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How a Race to the Bottom Can Make You Fat

Gregmar I. Galinato, You Zhou and Benjamin Cowan

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Abstract. This article measures the effect of fiscal competition on obesity rates in the United States. We hypothesize that fiscal competition to attract firms results in lower business tax revenues and higher public infrastructure spending which crowds out education and health spending leading to an increase in obesity rates. We empirically test this hypothesis. We find that there is significant fiscal competition to attract firms. Next, we show if business tax revenues are lowered and public infrastructure spending favoring businesses increased, public health and education spending declines and obesity rates significantly increase. Thus, fiscal competition significantly contributes to obesity rates.

Key words: Fiscal competition; tax competition; education and health spending; obesity rates

JEL Codes: H5, H7, I18

Gregmar I. Galinato,* School of Economic Sciences, PO Box 646210, Washington State University, Pullman, Washington 99164 USA. Tel: 1-509-335-6382. Fax: 1-509-335-1173. Email: ggalinato@wsu.edu.

You Zhou, School of Economic Sciences, PO Box 646210, Washington State University, Pullman, Washington 99164 USA. Tel: 1-509-335-5555. Fax: 1-509-335-1173. Email: you.zhou@email.wsu.edu.

Benjamin Cowan, School of Economic Sciences, PO Box 646210, Washington State University, Pullman, Washington 99164 USA. Tel: 1-509-335-2184. Fax: 1-509-335-1173. Email: ben.cowan@wsu.edu.

*Contact Author

1. Introduction

More than 33% of adults and 17% of children in the United States are now considered obese (Ogden, et al. 2014). The percentage of obese adults has remained steady in recent years but the prevalence of obesity in children is still rising. Obesity is related to heart disease, diabetes and cancer. The medical cost of obesity is estimated to be $147 billion annually in the United States (Finkelstein et al. 2009), which underscores a strong public interest in identifying policy prescriptions to curb the trend.

A number of studies have pointed to a mix of genetic and behavioral factors as the main direct determinants of obesity. Poor diets and low levels of physical activity are the primary behavioral factors leading to obesity (Rennie et al. 2005). One important factor that can correct for negative behavior is education and health programs. The availability of such programs that reinforce the link between positive behavioral decisions in diet and physical activity to lower obesity rates are likely related to the level of funding in a jurisdiction. Various jurisdictions not only decide on what types of expenditures to incur but also the types of revenue generating mechanisms to employ. One important factor determining the spending and revenue generation choices of a jurisdiction is its decision to attract capital and firms.

In this paper, we examine the previously unexplored link between obesity and fiscal competition, where jurisdictions compete to attract capital and firms. Our hypothesis is that greater fiscal competition reduces government resources available for education and public health programs, which in turn leads to poorer health choices, resulting in greater obesity. By examining the link between fiscal competition and obesity, we can determine policies that can correct for any possible underprovision of public goods and programs that could improve health outcomes.

The first question underpinning this hypothesis is the extent to which fiscal competition is empirically relevant. Fiscal competition is a form of lowering the regulatory burden on capital investors, either by reducing relevant taxes and/or increasing spending that complements capital investment, leading to capital inflow (Wildasin 2005). Tax competition is a simpler version of fiscal competition where strategic interaction in choosing a single tax rate is studied and revenue from the tax is the only source of funding to provide a single public good. Such behavior results in a suboptimal equilibrium in which revenues raised for public goods provided by a jurisdiction are lower than the socially optimal level (Zodrow and Mieszkowski 1986). There is strong empirical evidence of strategic interaction in setting tax rates between local jurisdictions (Brueckner 2003) as well as across governments of countries (Genschel and Schwarz 2011).[1] Though the literature has shown empirically that there is strategic interaction between different taxes, regulatory schemes and spending levels, an important follow up question that has not been systematically analyzed is the health-related welfare effects of fiscal competition.

To the extent that fiscal competition crowds out certain types of government spending, another relevant question tied to our hypothesis is whether such spending is efficacious in improving public health generally and reducing obesity specifically. Government programs, some of which directly reinforce the link between positive behavioral decisions in diet and physical activity and health, have been shown to have public health benefits in many contexts. Brown et al. (2014) find that increases in county public health expenditures leads to an

[1] There is strong empirical evidence showing that local governments within states are in tax competition when setting property taxes (Brueckner and Saavedra, 2001) and other measures that control growth of a city (Brueckner 1998). At the state level, there is also evidence of a state's level of per capita expenditure positively correlating with its neighboring state's spending level per capita (Case et al., 1993). Strategic interaction across states in deciding environmental regulations is also significant (Fredriksson and Millimet 2002). Similar strategic interaction of environmental regulations exists across European countries when examining sulfur and nitrogen oxide emissions (Murdoch et al. 1997).

improvement in self-reported health among residents. The Head Start Program, a comprehensive early childhood program for low-income children and their families, has been shown to have medium and long term significant effects in reducing obesity rates (Carneiro and Ginja, 2014). Frisvold and Golberstein (2011) examine changes in school quality (e.g. the student-teacher ratio) brought about by de-segregation in the South and find significant improvements in health later in life, including less obesity. Lastly, school-based nutrition programs have been shown to reduce obesity among children (Veugelers and Fitzgerald 2005). Given the growing literature linking education and health spending to obesity rates, we believe the connection between fiscal competition and obesity is worth exploring.

This article measures the effect of fiscal competition across states on U.S. obesity rates. We use a system of three equations to establish the empirical link. First, we use a spatial panel model to measure the incidence of fiscal competition between states. In particular, we estimate the effect of a neighbor's firm-related fiscal policy on own state's fiscal policy.[2] Next, we use a panel model to determine how own state's fiscal policy affects education and health spending per capita in that state. Finally, we use a dynamic panel model to measure the effect of education and health spending on obesity rates. By combining the estimates from all equations, we trace out the effect of a neighboring state's firm-related fiscal policy on own state's obesity rates in the short, medium and long run.

One of our most significant estimation challenges is endogeneity in these equations, such as that of education and health spending when obesity is the dependent variable. We rely on the mechanism outlined above along with the empirical tax competition literature to identify plausible instruments. In that literature, neighbors' characteristics are usually used to instrument

[2] To do so, we define a state's "business-friendly fiscal measure," which indexes a state's business or corporate taxes and, in some cases, its public infrastructure spending.

for own state's fiscal measures. In our case, we rely on neighboring states' median age and income since they proxy for wealth and willingness to pay for public goods. Demand for public goods, such as environmental quality, increases with income because they are normal goods (Allen 2003; Salka 2001). Individuals with low income are more likely to favor lowering barriers to entry of firms, either by lowering taxes or subsidizing production, to the detriment of lower public good levels in exchange for more jobs (Hassink and Broersma, 1996). This behavior may lead to strategic responses in neighboring jurisdictions where they also lower taxes and increase subsidies to attract firms and capital. We show that when the neighboring states' median age and income are lower, states take in less adjusted business tax revenues. Given the channel outlined above, we use these two instruments to also identify the effect of education and health spending on obesity.

We find that there is evidence of fiscal competition as measured by business tax revenue per unit of public infrastructure spending and business tax revenue per capita. We also find that own fiscal policies affect obesity rates through their impact on education and health spending. For instance, a 1% decrease in business tax revenue per capita (or approximately a $1 per capita decline) significantly leads to a 0.07% to 0.24% increase in obesity in the short run and 0.08% to 0.30% increase in steady-state obesity in the long run. A change in a neighboring state's firm-related fiscal policy significantly affects obesity where a 1% decrease in neighbor's business revenue per capita leads to a 0.07% to 0.21% increase in obesity rates in own state during the short run. Thus, when own state governments respond to their neighboring state's choices strategically, it can lead to adverse effects on the obesity rates in their own states. The mechanism by which these effects occur is through the change in education and health spending per capita brought about by changes in own fiscal policies. For instance, if a reduction in own business revenues per capita leads to a decrease in lagged education and health spending per capita by 1% (or approximately $8 per capita), obesity rates increase by 0.2% to 0.3% in the short run.

2. Model

We outline the mechanism relating fiscal competition to obesity rates and the corresponding empirical strategy.

2.1 Conceptual Framework

The main determinants of obesity are physical activity levels and types of food consumed (Rennie et al. 2005). Utility maximizing individuals optimally decide on the level and types of food consumed given prices and income levels. A variety of indirect factors may influence consumption decisions such as education (Carneiro and Ginja, 2014) and public health programs (Daouli et al., 2014).[3] Education plays an important role in food selection since it influences the shadow price of consuming different food types. More educated individuals are likely to deem the true price of unhealthy food as high especially since they internalize the long term effects of food consumption on health and quality of life (Gittelsohn and Lee, 2013). The level of education and access to public health programs are dependent not only on income (Epple and Romano, 2014), but also government fiscal choices.

