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Are Idle Hands the Doctor's Workshop? Trade Liberalization, Employment Shocks, and Adult Mental HealthT [*]

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Abstract: Although studies have found that adult and infant mortality rates in the United States decrease and health-related behaviors improve during periods of economic downturn, the mental health status of individuals may deteriorate. This study provides quasi-experimental evidence of the effects of changes in employment opportunities on mental health outcomes – depression, anxiety, & psychosocial dysfunction – of the low-income adult population of Puerto Rico. We take advantage of the tariffs changes affecting local manufacturing production as a result of NAFTA and its variation across municipalities to assess its effects on mental health outcomes. In addition, we examine whether these impacts are mediated by the public or market-based provision of health care services. We exploit the timing of the gradual phase-in of reform across municipalities over a 5-year period to identify whether the health effects of employment opportunities are exacerbated or moderated due to this change in health care provision.

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I. Introduction

Social scientists in various disciplines have hypothesized various relationships between short-term macroeconomic shocks and individuals' health outcomes. In particular, changes in access to employment may exacerbate or improve an individual's health status as a result of the interplay of complex channels. On one hand, as shown by Ruhm (2000; 2003a; 2003b), time constraints for health-improving activities may be relaxed, improving an individual's physical health status. On the other hand, as initially formulated by Grossman (1972), lower household incomes may lead to a more limited access to health care and health-improving behaviors. In addition, uncertainty over future employment opportunities and unemployment shocks may lead to increased levels of stress, anxiety, and depression, which can in turn have dynamic effects on the economy (Darity and Goldsmith 1996).

The empirical literature has not reached a consensus on the effects of short-run macroeconomic fluctuations on health outcomes and health behaviors. Recent empirical studies for the U.S. show that total adult mortality has a procyclical fluctuation with the business cycle (with suicides representing an important exception) (Ruhm 2000), and adult health-related behaviors and infant health have a countercyclical fluctuation with the business cycle (Ruhm 2000; 2003a; 2003b; Deaton and Paxson 2001; Dehejia and Lleras-Muney 2004). However, it is well known that health status is multi-dimensional. Whereas it is possible that physical health status improves in the population as a result of increases in unemployment, the mental health status of individuals may deteriorate as a result of job loss, increased employment insecurity, or limited occupational options – as found in the empirical literature (Bjorklund 1985; Bardasi and Francesconi 2004; Llena-Nozal et al. 2004; Mayer et al. 1991).

Moreover, the existing empirical literature suffers from two salient methodological limitations that may partly explain the resulting apparent opposition in their conclusions. First, previous empirical studies may suffer from reverse causality problems, to the extent that an individual's mental health (i.e., stress, depression) have strong negative effects on employment and individual earnings, as documented in various observational and experimental studies (Bartel and Taubman 1986; French and Zarkin 1998; Smith et al. 2002). Another potential concern of these empirical studies is the extent to which macroeconomic shocks and cycles may be partly the result of unobserved factors (e.g., the provision of public services or government

expenditures in general, crime rates), which may lead to both recessions and changes in mental and physical health outcomes.

This study improves our understanding of the causal impacts of employment shocks on individual mental health outcomes using quasi-experimental evidence from Puerto Rico. During the 1990s, Puerto Rico experienced two major macroeconomic events that intensified a previously on-going trend towards de-industrialization. First, a phased-in derogation of U.S. federal tax incentives for manufacturing firms in Puerto Rico induced changes in manufacturing employment. Secondly, changes in Mexican import competition due to the advent of the North American Free Trade Agreement (NAFTA) changed incentives for local manufacturing production, thereby impacting the likelihood of keeping their manufacturing operations in Puerto Rico and the employment levels of those operations. We take advantage of the exogeneity of the phase-out of tax incentives, changes in tariffs affecting local manufacturing production (and employment) and its variation across municipalities – since not all municipalities are equally impacted – to assess its effects on the health status of the population. We examine how changes in unemployment rates at the municipality level, as a result of these tax incentives and tariffs changes, affect changes in the mental health status of adults. This provides us with a unique setting to study the interrelation between employment shocks, de-industrialization, and the mental health status of the adult population.

In addition, we examine whether these impacts are mediated by the provision of health care services, either publicly-provided or based on publicly-financed managed health care provision systems. During the same period of study, the public health care system in P.R. was reformed into a publicly-funded managed-care system (Alegría et al. 2001a). The reforms were largely inspired on the Clinton administration health plan model. The P.R. government sought to remove itself from the direct provision of health care and adopt the role of overseer of privately-provided health care services to the medically indigent population. The stipulated objective of the reforms was to induce greater equality of opportunity in health access and to eventually decrease the inequality in health outcomes between those were able to afford private insurance and those who could not afford to opt out of state-provided health.

The health reform was gradually phased-in across municipalities over a seven-year period (1994-2000), and we use the variation in the timing of phase-in to identify how the effects of

unemployment shocks are exacerbated or inhibited as a result of this structural change in health care provision. We discuss the identification of these effects in detail in the methodology section.

