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# PANEL DATA ANALYSIS OF THE IMPACT OF ECONOMIC FREEDOM AS WELL AS ECONOMIC CONDITIONS, THE QUALITY OF LIFE, AND PUBLIC EDUCATION SPENDING ON U.S. UNDOCUMENTED IMMIGRANT SETTLEMENT PATTERNS

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## ABSTRACT

*This study seeks to identify key factors influencing the geographic settlement pattern of undocumented immigrants in the U.S., with a particular emphasis on the impact of economic freedom, and to extend the OLS findings in previous related studies. Indeed, this study adds to the literature in several ways. First, it provides current insights into the link between the settlement patterns of undocumented immigrants in the U.S. and economic freedom. Second, the study adopts a panel data-set and provides estimates using cross-section fixed-effects. Third, this study also endeavors to provide further insights into the impacts on the settlement patterns of undocumented immigrants of non-economic-freedom economic conditions, as well as the quality of life and spending on primary and secondary public education. The various state fixed-effects estimates provided in the present study yield several conclusions. In particular, according to these estimations, the settlement pattern of undocumented immigrants in the U.S is inversely a function of colder climates, higher crime rates, higher population density, and a higher cost of living. In addition, the interstate distribution of undocumented immigrants to the U.S. is positively a function of the annual per pupil outlays on public primary and secondary education; it is also positively a function of the degree of economic freedom, the principal focus of this study.*

**Keywords:** Undocumented immigrant settlement patterns, Economic freedom, Economic factors, Quality of life, Panel data analysis.

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## Contribution/ Originality

This study contributes to the literature by providing contemporary insights into the factors influencing settlement patterns of undocumented immigrants in the U.S. using panel data. It is also one of the few studies to examine the influences of economic freedom and primary and secondary public school outlays.

## 1. INTRODUCTION

Numerous studies have been expressly conducted to investigate the impact of economic freedom and certain institutional frameworks (such as regulatory quality, political corruption, political stability, and so forth) on economic growth. Most of these empirical studies find that there exists a strong, positive impact of economic freedom, especially a measure of overall economic freedom, as well of course as measures of good governance, including good quality regulation, lower levels of corruption, and greater political stability, on economic growth and development and real income (Tortensson, 1994; Islam, 1996; Norton, 1998; Dawson, 1998;2003; Heckelman and Stroup, 2000; Ali and Crain, 2001; Gwartney *et al.*, 2006; Aidt, 2008; Clark and Lawson, 2008; Nissan and Niroomand, 2008; Hall *et al.*, 2010; Belasen and Hafer, 2013; Bennett and Vedder, 2013; Cebula *et al.*, 2013; Hall, 2013; Nikolaev *et al.*, 2013; Cebula and Mixon, 2014; Nikolaev, 2014). Central to this literature is a theory that

increased economic freedom elevates the growth/pace of economic activity through improved incentives to work, invest, save, hire, take risk, and, in general, to make more efficient market-based business and economic decisions involving production, R&D, innovation, and capital formation. In any event, these studies are of value not only to researchers but also to well-intended policymakers seeking to address the broad issues of how to elevate economic growth, create jobs, and elevate living standards. Of course, underlying this focus on the role of economic freedom in augmenting real GDP growth, in creating jobs, and in improving living standards is the fundamental, although often only implicitly stated, objective of increasing happiness (well-being) among *homo sapiens*. Arguably, were it not for this underlying goal, the findings of these studies might well be of little genuine interest and real-world significance. In recent years, there has been an expressed increased awareness of the potential linkage between increased economic freedom and this goal of increasing "human happiness." Indeed, a number of studies expressly linking greater well-being to higher levels of economic freedom have been published, including Esposito and Zaleski (1999); Frey and Stutzer (2002A;2002B); Hagerty and Veenhoven (2003); Tella *et al.* (2003); Stroup (2007); Gropper *et al.* (2011); Belasen and Hafer (2013) and Nikolaev (2014). The present study seeks to add to this literature in a number of ways. First, it provides current insights into the linkage between the settlement patterns of undocumented immigrants in the U.S. and the level of economic freedom. Second, the study adopts a panel data-set and estimates that data using cross-section fixed-effects estimations reflecting the study period 2005-2012, a period that includes pre-Great Recession years, the years of the Great Recession, and years following the Great Recession. Third, this study also endeavors to provide further insights into the impacts on the settlement patterns of undocumented immigrants of other economic conditions, as well as the quality of life and spending on primary and secondary public education.[1] The settlement pattern decision process of undocumented immigrants is treated as a reflection of their active pursuit of greater well-being. Thus, this study employs a well-being maximization model to explore the impact of these four sets of factors on undocumented immigrant settlement patterns. Following Belasen and Hafer (2013); Cebula *et al.* (2013); Cebula and Mixon (2014) and Nair-Reichert (2015) we work with available state-level data for the U.S. This study is motivated in part by the fact that, given the magnitude of these undocumented immigrants in the U.S., their geographic distribution has implications for the pattern of economic growth and development and for state and local government finances.

## 2. PRIOR RELATED RESEARCH

Undocumented or illegal immigration has been a serious political and economic issue in the U.S., especially during the past decade. Policies recommended for addressing the "problem" have ranged from increasing border security and sterner deportation policies to publicly provided opportunities that can provide/pave a direct pathway to U.S. citizenship. Arguably, the need for a policy solution to undocumented immigration to the U.S. is reflected in the certain statistics. For example, in the year 2012, there were an estimated 11.2 million undocumented immigrants residing in the U.S., about 76% of which were Hispanic, including 59% from Mexico (Pew Research Center, 2013, p. 1); undocumented immigrants composed an estimated 5.2% of the U.S. labor force in 2012 (Pew Research Center, 2013). Regarding the skill level of these undocumented immigrants, the Pew Research Center (2013) finds that they constitute approximately 24% of all workers in farming occupations, 17% in cleaning occupations, 14% in construction, and 12% in food preparation industries. In addition, the issue of immigration, especially undocumented immigration, has recently become the subject matter of scholarly research that addresses a

[1] Interestingly, the latter variables has not heretofore been investigated in this context.