From the state government's point of view, the obesity rate, O, is a stock that evolves over time and is affected by direct factors such as the level of physical activity, A, the level of consumption of a vector food types, $\boldsymbol{F}$, and a vector of characteristics of an individual, $\boldsymbol{x}$. The optimal level of physical activity, A^*, and optimal consumption of different food types, $\boldsymbol{F}^*$, will depend on average income, I, individual characteristics, a vector of food and physical activity

[3] For reviews of the large literature on the relationship between education and health, see Cutler and Lleras-Muney (2006) and Grossman (2006).

prices, $\boldsymbol{P}$, and state education and health spending, *e*. Given these relationships, we define a dynamic equation relating the evolution of obesity over time,

(1) $O_{t+1} = \beta O_t - \tau A_t^*(\boldsymbol{P}, I; \boldsymbol{x}, e) + \boldsymbol{\delta F_t^*}(\boldsymbol{P}, I; \boldsymbol{x}, e)$,

where $\beta > 0$ is a parameter relating the proportion of obese that remain obese in the next period, $\tau > 0$ is a parameter that converts physical activity levels to obesity rates and $\boldsymbol{\delta}$ is a vector of parameters relating the type and level of food consumption to obesity rates. An individual parameter from the vector $\boldsymbol{\delta}$ may be negative if the type of food is healthy and positive if it is an unhealthy food type.

State education and health spending, *e*, is dependent on the own state government's level of business-related fiscal choice, g.[4] From the fiscal competition literature, the government's business-related fiscal choice is dependent on the business-related fiscal choice of neighboring jurisdictions, g_n. Thus, we can write,

(2) $e = e(g(g_n))$.

Substituting (2) into (1) and taking the derivative with respect to g_n, we can derive the short run effect of neighboring government's business-related revenue and spending as,

(3) $\frac{\partial O_{t+1}}{\partial g_n} = \left(\sum_k \delta_k \frac{\partial F_{kt}^*}{\partial e} - \tau \frac{\partial A_t^*}{\partial e}\right) \frac{\partial e}{\partial g} \frac{\partial g}{\partial g_n}$.

The short run effect of neighboring government's business-related revenue and spending on obesity rates is partitioned into three parts. The first is the effect of neighbor's fiscal choice on own fiscal choice, $\frac{\partial g}{\partial g_n}$. If fiscal competition does exist, we expect this effect to be positive where a decline in business tax revenues or increase in business-related spending in one state leads to a similar response by a neighboring state in a race to attract capital and firms. The second effect is

[4] Education and health spending could be considered an *indirect* contributor to a business firm's environment by boosting labor productivity. However, our measure of business-related revenue and spending only relate to those that *directly* affect the firm.

the impact of own government's business-related revenue and spending on education and health spending, $\frac{\partial e}{\partial g}$. Because of the state government's budget constraint, less revenue from firms or more spending favoring businesses is likely to crowd out education and health spending. Finally, we have the direct effect of education and health spending on lifestyle choices, $\left(\sum_k \delta_k \frac{\partial F_{kt}^*}{\partial e} - \tau \frac{\partial A_t^*}{\partial e}\right)$. Obesity rates are lower if healthier choices are made when education and health spending increases. Thus, we expect this result to be negative. The total short run effect of a neighboring state government's business-friendly revenue and spending on obesity is negative in the presence of fiscal competition. This is because favoring firms by lowering the taxes they face and providing more state resources for their production crowds out education and health spending leading to poor health and lifestyle choices, which raises obesity rates.

The long term effect of neighboring government's business-related revenue and spending variables on the steady state obesity rate, O^{ss}, can also be derived. First, recognize that in the long run $O_{t+1} = O_t = O^{ss}$. Substituting this relationship in equation (1) and taking the effect of g_n on O^{ss} yields,

$$(4)\ \frac{\partial O^{ss}}{\partial g_n} = \frac{1}{1-\beta}\left(\sum_k \delta_k \frac{\partial F_k^*}{\partial e} - \tau \frac{\partial A^*}{\partial e}\right)\frac{\partial e}{\partial g}\frac{\partial g}{\partial g_n}.$$

The mechanism by which neighboring government's business-friendly revenue and spending affects the steady state obesity rate is similar to the short run effect. The main difference is the presence of $\frac{1}{1-\beta}$. When $1 > \beta > 0$, there is a convergence toward a steady-state obesity rate. However, when $\beta > 1$, the system will not converge to a steady-state obesity rate and continue to increase over time.

2.2 Empirical Model

We estimate a system of three equations that reflect the mechanism discussed in the conceptual framework to measure the effect of fiscal competition on own state obesity rates. The first equation is a spatial autoregressive model that relates neighbor's fiscal policy to own fiscal policy,

$$(5)\ g_{iy} = \rho \sum_{j=1}^{n} w_{ij} g_{jy} + \alpha_0 + \sum_{k=1}^{K} x_{iyk}\alpha_k + \mu_i + \mu_y + \epsilon_{iy}$$

where g_{iy} is the level of the fiscal policy measure in state *i* during year *y*; w_{ij} is the spatial weight assigned to neighboring state *j* when it comes to state *i*; g_{jy} is the level of the fiscal policy measure in neighboring state *j* during year *y*; x_{iyk} is the k^{th} state characteristic (detailed in the next section); μ_i is a state fixed effect; μ_y is a year effect; ϵ_{iy} is the regression error term; and ρ, $\alpha_k \forall\ k = 0 \dots K$ are parameters of the model. If ρ is positive and significant, then we interpret this as the presence of fiscal competition between states.

The second equation is associated with the state's budget constraint, which relates health and education spending to the state's fiscal policy related to firms. We estimate the following panel model:

$$(6)\ e_{iy} = \beta_0 + \beta_1 g_{iy} + \sum_{k=2}^{K} x_{iyk}\beta_k + \sigma_i + \sigma_y + \vartheta_{iy}$$

where e_{iy} is the measure of education and health spending per capita in state *i* during year *y*; σ_i is a state fixed effect; σ_y is a time (year) effect; ϑ_{iy} is the regression error term; and $\beta_k \forall\ k = 0 \dots K$ are parameters of the model. If the fiscal policy measure is related to business tax revenues, then $\beta_1 > 0$ is likely since more revenues would mean more education and health spending, holding other factors constant.[5]

[5] Note that we also test to see if higher obesity rates affect education and health spending and we find that the effect is insignificant as shown in Table A1 in the Appendix.

The final equation is a dynamic panel model that relates the effect of education and health spending to obesity rates,

(7) $O_{iy} = \varphi O_{i,y-1} + \gamma_0 + \gamma_1 e_{iy-1} + \sum_{k=2}^{K} x_{iyk}\gamma_k + \theta_i + \theta_y + \omega_{iy}$,

where O_{iy} is the obesity rate in state *i* during year *y*; θ_i is a state fixed effect; θ_y is a time (year) effect; ω_{iy} is the regression error term; and φ, $\gamma_k \forall\ k = 0 \dots K$ are parameters of the model. We expect $\gamma_1 < 0$ since more spending in education and health programs should reduce obesity rates. This parameter captures the short run effect of education and health spending on obesity rates. The long run effect relating education and health spending on obesity rates is $\frac{\gamma_1}{1-\varphi}$. We also measure if there are medium run effects by successively substituting the expression for obesity into the lagged operator. The two-period lagged effect of education and health spending on current obesity is $\varphi\gamma_1$. The effect of education and health spending lagged three periods is $\varphi^2\gamma_1$ while the effect of lag of four periods would be $\varphi^3\gamma_1$ and so on. We calculate the significance of education and health spending per capita on obesity to determine if there are any lingering effects during medium run.

There are four important issues in estimating this system. First, there is potential endogeneity in each equation. If fiscal competition does exist, then reverse causality may exist where own fiscal policy affects neighbor's fiscal policy in equation (5). Also, in equation (6), simultaneity bias may occur since fiscal policy choices and education and health spending can be jointly determined. Finally, in equation (7), reverse causality can occur because obesity rates can influence the level of spending on education and health programs combating obesity. Omitted variables affecting a state's obesity rate may also be related to education and health spending (such as discount rates).

We turn to the literature on tax competition for identification, in which neighborhood characteristics are used as instruments to identify neighborhood fiscal policies.[6] We use lagged neighbor's median age and lagged neighbor's median income as instruments for neighboring government's "business-friendly" revenue and spending policy. Median age and income represent wealth and willingness to pay of the population for public goods. Demand for public goods, such as knowledge and environmental quality, decrease as wealth declines because they are considered normal goods.[7] Instead, low income individuals are more likely to increase demand for job openings (Hassink and Broersma, 1996) and are, therefore, more amenable when the policymaker attracts capital by lowering business-related taxes. The decline in business related taxes could induce a race to the bottom in neighboring jurisdictions. We find that these instruments consistently, significantly and positively affect our fiscal proxies for business-friendliness where lower median age and income leads to lower business tax revenue per capita and business revenue per unit of infrastructure spending as shown in Table A2 in the appendix. Given the mechanism we outline above, the same instruments can identify own government's business-friendly revenue and spending in equation (6) and education and health spending in equation (7).

Second, to estimate the spatial model in equation (5), a weighting matrix needs to be chosen. The simplest weighting matrix, a border weight, is to put the same weight on states that border a given state and no weight on non-bordering states. To ensure robustness in our results, we employ four other weighting schemes. The second is based on distance between states, specifically the distance between geographic centroids. The inverse distance between the two

[6] See Millimet and Fredriksson (2002) for example.