These preliminary results have important policy implications for numerous reasons. First, these will aid policy-makers better understand the potentially significant (short-term) unintended consequences of rapid de-industrialization, as a result of trade and fiscal policy changes; these could become influential in the policy debate on investment incentives at the local level. In a related point, these results could bring to bare previously unconsidered detrimental or beneficial effects of trade liberalization in middle-income countries. To the extent that labor market adjustments as a result of trade liberalization – well-documented effects of trade liberalization – have temporary or permanent effects on the health of the population, these studies could improve the measurement of the benefits and costs of trade liberalization in middle-income countries.[1]

The paper is structured as follows. Section II provides a brief discussion of the extent of trade liberalization in PR as a result of NAFTA, and also discusses the state-level managed care reform. Section III discusses the data used in the analysis. In section IV, we describe our research design, and how it avoids well-known identification pitfalls. Preliminary estimates are reported in Section V and Section VI concludes.

II. Trade Liberalization, Employment, and Health Reforms in Puerto Rico

A. NAFTA and Trade Liberalization in Puerto Rico

This study seeks to analyze the mental health impacts of employment shocks as a result of preferential FTA-mandated tariff cuts, using variation from NAFTA. On January 1st, 1994, the North American Free Trade Agreement (NAFTA) between the United States, Mexico, and Canada entered into force and incorporated the prior Canada-U.S. Free Trade Agreement (Romalis 2004). A main component of the FTA, among others, is the gradual removal of tariffs and quantitative trade restrictions (i.e., non-tariff barriers) between the partner countries.[2] Puerto Rico's political status as a U.S. territory implies that its productive activities lie within U.S. tariff

[1] The literature discussing the short-term labor market adjustment effects of trade liberalization is vast. For detailed evidence from various trade liberalization episodes in both developed and developing countries, see Gaston and Trefler (1994; 1995), Revenga (1997), Levinsohn (1999), Beaulieu (2000), Krishna et al. (2001), and Trefler (2004).
[2] Other provisions in the agreement include the liberalization of the regulation of investment, transportation and financial services, intellectual property, government purchasing, competition policy, and the temporary entry of business persons (Huffbauer and Schott 1993).

barriers. Therefore, any policy-mandated reduction of trade barriers against foreign imports effectively serves as a decrease in the tariff wall against production in P.R.

Figure 1 plots the average U.S. manufacturing tariff rates (imports-based and statutory-rates measures) against Mexican imports.[3] Since the imports-based tariff rate measure captures the weight that each product carries in terms of import competition to domestically-produced goods, we focus on this tariff measure in the current analysis, but show the statutory tariff measure for comparison purposes. The average U.S. tariff rate against Mexico during the period 1990-1993 is approximately 4.1 percent (4.4 percent for the statutory tariff measure). As mentioned above, the core feature of NAFTA was to reduce tariff barriers substantially for U.S. imports from Mexico as well as Mexican imports from the U.S..[4] As of 1994, the average tariff rate against Mexico dropped substantially to 2.0 percent and continued a reduction throughout the 1990s, reaching an average tariff rate of 0.4 percent during 1999 (an average tariff rate of 1.3 percent throughout 1994-1999). Essentially, this reduction in trade protection should have led to an increase in import competition, potentially reducing labor demand in particular industries. We will defer discussion of the evidence on employment shocks until after we discuss in detail the data used in the paper.

B. Puerto Rico's Managed Care Reform

In 1994, the Island's public health care sector was reformed in order to provide health care to the medically indigent population, defined as those whose annual household income were at or below 200% of the U.S. poverty level. The P.R. government established a public corporation, the P.R. Health Insurance Administration (PRHIA), in order to institute managed care. PRHIA reorganized the island into ten (10) geographic health regions and gradually phased-in regions into reform. One health region was brought under reform in 1994 followed by two regions per year thereafter. As a second step, and sequentially for each region, PRHIA auctioned fixed capitation contracts for private health insurers to take responsibility for public health sector coverage. Moreover, private insurers were free to contract with providers of their choice in each

[3] Both the imports-based and statutory tariff rates were aggregated up from the 4-digit Standard Industrial Classification (SIC) level using *simple averages* by industry. Details about the construction of the two tariff rate measures appear in Appendix A.

[4] We have not yet constructed measures of effective Mexican tariff rates against U.S. imports for this period. We plan to do this and include variation in the employment impacts of these tariff rate reductions in the future.

region. This reform gradually transformed the public health care provision system into a managed care system.[5]

The overall effect of managed care on the health care utilization and status of individuals during times of economic uncertainty remains an empirical question. Studies on the managed health care industry during the past decade have shown evidence of the pros and cons of managed care in terms of cost-containment, quality, and access to health care. We cannot discuss the existing literature in detail due to reasons of space and refer the reader to Glied (2000) and Frank & McGuire (2000) for a survey of the literature. However, we will briefly discuss the main expected impacts. First, it has been hypothesized that access to health care (rationing) may be reduced (increased) as a result of problems of adverse selection and competition by insurers to exclude poor-risk individuals from the insured pool. Moreover, there is evidence that these problems are exacerbated in the mental health care sector (see Buck and Umland 1997, Frank & McGuire 2000 for details). On the other hand, researchers have shown that managed health care improves cost containment and may improve effective quality of care by providing contracts to providers in which the latter have incentives to improve managerial efforts for profit maximization (Glied 2000). However, it is crucial to empirically understand how increases in the demand for health care as a result of economic shocks can be absorbed by or put strains on the managed care system, relative to traditional publicly-provided health care.

