.

⁹ Labor cohorts are mapped over a joint distribution of age and education that varies over time, and consequently not equivalent to birth cohorts.

ascriptive determinant of earnings and participation since between 1970 and 2000, of all adults in the sample, between 7 and 11% were born elsewhere. Thus, all models include a control for place of birth as a nominal variable with four-categories: Cuban, Dominican—the two most important migration waves into Puerto Rico since the 1950s—Puerto Rico-born, and a residual category for birth in all other countries or regions.

Instrumental variable: I relied on an instrumental variable to address the potential issues raised by the reciprocal causal relationship between participation and earnings. On the one hand, estimates of the odds of participation are partly determined by expected earnings, but on the other hand, earnings are observed upon entering and remaining in the work force, a process affected by competing family obligations that condition the odds of participation. Estimates of labor force participation should account for this reciprocal relationship or risk biased and inconsistent estimates of expected earnings, thereby inducing bias in all coefficients (Wooldridge, 2002).

To this end, I rely on a non-recursive two-step estimation approach, using English ability as a dichotomous instrumental variable (Paxton, Hipp, & Marquart-Pyatt, 2011). The first-step equation is an ordinary least squares regression (OLS), from which I derive the predicted log of annual earnings, conditional on English ability and on all aforementioned controls. The goal is to produce exogenous variation in earnings so as to obtain an unbiased estimate of the effect of expected earnings on participation. English ability is a valid instrument since in the context of Puerto Rico's labor market, where Spanish is the predominant language of social intercourse, it is unlikely that English ability affects labor force participation directly. The net effect of English ability on participation plausibly operates only through its impact on expected earnings, even when English might be a requirement for employment in specific jobs.¹⁰ The instrumented measure is generated for all observations analyzed. For those who are unemployed or out of the labor force, expected earnings constitutes a best “guess” based on the earnings predicted for employed individuals with otherwise equivalent observable characteristics.

The second-step equation is a multivariate logistic regression of the likelihood of being in the labor force, conditional on the log of predicted earnings, education, labor cohort, and control variables included in the first stage OLS.¹¹ I also report results generated without controlling for expected earnings to facilitate examining its relative importance for inter-cohort differences in participation. I report bootstrapped standard errors for all logits estimated with an instrumented regressor to avoid overstating the level of confidence in my results.

My empirical strategy examines cohort-by-period differences between 1970 and 2000 in the likelihood of labor force participation. While this approach does not control for period effects, it facilitates the examination of cohort differences at comparable experience levels. All cohort analyses have to grapple with the linear dependence of age, period, and cohort (APC) variables. In the present analysis, experience is equivalent to age, and census year is equivalent to period. Because experience is pre-determined by the difference between period and cohort, cross-sectional analyses cannot avoid confounding the net effect of cohort with that of experience. Similarly, comparisons of cohorts across time periods at equivalent experience thresholds confound the net effect of differences in time period with effects resulting from differences in labor cohort. Available statistical techniques to identify

¹⁰ English ability could be an invalid instrument if unobserved preferences for jobs of a specific quality affect the probability of participation and English ability. This could happen if individuals knowing English have a proclivity for certain occupations and would only enter the work force to work on those specific jobs. This seems like an improbable scenario, and even less likely net of other observable characteristics, but would violate the requirement of no correlation between the error and the instrumental variable.

¹¹ Relying on predicted earnings for 1970 as a proxy for expected earnings across census years produces similar results to those reported in Tables 3B and 5B.

APC effects require imposing dimensionality restrictions for at least one of the age, period, or cohort vectors, or deriving identification from the functional form (Mason, Mason, Winsborough, & Poole, 1973; Yang & Land, 2006). To identify cohort effects, researchers draw on information that is, in a statistical sense, external to the analysis, such as theory, or evidence external to the data itself (Glenn, 2005). The historical discussion in Section 3 above fulfills this purpose by providing the substantive underpinning for the interpretation of labor cohort effects. I have chosen to examine inter-cohort differences without modeling parametrically the effect of experience or period. This approach is preferable when the aim is to uncover discontinuous patterns of cohort-experience profiles that might emerge with economic development.

5. Results

5.1. Descriptive patterns

I begin by discussing measures reported in Table 1, summarizing the most salient changes in demographic and economic characteristics of the adult population in Puerto Rico between 1970 and 2000, to assess whether any of the theories has *prima facie* support. The percentage of men and women who report being married, or who report any children in the household, has declined, a trend most consistent with the labor-leisure choice model and modernization theory since all suggest declining opportunity costs to participation. Educational attainment has improved consistently over time, a trend that suggests the potential for improved economic opportunities. For example, the percentage of men with a completed high school education rose from 27.5 to 52.5 in 2000. The corresponding change for women is marginally smaller, from approximately 24 to 51%.

However, trends in participation rates by sex, as well as trends in annual earnings, suggest a more complex empirical picture. Female-specific participation rates rose from 28.2 to 39.7%, but male-specific rates dropped from 73 to 58.4%, a pattern harder to reconcile with the labor-leisure choice model. Trends in real annual earnings, do not indicate consistent improvement, but instead indicate a substantial dip in the 1980s and 1990s for men as well as for women. Since these trends may confound changes associated to cohort-specific participation dynamics, their analysis does not shed sufficient clarity in favor of any specific theory. The multivariate analysis allows for a more adequate discernment between the various theoretical frameworks discussed in Section 2.