[7] The Environmental Kuznets Curve literature linking income to demand for environmental quality has shown that higher demand for environmental quality is correlated with more wealth (see Dinda, 2004 for a survey of the literature). In a parallel series of studies, higher average income also increases voting support for environmental referendums (Allen 2003; Salka 2001).

states is its assigned weight. In this case, even if the states are very far apart, their relationship will have a small non-zero weight. The third is a combination of the two weighting schemes where no weight is placed on non-bordering states but states that border each other are weighted by the inverse distance between their geographic centroids. Next, we employ a truncated distance weight where the inverse distance is used as weights but any distance beyond the average distance of all samples is assigned a zero weight. Finally, we employ a population weighted matrix scheme where non-bordering states are given zero weight but the weight of a bordering state is equal to the share of the total population of all neighboring states.

The third issue is the proper estimation of the dynamic obesity panel model. We employ system Generalized Method of Moments to estimate the equation. The estimation procedure is designed for panel data that has fewer time periods than cross sectional observations which occurs in our dataset. Here, the lagged dependent variable is instrumented with the second lagged difference of obesity to achieve consistent estimates. We instrument for the lagged education and health spending measure with twice lagged neighbor's median age and income, where the assumption is that all instruments are uncorrelated with the error term, including the fixed effect. This assumes that the correlation between the instruments and the fixed effect is time invariant (Roodman 2009). A necessary condition for this assumption to hold is that the parameter associated with the lagged dependent variable is less than 1, i.e. $\varphi<1$ (Blundell and Bond 1998).

The final issue is the estimation of the entire system. We opted to estimate each equation separately. Doing so yields unbiased and consistent estimates. The alternative is to estimate all three equations as an entire system. The advantage of estimating the three equations as a system as opposed to separate regressions is a gain in efficiency. However, misspecification in one equation not only biases the estimates from that equation but the entire system. Given this potential drawback, we opted to estimate each equation separately.

3. Data

We compile an unbalanced panel dataset for the 48 contiguous states from 1992 to 2011. Table 1 summarizes the descriptive statistics from our sample and Table A3 in the Appendix elaborates on the definition and sources of the data. The three most important variables in our estimation are a measure of obesity, a measure of education and health spending, and a measure of "business friendly" fiscal spending and revenues. The obesity data is from the Centers for Disease Control and Prevention and is a measure of the percentage of adults in the state who are considered to have a body mass index of 30 or higher in a given year. The top frame of Figure 1 shows that obesity rates are concentrated in the South and Midwest regions of the country.

We focus on two programs that could directly affect food consumption decisions and physical activity levels: education and health programs. We use spending on elementary and secondary education as our main representations for state education spending. We add total state health expenditures along with our measure of education spending and divide it with total population to arrive at education and health spending per capita.[8] These data are from the U.S. Census Bureau. In the bottom half of Figure 1, we summarize education and health spending per capita and show that, with the exception of Wyoming, the largest spending per capita for these services are in the West and Northeast regions. We find a strong negative correlation between education and health spending per capita and obesity rates. An overlap of the obesity map by state and spending per capita on education and health hints at this inverse relationship. However, this correlation may be due to many factors and need not represent any causal effect of spending

[8] Health expenditures refers to public health programs and do not include hospital care and support of federal health programs.

on obesity. For this reason, we include state fixed effects in our model to control for time-invariant state differences and instrument for spending with neighbors' characteristics.

Our main measures of the "business-friendliness" of state fiscal spending and revenues are from the US Census Bureau.[9] To encompass a relatively comprehensive measure of fiscal competition, we calculate business tax revenues per capita and business tax revenues divided by public infrastructure spending.[10] Business tax revenue is the sum of corporate tax revenues, corporate license fees and occupation and business fees. Corporate tax revenues are based on corporate tax rates set by the state and gross income or receipts of the corporation. Corporation license fees are franchise license taxes based on the value of the corporate property. Finally, occupation and business fees are payments for licenses to operate a particular trade.

Spending that would directly benefit businesses are related to public infrastructure. This includes expenditures on highways, air transportation, water transport and terminals, parking facilities, and utility. The average amount of public infrastructure spent per person is approximately $500. The lowest public infrastructure spending per capita is New Hampshire at $275 and the highest is Nebraska at $1,119.

By dividing business tax revenues with state population, we arrive at one measure of business friendliness where a lower tax revenue per capita implies a larger weight placed by the state on businesses. The average business tax revenue per capita is $96. The lowest values are from Wyoming and Washington with average business tax revenue per capita equal to $17 and $18, respectively. Delaware has the highest business tax revenue per capita with a value of $630.

[9] All revenues and expenditures are deflated by the consumer price index using 1982-84 as the base year.
[10] Note that by using aggregate revenues instead of the tax rates, we account for all the possible business-related fiscal choices a government can make which not only includes the corporate tax rate choice but also the license fee level, operation fee, occupation fee and other related business fees.

The second measure we use is business tax revenues divided by infrastructure spending. A lower tax revenue per unit spending implies a larger weight placed by the state on businesses. The average level is 0.218 which means that for every dollar of public infrastructure spent, $0.22 come from business tax revenues. The lowest business tax revenue per unit of infrastructure spending is Washington and Wyoming with rates at 0.02 while the highest rates are New Hampshire and Delaware at 0.61 and 1.27, respectively. Delaware is the only state where business tax revenues account for more than 100% of public infrastructure spending.[11]

To construct our spatial weighting matrices, we use GIS data from National Weather Service GIS Map Group. The data contains information on contiguity and location of geographic centroids for each state which are used to calculate all our spatial weighting matrices.

In all of our models, we employ eight control variables which represent demographic, economic, and political features of each state. Unemployment rates are collected from Bureau of Labor Statistics. The U.S. Census Bureau provides data on median age, proportion of the state population that is male, proportion of the population who are identified as black, proportion identified as "other race" (neither white nor black), proportion identified as being of Hispanic ethnicity, and median household income. The proportion of democratic politicians in each state legislature is calculated with data from the Book of States.

4. Results

We present an IV-spatial autoregressive model to estimate equation (5), an IV-panel model to estimate equation (6) and system GMM to estimate equation (7). We cluster

[11] We also construct an alternative measure of business-friendliness that focuses only on the corporate tax rate set by the state - corporate tax revenues per unit of public infrastructure spending and corporate tax revenue per capita. The average corporate tax revenues per unit of public infrastructure spending in our sample is 0.145 which means that for every dollar spent on infrastructure, $0.145 came from corporate taxes. The average corporate tax revenue per capita is $63. The lowest levels are in Nevada, South Dakota, Texas, Washington, and Wyoming where corporate taxes are zero while the highest corporate tax revenue per unit of spending and corporate tax revenue per capita are New Hampshire and New York, respectively, with values equal to 0.52 and $203.

observations at the state level to obtain standard errors that account for heteroskedasticity and serial correlation. We also conduct Hansen overidentification tests and find that for all of our baseline specifications, we do not reject the null of valid instruments.

4.1 Baseline Results

Table 2 summarizes the results from the spatial model that tests for the presence of fiscal competition. The measure of weighted neighbor's business tax revenue per capita has a positive effect on own fiscal measure. It is significant in all weighting specifications after instrumenting neighbor's fiscal measure with lagged neighbor's median age and income.[12] This indicates that fiscal competition to attract businesses by reducing business tax and increasing infrastructure spending is most significant between neighboring states. A 1% decrease in neighborhood business tax revenue per capita reduces own business tax revenue per capita by 0.9% to 1.1%. We find a similar result when using business tax revenue per unit of infrastructure spending.

Table 3 summarizes the estimates of the effect of own business fiscal measure on education and health spending per capita. Own business fiscal measures are instrumented with lagged neighbor's median age and income, so we report results based on the weighting matrix assigned to neighboring states. We find that after instrumenting for own business fiscal measure, an increase in own business tax revenue per capita increases education and health spending per capita where the elasticity ranges from 0.3 to 0.9. In this case, if business tax revenues per capita increases by one standard deviation from the mean which is equal to $89 per capita, then education and health spending per capita increases from the current mean level of $836 to approximately $863 to $919. The effect of business tax revenue per unit of infrastructure

[12] To examine the robustness of the weighting matrix, we randomly assign spatial weights for each state and find that the new weighted neighbor's fiscal policy measure is insignificant in our fiscal competition equation. Thus, our measure of proximity between states appears to have economic content. The results are available from the authors upon request.

spending on education and health spending per capita is also similar in magnitude with elasticities ranging from 0.3 to 0.6.

Table 4 summarizes the estimates for the dynamic obesity model. The Arellano Bond test for autocorrelation in the second lagged difference is not significant in all specifications. Also, the Hansen test for overidentification is insignificant at the 5% level across all specifications. There is a positive and significant effect of lagged obesity rate on current obesity rates which illustrates a persistent stock of obesity. A 1% increase in obesity rates in the current period contributes to an increase in obesity rates in the following period by 0.2%.

After instrumenting for lagged education and health spending per capita using twice lagged neighbor's median age and income, we find that lagged education and health spending significantly reduces obesity rates. A 1% increase in lagged education and health spending per capita results in a short run decline in obesity rates by 0.2% to 0.3%. The medium run effects are calculated using previous lagged effects of education and health spending based on estimates from Table 4 and are also significant with magnitudes that taper off over time. As seen in Figure 2, a change in lagged education and health spending per capita has a lingering effect on obesity rates up to two years into the future.