III. Data

The empirical analysis relies on various datasets: the Mental Health Care Utilization among Puerto Ricans (MHCUPR) Survey, Waves I, II, III; the Puerto Rico Industrial Development Corporation (PRIDCO) Industry Research Database for the period 1990-2000; the Puerto Rico Bureau of Labor Statistics municipality-level unemployment rates; U.S. imports and tariffs data for Mexican imports for the period 1990-2000.[6]

The MHCUPR Survey is a longitudinal survey of approximately 3,500 individuals ages 18-69 (in 1992) *living in poor areas* across Puerto Rico; it is a representative stratified clustered sample of households living in poor areas (according to U.S. poverty standards – approximately

[5] The texts from which this summary is based, which provide a detailed discussion of intricacies of the PR. health care reform, are Alegría et al. (2001a; 2001b).

[6] We are also considering using the P.R. Behavioral Risk Factor Surveillance System (BRFSS) data, since it would provide direct comparisons to previous research for the U.S. (Ruhm 2000; Dehejia & Lleras-Muney 2004). However, this data for P.R. is available for P.R. only since 1995, limiting the reliability of potential results from these.

50 percent of the population). Individuals were originally interviewed in 1992 (Wave I), and re-interviewed during 1993-94 (Wave II) and 1996-98 (Wave III); the overall response rate for the three waves is 81.5% after excluding deaths (Alegría et al. 2001a). The survey data contains detailed population-based mental health measures on anxiety, depression, disthymia, alcohol dependence, and psychosocial dysfunction. In particular, it contains individual measures of the (i) Psychiatric Symptoms and Dysfunction Scale (PSDS), the (ii) Center for Epidemiological Studies Depression Scale (CES-D), and the (iii) Composite International Diagnostic Interview Scale (CIDI). These population-based measures of mental health are considered to be much more reliable than utilization-based measures, common in socio-economic surveys (Frank and Gertler 1986). In addition, the MHCUPR Survey contains standard measures of self-rated physical health and physical and mental health care services utilization, as well as data on household socio-economic and demographic characteristics, employment outcomes, income transfers, and access to health insurance. The specific mental health status measures used in the study are:

- *Psychiatric Symptom Dysfunction Scale (PSDS)*. This scale measures the extent of mental health conditions with five sub-scales, including (i) anxiety, (ii) depression, and (iii) psychosocial dysfunction, among others. These sub-scales allow for distinguishing particular mental health effects. It has been validated for Hispanic populations in the United States (Warheit et al. 1985).
- *Center for Epidemiological Studies Depression Scale (CES-D)*. This measure, created by the CES (U.S. National Institute of Mental Health) is a short self-report scale designed to measure depressive symptomatology in the general population, and is a useful tool for epidemiologic studies of depression, partly due to its cost-effectiveness. Its validity has been shown by comparison to other self-reported measures of depression, as well as with clinical ratings of depression (Radloff 1977), and its validity and reliability for various populations has been shown (Roberts 1980).
- *Composite International Diagnostic Interview Scale (CIDI)*. The CIDI is an interview that captures DSM-III-R diagnoses of various mental conditions, including disthymia, depression, and alcohol dependence and abuse. The measures have been tested successfully for validity and reliability among Hispanic populations (Rubio-Stipec, Bravo, and Canino 1991).

The PRIDCO Industry Research Database is a confidential plant-level longitudinal census dataset for all plants provided state-level tax incentives by the P.R. government

(approximately 1,500 plants).[7] Based on our calculations, the dataset represents approximately 95.5% of total manufacturing employment in P.R. during 1990-2000, as compared to estimates from the U.S. Bureau of Labor Statistics establishment survey. The database includes yearly measures of total employment and production employment for the period 1990-2000, municipality of operation, and the plant-specific 4-digit Standard Industrial Classification (SIC) code (1987-revision). Therefore, we can match U.S. tariff rates for Mexican imports at a highly disaggregated level.

As briefly mentioned in Section II, we use the NBER U.S. imports and statutory tariffs data, available at the product (tariff line) level. We use a longitudinal plant-level dataset with variation in tariffs to Mexican imports over the period 1990-1999 that is created as follows. First, the data on U.S. tariff for Mexican imports (the product-level data)[8], are aggregated into tariffs for the 447 industries in which Mexican manufacturing firms can potentially export to the United States.[9] The resulting aggregated data is matched to Puerto Rico's. plant-level data, which covers 411 of these industries.

IV. Empirical Strategy

A. Identifying Effects of Employment Shocks on Health Outcomes

We test whether *changes* in unemployment rates of individuals at the municipality level – as a result of changes in manufacturing employment driven by import competition – affect the *changes* in the mental health status and health care use outcomes of adults in these municipalities. We will compare the outcomes between the municipalities most-impacted ("treatment") vs. least-impacted ("control") by the de-industrialization process, and this should provide us with a quasi-experimental test of the health effects of de-industrialization at the municipality level. We estimate the following relationship:

$$h_{imt} = \alpha_i + \gamma_t + \theta U_{mt} + X_{it}\beta_1 + Z_{mt}\beta_2 + u_{mt} + \eta_{imt} \qquad (1)$$

