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Economic Freedom and Participation in Physical Activity

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Abstract

Physical activity is an important part of a healthy lifestyle and influences a variety of health outcomes. A recent paper has found economic freedom to be positively associated with greater participation in physical activity in a sample of 34 European countries. We empirically investigate the relationship between economic freedom and physical activity across U.S. states. Contrary to the cross-country results, we find that states with higher levels of economic freedom have lower rates of participation in physical activity.

JEL Codes: I12; I18; J22; R5
Key Words: economic freedom, health outcomes, physical activity
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Introduction

The consequences of economic freedom, in terms of the effect of increased economic freedom on economic growth, income, employment, and other tangible economic outcomes, have been extensively investigated (Hall and Lawson, 2014). Researchers typically have paid less attention to the effect of economic freedom on less tangible, but still important, outcomes like subjective well-being and health. Since well-being and health represent important quality-of-life outcomes, understanding the relationship between economic freedom and these intangible outcomes is important for an overall assessment of economic freedom. Understanding the relationship between economic freedom and subjective well-being is important because many non-market factors affect well-being, for example leisure time activities, and increases in the opportunity cost of time generated by higher income may reduce the incentive to devote time to non-market activities.

We investigate the relationship between economic freedom and participation in physical activity in the United States. Physical activity is an important component of a healthy lifestyle and contributes to overall well-being. A few studies show that participation in physical activity increases individual happiness (Humphreys et al., 2014; Rasicute and Downward, 2010; Ruseski et al., 2014). Humphreys et al. (2014) show that participation in physical activity generates health benefits. Despite these links, the relationship between economic freedom and participation in physical activity is difficult to determine a priori because the substitution effect (spend less time in physical activity because the opportunity cost of time increases when economic freedom increases income) may or may not outweigh the income effect (spend more time participating in physical activity, a normal good, when economic freedom increases income), depending on individual circumstances (Humphreys and Ruseski, 2011).

While the relationship between economic freedom and health has been studied, it is small compared to the overall literature on economic freedom (Hall and Lawson, 2014). In a paper closely related to ours, Ruseski and Maresova (2014) examined economic freedom and participation in physical activity using international data from 34 countries and found a positive relationship. Other research on the relationship between economic freedom and aspects of health such as life expectancy or obesity includes Esposto and Zaleski (1999), Mixon and Roseman (2003), Stroup (2007), and Ljungvall (2013). These studies exploit variation in economic freedom across countries.

We analyze the relationship between economic freedom and participation in physical activity using data from the U.S. over the period 2001-2012. We exploit variation in economic freedom over time and across states, using data from the Fraser Institute’s Economic Freedom of North America (EFNA) project and data on participation in physical activity from a large scale annual, nationally representative survey administered by the Centers for Disease Control and Prevention. We find that greater overall economic freedom is associated with a lower likelihood of participation in physical activity. A look at the sub-components of the EFNA finds the areas called Size of Government and Takings and Discriminatory Taxation leading to decreases in the likelihood of physical activity. These results likely reflect a substitution effect, as the opportunity cost of time will be higher in states with greater economic freedom since income levels and economic growth are higher in more economically free states (Compton et al., 2011). Our results show that the effect of economic freedom on outcomes need not be uniformly positive, especially in terms of outcomes related to non-market activities related to well-being like leisure.
Economic Freedom and Economic Outcomes

The Literature on Economic Freedom

A large body of previous research shows that economic freedom is positively related to a wide variety of normatively good economic, political, and social outcomes across countries. Hall and Lawson (2014) provide an accounting of hundreds of journal articles using the Fraser Institute’s Economic Freedom of the World (EFW) index Gwartney et al. (2014) and show that in fewer than 5% of cases is economic freedom negatively related to “good” outcomes or positively related to “bad” outcomes.¹ While a recent survey by Hall et al. (2015) shows that the same is generally true for papers using the Fraser Institute’s Economic Freedom of North America (EFNA), the relative homogeneity U.S. states often leads to less straightforward results. For example, Apergis et al. (2014) find bidirectional causality between economic freedom and income inequality across U.S. states. Hoover et al. (2015) find that economic freedom is positively related to incomes of whites across states but not blacks.

While showing there are distributional concerns regarding economic freedom, especially sub-nationally, this research is typical of much of the literature in that it focuses on economic well-being. More recently, however, a growing group of scholars has broadened the scope of the potential impact of economic freedom to include subjective well-being. A growing body of research examines the relationship between economic freedom and subjective well-being, including Ovaska and Ryo (2006), Bjørnskov et al. (2010), Gropper et al. (2011), Belasen and Hafer (2012), Gehring (2013), and Nikolaev (2014). These studies, which are cross-country and cross-state, find a strong, positive relationship between economic freedom and various measures of subjective well-being.