5.2. Models of expected earnings

Models 1 through 8 in Table 2 report OLS estimates of the log of annual earnings generated separately by census year for men and women. As discussed in Section 4, the primary aim of these models is to obtain an instrumented measure of expected earnings, relying on English ability as the instrumental variable. Net of other covariates, English ability has a strong positive effect on male and female earnings across all cross-sectional estimates. For example, men who indicated any English ability in 1970, show 14.6% higher earnings ($100 * [\exp(.137) - 1]$) than adults with equivalent observable characteristics, the lowest estimate across all estimations regardless of the sex of respondent. The lowest percentage difference among women is for 1980, year in which those reporting any English ability expected 16.4% higher earnings ($100 * [\exp(.152) - 1]$). More pertinently, the association of English ability to earnings does not indicate that it is a weak instrument. Across models, *F*-tests for the overall improvement in OLS regressions resulting from the inclusion of English ability are significant at $p < .0001$. This suggests that the instrument provides sufficient exogenous variation in the predicted regressor that its inclusion in the second-step logistic regression is unlikely to induce a high level of collinearity (see discussion in Appendix A and the accompanying Table A1).

Table 1
Percentage of men and women by socio-demographic characteristics, and average annual income by type; Puerto Rico (P.R.), 1970–2000, adults 20–66.
Source: Author's calculations.

	Men				Women			
	1970	1980	1990	2000	1970	1980	1990	2000
In the labor force	73.0	67.4	70.7	58.4	28.2	34.5	43.0	39.7
Married	77.1	73.0	71.7	66.1	71.6	66.0	65.2	59.3
Any children in the household	70.9	63.8	57.3	48.6	73.0	66.8	61.0	54.2
Education								
8th grade or less	49.6	38.8	28.1	20.2	58.5	42.0	29.0	18.4
9th–11th grade	15.4	15.8	13.3	11.9	12.7	14.0	12.4	10.2
High School	27.5	35.1	45.6	52.5	23.6	34.5	43.6	51.0
College or more	7.6	10.3	13.0	15.3	5.2	9.5	15.1	20.4
English ability	53.0	55.3	57.4	65.2	38.8	45.9	50.6	63.4
Place of birth								
Puerto Rico	90.3	92.9	91.2	89.6	91.2	92.7	91.3	89.2
Cuba	1.7	1.2	0.9	0.7	1.4	1.0	0.7	0.6
Dominican Republic	0.9	0.9	1.4	2.1	0.7	1.1	1.6	2.3
Other	7.2	5.0	6.5	7.6	6.7	5.2	6.4	7.9
Residing in San Juan	20.0	14.2	10.9	9.7	19.2	15.0	11.7	10.8
Income (adj. to 1999 values)								
Earnings ^a	\$9924	\$7778	\$9364	\$14,518	\$2746	\$2926	\$4271	\$7003
Personal unearned income	\$3	\$9	\$10	\$11	\$3	\$6	\$13	\$16
Other household income	\$150	\$151	\$526	\$677	\$2659	\$1420	\$1618	\$1583
Sample size	4938	33,516	39,182	44,802	6060	39,538	45,380	51,776

Data: Public Use Microdata Sample from the U.S. census for Puerto Rico.

Note: Sample refers to adults 20–66, not enrolled in school, not institutionalized.

^a Based on sub-sample of adults with earnings (excludes those in farming-related occupations).

Table 2
Ordinary least squares regressions of logged annual earnings on education, labor cohort and control variables; P.R. 1970–2000, adults 20–66.