We calculate short-run and long-run effects of own and neighbor's business-friendly fiscal measures on obesity rates using estimates from Table 4 and summarize them in Table 5. Attracting firms by reducing business tax revenues leads to a short-run increase in obesity rates. We obtain a short run obesity elasticity from own business tax revenue per capita of approximately -0.07 to -0.24. A one standard deviation decrease in own business tax revenue per capita leads to a 7% to 23% increase in obesity rates. The mechanism driving these results is the crowding out of education and health spending in the state.

Our results also show a significant long-run effect with elasticity values that are larger than their short-run counterparts. For business tax revenue per capita, the elasticity is approximately -0.09 to -0.29. Given the same one standard deviation decrease in business tax revenue per capita, the steady state obesity rate increases by 8% to 28%. The long run effect accounts for the accumulated effect of the state's own fiscal policy in the short run as well as the medium run. This may explain the larger magnitude associated with the long run obesity elasticity given a change in own state's fiscal policy compared to the short run obesity elasticity.

Based on our regression results investigating the presence of fiscal competition, we show that strategic interaction in setting business tax rates and spending on infrastructure that favors business exists. Such strategic interaction contributes to lower business tax revenue per unit of infrastructure spending and lower business tax revenues per capita. This, in turn, significantly increases obesity rates because of a decline in education and health spending per capita.

From Table 5, we test to see if there are direct negative spillovers from a neighboring state's unilateral decision to change their corporate tax rate, business fees and infrastructure spending on own state's obesity rate. All coefficients in the long run and short run are negative but significant only in the short run. Therefore, a unilateral change by a neighboring state when attracting firms has a significant effect on own state's obesity rates in the short run. However, such a relationship only becomes significant if the own state strategically responds to their neighbor's change in fiscal policy by implementing fiscal policies that benefit businesses and firms to the detriment of providing education and health services.

Though it is not our main focus, we also explore the mechanisms by which education and health spending affect obesity. Recall that our main variable of interest measures the obesity rate of the state across all individuals. If health spending and educational spending before the tertiary level have a truly causal impact on obesity rates, we expect to find the effects taper off as the age group range increase. We re-estimate the obesity equation using the obesity rates by different age groups while continuing to use the same specification and instruments. Table 6 summarizes the effect of education and health spending on obesity rates by age group. We find that, with the exception of the age range 45-54 years old, there is a gradual reduction in magnitude and significance of the effect education and health spending on obesity rates by age groups. The age group that is most significantly affected by current education and health spending is the young adults ranging from 18-24 years old while the oldest age group at 65 and above are insignificantly affected by current education and health spending and their coefficient magnitudes are about 10% that of the young adults. Our results show the significance of lagged education and health spending as a plausible causal factor negatively affecting obesity rates of young adults and to a lesser extent those from 25 to 34 years old.

4.2 Robustness Checks

To test the robustness of our results, we re-estimate our model using different specifications and measures of fiscal business-friendliness. When using levels instead of logs, there is still a consistent indication of fiscal competition with our original measures of business-friendliness as shown in Table A4. Also, there is a consistent positive effect of these business-friendliness measures on education and health spending per capita as summarized in Table A5. Finally, the lagged effect of education and health spending on obesity rates are robust and significantly negative as shown in Table A6.

We also ran some specifications using corporate tax revenues only as opposed to all business tax revenue sources.[13] When using logs, we still find consistent proof of fiscal competition. Additionally, we find a positive effect of corporate tax revenues on education and

[13] Results using corporate revenues are available upon request.

health spending with elasticities at approximately 0.3. This indicates that a 1% increase in corporate tax revenue per capita or corporate tax revenue per unit of infrastructure spending lead to an increase in education and health spending by 0.3%. Such a result falls within the lower end of our education and health spending per capita elasticity range when using our baseline measures of business-friendliness where we derived elasticities of 0.3 to 0.9. This indicates consistency in our results since corporate tax revenue is only one component of overall business tax revenue. Finally, the total effect of own corporate tax revenue and neighbor's corporate tax revenue on obesity in own state are similar to our baseline results but the magnitudes are smaller.

5. Conclusion

This article measures the effect of fiscal competition on obesity rates at the state level. We find that there is fiscal competition to attract businesses by reducing corporate tax and business fee rates while favoring public infrastructure spending to the detriment of other forms of spending such as education and health spending. We also find that education and health spending reduce obesity rates. Specifically, lagged education and health spending affect young adults but have no impact on relatively older age ranges. Thus, we show that a causal link may occur between lagged education and health spending on obesity rates for young adults. Given these results, we show that fiscal competition significantly increases obesity rates.

The effect of fiscal competition is not just in in the short run. There is also a medium run where a reduction in education and health spending, because of fiscal competition, significantly increases obesity rates up to two years in the future. Thus, there is also a long run effect where the steady state obesity rates rise from fiscal competition due to the accumulated short run and medium run effects.

Our results have implications for public health policy. We find that unilateral changes in business tax rates and public infrastructure spending by one neighbor may significantly impact obesity rates in own state if these unilateral changes are strategically reciprocated by the own state. The ensuing fiscal competition lowers the optimal corporate tax rate and related business fees while increasing infrastructure spending which siphons spending away from education and health programs. If states harmonize corporate tax rates, business fees and infrastructure spending to become closer to the socially optimal level, obesity rates may significantly decline in the short, medium and long run.

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Tables

Table 1. Summary Statistics

Variable	Mean	Minimum	Maximum	Standard Deviation
Obesity rate	20.769	7.7	35.4	5.427
Education and health spending per capita (in thousand US dollars)	.836	.069	1.702	.168
Business Tax Revenue per unit of Infrastructure Spending	.218	.010	1.620	.194
Business Tax Revenue per Capita (in thousand US dollars)	.096	.004	.716	.089
Corporate tax revenues per unit spending	.145	.000	.710	.109
Corporate Tax Revenue per Capita (in thousand US dollars)	.063	.000	.313	.043
Unemployment rate	5.499	2.3	13.8	1.909
Proportion of democratic politicians	.525	.152	.903	.149
Median age	35.940	26.7	43.2	2.290
Proportion of male	.491	.478	.511	.007
Proportion of Hispanics	.082	.005	.467	.093
Proportion of Blacks	.106	.003	.373	.096
Proportion of other races	.050	.006	.194	.035
Median income	53.311	32.975	78.632	8.130

Table 2. Measuring Tax Competition Across Different Types of Fiscal Measures

Fiscal Measure	Business Tax Revenue per capita					Business Tax Revenue per unit of Infrastructure Spending				
Weighting Matrix	Border	Distance	Border-Distance	Truncated Distance	Population	Border	Distance	Border-Distance	Truncated Distance	Population
Neighbor's business tax revenue per capita	1.082*** (.344)	1.830** (1.027)	1.057*** (.357)	.882** (.454)	.919*** (.293)					
Neighbor's business tax revenue per unit of spending						1.038*** (.433)	1.168 (1.073)	.989*** (.439)	.567 (.509)	.858*** (.322)
Unemployment rate	-.183*** (.093)	-.333*** (.109)	-.193*** (.091)	-.305*** (.103)	-.230*** (.103)	-.195** (.108)	-.301*** (.119)	-.215*** (.107)	-.278*** (.113)	-.220** (.119)
Proportion of democratic politicians	.073 (.097)	.057 (.088)	.077 (.096)	.048 (.087)	.071 (.102)	.202** (.121)	.143 (.101)	.196* (.120)	.135 (.095)	.180* (.117)
Median age	-.273 (2.098)	.066 (2.292)	-.057 (2.108)	.340 (2.163)	.107 (2.131)	.263 (2.111)	1.051 (2.174)	.453 (2.086)	1.322 (1.974)	.600 (2.067)
Proportion of male	1.608 (5.387)	1.641 (5.242)	2.923 (5.239)	2.338 (5.532)	1.175 (6.077)	2.027 (5.498)	.107 (5.318)	2.701 (5.663)	.773 (5.523)	.325 (6.036)
Proportion of Hispanics	.049 (.111)	.070 (.117)	.069 (.113)	.061 (.113)	.077 (.120)	.100 (.118)	.104 (.132)	.124 (.123)	.090 (.122)	.058 (.121)
Proportion of Blacks	-.092 (.172)	.131 (.168)	-.114 (.176)	.144 (.172)	.029 (.182)	-.212 (.171)	-.001 (.165)	-.215 (.178)	.022 (.162)	-.135 (.163)
Proportion of other races	-.180 (.145)	-.175 (.138)	-.244* (.155)	-.156 (.137)	-.131 (.159)	-.179 (.142)	-.133 (.143)	-.237 (.166)	-.109 (.137)	-.078 (.136)
Median income	.509** (.276)	.526*** (.266)	.515** (.280)	.530*** (.254)	.586*** (.277)	.500*** (.038)	.605*** (.247)	.491** (.251)	.613*** (.238)	.603*** (.248)
Constant	-1.477 (7.733)	.124 (10.362)	-1.664 (8.043)	-2.537 (8.693)	-2.885 (8.101)	-3.796 (7.523)	-7.298 (8.984)	-4.197 (7.867)	-8.678 (7.694)	-6.206 (6.770)
Year and state dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	816	816	816	816	816	816	816	816	816	816
F Test (P value)	21.29*** (.000)	63.12*** (.000)	17.81*** (.000)	43.95*** (.000)	14.14*** (.000)	17.38*** (.000)	45.56*** (.000)	17.36*** (.000)	37.76*** (.000)	14.73*** (.000)
Hansen Test (P value)	2.753** (.097)	1.460 (.227)	2.333* (.127)	1.044 (.307)	.552 (.458)	.524 (.469)	.119 (.730)	.250 (.617)	.037 (.847)	.542 (.462)

Note: The spatial lag is instrumented with lagged neighbor's median age and income. Standard errors are clustered at the state level. All continuous variables are in logs. *** 5%, ** 10%, * 15%.

