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Crimes and Moving Decision in the United States: A Conditional Logit Approach

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Abstract

This paper examines the relationship between crime and an individual's decision to migrate to another state. The study is based in the United States and spans from 2011 to 2015. The samples used in this study are interstate migrants. The findings reveal that the ratios of violent and property crimes between the origin and the destination are associated with migration. The study finds that higher number of violent crime at the destination discourages migrants to move out of their original state. However, people tend to move out although it has a higher number of property crime at the destination state. The different perceptions of crime severity between violent and property crimes may have an impact on individual's decision to migrate. The study also investigates the heterogeneity of individual's characteristics and their migration decision. The results reveal that migrants' concern about crime does not depend on age, education level, or income level.

Keyword: Crime, moving decision, state-to-state migration, conditional logit approach

JEL Classification: D01, D91, R00

Introduction

There are numerous studies that have investigated the determinants of an individual's decision to move to another area. Most factors that have been examined are associated with economic opportunities, such as income (Beine, Bertoli & Fernandez-Huertas, 2016) and unemployment rates (Basu & Pearlman, 2016), and individual characteristics (Lee & Waddell, 2010). Investigating about crime is important for sociology and population studies. However, only few studies in economics have addressed the influence of crime rates on

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migration decisions. Therefore, the main purpose of this study is to contribute and extend previous research in this area by investigating the determinants of migration decisions, with an emphasis on the role of crime. Specifically, this study examines the relationship between crime rates and internal migration in the United States. The findings from this paper will hence fill the gap in the economics literature regarding crime rates; one of the determinants of an individual's migration decision.

In general, crime has fallen substantially in the U.S. since 2005 (Ellen &O'Regan, 2009). Even so, the desire to live in less crime neighborhoods is still one of the reasons why people choose to migrate. As mentioned previously, many studies about the impact of crime on migration have been done in sociology and population fields. Their findings show a negative relationship between crime and migration. Ihrke (2016), for instance, finds that approximately 3%-5% of the U.S. population migrated from unsafe areas to safe areas from 2005-2016. In some areas such as Cleveland, Ohio, high rate of crime is a major reason that triggers people to migrate out continually from the area (Smith, 2011). Having more minority residents and lower income people within a neighborhood are associated with higher crime rates (Boyle & Hassett-Walker, 2008; Yonas et al., 2007; Suresh & Vito, 2009). This motivates people to move out of these areas and motivates others to choose not to move in. Low-income neighborhoods and their associated crime compel working age migrants to relocate to better areas (Mateyka, 2015). Furthermore, violent crime rates in the core cities of major metropolitan areas is nearly 3.5 times higher than in the suburbs. Therefore, this factor is driving people out of the urban areas and into the suburbs that are considered safer (Kotkin, 2016).

Although crime and migration have been debated academically for more than 100 years, it's only recently that researchers have begun to investigate whether such a relationship exists empirically (Papadopoulos, 2014). Unfortunately, only a few economics studies regarding the relationship between crime rates and migration have been conducted, and only in some parts of the U.S.. The findings regarding this relationship are still ambiguous depending on the considered areas, data, and methodologies applied. The recent study of Zheng (2016), for instance, focuses more on the impact of city amenities in metropolitan areas on migration of smart individuals. The study demonstrates a positive relationship between crime rate and migration. People tend to move to a high crime rate area, which contradicts to the results of sociology and population studies. The study further suggests that people may enjoy the other unobserved amenities in high crime rate area. The study by Duncombe, Robbins & Wolf (2001) also find similar results of how a retiree chooses which location to migrate. Their findings reveal that crime rates have a positive impact on their decisions. The researchers concluded that the elderly are more likely to migrate to an area with high crime rates and explained that these retirees may be compensated with other amenities at such destinations.

The findings of some studies, on the other hand, show the different impact of crime on migration. Glaeser & Gottlieb (2006) examine whether the reductions in central city crime rates lead to overall in-migration gains in Cleveland and Denver cities. The results reveal that lagging crime rates and the percentage of black people have negative impacts on current net migration growth. Another study conducted by Basu &

Pearlman (2016) also supports that high crime rates trigger people to migrate to another area. In regard to individual-level study, the findings of Morrison (1993) finds that increased origin violence (relative to destination violence) stimulate out-migration, and this effect is intensified as the level of violence increases.