variety of diverse topics.[2] For instance, Mavisakalyan (2011) examines the issue of undocumented immigration and its implications for public education spending and private schooling. Mavisakalyan (2011) investigates the impact on private school enrollment through the mechanism of public primary and secondary education outlays, finding that a growing immigrant share of the population raises enrollment in private schools, confirming similar conclusions in previous studies by Betts and Fairlie (2003); Gerdes (2013) and Gradstein and Justman (2000;2002). As Mavisakalyan (2011) states it, "Immigration may contribute to private school enrollment…[as] suggested by recent micro-level studies that document 'native flight' from public to private schools in response to inflows of immigrants." Other topics have also been examined regarding undocumented immigrants. For example, Nair-Reichert (2015); Flores and Horn (2009) and Kaushal (2008) have studied the effects of granting in-state tuition to undocumented immigrants wishing to attend public colleges and universities. Alternatively, Koch (2008) investigates the impact of undocumented immigration on identity theft (ID theft) in the U.S., finding strong empirical evidence that identity theft is an increasing function of the extent of undocumented immigration. From yet a different perspective, Hanson (2006) investigates reasons underlying the increased flow of undocumented immigrants from Mexico to the U.S. He finds that there are three specific contributors to this phenomenon: (1) an increase in the size of the working-age population as a percentage of the total population in Mexico; (2) greater volatility in U.S.-Mexico relative wages; and (3) changes in U.S. immigration policies. Related to the latter, Hanson (2006) observes that although U.S. law requires authorities to prevent illegal immigration and take punitive measures against firms employing undocumented immigrants, there has often been relatively lax enforcement of these laws, a view shared by the Congressional Research Service (2006). Finally, four recent studies, Cebula *et al.* (2013); Cebula *et al.* (2014); Nair-Reichert (2015) and Cebula (2015) have focused on identifying factors influencing the settlement pattern of undocumented immigrants in the U.S. Cebula *et al.* (2013) find that warm climate, higher median family income, and higher overall economic freedom all act to attract this population cohort. Meanwhile, Cebula *et al.* (2014) find that illegal immigrants, while attracted to warmer climates and higher median income levels, have an aversion to settling in states where the unionization rate is higher, arguably because joining a union might increase detection of their illegal presence in the U.S. and ultimately elevate deportation risks. Meanwhile, even more recently, Cebula (2015) found preliminary evidence for the year 2010 that "Sanctuary cities" may have acted to attract undocumented immigrants to the U.S. Finally, Nair-Reichert (2015) studies the impact of educational access to higher public education on the location decisions of undocumented migrants in the U.S. Nair-Reichert (2015) finds that undocumented migrants locate in states with higher median income and large pre-existing clusters of other undocumented migrants. However, the effect of financially easier educational access to higher public education is found to have very little impact on the settlement pattern of this group.

## 3. THE FRAMEWORK

In this study, the undocumented migrant is treated as viewing the decision to migrate to the U.S. ultimately as a utility-maximizing/well-being-maximizing behavior. Once the decision to migrate to the U.S. is made, the settlement pattern of undocumented immigrants in this destination country reflects a decision-making process intended to maximize well-being. In other words, undocumented immigrants settle in those states that are expected to best meet their economic and non-economic needs and thereby to maximize their well-being. More specifically, for the *representative* undocumented immigrant in the U.S., individual *i*, the settlement pattern decision is treated in this study as a benefit-cost analysis intended to maximize *i*'s well-being:

[2] The PRC (2013). refers to an "unauthorized migrant" as a "…person who resides in the U.S. but is not a U.S., citizen, has *not* been admitted for permanent residence, and is *not* in a set of specific authorized temporary statuses permitting longer-term residence and work.

$$\text{MAX: } EWB_{ij} = f(EGB_{ij}, EGC_{ij}) \quad (1)$$

where $EWB_{ij}$ = representative individual $i$'s expected *net* well-being from settling in (residing in or migrating to) state $j$; $EGB_{ij}$ = representative individual $i$'s expected gross benefits/well-being associated with settling in (residing in or migrating to) state $j$; and $EGC_{ij}$ = representative individual $i$'s expected gross costs/reduced well-being associated with settling (residing in or migrating to) state $j$. Following the conventional wisdom, it is expected that: $f_{EGB_{ij}} > 0$; $f_{EGC_{ij}} < 0$ (2)

Following in principle the prior models of domestic U.S. migration in Renas (1983); Vedder *et al.* (1986); Saltz (1998) and Cebula and Alexander (2006) among others, as well as the studies of this immigrant cohort by Cebula *et al.* (2013); Cebula *et al.* (2014); Nair-Reichert (2015) and Cebula (2015) the factors that influence $EGB_{ij}$ and $EGC_{ij}$ consists in this study of three broad sets of institutional, economic, and quality-of-life considerations. These three sets of variables are, as follows:

1. Economic conditions in the states, including those impounded in the variable for economic freedom in state $j$ in year $t$, $ECONFREE_{jt}$, the variable reflecting the average cost of living in state $j$ in year $t$, $COST_{jt}$, and a measure of income potential in state $j$ in year $t$, i.e., median income, $MEDINC_{jt}$;
2. Quality-of-life conditions in the states, including those embedded in this study in the variables reflecting climatic conditions in state $j$ in year $t$, i.e., heating degree days ($HDD_{jt}$) and cooling degree days ($CDD_{jt}$), the crime rate in state $j$ in year $t$ ($CRIME_{jt}$), and population density in state $j$ in year $t$ ($POPDEN_{jt}$); and
3. Public/government policies in the states, including not only those embedded in the variable $ECONFREE_{jt}$ but also those reflected in per pupil state and local government expenditures on public primary and secondary education in state $j$ in year $t$, $PPEDSP_{jt}$.

