Domestic Pollution Havens: Evidence From Cancer Deaths in Border Counties[1]

Matthew E. Kahn

Tufts University

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ABSTRACT

Tests of the international pollution havens hypothesis have yielded mixed results. One explanation for this finding is that domestic pollution havens substitute for international pollution havens. Such pollution havens are likely to grow at state borders. Using a new panel data set on county cancer death rates from 1950 to 1994, this paper documents that cancer death rates have grown at specific state borders that have not imposed stringent labor regulation and are adjacent to high regulation states while cancer rates are falling at the Mexico border and rising at the Canadian border.

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[1] Fletcher School of Law & Diplomacy, Tufts University, Medford, MA 02155 Matt.kahn@tufts.edu, Fax: 617-627-3712. I gratefully acknowledge the support of NIH grant R01 AG119637. I thank Dora Costa and seminar participants at the Federal Reserve Banks of Chicago and Philadelphia for useful comments and I thank Randy Becker, Jerry Carlino, and Jordan Rappaport for providing some data used in the analysis.

I. Introduction

Environmentalists often voice the concern that international free trade agreements foster the growth of pollution havens in poorer nations. Such nations may have a comparative advantage in producing dirty goods because they impose less regulation and because their workers require lower compensating wages to take on low quality job tasks. While this argument has intuitive merit, the international trade literature has found mixed evidence in favor of the pollution haven hypothesis. Between 1958 and 1994, the pollution content of U.S manufacturing imports has fallen relative to the pollution content of domestic manufacturing production (Kahn 2003a). Some research investigating trade patterns and foreign direct investment has found evidence in support of the pollution havens hypothesis (Ederington and Minier 2002, Xing and Kolstad 2002, Keller and Levinson 2002, Grether and de Melo 2003). Other research has disputed this claim (see Eskeland and Harrison 2002). For footloose, cheap to ship industries, the volume of international trade is greater for more pollution intensive industries than less pollution intensive industries (Ederington, Levinson and Minier 2003, Kahn2003a). But, for most industries, pollution control costs are not a major determinant of relocation (Dasgupta, Laplante, Wang and Wheeler 2002).[2]

Domestic pollution havens may substitute for international pollution havens. Domestic locations economize on transportation costs to U.S consumers and reduce exchange rate risk. Previous research has investigated whether pollution havens grow in poorer minority communities (Been 1994). This paper pursues an alternative strategy of

[2] Survey evidence shows that environmental regulatory costs rank low in terms of factors that influence firm locational choice (Panayotou 2000).

studying whether domestic pollution havens are growing at specific state borders. At state borders there can be abrupt changes in regulatory intensity. Within the United States, environmental, safety and labor regulation is not uniformly imposed. Some states such as California are known as regulatory leaders (Fredriksson and Millimet 2002) while other states such as Texas have the opposite reputation (Berman and Bui 2001, Levinson 2001). When a "high regulation" state borders a "low regulation" state, there is an incentive for dirty activity to agglomerate on the "low regulation" side of the border.

A growing labor regulation and environmental regulation literature has documented that an unintended consequence of differential regulation is to encourage production activity to move to less regulated areas (Becker and Henderson 1999, Greenstone 2002, Henderson 1996, Holmes 1998, Kahn 1997, Keller and Levinson 2002, Levinson 1996, 2000). Of this list, only Holmes' (1998) study specifically focuses on state borders. Building on his work, this paper studies whether domestic pollution havens are growing at state borders. Using a new county level data set of cancer death rates from 1950 to 1994, I test whether cancer deaths are rising on the low regulation side of the border. An attractive feature of cancer data is that it offers a pre-regulation data point (i.e data before the 1970s) and it represents an important health metric for judging the consequences of border effects.

Consistent with the domestic pollution haven hypothesis, evidence is presented that cancer death rates for cancers with an environmental component are rising at regulatory borders where "high" regulation states are adjacent to "low" regulation states. Cancer death rates for cancers that are not believed to have an environmental component, such as brain and colon cancer, are not growing at these regulatory borders.

International border counties offer a second set of places to look for domestic pollution havens. During the years 1950 to 1994, U.S trade with Canada and Mexico sharply increased. At counties that border these nations, there is a regulatory discontinuity and a market potential discontinuity (Hanson 1998, 2001). As international trade increases, these borders may experience rising or falling cancer rates depending on scale, composition and technique effects (Antweiler, Copeland and Taylor 2001). International trade increases the scale of activity at these borders but it can also affect industrial composition and the workforce's demographic composition. I find that cancer death rates are falling at the Mexican border and rising at the Canadian border.

Section II presents a simple argument for why domestic pollution havens may grow at state borders. Section III discusses the data sources and the empirical approach. Sections IV and V present the regression results. The last section of the paper examines the welfare implications of pollution havens agglomerating at geographical borders.

II. **Why Can Cancer Death Rates be Higher at State Borders?**

Cancer death rates will be higher at state borders if manufacturing is agglomerating at such borders, and if this manufacturing growth has increased local pollution levels and if this higher pollution increases cancer rates. Since this paper's empirical work will focus on estimating cancer death rate regressions as a function of state border indicators, this section examines the empirical underpinnings of each of these three logic steps.

The first piece of the argument is that manufacturing tends to agglomerate at certain geographical borders. All else equal, manufacturing will agglomerate in areas where regulation is low, factor inputs are cheap and market potential is high (Dumais, Ellison and Glaeser 2002, Hanson 1998, Holmes 1998). By locating on the "low regulation" side of the border, a firm can evade a stringent regulatory burden and can enjoy the benefits of proximity to markets (Holmes 1998). Several studies have documented a displacement effect induced by differential environmental regulation (Becker and Henderson 1999, Greenstone 2002, Henderson 1996, and Kahn 1997).

By locating on an international boundary, domestic firms will have greater access to factor inputs, intermediate goods and final product consumers in Mexico and Canada (McCallum 1995). Hanson (2001) documents the recent growth of economic activity in U.S cities that border Mexican cities. Given the increase in the stringency of environmental and labor regulation and the rise in international trade, there is an increased incentive for manufacturing to agglomerate at these state borders.

The second piece of the argument is that manufacturing agglomeration raises local pollution levels. It is intuitive that the rising scale of economic activity concentrated in dirty manufacturing industries raises local pollution levels. Environmental quality is a function of local scale of economic activity, composition and techniques used. In Kahn (1999), I document that an unintended consequence of the decline in steel production in the Rust Belt is that cities such as Pittsburgh have experienced a sharp improvement in urban pollution levels. In Kahn (2003b), I document that the decline of communism has led to scale and composition shifts away from manufacturing and into services such that urban ambient sulfur dioxide levels have sharply improved in the major cities in the Czech Republic, Hungary and Poland.

This paper's empirical focus is to examine cancer death rate trends at state borders. If manufacturing is agglomerating at state borders and this agglomeration raises pollution levels, then we can use cancer death rate patterns to identify domestic pollution haven growth if pollution exposure raises cancer death rates. If there is no link between pollution exposure and cancer, then cancer death rates are not an appropriate outcome measure for identifying rising domestic pollution clusters.

There has been an active medical research agenda correlating lung cancer incidence risk with a worker's industry (Ward et al 1997, Pezzotto et al 1999). This research has identified certain industries such as pulp and paper (Bergeret et al 2002), the metal, wood and furniture sector (Corella et al 2000), hard metal production and exposure to hard metal dust (Wild et al 2000) as causing cancer.

In this paper, I define a domestic pollution haven as a county with a high cancer death rate relative to other counties in the same state. If manufacturing agglomerates at state borders, and if this agglomeration raises local pollution levels that in turn increase cancer risk, then I can test for the presence of domestic pollution havens by studying changes in cancer death risk at border counties. For this effect to be present, each of the three pieces of the argument must hold. Excess cancer death rate provides a metric for determining whether domestic pollution havens are growing over time. Based on this cancer metric, pollution havens would not emerge if manufacturing agglomerates but little pollution is created by this agglomeration.