Variables	(A) Men				(B) Women			
	(1) 1970	(2) 1980	(3) 1990	(4) 2000	(5) 1970	(6) 1980	(7) 1990	(8) 2000
Education (8th grade, ref. group)								
9th–11th grade	0.235 ^{***} (0.037)	0.155 ^{***} (0.020)	0.163 ^{***} (0.023)	0.083 ^{***} (0.025)	0.179 ^{**} (0.066)	0.211 ^{***} (0.032)	0.126 ^{***} (0.035)	0.101 ^{**} (0.043)
High School	0.580 ^{***} (0.036)	0.536 ^{***} (0.017)	0.591 ^{***} (0.019)	0.494 ^{***} (0.020)	0.490 ^{***} (0.057)	0.532 ^{***} (0.026)	0.458 ^{***} (0.028)	0.485 ^{***} (0.034)
College or more	1.177 ^{***} (0.051)	1.221 ^{***} (0.022)	1.294 ^{***} (0.024)	1.215 ^{***} (0.023)	0.988 ^{***} (0.069)	0.978 ^{***} (0.031)	1.011 ^{***} (0.030)	1.100 ^{***} (0.036)
Labor Cohorts								
< 1920	0.048 (0.136)				0.103 (0.230)			
1920–29	0.175 ^{**} (0.054)	0.276 ^{***} (0.082)			0.189 ^{**} (0.084)	0.009 (0.189)		
1930–39	0.211 ^{***} (0.046)	0.383 ^{***} (0.028)	0.526 ^{***} (0.067)		0.067 (0.072)	0.202 ^{***} (0.045)	0.025 (0.188)	
1940–49	0.240 ^{***} (0.039)	0.410 ^{***} (0.022)	0.363 ^{***} (0.029)	0.380 ^{***} (0.102)	0.208 ^{***} (0.056)	0.285 ^{***} (0.028)	0.357 ^{***} (0.040)	0.627 ^{***} (0.178)
1950–59	0.211 ^{***} (0.033)	0.388 ^{***} (0.019)	0.428 ^{***} (0.021)	0.295 ^{***} (0.027)	0.223 ^{***} (0.045)	0.328 ^{***} (0.023)	0.392 ^{***} (0.024)	0.381 ^{***} (0.035)
1960–69	–	0.283 ^{***} (0.017)	0.402 ^{***} (0.019)	0.364 ^{***} (0.018)	–	0.239 ^{***} (0.020)	0.395 ^{***} (0.021)	0.383 ^{***} (0.021)
1970–79		–	0.241 ^{***} (0.017)	0.335 ^{***} (0.017)		–	0.330 ^{***} (0.019)	0.400 ^{***} (0.018)
1980–89			–	0.235 ^{***} (0.015)			–	0.299 ^{***} (0.017)
1990–99				–				–
English ability = 1	0.137 ^{***} (0.030)	0.199 ^{***} (0.014)	0.202 ^{***} (0.014)	0.175 ^{***} (0.012)	0.178 ^{***} (0.045)	0.152 ^{***} (0.018)	0.184 ^{***} (0.016)	0.180 ^{***} (0.015)
Constant	8.209 ^{***} (0.047)	7.925 ^{***} (0.023)	7.963 ^{***} (0.025)	8.438 ^{***} (0.025)	8.169 ^{***} (0.069)	8.066 ^{***} (0.033)	8.066 ^{***} (0.034)	8.299 ^{***} (0.038)
N	3888	21,327	25,978	29,134	1868	12,700	17,799	21,942
R-Squared	0.29	0.27	0.26	0.22	0.23	0.18	0.20	0.20

Robust standard errors in parentheses. Sample: Employed adults 20–66. Controls: San Juan residence, place of birth, married, number of children in the household by age group, personal unearned income (ln), other household income (ln), and knowing only English (models 4 and 8 only).

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

Table 3
 Estimated odds ratios from logistic regressions of men’s labor force participation on education, labor cohort, expected earnings, and control variables; P.R. 1970–2000.

Variables	(A) Excluding expected earnings				(B) Including expected earnings			
	(1) 1970	(2) 1980	(3) 1990	(4) 2000	(5) 1970	(6) 1980	(7) 1990	(8) 2000
Education (8th grade, ref. group)								
9th–11th grade	1.262** (0.134)	1.422*** (0.059)	1.320*** (0.055)	1.289*** (0.050)	0.662** (0.140)	0.868** (0.048)	1.031 (0.053)	1.102** (0.046)
High School	1.864*** (0.187)	2.165*** (0.078)	1.878*** (0.062)	1.609*** (0.048)	0.421** (0.177)	0.484*** (0.053)	0.839 (0.091)	0.716*** (0.059)
College or more	3.346*** (0.703)	4.644*** (0.302)	3.399*** (0.185)	3.241*** (0.135)	0.190** (0.154)	0.185*** (0.042)	0.621** (0.141)	0.464*** (0.089)
Labor Cohorts								
< 1920	0.561** (0.157)				0.505** (0.141)			
1920–29	0.662** (0.094)	0.272*** (0.028)			0.440*** (0.084)	0.134*** (0.016)		
1930–39	1.001 (0.131)	0.384*** (0.022)	0.179*** (0.020)		0.604** (0.117)	0.142*** (0.012)	0.091*** (0.013)	
1940–49	1.231* (0.150)	0.678** (0.034)	0.282*** (0.015)	0.195*** (0.024)	0.697* (0.139)	0.231*** (0.021)	0.171*** (0.014)	0.106*** (0.015)
1950–59	1.376*** (0.158)	1.046 (0.051)	0.516*** (0.025)	0.359*** (0.016)	0.832 (0.150)	0.377*** (0.032)	0.293*** (0.025)	0.224*** (0.014)
1960–69	–	1.098* (0.051)	0.734*** (0.035)	0.569*** (0.022)	–	0.533** (0.035)	0.437*** (0.035)	0.326*** (0.022)
1970–79		–	0.817*** (0.037)	0.771*** (0.028)		–	0.605*** (0.035)	0.467*** (0.029)
1980–89			–	0.878*** (0.031)			–	0.620*** (0.031)
1990–99				–				–
Expected earnings (ln) ^a					9.520** (5.804)	10.849*** (1.735)	3.268*** (0.497)	4.375*** (0.625)
Unearned incomes (ln)								
Personal unearned	0.791*** (0.010)	0.784*** (0.003)	0.782*** (0.003)	0.836*** (0.002)	0.849*** (0.019)	0.874*** (0.007)	0.841*** (0.009)	0.871*** (0.004)
Other unearned	0.994 (0.008)	0.974*** (0.003)	0.960*** (0.003)	0.999 (0.003)	0.994 (0.008)	0.973*** (0.003)	0.973*** (0.004)	1.003 (0.003)
Married = 1	3.730** (0.331)	3.273** (0.113)	3.058*** (0.102)	1.458** (0.037)	1.701* (0.389)	1.415** (0.095)	1.921** (0.131)	0.945 (0.046)
Number of children (by age group)								
5 or less	0.998 (0.041)	1.096*** (0.023)	1.066** (0.024)	1.048** (0.020)	1.032 (0.045)	1.108*** (0.023)	1.087*** (0.026)	1.058** (0.021)
6–11	0.951 (0.036)	1.032* (0.019)	1.068** (0.022)	1.027 (0.019)	0.952 (0.035)	1.005 (0.019)	1.072*** (0.022)	1.041** (0.020)
12–17	0.926* (0.035)	0.946** (0.015)	1.028 (0.020)	0.981 (0.018)	0.976 (0.040)	0.967* (0.015)	1.018 (0.020)	0.996 (0.018)
Constant	1.148 (0.140)	1.484*** (0.074)	2.857*** (0.148)	1.486*** (0.064)	3.213*** (1.002)	5.206*** (0.512)	4.809*** (0.407)	2.679*** (0.193)
N	4938	33,516	39,182	44,802	4938	33,516	39,182	44,802
Pseudo R-squared	0.17	0.26	0.26	0.16	0.18	0.27	0.26	0.17