[7] Based on our calculations, the dataset represents approximately 95.5% of total manufacturing employment in P.R. during 1990-2000, as compared to estimates from the U.S. Bureau of Labor Statistics establishment survey.
[8] 8,558 products potentially imported to the U.S. from Mexico, of which 7,285 were actually imported during 1990.
[9] Data at the tariff-line (product) level is aggregated to the 4-digit SIC code level as is usually done in the empirical trade literature, taking import-shares weighted-averages of the products feeding into each 4-digit SIC code. See Trefler (2004) for a detailed discussion of this aggregation problem.

where h_{imt} is the health outcome of individual i in municipality m at time t; U_{mt} is the municipality-specific unemployment rate at time t; X_{it} is a set of predetermined individual-specific factors that affect his/her health outcomes (e.g., age, schooling level); Z_{mt} is a set of municipality-specific factors that affect individual health outcomes (e.g. access to public health insurance); α_i is an individual-specific effect; γ_t is a set of time indicator variables; and u_{mt} and η_{imt} are unobserved factors that determine individuals' health outcomes. We are mainly interested in coefficient θ, the effect of an increase in the unemployment rate on individuals' mental health outcomes, as well as his/her health care services utilization.

Estimating equation (2) by ordinary least squares (OLS), and finding that the municipality unemployment rate is related to mental health outcomes does not allow us to conclude that unemployment risk leads to differences in health outcomes and health care utilization, after conditioning out observed individual (X_{it}) and municipality (Z_{mt}) traits as well as unobserved fixed individual characteristics ('individual fixed effects' α_i) and common time shocks that affect all individuals equally ('time effects' γ_t). Such a finding may still be driven by self-selection. For example, municipalities where the local government is quite ineffective may lead to poor provision of health care services and may also lead to plants choosing to move location (due to higher effective tax rates). Individuals may also sort over time into municipalities with relatively high or low employment opportunities based on unobserved determinants of their labor market outcomes, such as their skills, drive, and their mental and physical health status.

We propose an instrumental variables (IV) empirical strategy to get around the self-selection problem. We need to find shocks in municipality-level unemployment rates that are uncorrelated with the unobserved time-varying determinants of individuals' health. Changes in labor demand at the municipality-level that are driven by the FTA-mandated reductions in tariff rates of Mexican imports in particular industries can potentially provide us with this source of variation in municipality-specific labor demand which is uncorrelated with unobserved time-varying determinants of adult mental health outcomes.

Essentially, we will compare changes in health outcomes of individuals in the municipalities most-impacted ("treatment") vs. least-impacted ("control") by the de-industrialization process, as identified by the tariff changes; this provides us with a quasi-experimental test of the mental health effects of de-industrialization at the municipality level.

The idea behind this empirical strategy is to relate the individuals' mental health outcomes to $\bar{\tau}_{mt}$, the average tariff rate faced by plants in municipality *m* over time. We can estimate the following reduced-form model:

$$h_{imt} = \alpha_{Ri} + \gamma_{Rt} + \pi_{R1}\bar{\tau}_{mt} + X_{it}\pi_{R2} + Z_{mt}\pi_{R3} + u_{Rmt} + \eta_{Rimt} \qquad (2)$$

where all variables are defined as above. Under the assumption that the mean tariff-rate change is uncorrelated with unobserved factors at the municipality-level and at the individual-level that affect adult mental health outcomes ($E[\bar{\tau}_{mt}u_{Rmt}]=0$ & $E[\bar{\tau}_{mt}\eta_{Rimt}]=0$, respectively), π_{R1} in equation (2) represents the average effect of a one percent average municipality-level tariff increase on adult mental health outcomes at the municipality. We discuss below whether these assumptions are likely to hold in this context.

Moreover, to the extent that the average tariff rate changes at the municipalities affect individuals' health strictly by affecting the employment prospects at the municipality, then we can use $\bar{\tau}_{mt}$ as an instrumental variable for the unemployment rate in equation (1). Formally, we jointly estimate the following set of equations using a GMM estimator:

$$h_{imt} = \alpha_i + \gamma_t + \theta U_{mt} + X_{it}\beta_1 + Z_{mt}\beta_2 + u_{mt} + \eta_{imt} \qquad (1)$$

$$U_{mt} = \alpha_{1i} + \gamma_{1t} + \pi_{11}\bar{\tau}_{mt} + X_{it}\pi_{12} + Z_{mt}\pi_{13} + u_{1mt} + \eta_{1imt} \qquad (3)$$

Under the conditions of (i) robust partial correlation between the instrumental variable and the endogenous regressor ($\pi_{11} \neq 0$), and (ii) lack of correlation between the excluded IV and the disturbance terms in equation (1) ($E[\bar{\tau}_{mt}u_{mt}]=0$, $E[\bar{\tau}_{mt}\eta_{imt}]=0$), IV estimates give consistent estimates of parameter θ. These conditions will allow us to interpret the resulting estimate of coefficient θ as the average causal effect of the municipality-level unemployment rate on individuals' mental health outcomes.