Economic Freedom and Health – Empirics

Only a handful of studies, however, examine the relationship between economic freedom and health, broadly defined. This is even though health has been closely linked to overall subjective well-being and economic outcomes. Much of the existing evidence on economic freedom and health focuses on important health issues internationally such as longevity or infant mortality. We have not been able to find any studies on economic freedom and health at the U.S. state level.

In an early paper, Esposto and Zaleski (1999) found that life expectancy increased in countries where economic freedom increased from 1985 to 1990, based on a sample of 52 countries. However, literacy rates, an alternative quality of life measure, was not related to economic freedom. Mixon and Roseman (2003) examined the relationship between economic freedom and the male/female life expectancy ratio using international data from more than 100 countries and find weak support for the proposition that economic freedom helps to close the male/female life expectancy gap. Stroup (2007) examined the relationship between economic freedom and a variety of quality of life measures (life expectancy, infant mortality, adult literacy, percent of the population with at least a fifth grade education, and access to improved water) and found that increases in economic freedom increased life expectancy and lowered the child mortality rate, based on data from a sample of 121 countries. Economic freedom was also positively related to the other quality of life measures examined such as adult literacy rates, access to improved water sources, and percentage of two-year-old children having received the appropriate vaccinations.²

¹Hall and Lawson (2014) label outcomes as normatively good if reasonable people would view the outcome as good. Straightforward examples include income levels or life expectancy. Examples of normatively bad outcomes would be air pollution, deforestation, or unemployment.

²It is important to note that this literature merely reports cross-country regressions and does not address causality.
Ljungvall (2013) found a positive and statistically significant relationship between economic freedom and both the level and change in body mass index across a sample of 31 high income countries. Residents of countries with more economic freedom in her sample tended to be more obese. Since obesity is linked to a number of undesirable health outcomes, including heart disease and chronic conditions like diabetes, her result suggests that the effects of economic freedom on health may not be uniformly positive.

Our interest in this paper is physical activity and the possibility that state-level institutions of economic freedom influence the incentive of individuals to engage in physical activity. Greater participation in physical activity is associated with a number of desirable health outcomes, and has also been shown to increase self reported life-satisfaction (Huang and Humphreys, 2012; Rasciute and Downward, 2010; Ruseski et al., 2014). In the paper most closely related to ours, Ruseski and Maresova (2014) find that countries with more economic freedom have higher participation in sport and physical activity. They define an individual as being physically active if they report participating in sport daily or several times per week. Employing this measure of physical activity for nearly 50,000 individuals across 34 countries of varying income levels in the year 2007, they find that a country’s gross domestic product per capita and economic freedom are positively associated with higher participation in physical activity.

Economic Freedom and Health – Theory

How might economic freedom affect life expectancy, longevity infant mortality, and other aspects of health? Several channels are possible and include higher income, improved access to health care services through greater competition and supply, reduced stress, and better access to health insurance and, therefore, health care through employment.

The institutions of economic freedom are associated with higher income based on international evidence (de Haan and Sturm, 2000; Dawson, 2003; Justesen, 2008), and evidence from the United States and Canada (see discussion in Hall et al. (2015)). If health is a normal good, an increase in income will increase the demand for health; this increased demand for health will, in the long run, lead to increases in longevity and life expectancy. A healthier population is also more productive resulting in a more prosperous economy. This increased prosperity can also lead to better access to clean water and improved nutrition, which would also improve the general health of the population.

On the supply side of the health care market, increased economic freedom could increase competition among health care providers, which has the potential to improve quality of services. In the EFNA, the area Size of Government might reflect a more competitive health care sector. In addition, increased economic freedom may create incentives to innovate and provide cutting-edge procedures and medicines more broadly in the population. The increased prosperity associated with more economic freedom could provide resources that can be devoted to increased preventive medical care which would improve the general health of the population.

Economic freedom could indirectly affect health through stress. If people living in countries or states with more economic freedom spend less time worrying about government oppression, state control of living and working conditions, and are better able to provide for themselves and their family, this could reduce overall stress. Conversely, more economically free countries tend to be more competitive and more dynamic, which could reduce economic security and thereby increase overall stress. Stress has been linked to a number of serious, chronic health conditions like high blood pressure and heart disease (Lantz et al., 2005).

In the United States, given the link between health insurance and employment, economic freedom could work through its relationship to overall labor market conditions (Heller and Stephenson, 2014). If increased economic freedom increases employment, then health could be indirectly im-
proved because employment, in many cases, also means better access to health insurance, and therefore, health care. This suggests that the are a Labor Market Freedom, one of the three sub-areas of the EFNA, might be important for participation in physical activity.

How might economic freedom affect time spent in leisure time activities, like participation in physical activity? If the channel is through wages, then the effect of greater economic freedom on the demand for leisure time activities is difficult to determine \textit{a priori}. Evidence suggests that increased economic freedom increases wages and earnings, thereby increasing the opportunity cost of time. This would be best reflected in the EFNA area of Takings and Discriminatory Taxation.