The dependent variable, $SETTLE_{jt}$, indicates the percentage of the population in state $j$ that is estimated to consist of undocumented immigrants in year $t$. Expressing the latter as a percent of the state's total population permits comparisons of the undocumented immigrant settlement pattern across state lines. In effect, this variable can be regarded largely as a *de facto* cumulative net in-migration rate of undocumented immigrants. The value of $SETTLE_{jt}$ is positive for all states. The estimate of the total undocumented immigrant population residing in the U.S. was estimated at 11.2 million for the most recent year in this study, 2012, the data for which were estimated with rigorous methodologies according to the PRC (2013).[3] As observed above, in order to reflect economic conditions/prospects in state $j$ for the estimations provided in this study, three factors are adopted in the initial model. The first of these is economic freedom. The conventional wisdom is that individuals have economic freedom when the property they acquire without the use of force, fraud, or theft is protected from physical invasions by others and they are free to use, exchange, or give away their property so long as their actions do not violate the identical rights of others. Thus, "…an index of economic freedom should reflect the extent to which rightly acquired property is protected and individuals are engaged in voluntary transactions" (Gwartney *et al.*, 1996). Ruger and Sorens (2009) similarly offer the definition of individual economic freedom as being "…the ability to dispose of one's own life, liberty, and justly acquired property however one sees fit, so long as one does not coercively infringe on another's ability to do the same." Clearly, those economies that are the "freest" are those that operate with a minimal degree of government interference and instead depend upon the process of free choice and the efficiency of markets to answer the basic economic questions of what to be produced, how it is to be produced, how much is produced, and the price(s) at which the market will clear. Clearly, to the extent that governments impose

[3] For the interested reader, the highest concentrations of undocumented immigrants in 2012 were found in the so-called Texas/Louisiana/Oklahoma "zone," Florida, New York, New Jersey, Virginia, Colorado, and the so-called Arizona/Utah/Nevada "zone" ibid.

restrictions on these choices, there is less economic freedom Stansel *et al.* (2015). Typically, the greater the degree of economic freedom, the more successfully and efficiently markets perform and the greater the prosperity created through private enterprise. These outcomes from greater freedom accelerate economic growth, which in turn creates opportunities for yet further success. Given that a state with a higher degree of economic freedom by its very nature offers greater economic and entrepreneurial opportunities, our population cohort, undocumented immigrants in the U.S., should presumably prefer residence in such a state, *ceteris paribus* (Ruger and Sorens, 2009; Cebula *et al.*, 2013). There are several well-known measures (indices) of economic freedom, including those by Gwartney *et al.* (2013) the Heritage Foundation (2013) and Stansel *et al.* (2015). The Economic Freedom of North America Index (*EFNA*), as most recently generated by Stansel *et al.* (2015) is the oldest and possibly best established of the state-level indices of economic freedom for the U.S. Accordingly, this study adopts the *EFNA* economic freedom index by state generated by Stansel *et al.* (2015) whose form conforms to the other state-level data considered in this study. The subnational (state-level) index for each of the 50 states in the U.S. (*EFNA*) consists of ten variables which are divided into three equally weighted components, as follows: Area 1, Size of Government; Area 2, Takings and Discriminatory Taxation; and Area 3, Labor Market Freedom. Alternatively stated, the overall economic freedom index consists of three component freedoms: government spending freedom; freedom from government taxes; and labor market freedom. For simplicity and in the interest of space constraints, the reader is referred to Stansel *et al.* (2014;2015) and to Stansel (2013) for a detailed description and explanation of the computation of the overall economic freedom index and the variables used in that computation. It is observed that these indices in Stansel *et al.* (2015) are both geographically comparable and comparable over time. They assume values between 0.0 and 10.0, with higher index values corresponding to greater economic freedom. It is hypothesized in this study that *EGBij* is an increasing function of *ECONFREEjt*, other things held the same.

The choice of an income variable such as *MEDINCj* as a reflection of potential earnings opportunities is standard in empirical population studies (Vedder, 1976; Renas, 1983; Vedder *et al.*, 1986; Mixon, 1993; Saltz, 1998; Cebula and Alexander, 2006). Higher values of this variable can be regarded by undocumented immigrants as offering better economic prospects and thus as elevating gross expected well-being, *EGBij* (Renas, 1983; Conway and Houtenville, 1998; Gale and Heath, 2000; Frey and Stutzer, 2002B; Cebula *et al.*, 2013). Thus, it is hypothesized in this study that *EGBij* is an increasing function of *MEDINCj*, *ceteris pari*bus. The adoption of a variable such as *COSTj* has become increasingly common in migration studies of the U.S. in recent years (Renas, 1978;1983; Conway and Houtenville, 1998; Saltz, 1998; Gale and Heath, 2000; Cebula, 2014) with a higher level of this variable hypothesized in this study as being associated by undocumented immigrants already residing in the U.S. (or entering the U.S.) with a lower living standard and hence higher expected gross costs/reduced gross well-being, *EGCij*. Accordingly, it is hypothesized here that *EGBij* is a decreasing function of *COSTj*, *ceteris paribus*.

To measure quality of life conditions *per se* for undocumented immigrants in state *j*, the focus in this study is in part on climatic conditions, a consideration considered pertinent to migration patterns in general in the U.S. Cebula (2014). First, there is the variable *HDDj*, the average annual number of heating degree days in state *j*, which is regarded as a measure of *cold* climatic conditions, As in many prior studies of population settlement patterns in the U.S., the variable *HDDj*, or some reasonable substitute for *HDDj* such as average January temperatures, is considered as a potentially important influence on settlement patterns. In the case of *HDDj*, given the established finding of an aversion on the part of most people to cold weather and all that cold weather implies, e.g., snow, ice storms, blizzards, hazardous driving conditions, and so forth (Renas, 1978;1983; Conway and Houtenville, 1998; Saltz, 1998; Gale and Heath, 2000) a higher value for *HDDj* can be regarded by undocumented immigrants as elevating expected gross costs associated with residence in state *j*, *EGCij*, *ceteris paribus*. Similarly, climatic conditions involving high humidity levels combined with high temperature levels, which results in a greater

number of cooling degree days (*CDDj*), can be regarded a reducing the well-being associated with residence in state *j*, *EGCij*, *ceteris paribus* (Saltz, 1998; Cebula, 2014). Next, the overall crime rate per 100,000 population (*CRIMEj*) in a given environment can clearly be regarded as a measure of the risk associated with residence in that environment (Renas, 1978;1983; Saltz, 1998). Accordingly, for any given state *j*, the higher the overall crime rate, the less appealing residence in that state will in general be, i.e., a higher value in state *j* for the variable *CRIMEj* can be regarded a reducing the well-being associated with residence in state *j*, *EGBij*, *ceteris paribus*. Finally, the variable *POPDENj* can be viewed as a proxy for congestion and crowding in state *j* (Renas, 1978;1983; Saltz, 1998). To the extent that this perspective is valid, it is hypothesized in this study that a higher population density acts to reduce can be regarded a reducing the well-being associated with residence in state *j*, *EGBij*, *ceteris paribus*. Finally, there is the public policy variable, *PPEDSPj*. This variable, the per pupil state plus local outlays on public primary and secondary education in state *j*, arguably reflects to at least some degree the degree of commitment in state *j* to providing better quality public education, which is typically the only form of education to which most undocumented immigrants in the U.S. have access. Clearly, although undocumented immigrants may have only a limited interest in a college education (Nair-Reichert, 2015) there plausibly could be an interest in attaining a high school diploma (Nair-Reichert, 2015). Indeed, recent evidence from the PRC (2016) finds that "Educational attainment among U.S. Latinos has been changing rapidly in recent years. Over, the past decade, the Hispanic high school dropout rate has declined significantly." Furthermore, among U.S. Latinos, "…college enrollment has increased…" as well PRC (2016).