To study the relationship of crime, amenities, and migration, most cases rely on multinomial, and conditional logit empirical models (Morrison, 1993; Davies, Greenwood & Li, 2001; Knapp, White & Clark, 2001). Both approaches are used to analyze the choice of an individual in a set of J alternatives. However, conditional logit focuses on the set of alternatives for each individual, where the explanatory variables are characteristics of those alternatives (Hoffman & Duncan, 1988).

Unlike previous literature, this study proposes to investigate the association of crime rates with interstate migration covering all the states rather than a few cities. Moreover, the conditional logit approach is applied in this study in order to investigate the relationship of location attributes with individual's decision to migrate. The findings from this study reveal that crime rates significantly influence an individual's decision to migrate to another place. People are less likely to move out if there is a higher violent crime ratio at the destination state. However, they are more likely to migrate to another state with a higher property crime ratio. Moreover, this study also focuses on the heterogeneity of individual characteristics that are associated with the individual's decision to migrate because migrants with different characteristics may sort themselves to live in the areas with different attributes (Schuetz et.al., 2017). However, this study finds that, regardless of their ages, levels of education, and incomes, migrants are concerned about the aspect of crime indifferently. The evidence from this study could be extended and used by future researchers.

This paper has the following structure: Section II proposes an empirical framework that follows Davies, Greenwood & Li (2001), in which a person's moving decision is modeled in an expected utility framework. Section III provides a brief discussion regarding the data. Section IV presents the empirical results, which indicates the major association of crime with the individual's decision to migrate. Section V contains the conclusion as well as the areas for future research.

Empirical Approach

According to Davies, Greenwood & Li (2001), the conditional logit model for migration choices is motivated by a random utility model. The model is constructed below and shows how an individual faces J choices of moving to a different area or staying at the current location. The utility level of moving from area i to area j for this individual is as follows:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

Where the deterministic component of the utility function of the individual, V_{ij} is assumed to be a function of location-specific characteristics as the following equation:

$$V_{ij} = F(X_{ij}) \quad (2)$$

From the above equations, X_{ij} is a set of origin and destination-specific attributes, while ε_{ij} is a random disturbance term assumed to be independently and identically distributed with an extreme value type

I distribution. By assuming that each individual is rational and utility-maximizing, and chooses destination j , then the utility U_{ij} is the highest among all J choices.

Therefore, when choice j is made, the statistical model to represent the probability of moving to area j can be denoted as follows:

$$P(Y_{i=j}) = \text{Prob}\{\max(U_{1j}, \dots, U_{ij}) = U_{ij}\} \quad (3)$$

The general format of the conditional logit equation for each individual is

$$P(Y_{i=j}) = \frac{\exp(\beta' x_{ij})}{\sum_{k=1}^J \exp(\beta' x_{ik})}, \quad (4)$$

where $P(Y_{i=j})$ refers to the probability that an individual chooses to move from state i to state j . Since this study focuses on migration between states so there are a total of 49 potential destination choices (including the current state of residence) for each individual. Forty-nine choices for each individual are created where Y is equal to zero for each state not chosen, and equal to one for the state selected. β is a constant term across choices, and X_{ij} is a set of origin and destination-specific attributes. This study is seeking to condition all sets of origin-destination in order to explain why an individual finally chooses to move from origin i to destination j , given other origin-destination sets.

According to Glaeser & Gottlieb (2006), using lagged variables, especially for crime rates, could address the aspects of simultaneity and endogeneity. It is crucial therefore to note that lagged information is more theoretically appropriate when constructing the model; this is because it takes time to execute migration decisions (Foote, 2015). Therefore, all explanatory variables are one year lagged in order to explain the individual's decision making of moving from the origin to the destination.

A person's migration decision is based on the comparison between the destination state characteristics and the characteristics of the current state of residence. Therefore, a person's current state characteristics certainly affect their migration choice. However, variables that do not vary with choices, for example, the individual's characteristics and the origin state characteristics will be dropped out of the probability function (Knapp, White & Clark, 2001). The potential solution to this problem is to generate explanatory variables, which take the form of the ratios between the origin and the destination attributes.

The log-likelihood function for each individual moving from any area i to a specific area j is as shown below;

$$\ln L = \sum_i Y_{ij} \ln P(Y_{ij})$$

where $Y_{ij} = 1$ if an individual in area i chooses to migrate to a destination area j .

In general, this study focuses on migration between states. Therefore, a person has 49 potential destination choices including their current state of residence. Also, there are 49 source states because a person can originate from either of these states and can migrate to one destination state. The corresponding log-likelihood function is as shown below;

$$\ln L = \sum_{i=1}^{49} \sum_{j=1}^{49} N_{ij} \ln P(Y_{ij}),$$

where N_{ij} is the number of individuals moving from state i to state j .