All individuals face a time constraint, and must divide scarce time across work, sleep, leisure time activities, and home production activities like meal preparation and child rearing. The effect of an increase in the opportunity cost of time on these time allocation decisions is similar to the effect of a change in the price of some market good on demand for that good. The change in the price has both a substitution and an income effect. The substitution effect of an increase in the opportunity cost of time, given that increased economic freedom increases the return to an hour of work, is clear: spend more time in work and less time in all other activities. However, leisure time activities are normal goods, and the income effect generated by increases in economic freedom predicts that individuals with higher income want more of all normal goods, including leisure. If the substitution effect dominates, then increased economic freedom will be associated with less time spent in leisure time activities like participation in physical activity. If the income effect dominates, then increased economic freedom will be associated with more time spent in leisure time activities like participation in physical activities. The model developed in Humphreys and Ruseski (2011) describes these choices.

\section*{Empirical Analysis}

\subsection*{Data Description}

Data on individual participation in physical activity and other socio-demographic characteristics come from a pooled sample of individuals from the 2001 through 2012 Behavioral Risk Factor Surveillance System (BRFSS), a telephone survey conducted annually by the Centers for Disease Control and Prevention. The sample starts in 2001 because the questions about participation in physical activity changes significantly in this year. Beginning in 2010 respondents with only cell phones were included in the sample.\footnote{To deal with the demographic differences across landline versus cell phone households, the Centers for Disease Control has engaged in “raking” (iterative proportional fitting) to weight the sample to accurately reflect the state’s demographics. For more see Centers for Disease Control and Prevention (2012).} The BRFSS is a random representative sample of the population over the age of 18 in each U.S. state. The survey contains uniform state-specific data on preventative health factors, behavioral risk factors, and other economic and demographic characteristics and includes a rotating selection of modules one of which is on exercise and physical activity. These data are widely used in studies of health behavior, including physical activity.

The survey asks about general health, and specific healthy behaviors like participation in physical activity, which provides a relatively complete picture of self reported health. The survey also asks questions about demographic characteristics like age, gender, race, ethnicity, and marital status, and questions about economic factors like income and labor market participation. This makes the BRFSS data an ideal setting for examining health outcomes. We use data from the annual surveys 2001-2012 through and only use data for individuals who responded to the question about income.

The BRFSS is a random representative sample of the population over the age of 18 in each U.S. state. The survey contains uniform state-specific data on preventative health factors, behavioral risk factors, and other economic and demographic characteristics and includes a rotating selection of modules one of which is on exercise and physical activity. These data are widely used in studies of health behavior, including physical activity.
The income variable in the BRFSS is reported in ranges. Following Humphreys and Ruseski (2007) and Humphreys and Ruseski (2011) we code the income variable at the midpoint of the range and deflate this variable using the CPI-U, the Consumer Price index for All Urban Consumers. This procedure forces the effect of income on health-related variables to be linear. As an alternative, we could use indicator variables for income reported in each range, which would allow the effect of income on health-related variables to be non-linear. However, the variables cannot be expressed in real terms using this approach. The results reported below are not sensitive to this alternative income variable.

The number of individuals surveyed in BRFSS are large, even after excluding individuals who did not answer the income question. In 2001, 170,462 persons surveyed answered the question about income. The sample size increased in subsequent years; 295,822 persons were surveyed in the 2005 BRFSS survey, and by 2011 over 400,000 people participated in the survey and answered the income question. The complete pooled data set contains about 3.6 million observations.

We focus on the decision to participate in physical activity. The physical activity variable is an indicator variable that is equal to one if the individual answered yes to the question:

“During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?”

While this is a relatively low threshold for participation in physical activity, this question appears in all years of the BRFSS in the same form and represents a consistent identification of participation in physical activity. Ideally, information about time spent participating in physical activity would be analyzed. The BRFSS contained detailed information about time spent, and specific activities participated in up until 2000. After 2000, the survey was revised to include only the question above, so we lack recent information about time spent in for this sample period.

Table 1 shows some basic summary statistics for our sample of individuals in the BRFSS. Average reported household income is about $56,690 in real 2010 dollars. The average age is 52. The average level of education for individuals is about 13.7 years, suggesting that the average participant had some education beyond high school. The sample skews female, as only about 40% are male. More than half the individuals in the sample are married and more than half are employed. About a quarter of the sample are retired.

Nearly three-fourths of individuals in the sample report participating in physical activity in the past month. This is a relatively high participation rate, but the survey question eliciting this information is broad, and specifically includes common activities like walking and gardening. While these individuals report participating in some form of physical activity, they might not reach levels required to generate important health benefits.

