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THREE ESSAYS ON REGIONAL ECONOMIC DEVELOPMENT AND LOCAL DETERMINANTS OF POVERTY

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ABSTRACT

THREE ESSAYS ON REGIONAL ECONOMIC DEVELOPMENT AND LOCAL DETERMINANTS OF POVERTY

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This work focuses on several important issues of regional development, poverty, and public policy. It consists of three essays. The first essay examines the relationship between the characteristics of small communities in Michigan and variation of poverty rates across the State. The poverty model is based on the production behavior of community residents. It is estimated using the Census 2000 data. The difference in regional poverty rates is explained primarily by variation in the quality and quantity of community labor supply. Significant differences are detected among rural, metropolitan and metropolitan adjacent communities. Also, higher poverty rates in rural areas tend to persist over time, implying that urban and rural poverty should be treated with separate policies.

The second essay analyzes the impact of economic development policies and highway infrastructure improvements on growth of per capita income and jobs in Michigan counties. The policies considered for analysis have significant impact on growth outcomes. However this effect is non-linear. Significant heterogeneity in policy effects is also detected. The impacts are different with respect to average income level in a county as well as between metro and non-metropolitan areas. In addition, cross-policy effects are found. The study uses improved measurement of policy treatment while accounting for possible spillover effects.

The third essay analyzes the relationship between local economic growth and the distribution of businesses across size categories. The distribution is measured by the employment share in businesses of various sizes and by a business distribution index. The index provides a measure of the extent to which the local economy deviates from an equal employment share in each of nine business size categories. Strong links between a county's business size distribution and its economic growth are found. There is also a difference between the optimal income and job growth enhancing distributions. The results also indicate that the optimal growth-enhancing distribution of employment has a higher share of the smallest businesses (with 1 to 4 employees) than it is currently the average. In summary, the results support increased policy emphasis on encouraging small business start-ups and development. However, the optimal development strategy depends on the initial distribution of businesses within a local economy.

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1.1. INTRODUCTION

Poverty attracts considerable attention from researchers and policy makers (Glennerster, 2002; Lipton & Ravallion, 1995). As a result, a large number of policies and programs have been developed to alleviate poverty. Among them are subsidies, job training, minimum wage and job creation incentives, etc. Nevertheless, there is a debate on what would be the most efficient from the government standpoint – improving labor demand or increasing the quality of the labor supply in areas with high poverty. These and many other issues related to poverty still need to be investigated. Among them are whether the determinants of poverty are different between urbanized and rural communities, whether the sources of persistent regional poverty are beyond the conditions of the labor market, and, whether the high poverty rates in rural areas are just a reflection of imperfect poverty definition. This study provides answers to some of these questions.

Unlike most of the previous literature, this study focuses on explaining neighborhood poverty variation rather than focusing on the poverty status of individuals or the poverty variation across large geographic areas (e.g., county or state). This focus on the neighborhood (small community) is important for several reasons. Unlike the literature on individual poverty, the neighborhood model would reveal the net effect of the common resident's behavior on a community's poverty rate. It also eliminates the effect of individual unobservable determinants of poverty and endogenous location effects that dominate the individual's behavior. Neighborhood behavior would incorporate interdependencies among individual residents, which previous literature addresses only partially.

The focus on the neighborhood also has benefits in comparison to the other literature on regional poverty. Even though a neighborhood is rarely an independent administrative unit, many decisions of the state, federal or local government have a neighborhood scale. Opening or closing a school or military base, expanding a road or public transportation network, placing a job training or a poverty alleviation program affect directly an area that is much smaller than a county or a state. Moreover, when the effect of such a decision is studied on the county or state level, it is often found to be small and is anyway subject to aggregation error bias.

The geographic scale of this study is also important because the variation of poverty rates across smaller communities is much larger than the variation across larger geographic areas. For example, in the year 1999, when the State of Michigan had about 10 percent of its population in poverty, poverty rates varied from three to about nineteen percent across the counties. At the same time, the variation of poverty across smaller spatial units such as Census Tracts and Block Groups ranged from zero to one hundred percent. Thus, focusing on the smaller spatial units with wider variation of poverty rates would allow studying common determinants of poverty with higher precision. Also, smaller areas represent a more homogeneous population, which allows more consistent results to be obtained. Finally, the smaller spatial units allow for the testing of whether the determinants of rural and urban poverty are different. This difference is hard to measure at a larger geographic scale.