III. The Empirical Framework

This paper tests the hypothesis that cancer mortality rates for cancers with an environmental component are higher at certain borders. Being a border area does not *cause* cancer. Instead, an unintended consequence of rising regulation, when states differ with respect to their regulatory stringency, and rising international trade is to encourage a greater scale of economic activity and perhaps composition of economic activity that raises environmental hazards and thus cancer at certain borders.

Equations (1) and (2) present the basic regression framework.

$$Log(C_{ljmt}) = state_m + B_1{*}Border_j + B_2{*}Mexico_j + B_3{*}Canada_j + B_4{*}Right_j + U \quad (1)$$

$$Log(C_{ljmt}/C_{ljmt-1}) = state_m + B_1{*}Border_j + B_2{*}Mexico_j + B_3{*}Canada_j + B_4{*}Right_j + U \quad (2)$$

In equation (1), C is the mortality rate per 100,000 person-years from cancer type l in county j in state m in year t. The log of the cancer rate is regressed on state fixed effects and four dummy variables. The inclusion of state fixed effects means that I test for the presence of "domestic pollution havens" at borders by comparing border cancer mortality rates to interior counties (the omitted category) within the same state.[3] In the regression tables, equation (2) is called the "first difference". To focus solely on measuring cancer growth at geographical boundaries, the regression specification simply includes the four border effects as separate explanatory variables. The robustness of these results will be examined below.

The explanatory variables are border indicator variables. If estimates of equation (1) and (2) indicate that I cannot reject the hypothesis that all of the border dummy coefficients are not statistically different from zero then I reject the hypothesis that domestic pollution havens are growing at state borders.

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[3]State fixed effects control for a number of factors including climate, and overall state health care quality.

Border is a dummy that equals one if county j is adjacent to a county in another state. State borders are an interesting place to test for the presence of domestic pollution havens because a free rider argument would suggest that dirty activity might agglomerate there to export pollution to "downstream" neighbors. A recent empirical research has documented evidence of higher ambient water pollution, toxic emissions and particulate levels at borders (Kahn 1999, Sigman 2002, Hellend and Whitford 2003).

In equations (1 and 2), Mexico equals one if a county is adjacent to Mexico. Canada equals one if a county is adjacent to Canada. The Mexico border may or may not be a domestic pollution haven depending on the magnitude of scale and composition effects. A pollution haven can grow if economic activity is high (scale), because the economic activity is concentrated in dirty production (composition), and because the dirty production creates a high level of pollution per unit of output (technique). There is likely to be a growth in the scale of economic activity at the border over time but it may have a cleaner composition as the dirtiest industries migrate south. Increased trade with Canada could increase pollution levels at the Canadian border.

State "Right to Work" laws proxies for a host of pro-business regulations (Holmes 1998). "Right" is a dummy variable that equals one if a county is located in a state that has a Right to Work law and it is adjacent to a state that does not have a Right to Work law. [4] A Right to Work law bans the union shop, that is, a workplace in which all employees are required to join the union. Right to work law is a policy that has some appeal to manufacturers because a right to work law weakens unions. Holmes (1998)

[4] The states that have a Right to Work law span the regions of the United States except for the Northeast. These states include; Texas, Alabama, Virginia, South Dakota, South

shows that manufacturing activity agglomerates on the low regulation side of borders.[5] He shows that this regulatory agglomeration effect has grown between the 1950s and the 1990s (see his Table Seven).

Right to Work states are consistently "low regulation" states. Such states have lower cigarette taxes. Cigarette taxes average 57 cents a pack across the country in the year 2002 but the average in No Right to Work states is 75 cents while it is 32 cents in Right to Work states. Congressional representatives from Right to Work states are anti-environment as compared to representatives from No Right to Work states. The League of Conservation Voters (LCV) provides an annual ranking of Congressional representatives' environmental scores (see www.lcv.org). These rankings are constructed by calculating the mean of pro-environmental votes on legislation that a panel of environmental experts has identified to be the most important issues voted on that year. This group identifies the "pro-environment" position. In the year 2002, the mean LCV for states without a Right to Work law was 56 while the mean for representatives from Right to Work states was 26. This is a standard deviation lower.

In estimating equations (1) and (2), I pursue a different estimation strategy than Holmes (1998). He compares manufacturing activity in the highly regulated county relative to manufacturing activity in the less regulated "twin" adjacent county. Figure One makes the distinction between his approach and mine. For states that have a Right

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Carolina, North Carolina, Florida, Arkansas, Utah, North Dakota, Mississippi, Georgia, Iowa, Tennessee, Arizona, Nebraska, Wyoming, Idaho and Louisiana, and Nevada.

[5] There are 34 Right to Work border pairs where a Right to Work state borders a No Right to Work state. These include: where Arizona borders California, Arkansas borders Missouri, Idaho borders Minnesota, Kansas borders Oklahoma, Nebraska borders Colorado, Tennessee borders Kentucky, Texas borders New Mexico, Virginia borders Maryland. These examples highlight the geographical diversity of these borders pairs.

to Work law, I compare county "B" to county "A" within the same state while Holmes (1998) focuses on testing whether manufacturing is agglomerating in county "B" rather than county "C" at state borders between high and low regulation states.[6] My approach allows me to study domestic pollution haven growth at the multiple state boundaries listed in equation (1).

I estimate the cancer regressions using OLS. Given that the unit of analysis is the county and that state fixed effects are included, it is hard to imagine why I need to instrument for the dummy variable "Right" in equations (1) and (2). This dummy is a function of the geographical location of the county (at a border) and the choice of the county's state to have a "Right to Work" law and the choice of the neighboring state to not have a "Right to Work" law. Even if states strategically choose their regulatory severity taking their neighbor regulation as given, the counties that are next to the border are not picking their own regulatory status.[7]

IV. Data

County level cancer data is available from the National Cancer Institute (www3.cancer.gov/atlasplus/geo.html). This rich data set provides cancer mortality rates per 100,000 person-years broken out by county of residence, year, sex, and cancer type. It is important to note that census data indicates that in the year 1960, 90% of people who worked in a given county also lived in that county. This linkage of place of work and

[6] I also test for evidence of symmetry by testing for whether cancer death rates are falling at county "C" in Figure One relative to interior counties in the same high regulation state. If manufacturing were perfectly mobile, it would be rational for existing factories in C to migrate to county B.

[7] I am assuming that counties are small in the setting of state regulatory policy.

place of residence is important because if everybody lives 400 miles from their place of work, then domestic pollution havens could be booming at state borders but residential data on cancer deaths in these border counties would not indicate this.[8] The reported cancer results below are for whites.[9] Hispanics are grouped with whites if they are classified as being white.[10]

The county cancer data offers a series of contrasts. Cancer death rates are reported separately for men and women. Men face greater work place exposure to cancer risks while both men and women face cancer risks that diffuse into the residential community. The overall cancer death rate is reported and it is disaggregated into several types of cancer. I will look at: all, lung, brain, and colon cancer. While lung cancer is believed to have an environmental component, brain and colon cancer are not believed to have one. Average county cancer death rates are reported in the early time period of 1950 to 1969 and the later time period of 1970 to 1994. These two time periods can be thought of as spanning a "pre-regulation" and "post-regulation" period. The Environmental Protection Agency (EPA) was started in the early 1970s. Since the EPA is the major environmental data supplier, it is rarely the case that a researcher has "pre-EPA" outcome data. Cancer death data are an attractive outcome measure both because such data are available pre-EPA and because it is an important outcome indicator.