The economic freedom index, and its sub-components, come from the Fraser Institute’s Economic Freedom of North America (EFNA) project (Stansel and McMahon, 2013). The EFNA sub-national index is constructed entirely from third-party data drawn from sources such as the US Census Bureau and Statistics Canada. As this study focuses on US health outcomes, we do not employ the data on Canadian provinces. Stansel and McMahon (2013) identify ten economic variables consistent with their definition of economic freedom and use those variables to construct...
Table 1: Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>mean</th>
<th>sd</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income (000) 2010 dollars</td>
<td>56.69</td>
<td>40.51</td>
<td>4.75</td>
<td>141.62</td>
</tr>
<tr>
<td>Age</td>
<td>52.62</td>
<td>16.74</td>
<td>18.00</td>
<td>99.00</td>
</tr>
<tr>
<td>Years of Education</td>
<td>13.67</td>
<td>2.15</td>
<td>0.00</td>
<td>16.00</td>
</tr>
<tr>
<td>Female</td>
<td>0.599</td>
<td>0.49</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Married</td>
<td>0.558</td>
<td>0.50</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Employed</td>
<td>0.566</td>
<td>0.50</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Retired</td>
<td>0.234</td>
<td>0.42</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Active</td>
<td>0.748</td>
<td>0.43</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Economic Freedom Index - Overall</td>
<td>6.63</td>
<td>0.69</td>
<td>4.43</td>
<td>8.18</td>
</tr>
<tr>
<td>Economic Freedom Index - Labor Market</td>
<td>6.81</td>
<td>0.51</td>
<td>5.24</td>
<td>8.34</td>
</tr>
<tr>
<td>Economic Freedom Index - Size of Government</td>
<td>6.43</td>
<td>1.06</td>
<td>3.10</td>
<td>8.60</td>
</tr>
<tr>
<td>Economic Freedom Index - Takings/Taxes</td>
<td>6.65</td>
<td>0.878</td>
<td>4.23</td>
<td>9.40</td>
</tr>
</tbody>
</table>

Observations: 3,665,309

an index of economic freedom for each state. For example, their Component 1A is general government consumption as a percentage of a state’s economy. Higher government consumption in a state therefore lowers its economic freedom in the EFNA. It is important to note that this is strictly an application of their definition of economic freedom, not a normative statement about the value of government consumption on the margin. A listing of the ten components can be found in Table 2.

Table 2: EFNA Components

<table>
<thead>
<tr>
<th>Area/Component</th>
<th>Variable Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>General Consumption Expenditures by Government as a % of GDP</td>
</tr>
<tr>
<td>1B</td>
<td>Transfers and Subsidies as a % of GDP</td>
</tr>
<tr>
<td>1C</td>
<td>Social Security Payments as a % of GDP</td>
</tr>
<tr>
<td>2A</td>
<td>Total Tax Revenue as a % of GDP</td>
</tr>
<tr>
<td>2B</td>
<td>Top Marginal Income Tax Rate and the Income Threshold at Which it Applies</td>
</tr>
<tr>
<td>2C</td>
<td>Indirect Tax Revenue as a % of GDP</td>
</tr>
<tr>
<td>2D</td>
<td>Sales Taxes Collected as a % of GDP</td>
</tr>
<tr>
<td>3Ai</td>
<td>Minimum Wage Legislation</td>
</tr>
<tr>
<td>3Aii</td>
<td>Government Employment as a % of Total State Employment</td>
</tr>
<tr>
<td>3Aiii</td>
<td>Union Density</td>
</tr>
</tbody>
</table>


Each of the ten components is then placed on a 0-10 scale, with 0 representing a low amount of economic freedom and 10 representing a high amount. These ten components are then placed into one of three areas: Size of Government, Takings and Discriminatory Taxation, and Labor Market Regulation. For example, Component 1A is placed in the Size of Government area while government employment as percentage of state employment is a component placed in the Labor Market Regulation area. Within each area, the components are aggregated into a 0-10 index, which
is then aggregated using equal weights across area into an overall index number for each state. In 2011 the most economically free state in their index was South Dakota with a score of 7.9 and the least free was New York (5.4). The state with the lowest economic freedom in 2001 was West Virginia (5.2) and the most free economically was Delaware (8.2). While states have changed their ratings and rankings over time, the average economic freedom score at the subnational level has gone from a 6.7 in the first year of measurement (1981) to 6.6 in 2011.

**Empirical Approach**

We estimate linear reduced form models explaining the decision to participate in physical activity as reported in the BRFSS. These models take the form

\[
P_{Ai} = \alpha_s + \gamma_t + \beta_i X_{ist} + \beta_{ef} EFi_{jst} + u_{ist}
\]

where \(P_{Ai} \) is an indicator variable for reported physical activity for individual \(i\) living in state \(s\) in survey year \(t\), \(\alpha_s\) is a state-specific indicator variable, \(\gamma_t\) is a year-specific effect, \(X_{ist}\) is a vector of characteristics of individual \(i\), \(EFI_{jst}\) is economic freedom index \(j\) for state \(s\) in year \(t\). We use four different economic freedom indexes \((j = 1, 2, 3, 4)\): the overall economic freedom index, the economic freedom size of government index, the economic freedom from takings and discriminatory taxes index and the economic freedom in labor market index. \(u_{ist}\) is an unobservable equation error term which captures other factors that affect the observed health outcomes. \(\beta_i\) and \(\beta_{ef}\) are unobservable parameters to be estimated.