The Independence of Irrelevant Alternatives (IIA) property is required for the conditional logit model. That is, the relative probabilities between choices must be independent of other alternatives. This test can be conducted by eliminating a subset of choices from the choice set and re-estimating the models. If the parameters of the restricted model are not systematically different from the parameters of the full model, then the IIA property holds. The IIA test is conducted following Hausman and McFadden (1984). The test statistic is

$$\chi^2 = (b_s - b_f)'(V_s - V_f)^{-1}(b_s - b_f).$$

It has the χ^2 distribution with k degrees of freedom, where k is the rank of $(V_s - V_f)$. While b_s and b_f are the parameter estimates based on the restricted subset of states and the full subset of states, respectively. V_s and V_f are the respective estimates of the asymptotic covariance matrices.

In this study with 49 potential destination choices, the number of subset combinations to test IIA is enormous, and these tests do not offer a guideline for selecting the subset to eliminate. To test the IIA property, this paper follows Davies, Greenwood and Li (2001), by eliminating some alternative choices arbitrarily.

The results of IIA tests show the negative χ^2 values because $V_s - V_f$ is not positive semidefinite.

According to Cheng and Long (2007), those are the evidences that IIA holds.

Finally, in the model, the state-fixed effects are used to control the unobservable economic and noneconomic state characteristics, which vary across states. Initially, the dummy variable for each state is created; this results in 49 dummy variables. For this study, the computation failed to converge due to a large number of parameters that are estimated. Another possible issue is the correlation between the state-fixed effects and the destination characteristics. As a result, this study utilizes the state dummy variables that are based on the definition of the subregion, and a total of 9 state-group dummies are reported in Table A1 (See Appendix). Also, time-fixed effects are applied in order to control the unobservables that change over time.

Data Description

Migration data in this study are individuals who either choose to migrate out of a current state (interstate movers) or stay in the current state (non-movers) during 2011 to 2015. The yearly migration data is obtained from the Integrated Public Use Microdata Series (IPUMS); it is drawn from 1% of American Community Survey (ACS). The IPUMS provides the individual-level population database, which is advantageous when investigating an individual's decision to move. From the IPUMS migration data, a subsample of 5 in 100 is drawn each year. As a result, this study is based on 53,609 individuals, in which 44,909 of individuals are non-movers and 8,700 of individuals are interstate movers.

To avoid any confounding effects of immigration on the U.S. interregional migration, individuals who immigrate to or emigrate from foreign countries are excluded. Moreover, the migration is restricted to out-migrants who are 21 years and above; this ensures that migration is a decision of the individual due to the consequence of labor market participation, or a movement with their parents. Furthermore, this study

investigates the economic incentives that influence people to migrate. It also focuses on the association of crime rates, which is one of the amenities of each state.

The analysis in this study focuses on the state level to reflect the differentials of state attributes that could affect interstate migration. Since this study examines the relationship between crime and migration, the important explanatory variable is crime. It is categorized into two types; these are 1) yearly number of violent crimes in each state including murders, rapes, robberies, and aggravated assaults and 2) yearly number of property crimes in each state including burglaries, larcenies, motor vehicle thefts, and arsons. By categorizing crime into two general categories, this study can compare the association of each type of crime to migration.

Other aspects regarding the original residence and the destination, which are used by most studies to examine migration include the economic opportunities (Etzo, 2011; Peeters, 2012; Beine, Bertoli & Fernandez-Huertas, 2016). In this study, the state per capita is included to control the monetary benefit between two different areas when people decide to move. The housing price is another control variable that is directly related to the cost of living in each state. Furthermore, housing price could reflect the neighborhood environment of each area; for example, Pope & Pope (2012) find a negative relationship of crime on property value. In the study of Gabriel & Painter (2003), on the other hand, they find that the decrease in local house prices at the destination motivates people to move out of their original residence. Thus, there may be the case that people are more likely to move to an area with high crime rate because they could enjoy a lower housing price, which is the unobserved benefit that previous studies ignore.

Besides the economic opportunity, the number of population is controlled because an area with high number of population may have a higher chance to have high crime rate. Also, the percentage of minority population is controlled following the previous sociology studies, as mentioned in the beginning of this study, that having more minority residents is associated with higher crime rates (Boyle & Hassett-Walker, 2008; Yonas et al., 2007; Suresh & Vito, 2009).