Hence, it is hypothesized in this study that higher levels of the variable *PPEDSPj* can be regarded by at least some portion of undocumented immigrants as offering better future economic prospects for their offspring and thus as elevating gross expected well-being, *EGBij*, *ceteris paribus*, which is in theory consistent with a number of previous studies (Cebula, 1978; Renas, 1978;1980;1983; Conway and Houtenville, 1998; Gale and Heath, 2000). Thus, the following model is hypothesized: $EGBij = g(ECONFREEj, MEDINCj, PPEDSPj, CRIMEj, POPDENj)$ (3)

where $g_{ECONFREEj} > 0$, $g_{MEDINCj} > 0$, $g_{PPEDSPj} > 0$, $g_{CRIMEj} < 0$, $g_{POPDENj} < 0$ (4)

and $EGCij = h(COSTj, HDDj, CDDj)$ (5)

where $h_{COSTj} > 0$, $h_{HDDj} > 0$, $h_{CDDj} > 0$ (6)

Substituting equations (3), (4), (5), and (6) into equation (1) yields:

$EWBij = k(ECONFREEj, MEDINCj, PPEDSPj, COSTj, HDDj, CDDj, CRIMEj, POPDENj)$ (7)

where

$k_{ECONFREEj} > 0$, $k_{MEDINCj} > 0$, $k_{PPEDSPj} > 0$, $k_{COSTj} < 0$, $k_{HDDj} < 0$, $k_{CRIMEj} < 0$, $k_{POPDENj} < 0$ (8)

## 4. EMPIRICAL RESULTS

Based upon the model summarized in system (7)-(8), this study now provides panel data evidence regarding the hypotheses proffered above. The 2005-2012 study period involves data for all 50 states but excludes Washington D.C., because it is not a state.[4] The model first is estimated in linear form and then in semi-log form. Table 1 provides the data sources (definitions) for the variables in the analysis, whereas Table 2 provides descriptive statistics for the variables in the model. The state fixed-effects (with cross-section weights) estimation of the system in *linear* form, with the "Effects Specification" being cross-section fixed (dummy variables), is provided in Table 3. As shown in Table 3, six of the eight estimated coefficients exhibit the expected signs, with three of these being statistically significant at the 1% level and the other three being statistically significant at the 5% level. The

[4] Data are fully available for the years 2005, 2009, 2010, 2011, and 2012.

coefficients on the *CDD* and *MEDINC* variables are not statistically significant at the 10% level (Nair-Reichert, 2015). The weighted $R^2$ and the weighted adjusted $R^2$ are 0.98 and 0.97, respectively, whereas the unweighted $R^2$ is 0.95, so that the model appears to explain nearly all the variation in the dependent variable. The F-statistic is statistically significant at the 1% level, reflecting the strength of the model estimation. According to this estimation, the geographic/interstate settlement pattern of undocumented immigrants in the U.S is a decreasing function of (is negatively associated with) colder climates (which is consistent with (Renas, 1983; Saltz, 1998; Cebula *et al*., 2013; Cebula *et al*., 2014) higher crime rates (which is compatible with (Renas, 1978;1983; Saltz, 1998)) higher population density (which parallels results in (Renas, 1978;1983; Saltz, 1998)) and a higher cost of living (paralleling studies by (Cebula, 1978; Renas, 1978;1980;1983; Saltz, 1998; Cebula *et al*., 2013; Cebula *et al*., 2014)) In addition, the interstate distribution of undocumented immigrants to the U.S. is an increasing function of (is positively associated with) the annual per pupil outlays on public primary and secondary education (Cebula, 1978; Renas, 1983; Conway and Houtenville, 1998; Gale and Heath, 2000). And, finally, the interstate distribution of undocumented immigrants to the U.S. is an increasing function of the degree of economic freedom (Ruger and Sorens, 2009; Cebula *et al*., 2013). To further investigate the study topic at hand, the model is now estimated by state-level fixed-effects for the case of a *semi-log* specification. These findings are presented in Table 4. As shown in Table 4, seven of the eight estimated coefficients exhibit the expected signs, with four of these being statistically significant at the 1% level (*ECONFREE*, *HDD*, *COST*, and *PPEDSP*), with one being statistically significant at the 5% level (*CRIME*) and one being statistically significant at the 10% level (*CDD*). In this estimate, the coefficients on *POPDEN* and *MEDINC* fail to be statistically significant at the 10% level. The weighted $R^2$ is 0.99 and the weighted adjusted $R^2$ is 0.98, while the unweighted $R^2$ is 0.94, so that, not surprisingly, the model in semi-log form also explains nearly all of the variation in the dependent variable. According to these findings, the interstate settlement pattern of undocumented immigrants in the U.S. is an increasing function of *ECONFREE* and *PPEDSP*, while being a decreasing function of *HDD*, *CDD*, *COST*, and *CRIME*. In particular, a one unit increase in the cost of living index in state *j* would elicit a 0.55% reduction in *SETTLEj*, while an increase in the crime rate per 100,000 population of 100 in state *j* would reduce *SETTLEj* by 0.1%. In addition, increasing *HDDj* by ten heating degree days would reduce *SETTLEj* by 1.35%, whereas increasing *CDDj* by ten cooling degree days would reduce *SETTLEj* by 1.4%.[5] Furthermore, increasing the annual per pupil outlays on public primary and secondary education in state *j* by \$100/\$1,000 would elicit a 0.1%/1.0% increase in *SETTLEj*. Finally, a one unit increase in the economic freedom index in state *j* would elicit a 9.6% increase in *SETTLEj*. These findings are qualitatively compatible with the OLS studies of earlier settlement patterns of undocumented immigrants in the U.S. (Cebula *et al*., 2013; Cebula *et al*., 2014; Cebula, 2015; Nair-Reichert, 2015). For the interested reader, it is noteworthy that multi-collinearity among the explanatory variables in the model is not a problem with a single exception, namely, for the case of the variables *HDDjt* and *CDDjt*, where $r$ (*HDDjt*, *CDDjt*) = -0.861. One solution to this issue would be to drop one of these two variables, arguably the less statistically significant variable *CDDjt*; a second solution would be simply to combine these two hypothesized measures *HDDjt* and *CDDjt* of cold weather and hot and humid weather, respectively, into a composite measure of "less preferable" weather/climate, where *CLIMATEjt* = *HDDjt* + *CDDjt*. For example, substituting the variable *CLIMATEjt* for the variables *CDDjt* and *HDDjt* in the system (7)-(8), and estimating by cross-section/state-level fixed effects, as in Table 3 and 4, yields results entirely compatible with those shown in Table 3 and 4. These new estimation results, first for the linear specification and then for the semi-log specification are provided in Table 5 and Table 6, respectively. In Table 5, with the sole exception of the *MEDINCjt* variable (which is statistically insignificant at the 10% level), all of the estimated coefficients exhibit the