We estimate the parameters of Equation (1) using ordinary least squares, the Linear Probability Model (LPM).\(^6\) Since the economic freedom index varies only by state, but the health outcome measures varies by individual, we cluster correct the estimated standard errors at the state level.\(^7\)

The economic freedom measures, \(EFI_{jst}\), could be correlated with unobservable factors that affect an individual’s decision to participate in physical activity, \(u_{ist}\). In this case, an endogeneity problem exists, which would affect econometric estimates of the parameters of interest, \(\beta_{ef}\). The robustness checks below use an instrumental variables (IV) approach to correct for this, and find no evidence that endogeneity, or reverse causality, affect the LPM results.

**Results**

Table 3 contains parameter estimates from Equation (1) and t-statistics based on cluster corrected estimated standard errors using the overall economic freedom index in column 1 and each of the sub-components entering in separately in columns 2-4 (along with individual characteristics). These models contain state-specific intercepts and year-specific intercepts for each state and year in the sample. The state-specific intercepts control for unobservable heterogeneity across states that affect the decision of individuals in each state to participate in physical activity. These factors include general weather conditions, factors related to the built environment (roads, sprawl, presence of sidewalks), the general attitude toward participation on physical activity in the state, state policies to encourage physical activity (or to encourage inactivity by encouraging driving instead of walking or biking), and access to fitness facilities, gyms, recreation facilities, and other places where physical

\(^6\)In situations with a dichotomous dependent variable, the LPM is fairly standard in the health economics literature for reasons of interpretability identifying causal relationships with dichotomous endogenous regressors. Some recent health papers that use the LPM and BRFSS data include Choi (2011), Wehby and Courtemanche (2012), and Tefft and Kageleiry (2014). Our results are robust to estimation with probit.

\(^7\)It is important to note that this negates one argument typically raised against the LPM, namely that the standard errors will be incorrect because of heteroskedasticity.
activity and exercise takes place. The year-specific intercepts control for unobservable heterogeneity that affects the decision of all individuals in the sample to participate in physical activity across years in the sample. These factors include business cycle effects, national-level weather variation, and changes in federal government policies that systematically affect the decision to participate in physical activity or the opportunity cost of time.

Table 3: Empirical Results - LPM of Participation in Physical Activity and Economic Freedom

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income (000) 2010 dollars</td>
<td>0.001***</td>
<td>0.001***</td>
<td>0.001***</td>
<td>0.001***</td>
</tr>
<tr>
<td></td>
<td>46.30</td>
<td>46.30</td>
<td>46.27</td>
<td>46.19</td>
</tr>
<tr>
<td>Age</td>
<td>-0.003***</td>
<td>-0.003***</td>
<td>-0.003***</td>
<td>-0.003***</td>
</tr>
<tr>
<td></td>
<td>-46.01</td>
<td>-46.05</td>
<td>-46.02</td>
<td>-45.99</td>
</tr>
<tr>
<td>Years of Education</td>
<td>0.030***</td>
<td>0.030***</td>
<td>0.030***</td>
<td>0.030***</td>
</tr>
<tr>
<td></td>
<td>77.53</td>
<td>77.62</td>
<td>77.48</td>
<td>77.52</td>
</tr>
<tr>
<td>Female</td>
<td>-0.014***</td>
<td>-0.014***</td>
<td>-0.014***</td>
<td>-0.014***</td>
</tr>
<tr>
<td></td>
<td>-5.10</td>
<td>-5.10</td>
<td>-5.10</td>
<td>-5.10</td>
</tr>
<tr>
<td>Married</td>
<td>0.008***</td>
<td>0.008***</td>
<td>0.008***</td>
<td>0.008***</td>
</tr>
<tr>
<td></td>
<td>7.07</td>
<td>7.13</td>
<td>7.07</td>
<td>7.07</td>
</tr>
<tr>
<td>Employed</td>
<td>0.045***</td>
<td>0.045***</td>
<td>0.045***</td>
<td>0.045***</td>
</tr>
<tr>
<td></td>
<td>19.61</td>
<td>19.63</td>
<td>19.60</td>
<td>19.62</td>
</tr>
<tr>
<td>Retired</td>
<td>0.103***</td>
<td>0.103***</td>
<td>0.103***</td>
<td>0.103***</td>
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<tr>
<td></td>
<td>36.70</td>
<td>36.69</td>
<td>36.68</td>
<td>36.74</td>
</tr>
<tr>
<td>Economic Freedom Index - Overall</td>
<td>-0.013**</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>-3.32</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Economic Freedom Index - Labor Market</td>
<td>—</td>
<td>-0.002</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>-0.38</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Economic Freedom Index - Size of Government</td>
<td>—</td>
<td>—</td>
<td>-0.008***</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>—</td>
<td>-3.95</td>
<td>—</td>
</tr>
<tr>
<td>Economic Freedom Index - Takings/Taxes</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>-0.007*</td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>-2.31</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.083</td>
<td>0.083</td>
<td>0.083</td>
<td>0.083</td>
</tr>
<tr>
<td>State &amp; Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The top seven rows on Table 3 contain parameter estimates of the effects of individual-level characteristics on the decision to participate in physical activity. These parameter estimates are all statistically significant, as should be expected in a sample of this size. The signs are all consistent with previously reported estimates in the literature. Since the results come from a LPM, the parameter estimates can be interpreted as the increase in the probability that a given individual participates in physical activity. Participation in physical activity increases with income and decreases with age. More educated people are more likely to participate in physical activity, even when controlling for income. Males and married persons are more likely to participate in physical activity. Both working and retired people are more likely to participate in physical activity than the unemployed. All these estimated signs support the idea that the decision to participate in physical activity is an economic decision and are consistent with findings from previous studies on
the decision to participate in physical activity (Farrell and Shields, 2002; Humphreys and Ruseski, 2007; Hawkins et al., 2009; Eberth and Smith, 2010; Brown and Roberts, 2011; Humphreys and Ruseski, 2011; García et al., 2011; Humphreys and Ruseski, 2015).