This exercise relies on the assumption that tariff changes as a result of NAFTA are not correlated with the *time-varying* unobserved determinants of individuals' health during the reform period. It is possible that individuals with better (or worse) health outcomes (or determinants of health outcomes) move out of economically-depressed municipalities, perhaps in search of improved health care or other public services provision (Gelbach 2004). The data allows two methods to test whether sorting of this type took place. First, because we have

longitudinal data for individuals, we can identify whether individuals have moved from economically depressed to booming municipalities during the 1993 – 1998 period. Second, because we have longitudinal data with health and other characteristics of individuals covering two time periods *before* the NAFTA-induced tariff changes (1992 and 1993-94), we can test whether individuals' initial health and socio-economic outcomes, as well as changes in these, are associated with future tariff reductions in the municipality. Finding correlations of this sort would suggest that individuals have sorted in the short-run due to expected or actual economic opportunities, and that it would be difficult to attribute causality to our IV estimates.

In addition, we will examine whether this relationship varies significantly in municipalities under the managed-care reform relative and under traditional publicly-provided health care services. To do so, it would be sufficient to make these comparisons separately for each subgroup of municipalities: the municipalities operating (i) under the managed-care system, and the ones operating (ii) under the traditional public health sector. Alternatively, it would be feasible to estimate a model including an interaction term of the unemployment rate with an indicator variable for whether the municipality is covered by the health reform during that period.

Essentially, the empirical model to be estimated is an augmented version of equation (1):

$$h_{imt} = \alpha_i + \gamma_t + \theta_1 U_{mt} + \theta_2 R_{mt} U_{mt} + \beta_1 R_{mt} + X_{it}\beta_2 + Z_{mt}\beta_3 + u_{it} + \eta_{imt} \qquad (1')$$

where all existing variables are defined as above, and we include an indicator variable for the municipality being under managed care reform at the stated time period (RB_{mt}). To the extent that the phase-in of the managed care reform is uncorrelated with unobserved determinants of health outcomes in the population, the instrumental variables estimate of parameter θ_1 measures the causal impacts of the (municipality-level) unemployment rate under publicly-provided health care; the analogous estimate of θ_2 measures the differential impact of unemployment from being in a managed-care reform municipality. As shown in Alegría et al. (2001a), municipalities in these two groups do not differ significantly in most observable characteristics before treatment, and therefore provides confidence of the quasi-experimental design of this component of the study. We reproduce Table 1 from their article to show evidence of the validity of the design (Appendix Table A1).

B. Identification of Tariff Reduction Effects on Employment

We will compare changes in mental health outcomes and health care services use of individuals in the municipalities most-impacted ("treatment") vs. least-impacted ("control") by the de-industrialization process. To identify these groups of municipalities, we will use the PRIDCO Industry Research Database to assess the municipalities with the largest numbers of plant closings and reduction in employment levels following NAFTA-driven tariff changes (the "treatment"), and examine how these affect unemployment rates at the municipality-level. To the extent that the characteristics of "treatment" and "control" municipalities do not differ significantly pre-treatment (except for their specific industrial structure), we can have some confidence that we have a quasi-experimental exogenous shock affecting a subgroup of the population under study. We will estimate the following model using the manufacturing plant-level data:

$$y_{ismt} = \alpha_{is} + \gamma_{mt} + \pi_1 \tau_{st} + X_{st}\pi_2 + Z_{mt}\pi_3 + u_{st} + \varepsilon_{ismt} \qquad (4)$$

where y_{ismt} is the employment outcome of plant i in sector s in municipality m at time t; τ_{st} is the sector-specific tariff rate at time t; X_{st} is a set of sector-specific factors that affect labor demand in plant i; Z_{mt} is a set of municipality-specific factors that affect labor supply and demand; α_{is} is a set of plant-specific indicator variables; γ_{mt} is a set of municipality-time indicator variables; and u_{st} and ε_{ismt} are unobserved factors that determine plant-level employment. To the extent that tariff rate reductions for Mexican imports, as a result of NAFTA, lead to greater import competition against P.R. and U.S. firms, we should observe reductions in employment levels of plants in P.R. (see Trefler 2004 and references therein for a discussion). Therefore, π_1 should be positive for plant employment outcomes.

This exercise relies on the assumption that tariff changes as a result of NAFTA are not correlated with the characteristics of plants pre-reform, such as productivity of firms in sector s. To the extent that, as hypothesized in the trade policy literature, it is plants in less-competitive sectors which have greater incentives to lobby for trade protection (and achieve greater trade protection), then tariff reductions are correlated with pre-existing plant productivity (Hillman 1982; Grossman and Helpman 1994). To address this potential selection problem, we use plant fixed-effects (α_{is}) in our specification, which control for time-invariant differences in productivity (and other plant characteristics), and shocks to industry determinants of employment

(X_{st}) (e.g., demand shocks in the U.S.). An additional reason why the endogeneity of tariffs may have very limited impact in this context is the fact that P.R. does not have effective representation in the U.S. Congress, effectively minimizing the possibilities for local firms to lobby to their respective representatives at the U.S. federal level, the level at which trade policy decisions are made.

V. Empirical Results

A. Estimates of Employment and Labor Market Impacts

In this section, we present evidence on the estimates of the tariff reduction effects on employment, production employment, and skill upgrading at the plant-, industry-, and municipality-levels. We start the discussion wit a graphical analysis to shed light on the patterns in the data. Figure 2 presents a series of graphs depicting the number of plants in operation and aggregate manufacturing employment by year. Based on the plant-counts and aggregate employment data, we can observe that the manufacturing sector in the Island suffers a shock during 1991-92, possibly due to the early 1990s U.S. and P.R. recession, and although it partially recovers during 1993, it suffers greater declines from 1994 onwards (Figure 2a & Figure 2b). Obviously, this aggregate evidence is less than suggestive that NAFTA led to reductions in employment. Thus, we use the more rigorous econometric techniques discussed above to identify the causal effects of NAFTA on plant-level and aggregate labor demand.