[5] Assuming that a coefficient with at statistical significance level of only 10% is sufficient to be credible evidence.

hypothesized signs and are statistically significant at either the 5% level (*POPDENjt*, *CRIMEjt*, and *PPEDSPjt*) or 1% level (*ECONFREEjt*, *CLIMATEjt*, and *COSTjt*). Thus, once again, it is found that cold climates and hot, humid climates are not attractive to undocumented immigrants settling in the U.S.; furthermore, these immigrants are discouraged from settling where crime rates are higher and where population density is higher. In addition, they are attracted to states with lower living costs, greater outlays on public primary and secondary education, and greater economic freedom. The semi-log results shown in Table 6, yield qualitatively the same conclusions to those just summarized. Namely, cold climates and hot, humid climates are not attractive to undocumented immigrants. In addition, these immigrants are discouraged from settling in states where the crime rate is higher and in states where the population density is greater. Moreover, these immigrants are attracted to states where living costs are lower, where outlays on public primary and secondary education are higher, and where there is greater economic freedom. More specifically, a one unit increase in the cost of living index in state *j* would elicit a 0.53% reduction in *SETTLEj*, while increasing the crime rate per 100,000 population by 100 in state *j* would reduce *SETTLEj* by 0.1%. Furthermore, increasing the annual per pupil outlays on public primary and secondary education in state *j* by \$100/\$1,000 would elicit a 0.16%/1.6% increase in *SETTLEj*. Additionally, increasing *CLIMATEjt* (which replaces *HDDjt and CDDjt*) by ten heating degree days would reduce *SETTLEj* by 1.3%. Finally, a one unit increase in the economic freedom index in state *j* would elicit a 9.7% increase in *SETTLEj*. Clearly, the magnitudes of these semi-log results closely parallel those in Table 4. Before closing this section of the study, it is observed that if the model is estimated in either in linear form or in semi-log form with the variable *CLIMATEjt* replaced by the variable *HDDjt* (i.e., *CDDjt* is dropped from the model altogether), the results are nearly identical to those shown in Tables 5 and 6. Finally, if the explanatory variables are lagged one period, ostensibly to allow for potential endogeneity, the results and conclusions are effectively unchanged.[6]

## 5. CONCLUSION

This study has empirically sought to identify key factors influencing the geographic settlement pattern of undocumented immigrants in the U.S., with a particular emphasis on the impact of economic freedom (Stansel *et al.*, 2015) and to extend the OLS findings in previous related studies (Cebula *et al.*, 2013; Cebula *et al.*, 2014; Cebula, 2015; Nair-Reichert, 2015). Indeed, this study adds to the literature in several ways. First, it provides current insights into the link between the settlement patterns of undocumented immigrants in the U.S. and economic freedom. Second, the study adopts a panel data-set and provides estimates using cross-section fixed-effects. Third, this study also endeavors to provide further insights into the impacts on the settlement patterns of undocumented immigrants of non-economic-freedom economic conditions, as well as the quality of life and spending on primary and secondary public education. The various state fixed-effects estimates for the study period provided in the present study yield several conclusions. In particular, according to these estimations, the geographic/interstate settlement pattern of undocumented immigrants in the U.S is inversely a function of colder climates, higher crime rates, higher population density, and a higher cost of living. In addition, the interstate distribution of undocumented immigrants to the U.S. is positively a function of the annual per pupil outlays on public primary and secondary education; it is also positively a function of the degree of economic freedom, the principal focus of this study. Indeed, among the more specific findings obtained by this study, it is shown that a one unit increase in the level of economic freedom is associated with a 9.6%-9.7% increase in the ratio of undocumented immigrants in state *j* to the total population in state j, expressed as a percent. Hence, according to these cross-section/state-level fixed effects panel data estimates, greater economic freedom acts to attract undocumented immigrants, whereas higher living costs

[6] All related estimates will be provided upon request.

acts to discourage undocumented immigrants. Furthermore, quality of life factors, such as cold climate, greater population density/congestion, and crime discourage the location of undocumented immigrants. Furthermore, unlike the case of higher education incentives (Nair-Reichert, 2015) higher per pupil spending on public primary and secondary acts to attract undocumented immigrants. The pattern of findings for the explanatory variables considered in this study is very consistent (see Tables 3 through 6). Nevertheless, alternative model specifications may warrant investigation; furthermore, other econometrics techniques, such as dynamic panel data estimation, can be adopted. Of course, the fact that the actual numbers of undocumented immigrants are not precisely known may confound any future related empirical research efforts to some extent, just as it has confounded existing research. The latter issue is especially noteworthy in view of the existence of "Sanctuary" cities (and "Sanctuary states" as well) across the U.S. because, by nature, they do not report the presence and number of undocumented immigrants to federal authorities (CRS, 2006). Given the substantial magnitude of the illegal immigrant presence in the U.S. and the implications thereof for regional growth and development as well as for state and local government finances, further analysis needs to be undertaken to serve as a resource for policymakers pursuing solutions to actual and potential long-term issues surrounding this cohort. As policymakers consider the types of factors reflected in the present study, questions which link institutions affecting economic freedom, economic factors, the quality of life, and annual per pupil spending on public primary and secondary education to the well-being of undocumented immigrants and their settlement patterns within the U.S., it appears likely that other explanatory variables will likely also need to be explored in the process.