In panel A, robust standard errors in parentheses; in panel B, bootstrapped standard errors in parentheses. Standard errors generated using delta rule. Sample: Men 20–66.

Notes: Controls used but not reported: San Juan residence, and place of birth (Cuba, Dominican Republic, other.)

^a Instrumented regressor, centered at log of mean annual earnings for those with 8th grade or less.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

5.3. Male cohort differences in odds of participation

Table 3A reports estimated odd-ratios of men’s participation generated with logistic regression models without a control for expected earnings. The cohort coefficients can be interpreted as the change in the odds of participation relative to those in the least experienced labor cohort (specifically, unmarried adults, with no children, and with an education of 8th grade or less, and with no unearned incomes). The results indicate that the likelihood of participation varied systematically across cohorts, evidence that suggests the importance of historical differences in labor market institutions and economic opportunities encountered upon entering the work force for the first time. I examine cohort arrays diagonally, from the upper left to the lower right, to highlight net differences between labor cohorts at comparable levels of exposure to the labor market.

I focus on differences at 11–20 years of experience. For the purposes of labor force participation, these constitute comparisons at the moment of peak exposure to the labor market, the point when individuals are most likely to be in the work force. This is a conservative assessment since it is the moment when inter-cohort differences are least likely to be found. Results along this diagonal array start in model 1 with the 1950–59 cohort, and contain estimates of the relative odds for the 1960s, 1970s, and 1980s cohorts. The men belonging to the 1950s and 1960s labor cohorts had corresponding net odds 1.376 and approximately 1.10 times higher than those of the least experienced cohorts. The z-values reported in Table 4A indicate that these relative odds are significantly different from all other cohorts observable with 11–20 years of experience, implying a higher relative chance of participation than comparably experienced cohorts that entered the labor force in the 1970s and 1980s. While the 1970s and

Table 4
Significance tests of inter-cohort differences among men by years of work experience.

Experience	(A) Based on coefficients from Table 3A				(B) Based on coefficients from Table 3B			
	Labor cohort				Labor cohort			
51-plus	< 1920	1920–29	1930–39		< 1920	1920–29	1930–39	
	1920–29	-1.815	-		-2.617	-		
	1930–39	-2.414	-2.679	-	-2.928	-2.102	-	
	1940–49	-2.309	-2.065	0.482	-2.811	-1.241	0.807	
41–50	1920–29	1930–39	1940–49		1920–29	1930–39	1940–49	
	1930–39	-2.880	-		-3.591	-		
	1940–49	-3.985	-3.847	-	-3.232	1.559	-	
	1950–59	-3.169	-0.913	3.469	-2.596	4.427	2.671	
31–40	1930–39	1940–49	1950–59		1930–39	1940–49	1950–59	
	1940–49	-2.378	-		-3.140	-		
	1950–59	-3.630	-3.812	-	-2.602	1.898	-	
	1960–69	-3.245	-2.681	1.614	-2.341	3.138	0.988	
21–30	1940–49	1950–59	1960–69		1940–49	1950–59	1960–69	
	1950–59	-1.159	-		-2.242	-		
	1960–69	-3.220	-5.062	-	-1.814	1.259	-	
	1970–79	-3.000	-4.698	0.849	-1.621	2.086	0.664	
11–20	1950–59	1960–69	1970–79		1950–59	1960–69	1970–79	
	1960–69	-1.677	-		-1.939	-		
	1970–79	-3.455	-4.507	-	-1.474	1.447	-	
	1980–89	-3.098	-3.713	1.280	-1.382	1.859	0.327	
1–10 (baseline group)	1960–69	1970–79	1980–89		1960–69	1970–79	1980–89	
	1970–79	2.123			1.771			
	1980–89	4.473	8.298		1.476	-0.607		
	1990–99	-1.737	0.015	-8.495	-0.523	-4.618	-4.729	

Bold terms, significant z-values for equality of coefficients (row cohort vs. column cohort).