Subsequently, we report estimates using the unbalanced panel of plants open at any point throughout the 1990s. Preliminary estimates of equation (4) suggest that significant reductions in employment occurred in sectors with high reductions in tariffs to Mexican imports, relative to sectors with low or no reductions in tariff rates (Table 1). The probability of a plant closing increased by 3 percentage points (10 percent, significant at 99 percent confidence) as a result of a reduction in tariff rates of 10 percent (Table 1, Panel A, column 1). In addition, for plants in operation at some point during the 1990-1999 period, tariff rate reductions of 10 percent led to reductions in total employment of 13.2 workers or 6.2 percent (both estimates significant at 95 percent confidence) (columns 2 and 6). These employment effects are concentrated among production workers; this particular group suffered employment losses of 12.4 workers (significant at 95 percent confidence), or 4.1 percent, although the latter estimate is imprecisely estimated (columns 3 and 7).

These estimated impacts for all plants open during the 1990s obscure the fact that plants can start-up and close production in Puerto Rico as a result of the tariff rate changes. To the extent that these production decisions are also correlated with time-varying unobservable characteristics of the firms, this could lead to biased estimates of the effect of tariff rate reductions on local employment. Therefore, we divide the sample into two groups: (i) plants operating in P.R. at baseline (during 1993, pre-NAFTA) and (ii) plants that start operations in P.R. post-NAFTA (1994 onwards). This grouping allows us to provide a clearer picture of the effects of the tariff rate reductions on labor demand at the plant-level.

Focusing first on regressions using the sample of plants in operation during 1993 (pre-NAFTA), the point estimates suggest that the probability of a plant closing increased by 4.9 percentage points (5.7 percent, significant at 95 percent confidence) as a result of a reduction in tariff rates of 10 percent (Panel B, column 1). Moreover, for pre-NAFTA plants that remained in operation, tariff rate reductions of 10 percent led to reductions in total employment of 13.2 workers, or 6.2 percent (columns 2 and 5, both estimates significant at 95 percent) and reductions in production-worker employment of 12.5 workers (column 3, significant at 95 percent confidence), or 4.2 percent (column 7, not statistically significant). On the other hand, for plants that started operations after the advent of NAFTA, the point estimates suggest that a reduction in tariff rates of 10 percent would decrease the probability of a plant-opening by 4.6 percentage points (not reported in the tables); although statistically insignificant, the estimates suggest some evidence of self-selection, perhaps being that these plants have extremely high unobservable characteristics that improve productivity and allow them to compete with Mexican imports. Moreover, the point estimates on the employment equations for this sample suggest very high tariff-employment and production employment semi-elasticities, although these are imprecisely estimated (not reported in the tables).

Finally, we report aggregate municipality-level estimates. This aggregation allows us to estimate specifications most similar to the equation (3), the first-stage equation. There are pros and cons from aggregating the data at this level. The data aggregation allows us to take into account reductions in employment driven by plant closings, which we cannot take into account with the plant-level data. However, the aggregation problem prevents us from including plant fixed-effects in the model, which capture a substantial amount of unobserved heterogeneity

potentially correlated with the reduction in tariffs, possibly biasing our estimates. Keeping this in mind, we report these less reliable estimates of the tariff rate reduction effects.

For plants in operation at some point during the 1990-1999 period, tariff rate reductions of 10 percent led to reductions in total manufacturing employment at the municipality-level of 104.1 workers (not significant; Panel C, column 2) or 39 percent (significant at 99 percent confidence; column 6). Again, estimates suggest that employment effects are concentrated among production workers (columns 3 and 7). In summary, these strong results suggest that – as expected – significant labor market restructuring occurred as a result of the trade policy reform.

B. Estimates of Adult Mental Health Impacts

(i) Discussion of reduced-form model of tariff rate changes on adult mental health outcomes (equation 2).

(ii) Discussion of 1st-stage regression and IV estimates of employment shock effects on adult mental health outcomes (equations 1 & 3).