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## REFERENCES

Aidt, T., 2008. Governance regimes, corruption and growth: Theory and evidence. Journal of Comparative Economics, 36(2): 509-533.

Ali, A. and W.M. Crain, 2001. Political regimes, economic freedom, institutions and growth. Journal of Public Finance and Public Choice, 19(1): 3-22.

Belasen, A.R. and R.W. Hafer, 2013. Do changes in economic freedom affect well being? Journal of Regional Analysis and Policy, 43(1): 56-64.

Bennett, D.L. and R.K. Vedder, 2013. A dynamic analysis of economic freedom and income inequality in the 50 U.S. States. Journal of Regional Analysis and Policy, 43(1): 42-55.

Betts, J.R. and R.W. Fairlie, 2003. Does immigration induce 'native flight' from public schools into private schools? Journal of Public Economics, 87(4): 987-1012.

Bureau of Business & Economic Research University of New Mexico, 2013. Medina income by state. Retrived from http://bber.unm.edu/.

Cebula, R.J., 1978. An empirical note on the tiebout-tullock hypothesis. Quarterly Journal of Economics, 92(4): 705-711.

Cebula, R.J., 2014. The impact of economic freedom and personal freedom on net in- migration in the U.S.: A state-level empirical analysis, 2000-2010. Journal of Labor Research, 35(1): 88-103.

Cebula, R.J., 2015. Give me sanctuary! The impact of personal freedom afforded by sanctuary cities on the 2010 undocumented immigrant settlement pattern within the U.S., 2SLS estimates. Journal of Economics and Finance, 40(4): 792–802. DOI 10.1007/s12197-015-9333-7.

Cebula, R.J. and G. Alexander, 2006. Determinants of net interstate migration, 2000-2004. Journal of Regional Analysis and Policy, 27(2): 116-123.

Cebula, R.J., J.R. Clark and F.G. Mixon, 2013. The impact of economic freedom on per capita real GDP: A study of OECD nations. Journal of Regional Analysis and Policy, 43(1): 34-41.

Cebula, R.J., C. Duquette and F.G. Mixon, 2013. Factors influencing the state-level settlement pattern of the undocumented immigrant population in the United States. Atlantic Economic Journal, 41(3): 203-213.

Cebula, R.J., M. Foley and R. Boylan, 2014. The impact of unionization and other factors on undocumented immigrant settlement patterns in the United States. Applied Economics Letters, 21(4): 272-275.

Cebula, R.J. and F.G. Mixon, 2014. The roles of economic freedom and regulatory quality in creating a favorable environment for investment in energy R&D, infrastructure, and capacity. American Journal of Economics and Sociology, 73(2): 299-324.

Clark, J.R. and R. Lawson, 2008. The impact of economic growth, tax policy, and economic freedom on income inequality. Journal of Private Enterprise, 24(1): 23-31.

Congressional Research Service, 2006. Enforcing immigration law: The role of state and local law enforcement. Washington, D.C.: The Library of Congress.

Conway, K.S. and A.J. Houtenville, 1998. Do the elderly 'vote with their feet'? Public Choice, 97(1): 63-85.

Council for Community and Economic Research, 2013. Cost of living index. Retrived from http://www.coli.org.

Dawson, J.W., 1998;2003. Institutions, investment, and growth: New cross-country and panel data evidence. Economic Inquiry, 36(4): 603-619.

Esposito, A. and P. Zaleski, 1999. Economic freedom and the quality of life: An empirical analysis. Constitutional Political Economy, 10(2): 185-197.

Flores, S.M. and C.L. Horn, 2009. College persistence and undocumented students at a selective public university: A quantitative case study analysis. Journal of College Student Retention, 11(1): 57–76.

Frey, B.S. and A. Stutzer, 2002A;2002B. The economics of happiness. World Economics, 3(1): 1-17.

Frey, B.S. and A. Stutzer, 2002B. What can economists learn from happiness research? Journal of Economic Literature, 40(2): 402-435.

Gale, L.R. and W.C. Heath, 2000. Elderly internal migration in the U.S. Revisited. Public Finance Review, 28(2): 153-577.

Gerdes, C., 2013. Does immigration induce. Native flight from public schools? Annals of Regional Science, 50(2): 645-666.

Gradstein, M. and M. Justman, 2000. Human capital, social capital, and public schooling. European Economic Review, 44(4): 879-890.

Gradstein, M. and M. Justman, 2002. Education, social cohesion, and economic growth. American Economic Review, 92(4): 1192-1204.

Gropper, D.R., R. Lawson and J. Thorne, 2011. Economic freedom and happiness. Cato Journal, 31(2): 237-255.

Gwartney, J., R.A. Holcombe and R.A. Lawson, 2006. Institutions and the impact of investment on growth. Kyklos, 59(2): 255-276.

Gwartney, J., R.A. Lawson and W. Block, 1996. Economic freedom of the world: 1975-1995. Vancouver, B.C. Canada: Fraser Institute.

Gwartney, J., R.A. Lawson and J. Hall, 2013. Economic freedom of the world. Fraser Institute. Retrived from http://www.freetheworld.com/datasets_efw.html.

Hagerty, M. and R. Veenhoven, 2003. Wealth and happiness revisited—growing national income does go with greater happiness. Social Indicators Research, 64(1): 1-27.

Hall, J., 2013. Economic freedom and regional economics. Journal of Regional Analysis and Policy, 43(1): 1-2.

Hall, J., R. Sobel and G. Crowley, 2010. Institutions, capital, and growth. Southern Economic Journal, 77(3): 385-405.

Hanson, G.H., 2006. Illegal immigration from Mexico to the United States. Journal of Economic Literature, 44(4): 869-924.

Heckelman, J.C. and M.D. Stroup, 2000. Which economic freedoms contribute to economic growth? Kyklos, 53(4): 527-544.