1980s cohorts reflect relative odds 18.3 and 12.2% respectively below those of the least experienced, this difference is not statistically significant (the z-value for this diagonal difference at 11–20 years of experience is 1.280). Beyond 11–20 years of experience, cohort arrays indicate significant differences in cohort-experience profiles wherein the relative odds of early cohorts are higher than those of subsequent ones.¹² For example, at 21–30 years of experience, the 1940s cohort had odds 1.23 times as high as those of the least experienced, implying relative odds higher than those of most subsequent cohorts observable with comparable experience. At 31–40 years of experience, the 1940s cohort also had higher relative odds than subsequent cohorts, but lower relative odds than the 1930s cohort.

Table 3B reports models that included as a control the log of expected earnings. The baseline odds reflect the expected likelihood of participation of the least experienced cohort with earnings equal to the average of the least educated in each cross-section. Cohort differences across models can be thought of as differences conditional on comparable relative earnings. These results are most consistent with the institutionalist perspective despite revealing that cohort differences are strongly shaped by relative earnings. While controlling for expected earnings reduces inter-cohort differences documented in Table 3A, significant differences persist across all experience thresholds. Cohort differentiation is strongest upon reaching 31 or more years of experience, threshold at which the 1930s cohort had relative odds 39% below those of the least experienced. Subsequent entrants belonging to the 1940s, 1950s and 1960s labor cohorts reflect lower relative odds. A similar pattern is observable at higher levels of experience. In general, conditional on earnings and education, pre-industrial cohorts of the 1930s and 1940s traversed distinct career paths relative to industrial-era cohorts by being more likely to remain in the work force than subsequent entrants from the 1950s and 1960s. The z-values for

significant differences reported in Table 4B illuminate this pattern, but also highlight that the strongest reduction of inter-cohort differences is observable at 11–20 years of labor market experience. While at this threshold most comparisons become non-significant, the difference between the 1950s and 1960s cohorts remains significant. The difference between the 1980s and the 1960s cohort turns positive (with a z-value of 1.859), indicating that a large component of the difference between these two cohorts is driven by higher expected earnings for the 1960s cohort.

5.4. Female cohort differences in odds of participation

Table 5A reports non-instrumented estimates of the likelihood of participation among women. Significant inter-cohort differences in these estimates are sparse, both at peak experience and across experience levels. Only inter-cohort differences relative to estimates for the year 2000 are significant, an exception that suggests a period effect. The models reported in Table 5B enable evaluating if the absence of differences across cohorts in the non-instrumented results partly owes to the effect of expected earnings. The results reveal cohort differences across most experience thresholds, thereby challenging the expectation derived from the labor-leisure framework that earnings would fully channel the impact of historical timing of entry. For example, among cohorts observable with 11–20 years of experience, the 1950s cohort had relative odds of .656, corresponding to odds 34% lower than the reference group, a higher rate of participation than the 1960s cohort or than other subsequent cohorts at comparable experience. This is the experience threshold at which cohort differences are most salient.

Beyond 11–20 years of experience, those belonging to older cohorts were more likely to be in the work force than comparably educated women in subsequent cohorts, a pattern consistent with the one documented for male cohorts. For example, at 21–30 years of experience, the 1940s cohort had relative odds of .565, a likelihood 43% below that of the least experienced cohort. This is more than twice as

¹² All documented intra-cohort differences are statistically significant, except for the 1970s cohort difference between 11 and 20 years and 21–30 years of experience.

Table 5
Estimated odds ratios from logistic regressions of women's labor force participation on education, labor cohort, expected earnings, and control variables; P.R. 1970–2000.