Table 3. Estimating the determinants of education and health spending per capita.

Weighting Matrix for Instruments	Border	Distance	Border-Distance	Truncated Distance	Population	Border	Distance	Border-Distance	Truncated Distance	Population
Business tax revenue per capita	.383*** (.160)	.882** (.506)	.505*** (.188)	.873** (.465)	.282*** (.134)					
Business tax revenue per unit spending						.446** (.261)	1.204 (1.175)	.574** (.305)	1.047 (.906)	.292* (.178)
Unemployment rate	.072 (.073)	.239* (.165)	.113 (.081)	0.236* (0.162)	.022 (.027)	.081 (.105)	0.313 (0.351)	.120 (.116)	.265 (.282)	.034 (.075)
Proportion of democratic politicians	-.052 (.037)	-.086 (.068)	-.060 (.044)	-0.086 (0.067)	-.065*** (.024)	-.087* (.055)	-0.191 (0.165)	-.104* (.065)	-.169 (.134)	-.066** (.039)
Median age	-.592 (.808)	-.933 (1.649)	-.676 (.930)	-0.926 (1.592)	.073 (.207)	-1.050 (1.185)	-2.272 (3.256)	-1.256 (1.363)	-2.018 (2.608)	-802 (1.003)
Proportion of male	-.094 (2.431)	.787 (4.240)	.121 (2.796)	0.771 (4.283)	.673 (.862)	.441 (3.101)	2.498 (6.327)	.787 (3.560)	2.070 (5.646)	.022 (2.654)
Proportion of Hispanics	-.033 (.040)	-.048 (.079)	-.037 (.048)	-0.048 (0.079)	-.034*** (.012)	-.049 (.055)	-0.095 (0.133)	-.057 (.066)	-.086 (.117)	-.040 (.043)
Proportion of Blacks	-.069 (.068)	-.168* (.113)	-.093 (.070)	-0.166 (0.119)	.044*** (.007)	-.020 (.093)	-0.065 (0.188)	-.027 (.104)	-.055 (.169)	-.010 (.085)
Proportion of other races	.127** (.068)	.176 (.140)	.139** (.080)	0.175 (0.133)	-.026** (.016)	.111* (.066)	0.148 (0.156)	.117* (.076)	.140 (.131)	.103** (.057)
Median income	-.072 (.138)	-.367 (.339)	-.144 (.164)	-0.362 (0.334)	-.101* (.065)	-.137 (.188)	-0.631 (0.727)	-.220 (.218)	-.528 (.575)	-.036 (.150)
Constant	3.959 (3.420)	8.305 (7.452)	5.021 (3.808)	8.226 (6.990)	3.081 (3.186)	6.468 (5.274)	16.397 (17.388)	8.141 (5.911)	14.330 (13.335)	4.447 (4.470)
Year and state dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	816	816	816	816	816	816	816	816	816	816
F Test (P value)	6.21*** (.004)	1.81 (.175)	.025 (.874)	2.04* (.141)	7.94*** (.001)	3.02** (.058)	.080 (.457)	2.69** (.078)	.86 (.429)	5.71*** (.006)
Hansen Test (P value)	.149 (.700)	.006 (.938)	5.10*** (.010)	.379 (.538)	.876 (.349)	.005 (.945)	.215 (.643)	.215 (.643)	1.772 (.183)	1.641 (.200)

Note: The own business-friendliness measures are instrumented with lagged neighbor's median age and income. Standard errors are clustered at the state level. All continuous variables are in logs. *** 5%, ** 10%, * 15%.

Table 4. Estimating the determinants of obesity using system Generalized Method of Moments.

Weighting Matrix for instruments	Border	Distance	Border-Distance	Truncated Distance	Population
Obesity rate lagged	.194***	.199***	.201***	.196***	.198***
	(.069)	(.093)	(.069)	(.088)	(.059)
Education and health expenditure per	-.182***	-.298***	-.173***	-.271***	-.116
capita lagged	(.089)	(.131)	(.087)	(.118)	(.082)
Unemployment rate	.036	.035	.035	.031	.022
	(.026)	(.031)	(.026)	(.031)	(.027)
Proportion of democratic politicians	-.068***	-.067***	-.067***	-.066***	-.065***
	(.026)	(.031)	(.026)	(.031)	(.024)
Median age	.148	.280	.136	.228	.073
	(.182)	(.261)	(.190)	(.244)	(.207)
Proportion of male	.634	.409	.617	.376	.673
	(1.042)	(1.728)	(1.005)	(1.574)	(.862)
Proportion of Hispanics	-.036***	-.024	-.035***	-.026*	-.034***
	(.013)	(.018)	(.014)	(.017)	(.012)
Proportion of Blacks	.045***	.040***	.044***	.041***	.044***
	(.013)	(.011)	(.008)	(.010)	(.007)
Proportion of other races	-.022*	-.026	-.023*	-.025	-.026**
	(.015)	(.020)	(.015)	(.018)	(.016)
Median income	-.070	-.044	-.074	-.051	-.101*
	(.064)	(.075)	(.065)	(.073)	(.065)
Constant	Omitted	Omitted	2.279**	2.172*	Omitted
			(1.171)	(1.483)	
Year dummies	Yes	Yes	Yes	Yes	Yes
Number of observations	624	624	624	624	624
Arellano-Bond test for AR(1)	-4.69***	-4.14***	-4.72***	-4.24***	-4.99***
(P value)	(.000)	(.000)	(.000)	(.000)	(.000)
Arellano-Bond test for AR(2)	.98	1.07	.98	1.04	.87
(P value)	(.329)	(.286)	(.325)	(.298)	(.387)
Sargan Tests	32.28***	31.23***	34.06***	29.14***	32.59***
(P value)	(.009)	(.013)	(.005)	(.023)	(.008)
Hansen Tests	22.61*	24.90**	22.44*	24.35**	19.52
(P value)	(.125)	(.072)	(.130)	(.082)	(.242)

Note: The education and health spending per capita variables are instrumented with twice-lagged neighbor's median age and income.

All continuous variables are in logs. Standard errors are clustered at the state level. *** 5%, ** 10%, * 15%.

Table 5. Short run and long run elasticities from different fiscal measures

Fiscal Measure	Business Tax Revenue per Capita					Business Tax Revenue per unit of Infrastructure Spending				
Weighting Matrix for Instruments	Border	Distance	Border-Distance	Truncated Distance	Population	Border	Distance	Border-Distance	Truncated Distance	Population
Neighbor's fiscal elasticity	1.082*** (.344)	1.830** (1.027)	1.057*** (.357)	.882** (.454)	.919*** (.293)	1.038*** (.433)	1.168 (1.073)	.989*** (.439)	.567 (.509)	.858*** (.322)
Education and health elasticity from fiscal measure	.383*** (.160)	.882** (.506)	.505*** (.188)	.873** (.465)	.282*** (.134)	.446** (.261)	1.204 (1.175)	.574** (.305)	1.047 (.906)	.292* (.178)
Short run obesity elasticity from fiscal measure	-.070* (.045)	-.263 (.190)	-.087* (.055)	-.236* (.163)	-.033 (.028)	-.081 (.062)	-.359 (.384)	-.099 (.073)	-.284 (.275)	-.034 (.032)
Long run obesity elasticity from fiscal measure	-.086* (.055)	-.329 (.229)	-.109 (.091)	-.294* (.196)	-.041 (.246)	-.101 (.076)	-.449 (.472)	-.124 (.114)	-.352 (.336)	-.042 (.040)
Short run obesity elasticity from neighbor's fiscal measure	-.075* (.046)	-.482 (.347)	-.092 (.099)	-.209* (.142)	-.030 (.024)	-.084* (.056)	-.420 (.428)	-.098 (.101)	-.161 (.161)	-.029 (.024)
Long run obesity elasticity from neighbor's fiscal measure	-.093 (.067)	-.601 (.538)	-.116 (.104)	-.259 (.218)	-.037 (.034)	-.104 (.090)	-.524 (.732)	-.123 (.125)	-.200 (.262)	-.036 (.037)

Note: *** 5%, ** 10%, * 15%. The elasticities are calculated based on equations (5) to (7). The neighbor's business revenue elasticity is ρ. The education and health elasticity from business revenue is β_1. The short run obesity elasticity from own business revenue is $\beta_1\gamma_1$. The long run obesity elasticity from own business revenue is $\frac{\beta_1\gamma_1}{1-\varphi}$. The short run obesity elasticity from neighbor's business revenue $\rho\beta_1\gamma_1$. The long run obesity elasticity from neighbor's business revenue $\frac{\rho\beta_1\gamma_1}{1-\varphi}$. Asymptotically, the variance of a nonlinear univariate function, *g(A)*, is equal to $V(g(A)) = \left(\partial g / \partial A\right)^T V(A) \left(\partial g / \partial A\right)$ where $\partial g/\partial A$ is a vector whose i^{th} element is the partial derivative of g with respect to the i^{th} element A, and $V(A)$ is the variance-covariance matrix of the parameters in the vector A.