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[8] Returning to Figure One, in an extreme case if all border workers in county B lived in county A and all residents in county B worked in location A and if all cancer is caused at the workplace, then positive coefficient estimates of border effects in equations (1) and (2) would not be a valid test of whether domestic pollution havens are growing at border counties. A valid test would be if these coefficients were negative!

[9] Black mortality rates are available only for the 1970-1994 period.

[10] The number of deaths by race, sex, place of residence and cause of death are based on original death certificates reported to the National Center for Health Statistics from the States.

The county correlations of cancer reveal some interesting facts. The correlation between men's cancer mortality rate during 1950 to 1969 and 1970 to 1994 is 0.39 and for women this correlation equals 0.41. During the period 1970 to 1994, the correlation of men's and women's mortality rates equals 0.41. During the years 1990 to 1994, the three states with the lowest cancer mortality rates are Utah (152), Idaho (180), and Colorado (181) and the three states with the highest cancer mortality rates are Kentucky (245), Louisiana (239) and Maine (236).[11]

Figure Two presents time trends in the average state level cancer mortality rates per 100,000 person-years for Right to Work States and Non-Right to Work states.[12] Cancer rates have significantly increased between 1950 and 1990. In the 1950s, Right to Work states had much lower cancer rates but over time convergence is observed. By the 1990s, Right to Work states have equal cancer rates as Non-Right to Work states. This finding is consistent with the hypothesis that dirty activity is increasingly agglomerating in the low regulation states.

Table One reports some demographic summary statistics for all counties and border counties. The average "Right to Work" border county has a smaller population and a lower population density than the average county. Human capital indicators and per-capita income in 1970 and 1990 suggests that there are few differences between border counties and the average county. Mexican border counties are poorer than the average county and Hispanics are vastly over-represented there.

To provide some evidence on time trends in scale and composition of economic

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[11] Numbers in parentheses are the mortality rates per 100,000 person years.
[12] The cancer death averages for the Right to Work and No-Right to Work states are population weighted using the state's 1970 population as the weight.

activity in border counties, Table Two reports eight OLS estimates of:

$$Y_{ijt} = state_j + B_1*Border_j + B_2*Mexico_j + B_3*Canada_j + B_4*Right_j + U \qquad (3)$$

The first two columns of Table Two report estimates of equation (3) where the dependent variable is the log of total county employment in the years 1951 and 1996. Since state fixed effects are included, the dummy variable coefficients represent the differential relative to an interior county in the same state. Over this 45 year period, there have not been dramatic changes in the relative scale of economic activity at state borders. At the Right to Work borders, the employment coefficient grows over time but it is statistically insignificant in 1996. Relative to interior counties within the same state, employment has grown at the Mexican border and declined at the Canadian border. Between 1951 and 1996, there has been a relative decline in employment activity in the average border county.

To measure composition effects at border counties, columns (3) and (4) present estimates of equation (3) where the dependent variable is the county's share of employment in manufacturing in 1951 and 1996. There is statistically significant evidence that manufacturing's share of employment is rising in Right to Work border counties, and rising at the Mexico border. No composition shift is observed at the Canadian border. Contrary to the free-rider hypothesis, the share of manufacturing at the average border county is declining over time.

An alternative method for measuring composition effects is to examine whether the age structure and the human capital levels of the population in border counties is changing over time. Columns (5) through (8) of Table Two examine how border county age demographics and human capital levels are changing over time. The age structure in border counties has not significantly changed over time. In 1970 and 1990, counties bordering Mexico had a larger share of their population in the age category of 0 to 34. All of the other coefficient estimates are statistically insignificant. The final right two columns of Table Two examine college graduation rates in border counties. Relative to interior counties in the same state, Canadian border counties have a smaller percentage of college graduates in 1970 and this differential grew over time to 3.8 percentage points. The other coefficient estimates are not statistically significant. Columns (5-8) show that there is not strong evidence of demographic composition shifts at border counties.

V. **Cancer Regression Results**

To test for the presence of domestic pollution havens, I estimate three OLS regressions based on equations (1 and 2), by sex for each cancer type. I estimate levels regressions based on equation (1) using 1950-1969 data and 1970-1994 data. I also present estimates of equation (2) to study the percent change in cancer over time. With the exception of the results presented in Table Five, all of the regressions only include exogenous geographical dummy variables without any other demographic controls. Given the state fixed effects included in each regression, the five dummy variables: "Right to Work Border County", "No Right to Work Border County", "Mexican Border", "Canadian Border", and "State Border" capture how much extra cancer risk is taking place at borders relative to interior counties. If these border coefficients were all insignificantly different from zero, then I would fail to reject the hypothesis that border counties are not domestic pollution havens.

Table Three reports seven regression estimates of the levels and first difference regressions where the dependent variable is the overall cancer mortality rate. As discussed above, the overall cancer rate represents a mixture of cancers some of which are unlikely to have an environmental component. The left two columns report estimates from the two cross-sections. The third column reports the "first difference" estimates of equation (2). The top panel presents men's regressions and the bottom panel presents the women's regressions. Right to Work Border counties that are adjacent to Non-Right to Work counties have experienced a 3.4% increase in cancer death rates relative to the average county in the interior of the state.[13] The "Double Difference Column" estimates equation (2) when the dependent variable equals Log(C_{ljmt} for men /C_{ljmt-1} for men) - Log(C_{ljmt} for women /C_{ljmt-1} for women). Relative to women, men's overall cancer death rate increased by 2.8% in Right to Work border counties. During the 1950 to 1969 period, cancer death rates were respectively 9% and 6% lower at the Mexican and Canadian borders than in interior counties in the same states. At the Mexican border, cancer rates have decreased while at the Canadian border cancer rates have increased. For women, both of these estimates are statistically insignificant. For men, cancer death rates have fallen by 10.2% at the Mexican border and have increased by 8.4% at the Canadian border. No evidence is found that the average state border is a pollution haven relative to interior counties. Across all seven of the levels and change regressions presented in Table Three, the "County Borders Another State" dummy is statistically insignificant.

[13] Due to life cycle migration, I would not expect to see enormous quantitative effects of borders on cancer death rates. Cross-county migration introduces a type of measurement error over the life-cycle. For migrants, today's cancer exposure (as measured by one's current county of residence) may not be representative of life time exposure. In addition, it unlikely that environmental exposure is a major cause of cancer.

As discussed above, lung cancer is the cancer that is most likely to have an environmental component. The first set of lung cancer results are presented in Table Four. [14] This table presents evidence consistent with the domestic pollution havens hypothesis at certain borders. For men, lung cancer rates have increased by 6% in Right to Work border counties that are adjacent to non-Right to Work states. [15] Lung cancer death rates have increased by 15% at the Canadian border.[16] For men, there has not been a statistically significant change in lung cancer death rates at the Mexican border or at the average border. For women, the results are qualitatively similar, except for at the Mexico border. In the 1950 to 1969 period, women's lung cancer death rates were 16% higher at the Mexican border while in the 1970 to 1994 period, they were 29% lower. The very large first difference coefficient of –0.45 is statistically significant at the 1% level. The results in Table Four reveal a puzzle concerning differences in men's and women's cancer rates at the Mexican border. During 1950 to 1969 period, men's lung cancer death rates were lower at the Mexican border while women's cancer rates were higher. In the 1970 to 1994 period, both sexes have roughly the same negative coefficient. This suggests that the average woman's smoking propensity has radically changed over time at this border. Unlike Mexico, men and women at the Canadian border display the same patterns.

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[14] I have dropped from the regressions those counties that report a zero cancer death rate during the 1950 to 1969 period.

[15] One hypothesis that can be rejected is that Right to Work Border counties are high cigarette tax states where people can easily cross the border into a No Right to Work state and buy cheap cigarettes. The tax on cigarettes is much lower in Right to Work states.

[16] At the Canadian border, the greatest cancer growth is taking place at the Minnesota, New Hampshire and New York northern borders.