Note that we control for the effect of individual-level characteristics on the decision to participate in physical activity, but we cannot control for any sorting effects in this context. If people who are more likely to participate in physical activity tend to move to states with more economic freedom, then our results will be biased up, in terms of the estimated effect of economic freedom on the PA participation decision.

The bottom four rows on Table 3 contain the parameter estimates of interest, on the overall economic freedom and then its sub-component areas. These parameter estimates show the effect of increasing economic freedom, as reflected in differences in estimated economic freedom across US states, on the probability that an individual participates in physical activity. For the overall economic freedom index the parameter estimates are negative and statistically significant at conventional levels. Individuals in states with more economic freedom are less likely to participate in physical activity, other things equal. A one unit increase in overall economic freedom is associated with a 1.3 percent decline in the probability of participation in physical activity. The same statistically significant relationship holds when we include just the Size of Government and Takings and Discriminatory Taxation areas in separately, although the quantitative effects are smaller.

Again, we interpret this effect as reflecting the fact that increasing economic freedom increases the return to an hour of work, and that the existence of a hard time constraint means that individuals who respond to this increase in the return to an hour of work by supplying more labor to the market place must reduce time spent on physical activity and other leisure time activities. In this sense, the increase in the return to an hour of work is effectively an increase in the price of leisure. The substitution effect associated with this price increase on time allocation decisions dominates the income effect of this price change, in terms of the total effect on physical activity participation decisions.

Ruseski and Maresova (2014) found that countries with more economic freedom have higher participation in sport and physical activity, based on a sample of individual level data from 34 countries, including the United States, in a single year, 2007. This study included measures of individual characteristics that are typically included in studies of the determinants of participation in physical activity such as age, education, sex, marital status, household size, and employment status. GDP per capita was included in the vector of country level characteristics. We find the opposite relationship using data from only the US states over the period 2001-2012. One reason for this difference may lie in the way the participation in physical activity data are collected. Recall that the BRFSS asks respondents if they participated in physical activity during the past month. The International Social Survey Programme (ISSP), the source of the individual level data in Ruseski and Maresova (2014), asks how often individuals engage in specific activities like walking and going to the gym. Possible responses included “daily”, “several times a week”, “several times a month”, “several times a year”, and “never”. The reported participation rates in Ruseski and Maresova (2014) are substantially lower than the participation rates in the BRFSS. None of the monthly participation rates in Ruseski and Maresova (2014) are higher than 25%, and the monthly US participation rate is 18%, while the participation rate in our BRFSS sample is substantially higher. The specific wording of the ISSP questionnaire clearly elicits different reported participation rates. BRFSS respondents appear to have a much more liberal interpretation of what it means to participate in physical activity than the ISSP respondents.

If the individuals who respond “yes” to the BRFSS survey question about participation in physical activity but would respond “no” to the ISSP survey question about participation (“switchers”) differ systematically from the individuals who would respond “yes” to both (“constants”), then the
results could differ dramatically. In particular, if increasing economic freedom affects switchers in a different way than constants, then the estimated sign on the parameters on the economic freedom variables could flip. In any event, the fact that the BRFSS participation rate exceeds the ISSP participation rate by a very large margin suggests that the results cannot be easily compared.