Table 6. The effect of Education and Health Expenditures on Obesity Rates across Age ranges using system Generalized Method of Moments.

Education and health expenditure per capita lagged	Weighting Matrix for instruments				
Age Range	Border	Distance	Border-Distance	Truncated Distance	Population
18-24	-.386 (.289)	-.499*** (.231)	-.347 (.271)	-.418*** (.200)	-.380 (.331)
25-34	-.212 (.164)	-.327*** (.140)	-.207 (.159)	-.296*** (.130)	-0.123 (.173)
35-44	-.004 (.151)	-.111 (.157)	.003 (.148)	-.097 (.149)	.067 (.166)
45-54	-.151 (.125)	-.345** (.201)	-.121 (.124)	-.283** (.147)	-.062 (.127)
55-64	.052 (.081)	-.092 (.098)	.049 (.077)	-.065 (.087)	.101 (.123)
65 and above	.021 (.096)	-.056 (.166)	.019 (.096)	-.030 (.072)	.070 (.100)

Note: The education and health spending per capita variables are instrumented with twice-lagged neighbor's median age and income.
All continuous variables are in logs.
Standard errors are clustered at the state level.
*** 5%, ** 10%, * 15%.

Figures

Figure 1. Obesity rates and public and health spending per capita across states, 2010

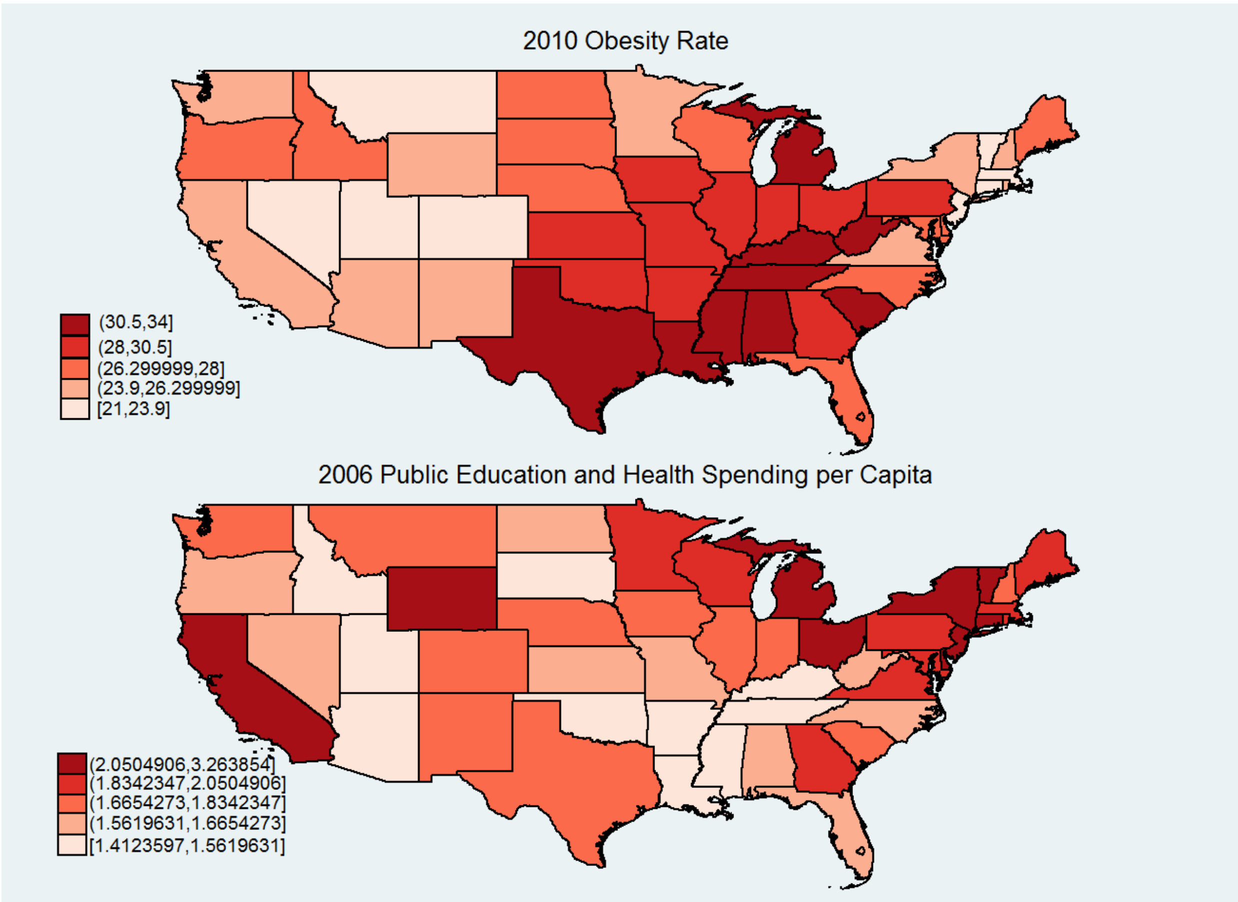
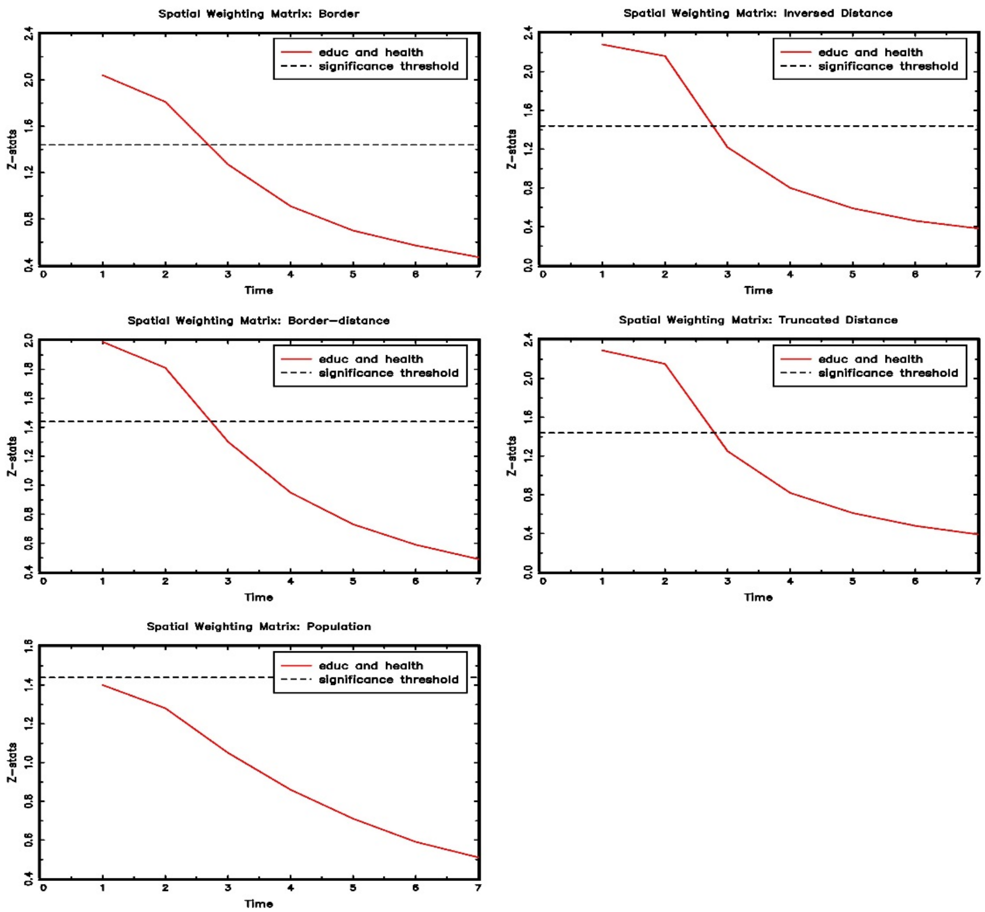


Figure 2. Lingering effects of education and health spending on obesity rates.



Note: Estimates are based on the results of contemporaneous education and health spending per capita in the obesity equation. All z-stats are absolute values.

Appendix.

Table A1. Estimating the determinants of education and health spending per capita, including obesity.