Since lung cancer is my best indicator of a health outcome that has an environmental component, in Table Five I further test for the robustness of my border estimates by including additional explanatory variables in the regression estimates of equation (2). Of particular interest is to test how my results are affected by including other regulatory measures and a richer set of county demographic controls. Column (1) reports the dummy variable coefficients when no demographic controls are included. In column (2), I follow Hanson (2001) and disaggregate Mexican border counties into those that are adjacent to a major Mexican city and those that are not. Counties that border a city in Mexico are more likely to become major trading centers. The rise of Mexican trade is likely to have the greatest impact on these counties. In column (2), I include a new dummy variable that equals one for the ten counties that border Mexico and that border a major Mexican city. This dummy's coefficient is –0.3294 and statistically significant. There has been a large decline in lung cancer death rates in Mexican border counties adjacent to major Mexican cities relative to other Mexican border counties. One plausible explanation for this finding is that rising trade with Mexico has changed the scale and composition of production near major Mexican cities.

Until now, none of the regressions have controlled for any demographic variables. To test the robustness of the border results, in column (3) I include controls for the county's population size, median age of residents, and average human capital levels. All of the border effects estimated in column (3) are quite similar to the coefficient estimates in column (2). [17] Column (3) also includes one other dummy variable that measures a

[17]Note that relative to the results in Table Four, columns (2) and (3) of Table Five show that the coefficient for counties in high regulation state that are adjacent to Right to Work states has a larger negative coefficient. I consistently reject the hypothesis that the

county's Clean Air Act regulatory level in the year 1978. The dummy variable "Ozone Non-Attainment County in 1978" equals one if a county was assigned to non-attainment status for the year 1978. As discussed in Becker and Henderson (2000) and Henderson (1996), a county's likelihood of being assigned to the high regulation category hinges on its past air pollution levels. Unlike the other dummy variables included in the regression, this dummy can equal one for interior counties. While a county's environmental regulatory status is not randomly assigned within state, it is still of interest to measure this regulation's effect on cancer death rate changes.[18] All else equal, non-attainment counties have experienced a 9.2% reduction in lung cancer death rates relative to attainment counties in the same state. Air pollution regulation could help reduce lung cancer death rates if this regulation is effective at reducing pollution per unit of economic activity. In addition, an unintended consequence of this regulation is to deflect economic activity to counties in attainment with this regulation (Henderson 1996).[19]

In column (4), I include the county's log cancer rate in the 1950 to 1969 time period. This variable should control for many county specific factors. Counties with higher initial cancer death rates experienced larger reductions in their cancer death rate over time. Including this variable does not affect the Right to Work border coefficient but

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counties "B" and "C" in Figure One are playing a zero sum game such that cancer increases in one state represent cancer decreases in the high regulation state.

[18] In the 1950-1969 pre-Clean Air Act period, all else equal, ozone non-attainment counties had 23% higher levels of lung cancer death rates relative to ozone attainment counties in the same state. This is consistent with the hypothesis that ozone regulation has been aimed at initially high polluted counties.

[19] An interaction of the Right to Work Border county dummy with the county ozone attainment dummy yielded a statistically insignificant estimate. I expected that border counties on the low labor regulation side of the border that were assigned to attainment (low environmental regulation) status would have the greatest growth as domestic pollution havens.

it does reduce the size of the Canadian border. The ozone non-attainment status dummy's coefficient shrinks to -.024 but it is still statistically significant.

Increases in cancer death rates at border counties can be caused by the rising scale of dirty industrial activity at such borders or because of changes in the types of people who move to such areas. If people with poor health habits are choosing to move to border communities, the selection hypothesis, then it is certainly possible that observed cancer death rates could rise at borders for reasons unrelated to environmental exposure. One way to test the selection hypothesis is to estimate cancer regressions for cancers that are not believed to have an environmental component. If we see that these non-environmental cancers are rising at borders, this would suggest that worker negative selection is the real reason we are observing rising lung cancers at borders. In Tables Six and Seven, I present estimates of equations (1 and 2) for colon and brain cancer. An F-test for the first difference regression for men and women for brain and colon cancer indicates that I cannot reject the hypothesis that all of the coefficient estimates are zero. This is strong evidence against the worker selection hypothesis.[20]

Unlike the first difference estimates, the levels estimates of equation (1) reported in Table Six and Seven reveal some statistically significant effects. In the 1970 to 1994 period at the Mexican border, both brain and colon cancer death rates are much lower for men and women relative to the interior of the state. One could certainly imagine that this "treatment" and "selection" are linked due to Tiebout migration and low skill labor

[20] I have also estimated equation (1) and (2) for women's deaths from breast cancer. In the popular press there are often articles linking cancer clusters to environmental hazards. My regression estimates showed that all of the border effects are statistically insignificant except for at the Canadian border that has experienced a fairly large decline in death rates.

demand by dirty industry. If a border has attracted dirty firms, this will lower nearby quality of life and depress housing prices, this in turn may attract poorer people to move into the area. The dirty firms may also hire low skill workers to work at the production facility.

The reason I emphasize the first difference results is that Holmes (1998) finds that border effects have grown over time. In his Table 7, Holmes (1998) presents evidence in the years 1947 and 1954, that agglomeration on the pro-business side of the border was not statistically significant but this differential doubled in size between 1963 and 1992.

This sections' regressions have used a state fixed effect approach to construct control groups for the border "treatment" counties. It must be acknowledged that Holmes (1998) test of domestic regulatory differences is "cleaner" in the sense that an adjacent county to a state must be a better control group than the average county within the same state (i.e the state fixed effects approach presented in equations 1 and 2). I have de-emphasized the "Holmes approach" in the empirical work because it throws away 95% of the data (all counties not on a differential regulatory border) and it does not allow an examination of the growth of domestic pollution havens at other state borders or international state borders.

Following Holmes (1998), I have also studied the manufacturing agglomeration at Right to Work border counties by estimating a regression of the form:

$$\mathrm{Log}(C_{ijt}/C_{ijt-1}) = \mathrm{pair}_j + B_1 * \mathrm{Right}_j + U \qquad (4)$$

Unlike in equations (1) and (2), I only include in the sample "twin" border counties on two different sides of the Right to Work boundary. As shown in Figure One, I compare cancer rates in counties "B" and "C". In estimating equation "4", counties "B" and "C" are part of the same pair. Including a pair fixed effect, I test whether there has been greater cancer growth on the Right to Work side of the boundary relative to the tighter regulation side of the boundary. For both men and women, I find that B1 is positive but statistically insignificant.

V. Welfare Implications

The previous section reported evidence that pollution havens are growing at Right to Work border counties, and at the Canadian border but not at all state borders or the Mexican border. In fact, at the Mexican border there is evidence that the cancer death rate is falling. These results are consistent with the general finding in the regulatory displacement literature that manufacturing industries are agglomerating in less regulated areas (Becker and Henderson 2000, Greenstone 2002). With the exception of Becker and Henderson (2001), the regulatory displacement literature has not attempted to measure the consequences of this effect. Does the growth of domestic pollution havens represent an important negative externality? Given the low population density of border areas (see Table One), there can be social gains from pushing dirty economic activity away from population centers (Henderson 1996). The social costs caused by the growth of pollution havens hinge on a number of factors. If cancer exposure is solely determined by whether one works in a dirty production facility and if workers are informed about the risks and if labor markets are perfectly competitive, then there would be no externality.[21] The

[21] Under these conditions, riskier jobs in the domestic pollution haven areas will feature wage premiums. Workers will be just indifferent between taking these jobs and their next best alternative and employers would have a financial incentive to consider "greening" their work place if such amenity improvements were cost effective.

compensating differentials literature has reported evidence of cancer compensation (Lott and Manning 2000).