There is a broad literature on poverty that shows that the sources of poverty variation across geographic areas are related to differences in historical, natural and human-made regional characteristics, as well as demographic characteristics of local population. However, modeling regional poverty as well as the empirical estimation of such a model is viewed in the literature as an unfinished task (Weber and Jensen, 2004). This paper confronts the modeling task and derives a relationship between community characteristics and poverty rates based on production behavior of households. The aggregation procedure is used for this purpose. This approach is similar to the micro-foundation tradition in the macroeconomics literature (Forni and Lippi, 1997, 1999), and is new to the field of regional science. The resulting model explains the role of the labor market in determining community poverty rates, and provides a solid base for the empirical analysis. The model is estimated using Census 2000 data on the smallest publicly available spatial units – partitions of the Census Block Groups[1]– for the State of Michigan. This estimation procedure provides for careful treatment of the aggregation error, non-randomness of regional characteristics and possible bias from omitted variables and simultaneity. The focus on the State of Michigan in this empirical analysis also has a number of benefits. The State is somewhat isolated from spillover effects from the neighboring states by the natural barriers of the Great Lakes. By considering just one state, the estimation avoids many unobservable disturbances in macroeconomic, institutional and legal environments, as all the communities share common political and historical background. The use of a single data source (US Census Bureau) insures consistency in definition and measurement approach.

1 Partition of a Census Block Group combines the Census Blocks within the same administrative and statistic boundaries. See www.census.gov for definitions. Average population of this unit in Michigan is

The rest of this paper is laid out as follows. Section 1.2 provides further motivation behind the research questions and reviews briefly the previous literature. Section 1.3 discusses the regional poverty model and the estimation procedure. Section 1.4 describes characteristics of Michigan communities. Estimation results and policy implications are presented in section 1.5. Section 1.6 concludes the paper.

1.2. MOTIVATION, BACKGROUND AND PREVIOUS STUDIES

As mentioned earlier, variation in poverty across the smaller communities is wider than across larger geographic units. The spatial distribution of community poverty rates also has some interesting patterns that cannot be observed among larger spatial units. The map of Michigan's community poverty rates (Figure 1.1) shows that most of the communities with above state average poverty rates are located in the northern, relatively rural part of the state. However, there are 826 communities (6.9% of total number of communities – Table 1.1) with extremely high poverty (30% and above), located in primarily urbanized areas. As can be seen on the map, the communities with the high poverty are adjacent to each other, and the boundaries of these contiguous high poverty areas do not coincide with the county boundaries. Thus, the county is not the best unit for regional poverty analysis. This spatial concentration of poor and non-poor areas has also been found in other states (Crandall and Weber, 2004). However, the questions regarding the drivers behind this spatial concentration, the conditions of labor demand or the characteristics of labor supply remain unanswered.

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about 1,300 residents.

In order to find an explanation to the observed distribution of poverty, we first refer to the previous literature. This literature can be put into two broad categories[2] (see Weber and Jensen, 2004 for a recent review). The first group explains the probability of an individual with given characteristics being poor. The explanatory factors include: education, health, working experience, household composition, asset endowment and other individual and household characteristics (e.g., Shimeles et al., 2000; Strauss and Thomas, 1995, 1998; Schultz, 1988). Some studies in this group also include regional and neighborhood characteristics in their explanations of individual poverty status. Galster (2003), in his review, points to neighborhood specific poverty effects. These effects work through behavioral norms, expectations, information sharing standards, etc. However, Ihlanfeldt (1999) suggests that the effect of these characteristics on individuals is often subject to the endogenous location bias.

The second group of poverty studies explores the distribution of poverty across geographic areas. Factors such as climate, industrial structure of the regional economy, conditions of the labor and other markets, history of settlement and migration affect this distribution (e.g., Levernier et al., 2000; Partridge and Rickman, 2003; Blank, et al., 1993; Powers and Dupuy, 1994; Triest, 1997). In particular, Blank et al. (1993) find that wage disparities and changes in family composition are the major determinants of cross-state differences in poverty rates. Levernier et al. (2000) find that education is another key factor in poverty reduction and that the effect is stronger in non-metropolitan areas. It is also found that higher labor force participation by women is associated with a lower

2 There is also a large literature on macroeconomic and institutional conditions such as variations in laws, terms of trade, foreign exchange and interest rates in explaining poverty variation across larger geographic areas (e.g., World Bank, 2001). However, these conditions are common for the studied communities and, thus, are not considered further.