Weighting Matrix for Instruments	Border	Distance	Border-Distance	Truncated Distance	Population	Border	Distance	Border-Distance	Truncated Distance	Population
Business tax revenue per capita	.431*** (.179)	.431*** (.179)	.431*** (.179)	1.100 (.787)	.297*** (.144)					
Business tax revenue per unit spending						.516** (.302)	1.427 (1.607)	.643** (.347)	1.342 (1.423)	.314* (.192)
Obesity rate	.006 (.072)	-.008 (.147)	.003 (.085)	-.009 (.152)	.009 (.060)	-.075 (.106)	-.234 (.352)	-.097 (.122)	-.219 (.313)	-.039 (.076)
Unemployment rate	.111 (.079)	.333 (.263)	.156** (.091)	.345 (.273)	.064 (.063)	.133 (.124)	.438 (.519)	.175 (.138)	.410 (.471)	.065 (.082)
Proportion of democratic politicians	-.046 (.040)	-.070 (.088)	-.051 (.049)	-.071 (.091)	-.041 (.033)	-.087* (.060)	-.190 (.198)	-.102 (.071)	-.180 (.183)	-.064* (.040)
Median age	-.637 (.845)	-.994 (1.960)	-.710 (.970)	-1.014 (1.994)	-.561 (.796)	-1.235 (1.355)	-2.719 (4.072)	-1.442 (1.525)	-2.581 (3.552)	-.905 (1.111)
Proportion of male	-1.713 (2.482)	-1.705 (5.294)	-1.711 (2.940)	-1.705 (5.477)	-1.715 (2.165)	-1.736 (3.171)	-1.766 (7.449)	-1.740 (3.681)	-1.763 (7.011)	-1.729 (2.532)
Proportion of Hispanics	-.033 (.040)	-.049 (.089)	-.036 (.049)	-.050 (.092)	-.030 (.033)	-.048 (.058)	-.093 (.150)	-.054 (.069)	-.089 (.144)	-.038 (.042)
Proportion of Blacks	-.077 (.068)	-.196 (.159)	-.102 (.072)	-.203 (.178)	-.052 (.074)	-.036 (.099)	-.106 (.232)	-.046 (.110)	-.099 (.226)	-.020 (.091)
Proportion of other races	.132** (.071)	.198 (.183)	.145** (.085)	.201 (.181)	.118*** (.058)	.110* (.070)	.149 (.183)	.115 (.081)	.146 (.164)	.101** (.056)
Median income	-.113 (.150)	-.473 (.503)	-.187 (.180)	-.494 (.530)	-.037 (.126)	-.192 (.209)	-.766 (.992)	-.273 (.237)	-.712 (.910)	-.065 (.153)
Constant	3.339 (3.592)	7.915 (9.176)	4.279 (3.972)	8.172 (9.233)	2.372 (3.354)	6.310 (5.852)	17.059 (21.221)	7.814 (6.392)	16.055 (18.499)	3.921 (4.758)
Year and state dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	816	816	816	816	816	816	816	816	816	816
F Test (P value)	5.99*** (.005)	1.09 (.344)	5.08*** (.010)	1.18 (.317)	7.69*** (.001)	2.64** (.082)	.54 (.587)	2.53** (.091)	.54 (.587)	.45 (.638)
Hansen Test (P value)	.029 (.865)	.015 (.901)	.006 (.939)	.071 (.789)	.259 (.611)	.085 (.770)	.091 (.763)	.303 (.582)	.898 (.343)	1.398 (.237)

Note: The own business-friendliness measures are instrumented with lagged neighbor's median age and income. Standard errors are clustered at the state level. All continuous variables are in logs. *** 5%, ** 10%, * 15%.

Table A2. The Effect of Our Instruments on Our Proxies for Business-Friendliness

Fiscal Measure	Business Tax Revenue per capita					Business Tax Revenue per unit of Infrastructure Spending				
Weighting Matrix	Border	Distance	Border-Distance	Truncated Distance	Population	Border	Distance	Border-Distance	Truncated Distance	Population
Neighbor's median age	2.570***	2.114***	2.532***	2.227***	1.305***	2.708***	2.940***	2.720***	2.873***	1.824***
	(.504)	(.286)	(.522)	(.324)	(.457)	(.554)	(.325)	(.578)	(.372)	(.434)
Neighbor's median income	.811***	.941***	.735***	.928***	1.062***	.717***	1.046***	.687***	1.001***	.938***
	(.125)	(.107)	(.124)	(.099)	(.151)	(.138)	(.122)	(.137)	(.114)	(.143)
Unemployment rate	-.133***	-.011**	-.132***	-.048***	-.104***	-.102***	-.017***	-.090***	-.067***	-.094***
	(.025)	(.006)	(.025)	(.013)	(.032)	(.027)	(.007)	(.028)	(.015)	(.030)
Proportion of democratic politicians	-.022	-.007	-.029	-.009	-.002	-.081***	-.022***	-.081***	-.034***	-.053**
	(.025)	(.006)	(.026)	(.013)	(.033)	(.028)	(.007)	(.029)	(.015)	(.031)
Median age	.239	.078	.011	-.043	.497	.608**	.122	.422	-.057	.978***
	(.327)	(.081)	(.343)	(.168)	(.388)	(.359)	(.092)	(.380)	(.193)	(.368)
Proportion of male	-2.627***	-1.312***	-3.841***	-3.248***	-1.940	-4.089***	-1.717***	-4.865***	-4.477***	-2.203*
	(1.149)	(.291)	(1.191)	(.606)	(1.512)	(1.263)	(.332)	(1.319)	(.697)	(1.433)
Proportion of Hispanics	.010	-.008	-.008	-.010	-.035	-.010	-.019***	-.034	-.021*	.023
	(.024)	(.006)	(.025)	(.012)	(.031)	(.026)	(.007)	(.027)	(.014)	(.029)
Proportion of Blacks	.118***	.013*	.150***	.010	.064	.114***	.022***	.130***	.006	.095***
	(.037)	(.008)	(.038)	(.017)	(.047)	(.041)	(.009)	(.042)	(.020)	(.044)
Proportion of other races	.024	.017***	.076***	.022	.022	.069**	.037***	.124***	.048***	.009
	(.033)	(.009)	(.035)	(.018)	(.041)	(.036)	(.010)	(.038)	(.020)	(.039)
Median income	.002	-.006	-.004	-.017	-.040	.078	-.011	.089	-.029	.030
	(.069)	(.018)	(.072)	(.036)	(.091)	(.076)	(.020)	(.079)	(.042)	(.086)
Constant	-16.962***	-14.875***	-16.266***	-16.160***	-14.336***	-19.212***	-17.962***	-18.876***	-18.912***	-17.202***
	(1.893)	(.989)	(1.920)	(1.122)	(2.278)	(2.081)	(1.126)	(2.126)	(1.290)	(2.160)
Year and state dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	816	816	816	816	816	816	816	816	816	816

Note: All specification are estimated by ordinary least squares. All continuous variables are in logs.
*** 5%, ** 10%, * 15%.

Table A3. Data Definition and Sources

Variable	Definition	Source	Time range
Obesity rate	Adult obesity rate	Centers for Disease Control and Prevention	1992-2010
Education and health spending per capita	Education and health spending divided by population	Author's own calculation using US Census Bureau data	1992-2000, 2002, 2004-2011
Business Tax Revenue per unit of Infrastructure Spending	Sum of corporate tax revenues, corporate license fees and occupation and business fees divided by public infrastructure spending.	Author's own calculation using US Census Bureau data	1992-2000, 2002, 2004-2011
Business Tax Revenue per capita	Sum of corporate tax revenues, corporate license fees and occupation and business fees divided by population	Author's own calculation using US Census Bureau data	1992-2000, 2002, 2004-2011
Corporate tax revenues per unit spending	Corporate income tax revenues per unit of public infrastructure spending	Author's own calculation using US Census Bureau data	1992-2000, 2002, 2004-2011
Corporate tax revenues per capita	Corporate income tax revenues divided by total state population	Author's own calculation using US Census Bureau data	1992-2000, 2002, 2004-2011
Unemployment rate	Unemployment rate	Bureau of Labor Statistics	1992-2011
Proportion of democratic politicians	Portion of democratic politicians in state legislature	Book of States	1992-2011
Median age	Median age in population	US census	1992-2011
Proportion of male	The portion of male in population	US census	1992-2011
Proportion of hispanics	The portion of people who are identified as being Hispanic ethnicity in population	US census	1992-2011
Proportion of blacks	The portion of people who are identified as black in population	US census	1992-2011
Proportion of other race	The portion of people who are identified as "other race" (neither white or black) in population	US census	1992-2011
Median income	Median household income	US census	1992-2011

Table A4. Measuring Tax Competition Across Different Types of Fiscal Measures using Levels