C. Mediating Effects of Medicaid Managed Care Provision on Mental Health Responses to Employment Shocks

VI. Conclusion

References

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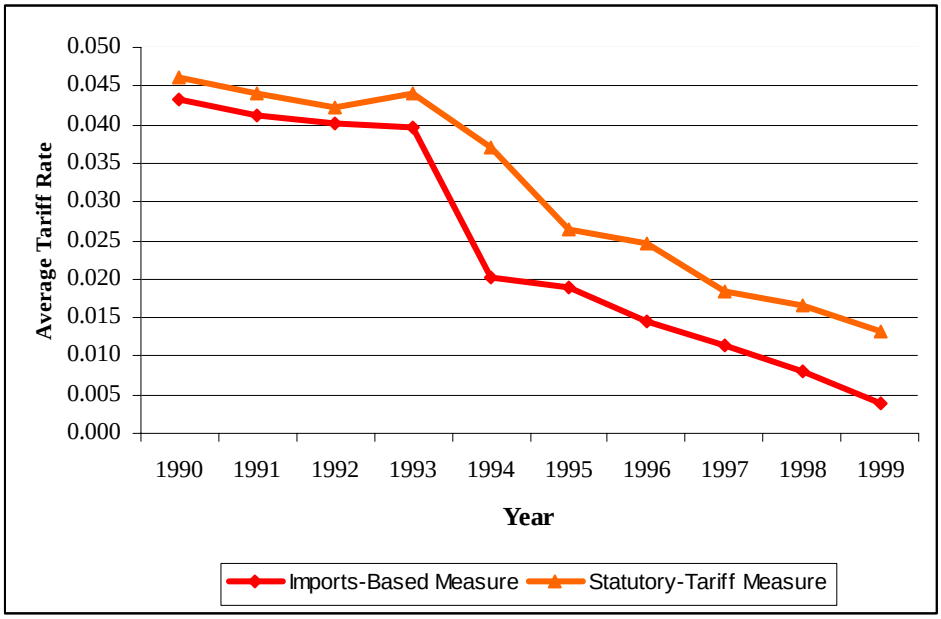
Table 1: Effects of U.S. Tariff Changes on P.R. Manufacturing Employment, Years 1990-1999

Dependent variables:	Open Plant	Employment-All workers	Employment-Production workers	Employment-Non-production workers	Skill upgrading	ln(Total Employment)	ln(Production workers)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Panel A: All Plants							
U.S. Tariff Rate	0.31***	131.8**	123.7**	2.00	0.32	0.62**	0.41
	(0.10)	(52.5)	(48.8)	(12.23)	(0.24)	(0.30)	(0.30)
Plant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of dependent variable, pre-NAFTA	0.34	111.7	90.7	18.69	0.34	-	-
Observations	36281	11609	11181	11181	11156	11609	11156
Panel B: Plants in Operation Pre-NAFTA							
U.S. Tariff Rate	0.49**	132.0**	124.8***	1.47	0.20	0.62**	0.42
	(0.23)	(51.9)	(48.3)	(12.08)	(0.21)	(0.29)	(0.30)
Plant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of dependent variable	0.86	118.6	95.8	20.45	0.34	-	-
Observations	11946	9739	9415	9415	9396	9739	9396
Panel C: Municipality-Level Data							
U.S. Tariff Rate	-6.43	1157.0	2,660.3P**	411.0	-4.49	4.02***	6.23***
	(7.87)	(1073.8)	(1,316.3)	(285.1)	(4.73)	(1.35)	(2.10)
Plant Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of dependent variable	20.24	1883.9	1427.5	289.8	0.20	-	-
Observations	810	810	810	810	795	796	795

Notes to Table 1: Each reported coefficient is from a different regression. Robust standard errors in parentheses; disturbance terms are allowed to be correlated within 4-digit industry SIC code but not across industries; statistically significant at (*) 90 percent, (**) 95 percent, and (***) 99 percent confidence levels.

Figure 1: Average U.S. Tariffs Against Mexican Imports, Manufacturing Industries Active in Puerto Rico



Source: Authors' calculations from the NBER multilateral tariffs and imports data (Feenstra, Romalis, and Schott 2002) and the PRIDCO Industry Research Database.

Notes for Figure 1: The imports-based measure of tariff rates for each industry are the weighted-average of actual duties collected from tariff line *i* divided by the dutiable value of the imports from tariff line *i*; weights are import-shares of the product in industry *s*. The statutory tariff measure is the simple average of statutory tariffs for all products *i* covering industry *s*.