Variables	(A) Excluding expected earnings				(B) Including expected earnings			
	(1) 1970	(2) 1980	(3) 1990	(4) 2000	(5) 1970	(6) 1980	(7) 1990	(8) 2000
Education (8th grade, ref. group)								
9th–11th grade	1.764*** (0.177)	1.543*** (0.061)	1.343*** (0.055)	1.254*** (0.061)	1.057 (0.159)	0.650*** (0.039)	0.981 (0.047)	0.924 (0.046)
High School	3.780*** (0.318)	3.559*** (0.113)	2.874*** (0.089)	2.612*** (0.093)	1.073 (0.304)	0.448*** (0.050)	1.057 (0.085)	0.700*** (0.056)
College or more	7.914*** (1.121)	9.642*** (0.461)	8.285*** (0.343)	6.217*** (0.252)	0.745 (0.389)	0.234*** (0.047)	0.997 (0.163)	0.332*** (0.055)
Labor Cohorts								
< 1920	0.060*** (0.036)				0.048*** (0.029)			
1920–29	0.272*** (0.041)	0.102*** (0.018)			0.182*** (0.032)	0.093*** (0.016)		
1930–39	0.586*** (0.068)	0.247*** (0.015)	0.151*** (0.021)		0.502*** (0.062)	0.114*** (0.008)	0.136*** (0.019)	
1940–49	0.893 (0.092)	0.486*** (0.022)	0.262*** (0.014)	0.131*** (0.021)	0.565*** (0.079)	0.169*** (0.012)	0.126*** (0.009)	0.027*** (0.005)
1950–59	1.057 (0.095)	0.831*** (0.033)	0.526*** (0.021)	0.206*** (0.010)	0.656*** (0.091)	0.250*** (0.019)	0.240*** (0.017)	0.078*** (0.006)
1960–69	–	1.028 (0.036)	0.867*** (0.032)	0.374*** (0.013)	–	0.435*** (0.025)	0.402*** (0.028)	0.143*** (0.009)
1970–79		–	1.034 (0.035)	0.637*** (0.021)		–	0.553*** (0.033)	0.238*** (0.015)
1980–89			–	0.814*** (0.026)			–	0.392*** (0.020)
1990–99				–				–
Expected earnings (ln) ^a					8.213*** (3.669)	30.391*** (5.393)	6.354*** (0.878)	11.558*** (1.579)
Unearned incomes (ln)								
Personal unearned	0.828*** (0.016)	0.878*** (0.004)	0.844*** (0.003)	0.885*** (0.003)	0.907*** (0.024)	1.046*** (0.011)	0.967*** (0.010)	0.967*** (0.006)
Other unearned	0.966*** (0.010)	0.961*** (0.004)	0.955*** (0.003)	0.989*** (0.003)	0.936*** (0.012)	0.945*** (0.004)	0.956*** (0.003)	0.983*** (0.003)
Married = 1	0.428*** (0.033)	0.496*** (0.015)	0.505*** (0.014)	0.538*** (0.013)	0.459*** (0.035)	0.515*** (0.015)	0.467*** (0.014)	0.508*** (0.012)
Number of children (by age group)								
5 or less	0.757*** (0.028)	0.718*** (0.012)	0.770*** (0.013)	0.882*** (0.015)	0.839*** (0.035)	0.656*** (0.011)	0.781*** (0.013)	0.994 (0.019)
6–1	0.914*** (0.032)	0.842*** (0.013)	0.887*** (0.014)	0.925*** (0.015)	0.954 (0.034)	0.961*** (0.016)	0.908*** (0.015)	1.027 (0.017)
12–17	1.055 (0.037)	0.951*** (0.014)	0.946*** (0.015)	0.984 (0.016)	1.085*** (0.040)	1.072*** (0.017)	1.008 (0.017)	1.112*** (0.020)
Constant	0.945 (0.117)	1.122*** (0.053)	1.718*** (0.085)	0.955 (0.046)	1.300* (0.187)	1.809*** (0.097)	2.157*** (0.109)	1.855*** (0.113)
N	6060	39,538	45,380	51,776	6060	39,538	45,380	51,776
Pseudo R-squared	0.18	0.20	0.22	0.18	0.19	0.21	0.22	0.18

In panel A, robust standard errors in parentheses; in panel B, bootstrapped standard errors in parentheses.

Sample: Women 20–66.

Notes: See Table 3.

^a Instrumented regressor; centered at log of mean annual earnings for those with 8th grade or less.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

high as the relative position of the 1950s and the 1970s cohorts, with relative odds close to .239 each, a relative position 75% below that of the corresponding baseline groups. Despite being significant, differences become small as experience rises, owing to declining participation rates, a life-cycle dynamic shared across cohorts. An exception to this general array of effects is that cross-sectional estimates for 1990 are relatively higher than those from other census years at comparable experience, evidence that suggests the influence of period-specific differences. The z -values reported in Table 6A and B show the array of statistically significant differences for the results reported in Table 5.

5.5. Educational attainment and cohort differences in participation

Including expected earnings as a covariate induces for men as well as for women, a shift from positive to negative in the net association between education and participation. This suggests that education covariates mediate a positive association between participation and earnings, as well as the impact on participation of unmeasured variables that are positively correlated to education but negatively related to participation, such as household savings, inherited wealth, and/or personal investments, the value of which rises with education.

Table 6
Significance tests of inter-cohort differences among women by years of work experience.

Experience	(A) Based on coefficients from Table 5A				(B) Based on Table 5B			
	Labor cohort				Labor cohort			
51-plus		< 1920	1920–29	1930–39	< 1920	1920–29	1930–39	
		1920–29	0.837	–	1.356	–	–	
		1930–39	1.500	1.782	–	2.525	1.716	–
		1940–49	1.251	1.056	–0.681	–0.728	–3.948	–5.537
41–50		1920–29	1930–39	1940–49	1920–29	1930–39	1940–49	
		1930–39	–5.383	–	–2.061	–	–	
		1940–49	–0.236	0.772	–	–1.676	1.019	–
		1950–59	–1.792	–2.402	–3.446	–3.186	–3.573	–4.438
31–40		1930–39	1940–49	1950–59	1930–39	1940–49	1950–59	
		1940–49	–1.500	–	–5.273	–	–	
		1950–59	–0.876	1.322	–	–4.073	3.419	–
		1960–69	–3.668	–4.529	–6.310	–5.722	–1.698	–5.022
21–30		1940–49	1950–59	1960–69	1940–49	1950–59	1960–69	
		1950–59	–0.647	–	–3.871	–	–	
		1960–69	–0.268	0.781	–	–1.943	4.481	–
		1970–79	–3.107	–5.132	–6.207	–4.065	–0.510	–5.163
11–20		1950–59	1960–69	1970–79	1950–59	1960–69	1970–79	
		1960–69	–0.286	–	–2.343	–	–	
		1970–79	–0.228	0.114	–	–1.065	2.851	–
		1980–89	–2.736	–4.943	–5.104	–2.831	–1.331	–4.163
1–10 (baseline cohort)		1960–69	1970–79	1980–89	1960–69	1970–79	1980–89	
		1970–79	1.379	–	2.416	–	–	
		1980–89	5.346	5.942	–	3.959	2.385	–
		1990–99	0.080	–2.371	–7.877	2.540	0.309	–1.924

Bold terms, significant z -values for equality of coefficients (row cohort vs. column cohort).