Domestic pollution havens could be a significant health externality if the pollution spills over into the residential community and people are unaware of the risks they face. Recent hedonic research has yielded mixed results on whether cancer exposure announcements are capitalized into home prices. Gayer, Hamilton and Viscusi (2002) show that cancer risk is capitalized into home prices. Conversely, Bui and Mayer (forthcoming) find little evidence of capitalization of Toxic Release Inventory announcements at the zip code level on changes in zip code level home price indices.

A revealed preference test of whether people are informed about the risks they are exposed to is to examine commuter patterns. Living in another county and commuting in to your county of work represents a form of costly self protection. Using data from the Bureau of Economic Analysis Journey to Work data set (see http://www.bea.doc.gov/bea/regional/reis/jtw/), I created a dependent variable that represents the share of a county's workers who live in another county. If this fraction is high, this indicates that there is a lot of cross-county commuting. I regress this measure in 1960 and 1990 on the geographical dummy variables to test whether there have been changes in cross-county commuting in counties that are border counties. Table Eight presents three regressions. At the Mexican border there has been a statistically significant 5.7 percentage point decline in cross-county commuting between the years 1960 and 1990 relative to the average county in the same state. This result is consistent with the self protection hypothesis. Given that cancer death rates have fallen at Mexican border, the environmental externality has diminished such that the area is now safer and commuters are now willing to live there. At the Canadian border where cancer rates are rising, more border county workers are choosing to live in this county. This evidence is inconsistent with the self protection hypothesis.

VI. Conclusion

Recent empirical research on the composition of international trade between the United States and poorer nations has revealed a puzzle. Contrary to the pollution havens hypothesis, the United States has not increased its imports of "dirty" manufacturing goods from poorer nations. There are several possible explanations for this finding. Multinational corporations, especially those that sell directly to final consumers, may care about their reputations with environmental conscious customers. Labor costs may swamp environmental costs as a key factor in determining where to locate factories.

An additional explanation is that domestic pollution havens substitute for international pollution havens. Using a new county panel on cancer death rates, I have documented that cancer death rates are rising in low regulation counties that border high regulation states but cancer death rates are not rising at the average state border. While residential cancer death data is an unusual metric for pinpointing pollution growth, it represents an important health metric. It is a valid indicator of pollution haven growth at regulatory borders if people tend to live in the counties where they work and spatial differences in regulation induce manufacturing agglomeration on the "low regulation" side of the border, and if this manufacturing agglomeration raises local pollution levels which in turn increase the fatality rates from certain cancers.

In addition to studying cancer growth rates at domestic borders, I have also tested whether the Canadian and Mexican borders are growing pollution havens. At the Mexican border, cancer rates for both environmental and non-environmental cancers are down. The fact that women's lung and colon cancer have fallen the most at this border suggests that non-environmental exposure factors are driving this progress. A reverse pollution havens hypothesis may explain these patterns. At the Mexico border, the rise of maquiladoras may allow for a composition shift on the U.S side of the border such that dirtier activity moves into Mexico (Hanson 2001). This greening of the average domestic job may attract higher quality workers, with healthier habits, to the Mexican border area. The key counter-factual here is would cancer rates at the Mexican border have fallen if trade with Mexico had not increased? At the Canadian border, cancer rates are rising for lung cancer but not for brain and colon cancer. This evidence is consistent with the hypothesis that this border is growing as a pollution haven.

References

Antweiler, Werner, Brian Copeland and Scott Taylor. 2001. "Is free trade good for the environment?," American Economic Review 91(4), 877-908.

Becker, Randy and Vernon Henderson. 2000. Effects of Air Quality Regulation on Decisions of Firms in Polluting Industries. Journal of Political Economy. 108(2) 379-421.

Becker, Randy and Vernon Henderson. 2001. Costs of Air Quality Regulation. In Behavioral and Distributional Effects of Environmental Policy. Edited by Carlo Carraro and Gilbert Metcalf. University of Chicago Press. 159-186.

Been, Vicki. 1994. Locally Undesirable Land Use in Minority Neighborhoods: Disproportionate Siting or Market Dynamics? The Yale Law Journal, 103, 1383-1422.

Bergeret A. Facchini LA. Kishi R. Kielkowski D. Rix BA. Henneberger P. Sunyer J. Colin D. Kogevinas M. Boffetta P. Mortality from lung cancer in workers exposed to sulfur dioxide in the pulp and paper industry. Environmental Health Perspectives. 110(10):991-5, 2002 Oct.

Berman, Eli and Linda Bui. 2001. Environmental Regulation and Labor Demand: Evidence from the South Coast Air Basin. Journal of Public Economics, 79(2), 265-295.

Bui, Linda and Christopher Mayer. Regulation and Capitalization of Environmental Amenities: Evidence from the Toxic Release Inventory in Massachusetts. Review of Economics and Statistics forthcoming.

Calle EE. Murphy TK. Rodriguez C. Thun MJ. Heath CW Jr. 1998. Occupation and breast cancer mortality in a prospective cohort of US women. American Journal of Epidemiology. 148(2):191-7, Jul 15.

Corella D. Herranz C. Calatayud A. Font G. Celma C. Laborda R. 2000. Cancer mortality and exposure to chemical carcinogens in the work place: an ecological study in the Valencian Community, Spain (1981-1995). European Journal of Epidemiology. 16(5):401-9, May.

Dasgupta, Susmita, Benoit Laplante, Hua Wang and David Wheeler, 2002. Confronting the environmental kuznets curve, Journal of Economic Perspectives 16(1), 147-168.

Dumais, Guy, Glenn Ellison and Edward Glaeser. 2002. Geographic Concentration as a Dynamic Process. Review of Economics and Statistics, 84(2) 193-204.

Ederington, Josh and Jenny Minier. 2002. Is Environmental Policy a Secondary Trade Barrier? An Empirical Analysis. Canadian Journal of Economics

Ederington, Josh and Arik Levinson and Jenny Minier. 2003. Footloose and Pollution-Free. NBER Working Paper #9718.

Eskeland, Gunnar and Ann E. Harrison 2002. Moving to Greener Pastures? Multinationals and the Pollution Haven Hypothesis. NBER Working Paper #8888, April.

Fredriksson, Per G and Daniel L. Millimet. 2002. Is There a 'California Effect' in US Environmental Policymaking? Regional Science and Urban Economics, 32(6), 737-64.

Gayer, Ted, James Hamilton and Kip Viscusi. 2002. The Market Value of Reducing Cancer Risk: Hedonic Housing Prices with Changing Information. Southern Economic Journal 69(2) 266-289.

Greenberg M. 1999. A study of lung cancer mortality in asbestos workers: Doll, 1955. American Journal of Industrial Medicine. 36(3):331-47.

Greenstone, Michael. 2002. The Impacts of Environmental Regulation on Industrial Activity. Journal of Political Economy. 110(6). 1175-1219.

Grether, Jean-Marie and Jaime de Melo. 2003. Globalization and Dirty Industries: Do Pollution Havens Matter? NBER Working Paper 9776.

Hanson, Gordon. 1998. Market Potential, Increasing Returns and Geographic Concentration. NBER Working Paper 6429.

Hanson, Gordon. 2001. U.S.-Mexico Integration and Regional Economies: Evidence from Border-City Pairs. Journal of Urban Economics 50 259-287.

Hellend, Eric and Andrew B. Whitford. Pollution Incidence and political jurisdiction: evidence from the TRI. Journal of Environmental Economics and Management, forthcoming

Henderson, Vernon. 1996. The Effect of Air Quality Regulation. American Economic Review. 789-813.

Holmes, Thomas J. 1998. The Effect of State Policies on the Location of Manufacturing: Evidence from State Borders. Journal of Political Economy, 106(4). 667-705.

Kahn, Matthew E. 1997.Particulate Pollution Trends. Regional Science and Urban Economics. February. 27 87-107.