Fiscal Measure	Business Tax Revenue per capita					Business Tax Revenue per unit of Infrastructure Spending				
Weighting Matrix	Border	Distance	Border-Distance	Truncated Distance	Population	Border	Distance	Border-Distance	Truncated Distance	Population
Neighbor's business tax revenue per capita	.647** (.353)	1.284 (.929)	.572** (.305)	.588 (.425)	.505** (.279)					
Neighbor's business tax revenue per unit of spending						.601*** (.293)	.198 (.626)	.473*** (.252)	.167 (.359)	.513*** (.233)
Unemployment rate	-.003*** (.002)	.004*** (.002)	-.003*** (.002)	-.004*** (.002)	.004*** (.002)	.005 (.007)	-.006 (.007)	-.006 (.007)	-.006 (.007)	.005 (.007)
Proportion of democratic politicians	.016 (.021)	.014 (.020)	.017 (.020)	.014 (.020)	.014 (.023)	.055 (.071)	.014 (.062)	.046 (.070)	.013 (.063)	.044 (.065)
Median age	.001 (.006)	.004 (.006)	.002 (.006)	.004 (.006)	.002 (.007)	.010 (.018)	.023* (.016)	.012 (.019)	.023* (.015)	.011 (.016)
Proportion of male	.174 (1.034)	.258 (1.000)	.076 (1.002)	-.195 (1.010)	.717 (1.131)	4.815 (4.427)	3.579 (3.779)	4.596 (4.649)	3.766 (3.729)	3.540 (4.172)
Proportion of Hispanics	.007 (.169)	-.032 (.148)	.024 (.165)	-.047 (.146)	-.134 (.190)	.638 (.490)	.733* (.450)	.659 (.483)	.714* (.444)	.503 (.482)
Proportion of Blacks	.390 (.399)	.452 (.400)	.405 (.383)	-.392 (.396)	.326 (.414)	1.678 (1.328)	-2.188** (1.299)	1.749 (1.401)	2.158* (1.325)	1.702 (1.307)
Proportion of other races	.342 (.239)	.318 (.248)	.367* (.238)	.316 (.245)	.293 (.263)	.699 (.791)	.334 (.679)	.721 (.765)	.345 (.676)	.439 (.720)
Median income	.001** (.001)	.001** (.001)	.001** (.001)	.001** (.001)	.001** (.001)	.004*** (..002)	.005*** (-.002)	.005*** (.002)	.005*** (.002)	.005*** (.002)
Constant	-.040 (.677)	.150 (.637)	.201 (.648)	.124 (.628)	.259 (.754)	-3.175 (2.604)	3.015 (2.234)	3.132 (2.712)	3.088 (2.207)	-2.535 (2.492)
Year and state dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	816	816	816	816	816	816	816	816	816	816
F Test (P value)	16.35*** (.000)	36.19*** (.000)	17.83*** (.000)	54.82*** (.000)	12.68*** (.000)	13.72*** (.000)	27.48*** (.000)	12.86*** (.000)	42.90*** (.000)	10.24*** (.000)
Hansen Test (P value)	8.618*** (.003)	3.175** (.075)	5.716*** (.017)	2.896** (.089)	2.749** (.097)	9.907*** (.002)	4.425*** (.035)	11.031*** (.001)	1.834 (.176)	2.103* (.147)

Note: The spatial lag is instrumented with lagged neighbor's median age and income. Standard errors are clustered at the state level All continuous variables are in levels. *** 5%, ** 10%, * 15%.

Table A5. Estimating the determinants of education and health spending per capita using levels.

Weighting Matrix for Instruments	Border	Distance	Border-Distance	Truncated Distance	Population	Border	Distance	Border-Distance	Truncated Distance	Population
Business tax revenue per capita	2.882***	10.113*	4.174***	11.343**	2.011*					
	(1.429)	(6.167)	(1.867)	(6.745)	(1.364)					
Business tax revenue per unit spending						1.034*	5.697	1.421*	8.980	.732
						(.698)	(6.167)	(.877)	(12.543)	(.610)
Unemployment rate	-.003	.030	.003	.036	-.007	-.009	.019	-.007	.040	-.011
	(.010)	(.029)	(.013)	(.033)	(.008)	(.010)	(.044)	(.012)	(.078)	(.008)
Proportion of democratic politicians	.004	-.145	-.022	-.170	.022	.049	-.018	.043	-.066	.053
	(.087)	(.179)	(.102)	(.200)	(.078)	(.077)	(.315)	(.091)	(.496)	(.069)
Median age	-.019	-.074	-.029	-.084	-.013	-.023	-.135	-.032	-.214	-.015
	(.026)	(.054)	(.028)	(.063)	(.029)	(.031)	(.155)	(.035)	(.312)	(.032)
Proportion of male	-1.987	.640	-1.518	1.087	-2.304	-6.650	-22.945	-8.002	-34.419	-5.592
	(5.301)	(9.067)	(5.397)	(10.191)	(5.368)	(7.626)	(28.646)	(8.505)	(51.635)	(7.159)
Proportion of Hispanics	-.120	-.076	-.112	-.069	-.125	-.915	-4.418	-1.206	-6.884	-.687
	(.771)	(1.572)	(.868)	(1.734)	(.724)	(.973)	(4.009)	(1.074)	(8.427)	(.973)
Proportion of Blacks	.871	2.934	1.240	3.285	.623	2.317	12.541	3.166	19.741	1.653
	(1.386)	(4.405)	(1.734)	(4.802)	(1.187)	(2.192)	(16.281)	(2.682)	(31.589)	(1.897)
Proportion of other races	-1.523	-4.203	2.002	-4.659	-1.200	-.778	-2.233	-.899	-3.258	-.684
	(1.322)	(3.203)	(1.430)	(3.369)	(1.438)	(1.597)	(4.473)	(1.715)	(6.986)	(1.553)
Median income	-.002	-.011	.003	-.012	-.000	-.003	-.028	-.005	-.045	-.002
	(.003)	(.008)	(.003)	(.009)	(.002)	(.004)	(.029)	(.004)	(.063)	(.004)
Constant	3.163	4.159	3.341	4.328	3.044	5.843	19.708	6.994	29.472	4.942
	(3.387)	(5.223)	(3.470)	(5.758)	(3.456)	(4.868)	(20.434)	(5.392)	(39.335)	(4.725)
Year and state dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	816	816	816	816	816	816	816	816	816	816
F Test	3.39***	1.17	2.94**	1.19	2.72**	2.84**	.50	2.48**	.30	4.43***
(P value)	(.042)	(.320)	(.063)	(.314)	(.076)	(.069)	(.613)	(.095)	(.745)	(.017)
Hansen Test	.000	.291	.000	.081	.058	.590	.013	.481	.048	.033
(P value)	(.993)	(.590)	(.995)	(.777)	(.810)	(.443)	(.909)	(.488)	(.827)	(.856)

Note: The own business-friendliness measures are instrumented with lagged neighbor's median age and income. Standard errors are clustered at the state level. All continuous variables are in logs. *** 5%, ** 10%, * 15%.

Table A6. Estimating the determinants of obesity using system Generalized Method of Moments in Levels

Weighting Matrix for instruments	Border	Distance	Border-Distance	Truncated Distance	Population
Obesity rate lagged	.272***	.203*	.286***	.224**	.262***
	(.131)	(.132)	(.132)	(.133)	(.112)
Education and health expenditure per capita lagged	-8.021***	-12.131***	-7.469***	-10.704***	-6.762***
	(3.130)	(3.879)	(3.304)	(3.716)	(3.217)
Unemployment rate	.141	.142	.148	.156	.130
	(.113)	(.139)	(.109)	(.131)	(.118)
Proportion of democratic politicians	-2.996***	-3.956***	-2.856**	-3.672***	-2.877***
	(1.527)	(1.827)	(1.506)	(1.743)	(1.359)
Median age	.192	.320*	.173	.255	.171
	(.158)	(.221)	(.162)	(.203)	(.141)
Proportion of male	-40.294*	-48.296	-42.149*	-49.080	-41.159*
	(27.490)	(44.546)	(26.037)	(35.874)	(25.831)
Proportion of Hispanics	-2.714	-1.208	-2.932	-2.363	-3.049
	(3.532)	(5.907)	(3.486)	(5.258)	(3.905)
Proportion of Blacks	6.710***	7.470***	6.471***	6.989***	6.894***
	(2.262)	(3.018)	(2.264)	(2.782)	(1.963)
Proportion of other races	-3.774	-4.299	-3.446	-3.036	-4.738
	(6.552)	(9.622)	(6.595)	(8.706)	(7.898)
Median income	-.036*	-.015	-.039**	-.021	-.046**
	(.023)	(.030)	(.023)	(.028)	(.024)
Constant	omitted	44.157**	omitted	48.156***	43.648***
		(24.472)		(20.392)	(15.496)
Year dummies	Yes	Yes	Yes	Yes	Yes
Number of observations	624	624	624	624	624
Arellano-Bond test for AR(1)	-3.74***	-3.48***	-3.74***	-3.56***	-4.02***
(P value)	(.000)	(.001)	(.000)	(.000)	(.000)
Arellano-Bond test for AR(2)	1.07	1.05	1.08	1.05	1.05
(P value)	(.283)	(.294)	(.278)	(.294)	(.294)
Sargan Tests	56.31***	43.50***	58.89***	47.09***	54.81***
(P value)	(.000)	(.000)	(.000)	(.000)	(.000)
Hansen Tests	26.38***	26.82***	26.79***	28.07***	25.09**
(P value)	(.049)	(.043)	(.044)	(.031)	(.068)

Note: The education and health spending per capita variables are instrumented with twice-lagged neighbor's median age and income.

All continuous variables are in levels. *** 5%, ** 10%, * 15%.