The sparse significance of the education covariates reported in Table 5B suggests that education mediates the earnings-participation relationship more strongly for women than for men, but unobserved alternative personal resources unrelated to earnings might be less available for women.¹³

6. Discussion

The most salient findings of my analysis are: (1) Differing aggregate participation rates for men and women, with the latter reflecting an upward trend similar to trends documented for middle-income countries (Brinton, Lee, & Parish, 1995; Enchautegui & Freeman, 2006; Roos, 1985). (2) Significant inter-cohort differences among men in results not conditioned by expected earnings, with the 1950s and 1960s cohorts reflecting higher relative odds than subsequent labor market entrants. (3) A reduction of significant inter-cohort differences among men, net of expected earnings, but significant cohort-experience profiles. (4) Significant inter-cohort differences among women net of education and expected earnings, reflecting higher odds-ratios for the 1950s cohort. (5) Significant cohort-experience profiles among women, indicating higher relative odds for the 1940s and 1950s cohorts than more recent entrants. (6) Education mediates the relationship between earnings and participation for both men and women, but the mediating effect seems stronger for the latter.

These results are not consistent with the labor-leisure choice model as summarized under Hypothesis 1 and Hypothesis 2 since both expected cohort effects to become non-significant when controlling for expected earnings. Earnings could be considered what Bollen calls an *exclusive-specific* effect since it captures one of the possible causal paths through which the covariate of interest (in this case cohorts)

¹³ Migration alters the distribution of educational attainment among residents owing to the overrepresentation of high school dropouts among Puerto Rican migrants to the United States, but this change was not more likely for some cohorts than others (Toro, 2014). These results are consistent with research on migrants from Puerto Rico (Ortiz, 1986; Feliciano, 2005).

affects the likelihood of participation (Bollen, 1987; Paxton et al., 2011). In the early stages of development, women may have actually entered the work force, not withdrawn from it, a pattern consistent with recent research that has called into question the accuracy of the U-shaped relationship between development and female labor force participation (Gaddis & Klasen, 2014). Additionally, evidence of a negative relationship between education and participation, challenges the labor-leisure framework's expectation that human capital affects participation positively and directly. Hypotheses 5 and 6, derived from the IDL perspective, and expecting low or non-existent inter-cohort differences in participation-experience profiles are also not supported by the results since such differences persist across experience thresholds.

The findings are most consistent with Hypothesis 3 and Hypothesis 4, derived from the comparative institutionalist perspective, which expected significant cohort arrays. This evidence is consistent with a growing body of findings across multiple disciplines that has documented non-convergent labor market outcomes across countries owing to their ability to maintain idiosyncratic labor market institutions or “hybrid” frameworks of regulation and social policy that enable opportunities for income smoothing over labor biographies even under the growing pressures of globalization (Boucher & Collins, 2003; Gahan, Mitchel, Cooney, Stewart, & Cooper, 2012; Muffels & Luijkx, 2006).

In challenging the notion that high inter-country integration between developing and developed countries produces a labor market characterized by long-term participation at low wages, evidence from Puerto Rico has implications for the IDL perspective. Research in this line of thought that documents general stability along a core, semi-periphery, and periphery trichotomy could benefit from considering explicitly the characteristics of employment systems in developing countries (Mathuga, 2006). Conceptualizing the specific ways in which developing countries have devised solutions to the principal-agent problem intrinsic to labor markets could be a useful starting point (Western, 1998). While differing from solutions documented for industrialized countries, developing country approaches can be formulated along a continuum on the basis of how policies “nest” workers

along the life-course. Some developing countries may have employment systems that approach a cooperative system, wherein wage bargaining, protection, training, and old-age insurance take place outside of the labor market. Other developing countries may reflect competitive systems wherein workers and employers negotiate with each other with limited or weak state intervention. The varied experiences of development can then be more fruitfully conceived in terms of the interaction of integrative economic forces with intra-country labor market regulations and institutions.

7. Conclusion

Theoretical interest in economic development has recognized the centrality of labor force participation because of its importance for outcomes ranging from aggregate economic performance to social inequality. Key in such formulations has been the role played by inter-country integration in shaping development trajectories. Yet, a general neglect of the study of countries where development has been pursued under high levels integration with more developed countries has led to disparate theoretical expectations: Either integration generates convergent participation patterns, or participation remains unchanged over the course of economic development due to insufficient absorption of the work force and to low wages. Forward movement

Appendix A

Assessing the strength of the instrumental variable

An imprecise relationship between the instrumental variable and the endogenous regressor can produce a low correlation between them. In the worst case, the correlation is too close to zero (i.e.: the confidence interval for the instrument is wide). This implies little confidence in the estimates of covariates in the second stage upon including the predicted regressor since it leads to multicollinearity. To examine the extent of the strength of an instrument, common practice has relied on the rule of thumb that the *F*-value for the partial association of the endogenous regressor and the instrumental variable should be at least as high as 10 (Staiger & Stock, 1997). More recent assessments suggest stricter thresholds that vary according to the number of instruments and the number of endogenous regressors (Stock & Yogo, 2005). For estimates as those reported above in Tables 3B and 5B, the critical values used as thresholds would be 16.38 or higher for a single instrumental variable, and 19.93 or higher for two instrumental variables. *F*-values above these thresholds are interpreted to mean that one can reject the null of a weak instrument (Paxton et al., 2011; Stock & Yogo, 2005). If the instrument were weak, then these specific critical values indicate that a researcher cannot be confident at 90% that the instrument is sufficiently precise.