Kahn, Matthew. E. 1999. Silver Lining of Rust Belt Decline. Journal of Urban Economics (46), 360-376.

Kahn, Matthew E. 2003a. Geography of Pollution Intensive Trade 1958-1994. Regional Science and Urban Economics. 33(4) 483-500.

Kahn, Matthew E. New Evidence on Eastern Europe's Pollution Progress, Topics in Economic Analysis and Policy 2003b, www.bepress.com/bejeap/topics/vol3/iss1/art4

Keller, Wolfgang, and Arik Levinson. 2002. Pollution Abatement Costs and Foreign Direct Investment Inflows to U.S. States Review of Economics and Statistics, 84(4), 691-703

Levinson, Arik. 1996. Environmental Regulations and Manufacturers' Location Choices: Evidence from the Census of Manufactures. Journal of Public Economics; 62(1), 5-29.

Levinson, Arik. 2000. The Missing Pollution Haven Effect: Examining Some Common Explanations. Environmental and Resource Economics, 15(4), 343-364.

Levinson, Arik. 2001 An Industry-Adjusted Index of State Environmental Compliance Costs. In Behavioral and Distributional Effects of Environmental Policy. Edited by Carlo Carraro and Gilbert Metcalf. University of Chicago Press. Pages 131-158.

Lott, John, and Richard Manning. 2000. Have Changing Liability Rules Compensated Workers Twice for Occupational Hazards? Earning Premiums and Cancer Risks. Journal of Legal Studies 29(1), Part 1 99-130.

McCallum, John 1995. National Borders Matter: Canada-U.S Regional Trade Patterns. American Economic Review 85 615-623.

Meijers JM. Swaen GM. Slangen JJ. 1996. Mortality and lung cancer in ceramic workers in The Netherlands: preliminary results. American Journal of Industrial Medicine. 30(1):26-30, Jul.

Panayotou, Theodore. Globalization and the Environment, CID Working Paper #53, Harvard University 2000.

Pezzotto SM. Poletto L. 1999. Occupation and histopathology of lung cancer: A case-control study in Rosario, Argentina. American Journal of Industrial Medicine. 36(4):437-43, Oct.

Rosamilia K. Wong O. Raabe GK. 1999. A case-control study of lung cancer among refinery workers. Journal of Occupational & Environmental Medicine. 41(12):1091-1103, Dec.

Savitz DA. Dufort V. Armstrong B. Theriault G. 1998. Lung cancer in relation to employment in the electrical utility industry and exposure to magnetic fields. Comment in: Occupational Environ Med. Apr;55(4):288;

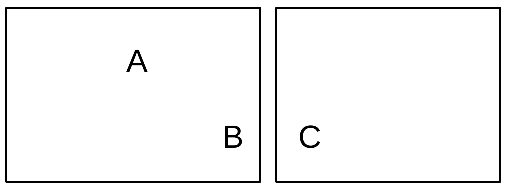
Sigman, Hilary. 2002. International Spillovers and Water Quality in Rivers: Do Countries Free Ride? American Economic Review 92(4): 1152-1159.

Ward EM. Burnett CA. Ruder A. Davis-King K. 1997. Industries and cancer. Cancer Causes & Control. 8(3):356-70, May.

Wild P. Perdrix A. Romazini S. Moulin JJ. Pellet F. 2000. Lung cancer mortality in a site producing hard metals. Occupational & Environmental Medicine. 57(8):568-73, Aug.

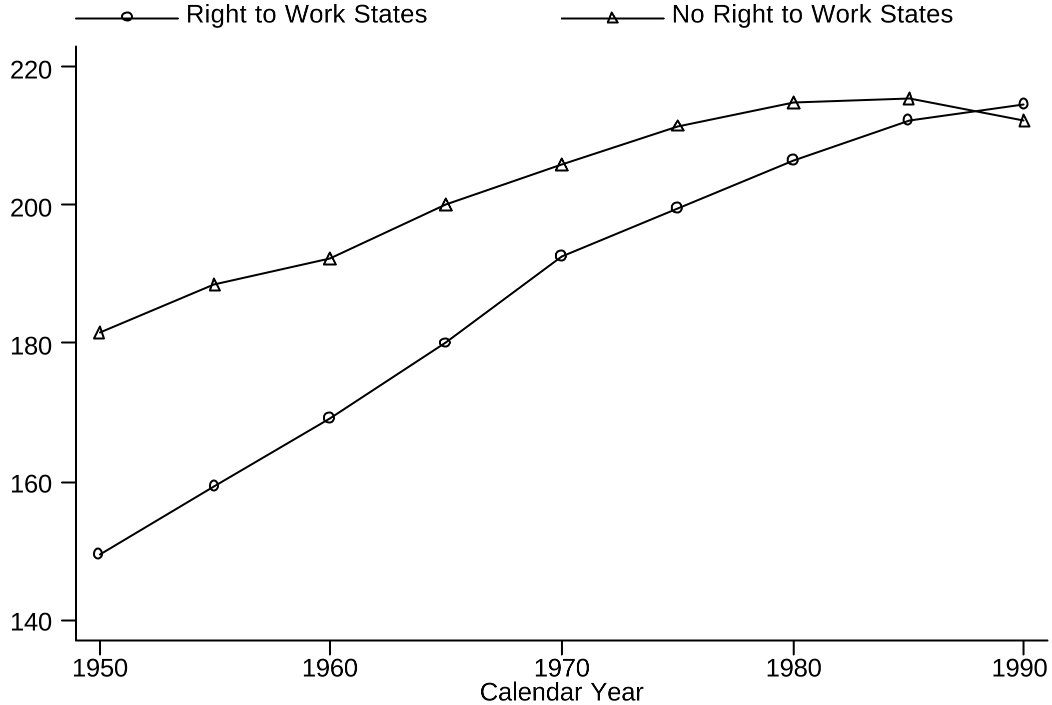
Xing, Yuquing and Charles D. Kolstad. 2002. Do Lax Environmental Regulations Attract Foreign Investment? Environmental and Resource Economics, 21(1), 1-22.

Figure One



Comparing Adjacent Border Counties B and C Versus Within State Counties B and A

Figure Two



Cancer Mortality Rates Per 100,000 Person-Years

Table One: County Summary Statistics

Column	(1)	(2)	(3)	(4)	(5)	(6)
	All	Right to Work Border County Adjacent to No Right to Work State	No Right to Work Border County Adjacent to Right to Work State	Border County	Border Mexico	Border Canada
Men's Cancer Death Rate From 1950 to 1969	159.6810	152.6009	153.8416	160.6648	144.9216	157.7644
Men's Cancer Death Rate From 1970 to 1994	201.4476	193.2040	196.8397	202.3364	160.2453	198.5665
People Per Square Mile in 1990	159.2255	41.1539	45.9665	233.6419	60.3296	13.7966
Population in 1990	78080.3800	32626.5800	42455.3000	76709.7400	193435.0000	24740.6300
Percent Black in 1990	8.4654	2.5719	2.5406	8.3369	1.2950	0.4938
Percent Hispanic in 1990	4.4856	6.2638	4.9049	3.4573	64.7852	1.0825
Percent over Age 65 in 1990	14.9688	15.6919	16.0688	14.9635	12.1333	15.4350
Percent College Graduates in 1970	7.2433	7.2564	7.2379	7.1968	8.7679	6.5696
Percent College Graduates in 1990	13.3670	12.8174	13.2559	13.3168	13.4106	12.9745
Average Wage Income in 1970 (2000 $)	22971.1200	22701.7900	22456.6900	23362.1100	21664.2000	23708.3300
Average Wage Income in 1994 (2000 $)	23023.3200	22245.5600	21460.2200	23309.8900	21622.3200	22137.8300
Observations	3053	221	205	1151	27	40

This table reports sample means. Each column reports means for a different sub-sample. Column (2) reports means for the subset of counties located in Right to Work States that are adjacent to a state that does not have Right to Work laws.
Column (3) reports means for the subset of counties located in states that do not have a Right to Work law that are adjacent to a state with a Right to Work law. Border counties touch a county in another state. Border Mexico counties are counties that are adjacent to Mexico and Border Canada counties are counties that are adjacent to Canada.