Figure 2a: Number of Manufacturing Plants in Operation, by Year

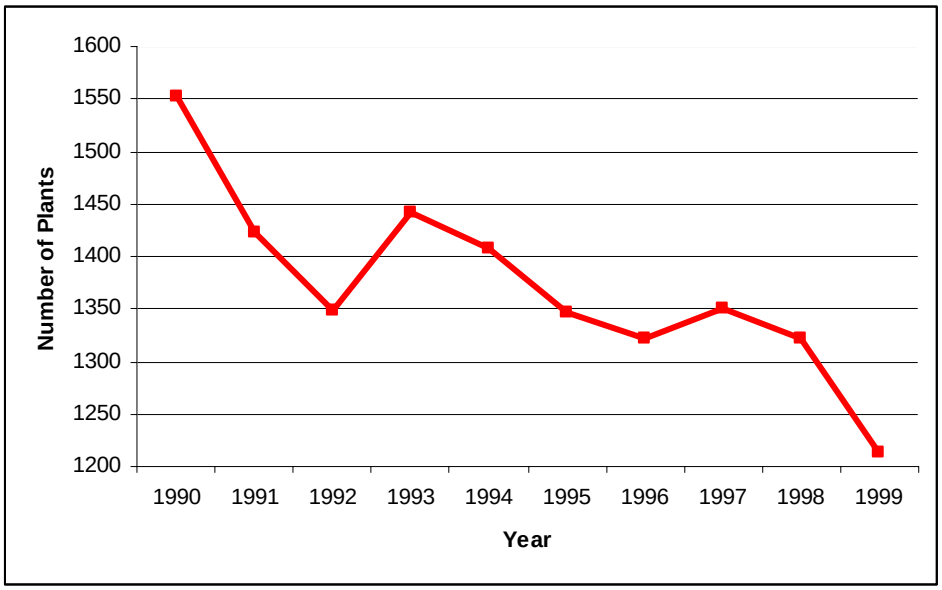
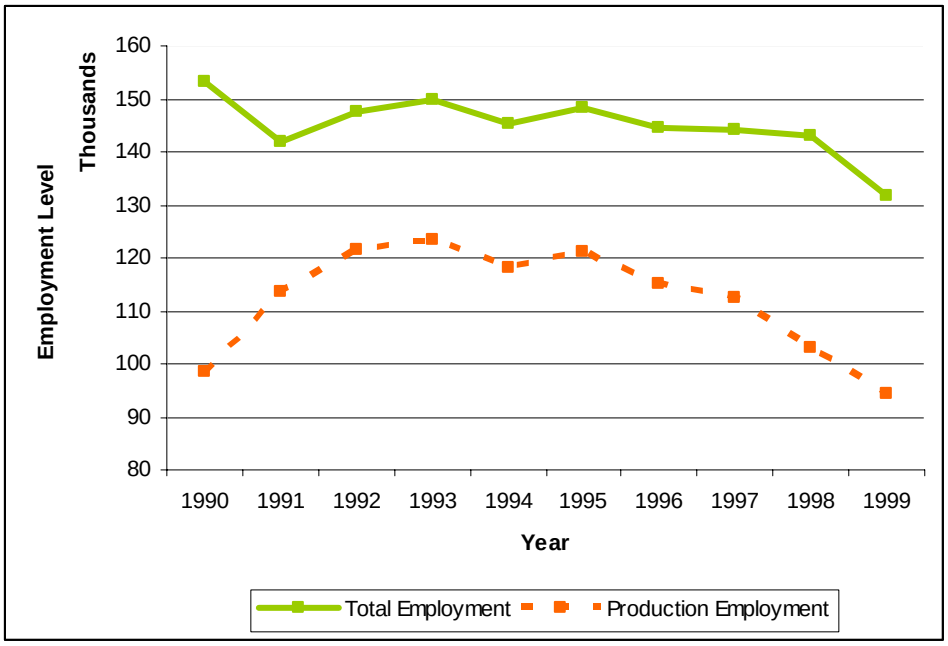


Figure 2b: Total Manufacturing Employment and Manufacturing Production Workers, by Year



Source: Authors' calculations from the PRIDCO Industry Research Database.

Appendix

Table A1: Distribution of characteristics of respondents in managed care regions as compared to those in non-managed care regions, 1996-98

Characteristics	Managed care regions (%) N = 1,868		Non-managed care regions (%) N = 1,060		Characteristics	Managed care regions (%) N = 1,868		Non-managed care regions (%) N = 1,060	
Sex					Marital status				
Female*	50.6	(1.3)	56.5	(2.0)	Married*	67.6	(1.4)	60.5	(1.9)
Male*	49.4	(1.3)	43.5	(2.0)	Disrupted marriage	17.9	(1.1)	20.3	(1.4)
Age					Never married*	14.5	(1.0)	19.2	(1.6)
18-24	7.8	(1.2)	7.5	(1.5)	Migration status				
25-34	30.4	(1.3)	32.3	(1.9)	Islander	96.3	(0.5)	94.5	(0.9)
35-44	20.9	(1.1)	19.6	(1.2)	Returned migrant	3.7	(0.5)	5.5	(0.9)
45-54	15.3	(0.9)	14.4	(1.0)	Employment status				
55-64	12.4	(0.8)	11.6	(1.0)	Employed	52.3	(1.4)	54.8	(2.0)
65+	13.2	(1.2)	14.6	(1.8)	Unemployed	11.2	(0.9)	11.8	(1.3)
Education					Out of labor force	36.6	(1.4)	33.4	(1.9)
0-6	18.9	(1.2)	19.6	(1.5)	Insurance				
7-9	15.6	(1.1)	13.9	(1.3)	Private	50.9	(1.8)	55.2	(2.4)
10-12	34.3	(1.3)	34.6	(1.8)	Public/none	49.1	(1.8)	44.8	(2.4)
13-15	17.7	(1.2)	18.9	(1.7)	Mental health problems				
16+	13.5	(1.2)	12.9	(1.5)	Definite	12.7	(0.9)	12.3	(1.2)
Poverty status					Probable	10.3	(0.8)	11.5	(1.2)
Poor	66.9	(1.7)	65	(2.0)	Unlikely	76.9	(1.2)	76.2	(1.7)
Nonpoor	33.1	(1.7)	34.9	(2.0)	Self-perceived general health				
Physical incapacity					Excellent/good*	55.8	(1.5)	61.4	(1.7)
Yes	21.2	(1.1)	18.6	(1.5)	Fair/poor*	44.2	(1.5)	38.6	(1.7)
No	78.8	(1.1)	81.4	(1.5)	Self-perceived mental health				
Chronic illnesses					Excellent/good	75.9	(1.2)	78.7	(1.4)
Yes	44.2	(1.5)	46.8	(1.9)	Fair/poor	24.1	(1.2)	21.3	(1.4)
No	55.8	(1.5)	53.2	(1.9)					

Source: Alegría et al. (2001a).

Note: Standard errors are in parentheses.

* Z-tests were computed to test for statistical significance, $p < 0.01$.