Table A1 presents evidence for the statistical significance of the partial correlation between English ability and annual earnings. For estimates reported in Table 2 in the main body of the article, all *F*-values reported in Table A1 are above the relevant critical values, except the one for women's earnings in 1970 (*F* = 16). By this criterion, the null that English ability is a weak instrument can be rejected for all estimates for 1980–2000 (and for male-specific estimates for 1970). While the coefficients for the women's results may be miss-estimated owing to a weak instrument, the pattern of effects seems very similar to that observed for years in which no evidence of a weak instrument was present. The earlier rule of thumb does indicate that there is likely to be no bias in any of the estimates in which I leveraged an instrumental variable.

Table A1
Significance tests of strength of English ability instrumental variable in OLS regressions in Table 2.
Source: Author's calculations.

	Men				Women			
	(1) 1970	(2) 1980	(3) 1990	(4) 2000	(5) 1970	(6) 1980	(7) 1990	(8) 2000
Model <i>F</i> -value								
No instrumental variable	89.96	437.02	472.42	410.25	32.01	139.13	235.65	287.63
With instrumental variable ^{a,b}	85.68	426.09	466.81	382.51	30.99	141.15	232.12	267.86
<i>F</i> -statistic	22.31	211.97	226.26	99.50	16.02	74.85	135.02	75.80
Critical values ^c	16.38	16.38	16.38	19.93	16.38	16.38	16.38	19.93

Bold terms, significant *F*-values for improvement in model fit, Note: Critical values are for rejection of the null hypothesis that the instrumental variable is weak.

^a Based on residual sum of squares and degrees of freedom for estimates reported in Table 2.

^b For 2000, models included an additional dummy control for reporting only knowing English.

^c In models 4 and 8, the critical values are for estimates with one endogenous regressor and two instrumental variables.

theoretically can be derived from the analytical and empirical insights extracted from studying countries or regions that pursue development through integration.

The study of Puerto Rico offers such a possibility. To evaluate the adequacy of theories with implications for the inter-play of inter-country integration and economic development, I have analyzed the extent of labor cohort effects on labor force participation. Perspectives found to be inconsistent with findings on status attainment in Puerto Rico (Toro, 2014), reflect additional limitations with regard to labor force participation. Labor cohort differentiation in participation rates points at the relevance even under high levels of integration of institutions and regulations that shape distinct paths into opportunities. Future research will benefit from formulating the nature of employment systems in such contexts to enable explaining how the waves of globalization and integration, while not unimportant, are constrained in their effects by country-specific institutional legacies.

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Appendix B

Predicted earnings

To simplify the interpretation of the likelihood of participation, predicted annual earnings are entered in the logistic regression models as logged ratios of the earnings of those with 8th grade or less. The ratio of the reference category across models, when logged, is zero. The averages and ratios reported in Table B1 help illustrate changes in magnitude over time and in relative position. Trends suggest an erosion of the earnings premium of high school dropouts relative to those with 8th grade, and a compression toward the relative position of the least educated for those with a high school education. College graduates retain their relative position more consistently over time. The exponentiated estimates indicate that annual earnings declined during the seventies and eighties, only to fully recover during the 1990s. This pattern is generally present for both men and women across all education levels.

Table B1

Ratio of predicted annual earnings to average of adults with 8th grade or less, and average annual earnings by level of education, P.R. 1970–2000.

Source: Author's calculations based on estimates derived from Table 2.

Education	Men				Women			
	1970	1980	1990	2000	1970	1980	1990	2000
8th grade or less	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	\$5918	\$4765	\$4513	\$7154	\$4194	\$3701	\$3649	\$5509
9th–11th grade	1.36	1.25	1.28	1.12	1.30	1.33	1.23	1.07
	\$8061	\$5973	\$5772	\$8029	\$5461	\$4928	\$4481	\$5905
High School	2.00	1.91	2.03	1.74	1.89	1.91	1.85	1.62
	\$11,833	\$9109	\$9141	\$12,469	\$7943	\$7064	\$6748	\$8938
College or more	4.18	4.17	4.50	3.89	3.26	3.04	3.44	3.20
	\$24,718	\$19,876	\$20,293	\$27,797	\$13,682	\$11,251	\$12,546	\$17,623
Annual Average	1.57	1.69	1.96	1.85	1.37	1.55	1.77	1.77
	\$9291	\$8042	\$8837	\$13,219	\$5732	\$5750	\$6443	\$9771
Sample	4938	33,516	39,182	44,802	6060	39,538	45,380	51,776

Data: See notes to Table 2, Note: Results including standard deviations available upon request. Indented values are the unlogged predicted average in inflation-adjusted values to U.S. 1999.

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