An additional consideration is that the measure of economic freedom employed in Ruseski and Maresova (2014) was the EFW index (Gwartney et al., 2014). This is important for two reasons. First, the EFW contains 42 different components and is therefore a much richer measure of economic freedom. To give but one important difference, the EFW measures differences in property rights and rule of law across countries but the EFNA is unable to do so at the state level. This is especially important given Rode (2013), who finds that property rights and a well-functioning legal system are much more important to subjective well-being in developed countries compared to developing countries. Second, the variation in economic freedom, even across the limited number of countries in Ruseski and Maresova (2014), is much greater than the variation within a federation of states like the US. Finally, the estimated relationship between economic freedom and physical activity is the average effect, holding all else constant, across 34 countries.

Robustness Checks

The results above come from linear probability model (LPM) estimates of a reduced form model for the determination of participation in physical activity. While this approach has been used extensively in the literature, it has a few potential limitations. First, the LPM has some limitations in terms of its asymptotic properties. Horrace and Oaxaca (2006) show that the LPM can generate biased and inconsistent estimates under some conditions, and advocate the use of probit or logit, despite the distributional assumptions associated with these estimators.

Second, the reduced form empirical model, Equation (1), may have endogeneity problems. These problems would arise if the economic freedom indexes are correlated with unobservable factors that affect the decision to participate in physical activity captured by the equation error term, $u_{ist}$, in Equation (1). In this case, the LPM estimator could also be biased and inconsistent.

We address both these issues by estimating an instrumental variables probit model. This alternative estimator addresses the LPM limitations identified by Horrace and Oaxaca (2006) and any potential endogeneity problems arising from correlation between the economic freedom indexes and unobservable factors affecting the decision to participate in physical activity. We use the standard two-step IV probit estimator that first estimates OLS models with each economic freedom index as the dependent variable and then uses the fitted values from these models in place of the actual economic freedom indexes in the second stage probit models.

The two-step IV approach requires an exclusion restriction to work. The first stage OLS model must include a variable that explains observed variation in the economic freedom indexes and is also uncorrelated with the unobservable factors that affect the decision to participate in physical activity captured by the equation error term, $u_{ist}$, in Equation (1). Like the economic freedom indexes, this instrument must vary across states and over time, which greatly reduces the number of possible instruments in this setting.

We use real Gross State Product per capita in the finance and insurance sector (NAICS 52) as an instrument. The US Bureau of Economic Analysis (BEA) produces annual estimates of Gross State Product for most NAICS/SIC industry groups, as well as annual state population estimates.\(^8\) From the NAICS handbook, the finance and insurance sector "comprises establishments primarily engaged in financial transactions (transactions involving the creation, liquidation, or change in

\(^8\)Available at http://www.bea.gov/industry/index.htm.
ownership of financial assets) and/or in facilitating financial transactions.” Principal activities of these firms include raising funds, pooling of risk through insurance, and facilitating financial intermediation.

All of these activities are related to economic freedom, so this variable should explain observed variation in economic freedom over time and across states. Existing models of individual participation in physical activity predict that only the health club and gym sector, which affects access to fitness facilities, would affect an individual’s decision to participate in physical activity; other sectors of the economy should not be related to this decision. The size of the finance and insurance industry, relative to the population in each state, should be uncorrelated with unobservable factors that affect an individual’s decision to participate in physical activity.

Table 4: Empirical Results - IV Probit Model

<table>
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<tr>
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<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
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<tbody>
<tr>
<td>Income (000) 2010 dollars</td>
<td>0.005***</td>
<td>0.005***</td>
<td>0.005***</td>
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</tr>
<tr>
<td></td>
<td>192.61</td>
<td>193.30</td>
<td>192.05</td>
<td>192.14</td>
</tr>
<tr>
<td>Age</td>
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<td>-0.010***</td>
<td>-0.010***</td>
<td>-0.010***</td>
</tr>
<tr>
<td></td>
<td>-167.05</td>
<td>-167.04</td>
<td>-167.05</td>
<td>-166.97</td>
</tr>
<tr>
<td>Years of Education</td>
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<td>0.090***</td>
<td>0.090***</td>
<td>0.090***</td>
</tr>
<tr>
<td></td>
<td>228.36</td>
<td>228.44</td>
<td>228.16</td>
<td>228.42</td>
</tr>
<tr>
<td>Female</td>
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<td>-0.043***</td>
<td>-0.043***</td>
<td>-0.043***</td>
</tr>
<tr>
<td></td>
<td>-26.35</td>
<td>-26.36</td>
<td>-26.35</td>
<td>-26.35</td>
</tr>
<tr>
<td>Married</td>
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<td>0.020***</td>
<td>0.020***</td>
<td>0.020***</td>
</tr>
<tr>
<td></td>
<td>11.77</td>
<td>11.83</td>
<td>11.75</td>
<td>11.72</td>
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<tr>
<td>Employed</td>
<td>0.123***</td>
<td>0.124***</td>
<td>0.123***</td>
<td>0.123***</td>
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<tr>
<td></td>
<td>59.11</td>
<td>59.13</td>
<td>59.09</td>
<td>59.02</td>
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<tr>
<td>Retired</td>
<td>0.307***</td>
<td>0.307***</td>
<td>0.307***</td>
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<tr>
<td></td>
<td>116.23</td>
<td>116.23</td>
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</tr>
</tbody>
</table>