Heritage Foundation, 2013. Economic freedom indices: Explore the data. Retrived from http://www.heritage.org/Index/Explore.aspx.

Islam, S., 1996. Economic freedom, per capita income, and economic growth. Applied Economics Letters, 3(10): 595-597.

Kaushal, N., 2008. In-State tuition for the undocumented: Education effects on Mexican young adults. Journal of Policy Analysis and Management, 27(4): 771–792.

Koch, J.V., 2008. The impact of undocumented immigration on ID theft in the United States: An empirical study: An empirical study. Open Economics Journal, 1(1): 37-46.

Mavisakalyan, A., 2011. The impact of immigration on school choice: Evidence from Australia. Paper Prepared for Australian Public Choice Conference 2009.

Mavisakalyan, A., 2011. Immigration, public education spending, and private schooling. Southern Economic Journal, 78(2): 397-423.

Mixon, F.G.J., 1993. Friends or strangers? Examining the theoretical and empirical evidence on immigration. International Journal of Social Economics, 20(10): 46-54.

Nair-Reichert, U., 2015. Access to higher public education and location choices of undocumented migrants: An exploratory analysis. International Advances in Economic Research, 21(2): 189-199.

Nikolaev, B., 2014. Economic freedom and quality of life—Evidence from the OECD's your better life index. Journal of Private Enterprise, 29(2): 97-117.

Nikolaev, B., J. Hall, J. Pulito and B. Van Metre, 2013. Economic freedom and entrepreneurship-new evidence from the States. American Journal of Entrepreneurship, 6(1): 85-99.

Nissan, E. and F. Niroomand, 2008. Linking labor productivity to economic freedom. American Economist, 52(2): 42-53.

Norton, S.W., 1998. Poverty, property rights, and human well-being: A cross-national study. Cato Journal 18(2): 233-246.

Pew Research Center, 2013. Unauthorized immigrant population, by state. Retrived from www.pewhispanic.org/interactives/unauthorized-immigrants-2012/.

PRC, 2016. Hispanic trends. Available from info@pewresearch.org.

Renas, S.M., 1980. An empirical note on the tiebout-tullock hypothesis: Comment. Quarterly Journal of Economics, 94(3): 619-623.

Renas, S.M., 1978. The cost of living, labor market opportunities, and the migration decision. Annals of Regional Science, 15(1): 95-104.

Renas, S.M., 1983. The cost of living, labor market opportunities, and the migration decision: More on problems of misspecification and aggregation bias. Annals of Regional Science, 17(1): 98-110.

Ruger, W.P. and J. Sorens, 2009. Freedom in the 50 states: An index of personal and economic freedom. Fairfax, VA: Mercatus Center, George Mason University.

Saltz, I.S., 1998. State income taxation and geographic labor force mobility in the United States. Applied Economics Letters, 5(5): 599-604.

Stansel, D., 2013. An economic freedom index for U.S. Metropolitan areas. Journal of Regional Analysis and Policy, 43(1): 3-20.

Stansel, D., J. Torra and F. McMahon, 2014;2015. Economic freedom of North America, 2014. Fraser Institute. Retrived from http://www.freetheworld.com/2014/efna/economic-freedom-of-north-america-2014-us-edition.pdf.

Stansel, D., J. Torra and F. McMahon, 2015. Economic freedom of North America. Fraser Institute. Retrived from www.freetheworld.com or http://www.fraserinstutute.org.

Stroup, M., 2007. Economic freedom, democracy, and the quality of life. World Development, 35(1): 52-66.

Tella, R., R. MacCulloch and A. Oswald, 2003. The macroeconomics of happiness. Review of Economics and Statistics, 85(3): 809-827.

Tortensson, J., 1994. Property rights and economic growth: An empirical study. Kyklos, 47(2): 231-247.

U.S. Census Bureau, 2007. Statistical abstract of the United States, 2007. Washington, D.C: U.S. Government Printing Office.

U.S. Census Bureau, 2008. Statistical abstract of the United States, 2009. Washington, D.C: U.S. Government Printing Office.

U.S. Census Bureau, 2009. Statistical abstract of the United States, 2007. Washington, D.C: U.S. Government Printing Office.

U.S. Census Bureau, 2012A. American community survey. Washington, D.C.: U.S. Census Bureau.

U.S. Census Bureau, 2012B. Statistical abstract of the United States, 2012. Washington, D.C: U.S. Government Printing Office.

Vedder, R.K., 1976. The American economy in historical perspective. Belmont, CA: Wadsworth.

Vedder, R.K., L.E. Gallaway, P.E. Graves and R. Sexton, 1986. An historical perspective in interregional migration in the U.S. In Housing and Migration, edited by Krumm, R.J. Mount Pleasant, MI: Blackstone Books. pp: 101-124.

**Table-1.** Definitions of Variables and Data Sources

| Variable | Definition and Data Source |
|---|---|
| *SETTLEjt* | the undocumented migrant population in state *j* as a *percent* of the state population in year *t*, 2005-2012; PRC (2013) |
| *MEDINCjt* | median income in state *j* in year *t*; (U.S. Census Bureau, 2008;2009) (U.S. Census Bureau, 2008;2009) (U.S. Census Bureau (2012A); Bureau of Business & Economic Research University of New Mexico (2013) |
| *ECONFREEjt* | index of economic freedom in state *j* in year *t*; Stansel *et al.* (2015) |
| *COSTj* | cost of living for the average 4-person family in state *j* in year *t*; Council for Community and Economic Research (2013) |
| *HDDj* | average annual cooling degree days in state j in year *t*; U.S. Census Bureau (2007;2008) (Census Bureau (2012B); U.S. Census Bureau (2012B) |
| *CDDjt* | average annual cooling degree days in state j in year *t*; (U.S. Census Bureau, 2007;2008) (Census Bureau ( 2012B); U.S. Census Bureau (2012B) |
| *POPDENjt* | population density in state *j* in year *t* as a persons per square mile, as a percent; U.S. Census Bureau (2007;2008;2009;2012B) |
| CRIMEjt | number of crimes per 100,000 population in state j in year t; U.S. Census Bureau (2008;2009) (Census Bureau (2012A; 2012B); BBERUNM (2013) |
| *PPEDSPjt* | annual state plus local government spending per pupil on primary + secondary education in state *j* in year *t*; U.S. Census Bureau (2007;2009) (Census Bureau (2012A; 2012B); BBERUNM (2013) |
| *CLIMATE* | sum of *CDDjt* and *HDDjt* |