Generally, most of the available variables in this study are yearly data. The two variables, unfortunately, that are not reported annually are the percentage of minority population and housing price. Therefore, this study uses the latest 2010 census data published by the U.S. Census Bureau. This should not affect the results since migrants have to search for information before they decide to migrate. It implies that the models with lagged information are more theoretically appropriate; this is because people take some time in order to execute migration decisions (Foote, 2015). As mentioned previously in the empirical approach, moreover, all independent variables are calculated to be the destination-to-origin ratios at the state level to explain why an individual finally chooses to move or stay. In addition, using one year lagged variables is not only theoretically appropriate, but it also could address the aspects of simultaneity and endogeneity. Table 1 below shows all variables used in this study including definitions, and the sources of data.

Table 1 Definitions of variables and data sources

Variable	Definition	Source	Year
Migration	Individual's moving decision whether to migrate to another state or to stay in the same state	Integrated Public Use Microdata Series (IPUMS)	2011-2015
Violent crime	<i>Lagged ratio</i> of yearly number of violent crime between origin and destination	Calculated from Uniform Crime Reporting Statistics	2010-2014
Property crime	<i>Lagged ratio</i> of yearly number of property crime between origin and destination	Calculated from Uniform Crime Reporting Statistics	2010-2014
Population	<i>Lagged ratio</i> of yearly number of total population between origin and destination	Calculated from Uniform Crime Reporting Statistics	2010-2014
State per capita income	<i>Lagged ratio</i> of yearly per capita income between origin and destination in dollars per person	Calculated from The State Science and Technology Institute (SSTI)	2010-2014
Minority population	<i>Lagged ratio</i> of percentage of black or African American alone between origin and destination	Calculated from 2010 Census of American Community Survey (ACS)	2010
Housing price	<i>Lagged ratio</i> of mean housing price between origin and destination in dollars	Calculated from 2010 Census of American Community Survey (ACS)	2010

Results and Discussion

As mentioned earlier, the advantage of this study is the separation of crimes into violent and property crime to investigate the effect of different crime types on individual's moving decision. Table 2 provides the results from conditional logit in which non-moving is the base category. The participants consider violent crime as a disutility factor. The negative signs of violent crime ratios are consistent across two specifications. This reflects that the increase in violent crime ratios compared to origin state deters people to migrate to another state, all other things being equal. Simply speaking, destination states with a higher number of violent crime tend to discourage inhabitants to those areas.

However, the property crime ratios have the positive signs across the two specifications, which contradicts with what the study expects. It could be explained that people still tend to migrate to a destination state with a higher number of property crime, all other things being equal. The different effects of violent crimes and property crimes that are found could be viewed as an evidence to support the study of Wanner &

Caputo (1987) that a migrant's perception of the violent crime is more serious than of the property crime. Higher property crime may lower housing price but lower housing prices are also correlated with higher property crime.(Pope & Pope, 2012). Consequently, people may be more concerned about the affordability of housing than the issue of serious property crime.

Other control variables, such as the population ratio, minority population ratio and housing price ratio, have a statistically significant negative sign. It says that a destination state with a higher number of population, a higher percentage of minority population, or a higher housing price could be the factors that discourage people to move to that area, all other things being equal. Contrarily, the state income per capita is the only one variable that has a positive sign. Although it is insignificant, it could be explained that people may be likely to move out to another state if the destination has a higher state income per capita.

Table 2 Conditional logit results

	Model 1	Model 2
Violent crime	-0.680*** (0.012)	-0.434*** (0.012)
Property crime	0.273*** (0.012)	0.197*** (0.016)
Control variables		
Population		-0.106*** (0.015)
Per capita income		0.013 (0.023)
Minority population		-0.622*** (0.008)
Housing price		-0.668*** (0.029)
Sub-region Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Pseudo R ²	0.100	0.139
Log likelihood	-153407.430	-146612.740

Note: *** Significant at the 1 percent level

Stand errors are in parentheses

All independent variables are destination-to-origin ratio.

As mentioned in the beginning, this study also investigate the heterogeneity of individual characteristics that are associated with the individual's decision to migrate because migrants with different characteristics may sort themselves to live in the areas with different attributes. The results in Table 3 below show the conditional logit results that categorizes the samples into different groups based on education level, age, and income level. In regard to income levels, this study uses the average total income of all individuals, which is equal to \$44,549.01 per person, as a cut-off between two groups. All individual characteristics are specified in the IPUMS-USA dataset.