Economic Freedom Index - Overall
-0.046
-1.80

Economic Freedom Index - Labor Market
-0.055
-1.82

Economic Freedom Index - Size of Government
-0.037
-1.81

Economic Freedom Index - Takings/Taxes
-0.053

First Stage Stock-Yogo F-Statistic
32.8
24.3
31.1
10.8

Observations
3,292,348
3,292,348
3,292,348
3,292,348

Table 4 contains parameter estimates, estimated t-statistics, and other diagnostic statistics for instrumental variables probit model estimates of the decision of individuals to participate in physical activity. The parameter estimates shown on Table 4 are probit parameter estimates; their magnitude cannot be directly compared to the LPM parameter estimates on Table 3.

The first stage regression is an OLS regression that includes real Gross State Product per capita in the finance and insurance sector as the exclusion restriction. The standard Stock-Yogo first stage F-statistic for instrument strength is at the bottom of the table (Stock and Yogo, 2002). The first-stage F-statistic exceeds 10 in all three models, suggesting that our instrument is not weak in this
The parameter estimates on the individual-level characteristics are all statistically significant at conventional levels and have the same sign as the corresponding estimates on Table 3. These results are robust to estimator choice and the IV endogeneity correction.

While the Stock-Yogo F-statistic has been widely used as a diagnostic tool for assessing instrument strength, it has been criticized in the literature, and some well-known limitations exist. See Mikusheva (2013) for a discussion of these limitations.

The parameter estimates on the economic freedom indexes from the IV probit approach have the same sign as the corresponding estimates on Table 3 in all four models. However, none of these parameter estimates are statistically significant at the 5% level. The P-value on the test of the null hypotheses that these parameters are equal to zero is about 0.07. This outcome is to be expected. The two-step IV estimator loses efficiency when compared to single equation methods because the fitted values for the endogenous regressor must be estimated (Murray, 2006). Increases in estimated standard errors can be expected when a two-step IV estimator is used instead of a single-equation approach. The P-values on the estimated parameters on the economic freedom index variables increase from about 0.02 to about 0.07 when the two-step IV approach is used, but the signs do not change. Thus the estimated impact of economic freedom on the likelihood of individual participation in physical activity also appears robust to estimator choice and the IV endogeneity correction.

Conclusions

We find consistent evidence using both the LPM and a two-stage IV approach that individuals living in states with higher levels of economic freedom have lower rates of participation in physical activity. Additionally, we find that the areas of the EFNA associated with lower rates of physical activity are the Size of Government and Taxings and Discriminatory Taxation areas. These results - especially the area results - appear consistent with economic freedom increasing the price of physical activity by increasing the return to an hour of work. Given that Ruseski and Maresova (2014) found that countries with more economic freedom have higher levels of physical activity, however, further research on the relationship between economic freedom and physical activity appears warranted.

This future research could take several paths. The Canadian Community Health Survey (CCHS) contains detailed information about participation in physical activity, including indicators for specific types of physical activity and information about time spent in participation. Since the EFNA includes sub-national indices for Canadian provinces, this analysis could be extended to the Canadian setting to determine if this relationship exists there as well. This would provide some evidence of our results being generalizable to other high-income countries. Increasing economic freedom could have a differential effect on the extensive and extensive margins of participation in physical activity. Humphreys and Ruseski (2011) find that a number of factors affect intensive and extensive margins differently.

Alternatively, US data sources that include information about time spent in physical activity, for example the American Time Use Survey (ATUS), could be analyzed using this approach. The ATUS can be linked to detailed labor market data through the Current Population Survey, which would provide much better estimates of the hourly wage, allowing for a formal test of the effect of the opportunity cost of time on participation.

The policy implications of our findings for well-being are less clear than the direction of our

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Stock and Yogo (2002) provide more precise critical values for weak instruments. This is especially important when there are multiple instruments or endogenous regressors. For cases with one instrument and one endogenous regressor, the rule of thumb of 10 is appropriate.
results. Maximizing the probability of engaging in some form of physical activity is not the same thing as maximizing well-being. While participation in physical activity does increase individual happiness (Huang and Humphreys, 2012), so does income, even when controlling for the disutility of work (Pouwels et al., 2008). If a trade-off between participation in physical activity and labor market activity exists, policy makers would need to consider the overall social impact of each when determining which goal to pursue.
References