**Table-2.** Descriptive Statistics

| Variable | Mean | Standard Deviation | Maximum | Minimum |
|---|---|---|---|---|
| *SETTLE* | 2.656 | 1.796 | 8.76 | 0.14 |
| *MEDINC* | 45,688 | 8,475 | 70,004 | 29,052 |
| *ECONFREE* | 6.924 | 0.604 | 8.4 | 5.2 |
| *COST* | 100.9 | 14.62 | 161.7 | 80.9 |
| *HDD* | 5,006 | 2,188 | 8,812 | 0.00 |
| *CDD* | 1,270 | 984 | 4,562 | 0.00 |
| *POPDEN* | 187.56 | 254.35 | 1,196 | 1.10 |
| *PPEDSPjt* | 9,928 | 3,032 | 19,817 | 4,282 |
| *CRIMEjt* | 5,958 | 1,751 | 9,138 | 762 |

**Table-3.** State Fixed-Effects Estimation Results: Linear Specification

| **Dependent Variable: *SETTLE*** | | | |
|---|---|---|---|
| **Explanatory Variables** | **Coefficient** | **t-value** | **p-value** |
| *ECONFREE* | 0.359*** | 4.48 | 0.0000 |
| *COST* | -0.013*** | -3.62 | 0.0004 |
| *CDD* | -0.0008 | -0.60 | 0.5558 |
| *HDD* | -0.0031*** | -4.26 | 0.0000 |
| *MEDINC* | -0.0000007 | -0.26 | 0.7929 |
| *POPDEN* | -0.0009** | -2.24 | 0.0265 |
| *PPEDSP* | 0.00003** | 2.28 | 0.0242 |
| *CRIME* | -0.00004** | -2.03 | 0.0439 |
| Constant | 16.19 | | |
| Effects Specification: Cross-section Fixed (Dummy Variables) | | | |
| Weighted Statistics: $R^2 = 0.98$; Adjusted $R^2$ | | | |
| F-statistic = 147.46*** | | | |
| Unweighted Statistics: $R^2 = 0.95$ | | | |
| Terms in parentheses are t-values. ***Statistically significant at 1% level;** statistically significant at 5% level;* statistically significant at 10% level. All t-statistics reflect White correction. | | | |

**Table-4.** State Fixed-Effects Estimation Results: Semi-log Specification

| **Dependent Variable: Log (*SETTLE*)** | | | |
|---|---|---|---|
| **Explanatory Variables** | **Coefficient** | **t-value** | **p-value** |
| *ECONFREE* | 0.096*** | 3.22 | 0.0016 |
| *COST* | -0.0055*** | -3.74 | 0.0003 |
| *CDD* | -0.00135* | -1.81 | 0.0717 |
| *HDD* | -0.0014*** | -5.18 | 0.0000 |
| *MEDINC* | -0.000002 | -1.22 | 0.2243 |
| *POPDEN* | -0.00087 | -0.49 | 0.6219 |
| *PPEDSP* | 0.000014*** | 4.27 | 0.0000 |
| *CRIME* | -0.00001** | -2.02 | 0.0451 |
| Constant | 9.24 | | |
| Effects Specification: Cross-section Fixed (Dummy Variables) | | | |
| Weighted Statistics: $R^2 = 0.99$; Adjusted $R^2 = 0.97$ | | | |
| F-statistic = 169.89*** | | | |
| Unweighted Statistics: $R^2 = 0.94$ | | | |
| Terms in parentheses are t-values. ***Statistically significant at 1% level;** statistically significant at 5% level;* statistically significant at 10% level. All t-statistics reflect White correction. | | | |

**Table-5.** Alternative State Fixed-Effects Estimation Results: Linear Model

| **Dependent Variable: *SETTLE*** | | | |
|---|---|---|---|
| **Explanatory Variables** | **Coefficient** | **t-value** | **p-value** |
| *ECONFREE* | 0.361*** | 4.59 | 0.0000 |
| *COST* | -0.0123*** | -3.64 | 0.0004 |
| *CLIMATE* | -0.0032*** | -4.52 | 0.0000 |
| *MEDINC* | -0.000001 | -0.41 | 0.6849 |
| *POPDEN* | -0.001** | -2.42 | 0.0166 |
| *PPEDSP* | 0.00003** | 2.37 | 0.0190 |
| *CRIME* | -0.00004** | -2.09 | 0.0380 |
| Constant | 21.55 | | |
| Effects Specification: Cross-section Fixed (Dummy Variables) | | | |
| Weighted Statistics: $R^2 = 0.98$; Adjusted $R^2 = 0.97$ | | | |
| F-statistic = 150.88*** | | | |
| Unweighted Statistics: $R^2 = 0.95$ | | | |
| Terms in parentheses are t-values. ***Statistically significant at 1% level;** statistically significant at 5% level;* statistically significant at 10% level. All t-statistics reflect White correction. | | | |

**Table-6.** Alternative State Fixed-Effects Estimation Results: Semi-log Specification

| **Dependent Variable: Log (*SETTLE*)** | | | |
|---|---|---|---|
| **Explanatory Variables** | **Coefficient** | **t-value** | **p-value** |
| *ECONFREE* | 0.0974*** | 3.21 | 0.0016 |
| *COST* | -0.0053*** | -3.73 | 0.0003 |
| *CLIMATE* | -0.0013*** | -5.70 | 0.0000 |
| *MEDINC* | -0.000002 | -1.46 | 0.1465 |
| *POPDEN* | -0.0008 | -0.45 | 0.6506 |
| *PPEDSP* | 0.000016*** | 4.73 | 0.0000 |
| *CRIME* | -0.00001** | -2.24 | 0.0266 |
| Constant | 8.82 | | |
| Effects Specification: Cross-section Fixed (Dummy Variables) | | | |
| Weighted Statistics: $R^2 = 0.99$; Adjusted $R^2 = 0.98$ | | | |
| F-statistic = 176.56*** | | | |
| Unweighted Statistics: $R^2 = 0.94$ | | | |
| Terms in parentheses are t-values. ***Statistically significant at 1% level;** statistically significant at 5% level;* statistically significant at 10% level. All t-statistics reflect White correction. | | | |