Table Two: The Scale and Composition of Economic Activity at Borders

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log County Employment in 1951	Log County Employment in 1996	Share of Employment in Manufacturing in 1951	Share of Employment in Manufacturing in 1996	Share of People Ages 0-34 in 1970	Share of People Ages 0-34 in 1990	Share College Graduate in 1970	Share College Graduate in 1990
Right to Work Border County Next to No Right to Work State	-0.0081	0.1480	-0.0203	0.0326	-0.0016	0.0013	0.0021	0.0014
	(0.1228)	(0.1313)	(0.0155)	(0.0112)	(0.0049)	(0.0045)	(0.0026)	(0.0042)
No Right to Work Border County Next to Right to Work State	-0.3579	-0.3951	-0.0504	-0.0054	-0.0126	-0.0091	-0.0042	-0.0060
	(0.1305)	(0.1359)	(0.0171)	(0.0119)	(0.0048)	(0.0043)	(0.0032)	(0.0053)
County Borders Mexico	0.4465	0.5186	-0.0953	-0.0069	0.0741	0.0526	0.0061	-0.0040
	(0.3546)	(0.4292)	(0.0253)	(0.0372)	(0.0120)	(0.0123)	(0.0068)	(0.0117)
County Borders Canada	-0.3502	-0.4762	0.0145	0.0295	0.0020	0.0029	-0.0212	-0.0384
	(0.1523)	(0.1727)	(0.0242)	(0.0217)	(0.0076)	(0.0087)	(0.0035)	(0.0063)
Borders Another State	0.1182	-0.0014	0.0252	-0.0056	0.0011	-0.0016	-0.0033	-0.0065
	(0.0679)	(0.0682)	(0.0083)	(0.0063)	(0.0024)	(0.0022)	(0.0015)	(0.0025)
Constant	7.7690	8.9883	0.3353	0.2349	0.5611	0.5133	0.0738	0.1366
	(0.0340)	(0.0359)	(0.0041)	(0.0030)	(0.0013)	(0.0012)	(0.0009)	(0.0014)
state fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.3129	0.2935	0.4748	0.3443	0.2089	0.1604	0.1850	0.2074
Observations	2610	2610	2610	2610	3046	3047	3046	3047

This table reports eight OLS regression estimates. The unit of analysis is a county. Robust standard errors are reported in parentheses. The omitted category is an interior county. The share variables in columns (3-8) range from 0 to 1.

Table Three: Cancer Mortality Rate Regressions

MEN	Sample Years 1950-1969	1970-1994	First Difference	Double Difference
Right to Work Border County Next to No Right to Work State	-0.0240	0.0100	0.0340	0.0275
	(0.0141)	(0.0127)	(0.0128)	(0.0175)
No Right to Work Border County Next to Right to Work State	-0.0162	-0.0038	0.0124	0.0211
	(0.0119)	(0.0127)	(0.0130)	(0.0189)
County Borders Mexico	-0.0930	-0.1957	-0.1027	-0.0581
	(0.0366)	(0.0317)	(0.0287)	(0.0413)
County Borders Canada	-0.0614	0.0229	0.0844	0.0489
	(0.0163)	(0.0141)	(0.0190)	(0.0312)
Borders Another State	0.0124	0.0039	-0.0085	-0.0035
	(0.0067)	(0.0048)	(0.0061)	(0.0080)
Constant	5.0602	5.2949	0.2347	0.2108
	(0.0031)	(0.0024)	(0.0033)	(0.0042)
state fixed effects included	yes	yes	yes	yes
Adjusted R2	0.2407	0.3943	0.2930	0.1225
Observations	3047	3047	3047	3046

WOMEN	Sample Years 1950-1969	1970-1994	First Difference
Right to Work Border County Next to No Right to Work State	0.0066	0.0107	0.0058
	(0.0130)	(0.0111)	(0.0142)
No Right to Work Border County Next to Right to Work State	-0.0147	-0.0232	-0.0086
	(0.0110)	(0.0094)	(0.0130)
County Borders Mexico	-0.0076	-0.0507	-0.0441
	(0.0423)	(0.0318)	(0.0420)
County Borders Canada	-0.0170	0.0185	0.0355
	(0.0216)	(0.0156)	(0.0261)
Borders Another State	0.0086	0.0034	-0.0051
	(0.0057)	(0.0049)	(0.0059)
Constant	4.7980	4.8219	0.0238
	(0.0028)	(0.0024)	(0.0034)
state fixed effects included	yes	yes	yes
Adjusted R2	0.2893	0.2988	0.1137
Observations	3047	3046	3046

This table reports seven regression estimates. The columns "1950-1969" and "1970-1994" present estimates of equation (1) in the text while the column "First Difference" reports an estimate of equation (2) in the text. The unit of analysis is a county. Robust standard errors are reported in parentheses. The column "Double Difference" is defined as "Men's First Difference - Women's First Difference". The explanatory variables are all dummy variables. They are defined at the bottom of Table One. The omitted category is a county located in the interior of a state.

Table Four: Lung Cancer Mortality Rate Regressions

MEN	Sample Years 1950-1969	1970-1994	First Difference
Right to Work Border County Next to No Right to Work State	-0.0095	0.0510	0.0605
	(0.0300)	(0.0202)	(0.0269)
No Right to Work Border County Next to Right to Work State	0.0008	-0.0066	-0.0073
	(0.0275)	(0.0206)	(0.0251)
County Borders Mexico	-0.2036	-0.2682	-0.0647
	(0.0959)	(0.0541)	(0.0975)
County Borders Canada	-0.1060	0.0462	0.1522
	(0.0565)	(0.0323)	(0.0585)
Borders Another State	-0.0020	-0.0030	-0.0010
	(0.0156)	(0.0087)	(0.0138)
Constant	3.3914	4.1949	0.8035
	(0.0068)	(0.0043)	(0.0065)
state fixed effects included	yes	yes	yes
Adjusted R2	0.3002	0.5547	0.2346
Observations	3042	3046	3042

WOMEN	Sample Years 1950-1969	1970-1994	First Difference
Right to Work Border County Next to No Right to Work State	-0.0024	0.0504	0.0509
	(0.0395)	(0.0296)	(0.0450)
No Right to Work Border County Next to Right to Work State	-0.0419	-0.0573	-0.0162
	(0.0404)	(0.0276)	(0.0461)
County Borders Mexico	0.1580	-0.2948	-0.4527
	(0.1067)	(0.0849)	(0.1121)
County Borders Canada	-0.0731	0.0556	0.1265
	(0.0742)	(0.0471)	(0.0788)
Borders Another State	0.0264	-0.00004	-0.0256
	(0.0204)	(0.0134)	(0.0214)
Constant	1.6382	2.9711	1.3333
	(0.0103)	(0.0065)	(0.0111)
state fixed effects included	yes	yes	yes
Adjusted R2	0.0927	0.3532	0.0781
Observations	2926	2922	2922

This table reports six regression estimates. The columns "1950-1969" and "1970-1994" present estimates of equation (1) in the text while the column "First Difference" reports an estimate of equation (2) in the text. The unit of analysis is a county. Robust standard errors are reported in parentheses. The explanatory variables are all dummy variables. They are defined at the bottom of Table One. The omitted category is a county located in the interior of a state.