The results in Table 3 below show that people with different ages, education levels, and income levels are concerned about crime ratios in a similar way. The violent crime ratios have a negative sign in all specifications; however, the property crime ratios have a positive sign. To make a decision to migrate, it could be concluded that a higher number of the violent crime at the destination state still discourage all people with different characteristics to migrate to that area, while a higher number of the property crime at the destination seems not to be a disutility factor for migration.

Table 3 Conditional logit results separated by characteristics of migrants

	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Age 21-65	Age>65	Educ<G12	Educ>G12	Inc<mean ^a	Inc>mean ^a
Violent crime	-0.433*** (0.014)	-0.438*** (0.026)	-0.457*** (0.019)	-0.416*** (0.017)	-0.448*** (0.015)	-0.408*** (0.021)
Property crime	0.187*** (0.019)	0.225*** (0.033)	0.237*** (0.024)	0.162*** (0.023)	0.242*** (0.020)	0.102*** (0.029)
Control variables						
Population	-0.102*** (0.017)	-0.114*** (0.031)	-0.107*** (0.023)	-0.102*** (0.020)	-0.125*** (0.019)	-0.062** (0.024)
Per capita income	0.060** (0.026)	-0.154*** (0.052)	-0.060 (0.037)	0.060** (0.029)	-0.077** (0.031)	0.158*** (0.035)
Minority population	-0.628*** (0.009)	-0.602*** (0.016)	-0.619*** (0.012)	-0.625*** (0.011)	-0.619*** (0.010)	-0.633*** (0.014)
Housing price	-0.648*** (0.033)	-0.722*** (0.059)	-0.880*** (0.043)	-0.472*** (0.039)	-0.779*** (0.036)	-0.422*** (0.049)
Sub-region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R ²	0.140	0.138	0.142	0.139	0.140	0.142
Log likelihood	-110995.350	-35587.706	-67837.787	-78636.610	-98130.900	-48299.091
# Observations	34,735	18,874	21,167	32,442	30,644	22,965

Note: *** Significant at the 1 percent level

** Significant at the 5 percent level

^aAverage total income of all samples

Stand errors are in parentheses.

All independent variables are destination-to-origin ratio.

For other control variables, the results are not different from the Table 2. The population ratios, minority population ratios and housing price ratios have a statistically negative sign in all specifications. Consequently, all people with different characteristics are less likely to migrate out from the original state if the destination state has a higher number of population, a higher percentage of minority population, or a higher housing price, all other things being equal.

Interestingly, this result finds that the state income per capita has a different impact on different individual's characteristics to make a moving decision. Younger, higher educated, and higher income workers are more likely to move to another destination state if it has a higher state income per capita. This reflects a better economic opportunity at the destination that could lead people to move out from the origin to another area. The result from this study is consistent with what was found in other studies (Winters, 2011; Betz, Partridge, &Fallah, 2016).

Conclusion

The findings from this study reveal a connection between crime and a person's decision to migrate. The study has also deduced that both violent and property crimes are major determinants of the decisions regarding which place to migrate to. For instance, higher differentials of crime between the origin and the destination increase the probability of individuals to make decisions regarding migration. Also, migrants are more likely to move to another state if the destination has a lower violent crimes, while they tend to move to another state with a higher property crimes compared to the origin. These opposite results may reflect the different perceptions of crime severity between violent and property crime that have an impact on individual's decision to migrate. Migrants with different characteristics such as age, education, and income are concerned about crime indifferently.

This study is limited to state-to-state migration data. Therefore, future extensions of this study will need to estimate the impact of crime on migration by using smaller units of analysis; such as intrastate movements. It is crucial to note that intrastate migration is important to study because there are many individuals who migrate within a state. This implies that the impact of crime on migration could either be underestimated or overestimated if the study only considers crime rates across states.

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Appendix

Table A1: Sub-region dummy

Sub-region Dummy	State
1 New England	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont
2 Mid-Atlantic	New Jersey, New York, and Pennsylvania
3 East North Central	Illinois, Indiana, Michigan, Ohio, and Wisconsin
4 West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota
5 South Atlantic	Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, District of Columbia, and West Virginia
6 East South Central	Alabama, Kentucky, Mississippi, and Tennessee
7 West South Central	Arkansas, Louisiana, Oklahoma, and Texas
8 Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming
9 Pacific	California, Oregon, and Washington