Table Five: Augmented Men's Lung Cancer Mortality Rate Regressions

Column	(1)	(2)	(3)	(4)
	First Difference	First Difference	First Difference	First Difference
Right to Work Border County Next to No Right to Work State	0.0605	0.0606	0.0608	0.0588
	(0.0269)	(0.0268)	(0.0266)	(0.0174)
No Right to Work Border County Next to Right to Work State	-0.0073	-0.0071	-0.0295	-0.0009
	(0.0251)	(0.0251)	(0.0247)	(0.0173)
County Borders Mexico	-0.0647	0.0568	0.0525	-0.1770
	(0.0975)	(0.1360)	(0.1351)	(0.0721)
County Borders a City in Mexico		-0.3294	-0.2754	-0.1378
		(0.1528)	(0.1525)	(0.1018)
County Borders Canada	0.1522	0.1522	0.1054	0.0557
	(0.0585)	(0.0585)	(0.0576)	(0.0315)
County Borders Another State	-0.0010	-0.0009	-0.0026	-0.0082
	(0.0138)	(0.0138)	(0.0138)	(0.0077)
Ozone Non-Attainment County in 1978			-0.0918	-0.0244
			(0.0161)	(0.0103)
Log(County Population in 1990)			-0.0208	0.0337
			(0.0081)	(0.0052)
Median Age in County in 1970			-0.0002	-0.0013
			(0.0015)	(0.0010)
Percent of County who are College Graduates in 1970			-1.2447	-1.2046
			(0.2779)	(0.1416)
Log(Lung Cancer Mortality Rate in 1950 to 1969)				-0.7603
				(0.0215)
Constant	0.8035	0.8034	1.1321	3.1727
	(0.0065)	(0.0065)	(0.0968)	(0.0833)
state fixed effects included	yes	yes	yes	yes
Adjusted R2	0.2346	0.2364	0.2830	0.7341
Observations	3042	3042	3041	3041

This table reports four regression estimates based on equation (2) in the text. The unit of analysis is a county.
Robust standard errors are reported in parentheses. The omitted category is a county located in the interior of a state.

Table Six: Colon Cancer Mortality Rate Regressions

MEN	Sample Years 1950-1969	1970-1994	First Difference
Right to Work Border County Next to No Right to Work State	0.0443	0.0134	-0.0310
	(0.0373)	(0.0228)	(0.0360)
No Right to Work Border County Next to Right to Work State	-0.0038	-0.0259	-0.0228
	(0.0322)	(0.0207)	(0.0367)
County Borders Mexico	-0.1406	-0.4370	-0.2984
	(0.0906)	(0.0667)	(0.1136)
County Borders Canada	-0.0450	-0.0136	0.0276
	(0.0490)	(0.0425)	(0.0696)
Borders Another State	0.0066	-0.0031	-0.0107
	(0.0159)	(0.0109)	(0.0169)
Constant	2.5515	2.8558	0.3054
	(0.0080)	(0.0057)	(0.0090)
state fixed effects included	yes	yes	yes
Adjusted R2	0.2708	0.2595	0.0687
Observations	3021	3014	3014

WOMEN	Sample Years 1950-1969	1970-1994	First Difference
Right to Work Border County Next to No Right to Work State	0.0259	0.0192	-0.0057
	(0.0310)	(0.0271)	(0.0388)
No Right to Work Border County Next to Right to Work State	-0.0055	0.0252	0.0309
	(0.0285)	(0.0225)	(0.0351)
County Borders Mexico	-0.2096	-0.4342	-0.2247
	(0.1188)	(0.0748)	(0.1209)
County Borders Canada	0.0291	0.0117	-0.0184
	(0.0529)	(0.0516)	(0.0796)
Borders Another State	0.0016	-0.0027	-0.0046
	(0.0133)	(0.0103)	(0.0158)
Constant	2.6533	2.6117	-0.0415
	(0.0075)	(0.0055)	(0.0087)
state fixed effects included	yes	yes	yes
Adjusted R2	0.266	0.2663	0.0406
Observations	3017	3015	3015

This table reports six regression estimates. The columns "1950-1969" and "1970-1994" present estimates of equation (1) in the text while the column "First Difference" reports an estimate of equation (2) in the text. The unit of analysis is a county. Robust standard errors are reported in parentheses. The explanatory variables are all dummy variables that are defined at the bottom of Table One. The omitted category is a county located in the interior of a state.

Table Seven: Brain Cancer Mortality Rate Regressions

MEN	1950-1969	Sample Years 1970-1994	First Difference
Right to Work Border County Next to No Right to Work State	-0.0236	0.0118	0.0361
	(0.0407)	(0.0359)	(0.0542)
No Right to Work Border County Next to Right to Work State	-0.0462	0.0318	0.0822
	(0.0422)	(0.0341)	(0.0548)
County Borders Mexico	-0.1572	-0.2783	-0.1091
	(0.0997)	(0.0930)	(0.1160)
County Borders Canada	-0.2019	-0.0962	0.1004
	(0.0791)	(0.0783)	(0.1232)
Borders Another State	0.0202	0.0108	-0.0133
	(0.0213)	(0.0175)	(0.0268)
Constant	1.3647	1.6009	0.2416
	(0.0110)	(0.0097)	(0.0143)
state fixed effects included	yes	yes	yes
Adjusted R2	0.0330	0.0445	0.0065
Observations	2878	2840	2840

WOMEN	1950-1969	Sample Years 1970-1994	First Difference
Right to Work Border County Next to No Right to Work State	0.0148	0.0115	0.0051
	(0.0535)	(0.0384)	(0.0609)
No Right to Work Border County Next to Right to Work State	-0.0128	0.0071	0.0251
	(0.0504)	(0.0383)	(0.0627)
County Borders Mexico	-0.1100	-0.2556	-0.1104
	(0.1342)	(0.1347)	(0.1705)
County Borders Canada	-0.1699	-0.1102	0.0159
	(0.0866)	(0.0909)	(0.1411)
Borders Another State	0.0276	0.0021	-0.0308
	(0.0232)	(0.0185)	(0.0280)
Constant	0.9347	1.2280	0.3050
	(0.0129)	(0.0097)	(0.0156)
state fixed effects included	yes	yes	yes
Adjusted R2	0.0644	0.0290	0.0206
Observations	2759	2716	2716

This table reports six regression estimates. The columns "1950-1969" and "1970-1994" present estimates of equation (1) in the text while the column "First Difference" reports an estimate of equation (2) in the text. The unit of analysis is a county. Robust standard errors are reported in parentheses. The explanatory variables are all dummy variables that are defined at the bottom of Table One. The omitted category is a county located in the interior of a state.

Table Eight: Cross-County Commuting Patterns in 1960 and 1990

	Percent of a County's Workers Who Live in Another County		
	1960	1990	First Difference
Right to Work Border County Next to No Right to Work State	-0.0005	-0.0078	-0.0064
	(0.0052)	(0.0074)	(0.0061)
No Right to Work Border County Next to Right to Work State	-0.0188	-0.0342	-0.0149
	(0.0058)	(0.0083)	(0.0056)
County Borders Mexico	-0.0215	-0.0772	-0.0558
	(0.0078)	(0.0115)	(0.0090)
County Borders Canada	-0.0225	-0.0480	-0.0248
	(0.0075)	(0.0125)	(0.0070)
Borders Another State	0.0082	0.0028	-0.0059
	(0.0030)	(0.0044)	(0.0033)
Constant	0.0763	0.1833	0.1065
	(0.0014)	(0.0021)	(0.0016)
state fixed effects	Yes	Yes	Yes
Adjusted R2	0.1452	0.2451	0.1842
Observations	3022	3028	3022

This table reports three OLS regression estimates. The unit of analysis is a county.
Robust standard errors are reported in parentheses. The omitted category is an interior county.
First Difference is defined as "Share in 1990 - Share in 1960" where the share is the percent of a county's workers who live in another county.