poverty rates. However, for the smaller regions migration plays the key role explaining variations in regional poverty (Madden, 2003; Goetz, 1999). It is also found that the impact of the labor market on poverty differs over time and space. Changes in the industrial structure of local economies (such as plant or mine closings) increase regional poverty in the short run but they have smaller long run effects (Levernier et al., 2000). The latter can be explained by responses in migration, unemployment, wages and prices to employment shocks (Blanchard et al., 1992). It is also found that the job growth effect on poverty depends on the composition of households in a region, industrial structure, employment rate and initial rate of poverty (Partridge and Rickman, 2003, 2005; Crandall and Weber, 2004). Bartik (2001) develops that idea further arguing for a large-scale labor demand program targeting poor regions.

The literature on regional poverty, however, has some gaps. First, there is a need for a structural regional model to justify the deterministic role of various factors. Most of the previous studies include into regional models characteristics of natural environment, economic structure, public and community institutions, social norms, cultural environment, and demographic characteristics of the population (see Blank, 2004 for a comprehensive review of this approach). However, this earlier model remains open ended. It does not suggest which factors in each group should be included and why, and what would be a source of endogeneity. Thus, many results of the previous studies are subject to omitted variable bias.

Second, the systematically higher rural poverty rates found in the literature (Weber and Jensen, 2004) may only reflect the problem with the poverty definition, where the lower cost of living (prices) in some areas is ignored (Fisher, 1997;

Glennerster, 2002). Moreover, in rural and urban areas labor demand and labor supply conditions may play a functionally different role.

Another issue related to the regional poverty is that it persists over time (e.g., Partridge and Rickman, 2003; 2005). This persistency reflects the effect of some unobservable factors that do not change over time. However, whether the sources of persistence are beyond the conditions of the labor market and whether the persistence is the same for rural and urban areas is not known. This difference (if exists) would have important implications both for the empirical analysis and for the policy design.

The issues mentioned earlier are formalized in the following hypotheses:

- Characteristics of the labor supply have stronger impact on community poverty rates than the conditions of labor demand.
- There is a significant difference between the rural and urban poverty responses to the conditions of the local labor demand and supply (heterogeneity).
- Poverty in rural communities tends to persist over time even after controlling for the labor market conditions and characteristics of the labor force.

The next section presents the theoretical and empirical models for testing these hypotheses.

1.3. REGIONAL POVERTY MODEL: DESIGN AND ESTIMATION

In order to bridge the gap in the literature and to gain a better understanding of the variation in poverty rates across the small communities, we derive a regional poverty model by taking the following steps. First, a household income function is derived and plugged into the Census Bureau poverty definition. Second, the resulting household poverty model is aggregated over the population of a small geographical area (community)[3]. This aggregated model relates the community poverty rates to the income generating patterns of the local population.

Poverty is a multidimensional phenomenon and can be determined and measured differently[4]. The Census Bureau definition of poverty is used for the purposes of this study[5]. According to this definition, a household is considered as poor ($p=1$) if its total monetary income (y_i) is below the poverty line (z). The line (known also as a poverty threshold[6]) depends on the total size of the household (h_i). The same thresholds are used throughout the United States (do not vary geographically). Thus, the poverty definition can be presented by the following function:

(1.1) $$p_i=f(y_i, z(h_i))+ \varepsilon_i$$

where ε_i is an individual household error. This error is due primarily to misreporting a household income and/or a household structure. It is assumed that the error is i.i.d. and follows standard normal distribution. The income (y_i), however, is an outcome of the household production activity and is a composite function. The household production model (Singh et al., 1986) was used to derive the relationship between the income and the characteristics of a household, conditions of the labor market, and other factors (see Appendix 1.1 for derivation). The household income function takes the following form:

(1.2) $$y_i = r_j a_i + w_j t_i + \pi_{ij}^*(w_j, r_j, k_j, c_{ij}, h_i) + v_{ij}$$

3 One may argue that justifying the community model there is no need to start at the household level. However, current approach reveals several theoretical and estimation issues. Among them are endogeneity, and possible inconsistency in earlier regional models due to an aggregation error. These problems cannot be revealed otherwise.
4 For a discussion of poverty definitions see Duclos, J-Y (2002).
5 More details on the definition at http://www.census.gov/hhes/poverty/povdef.html

where y_i is real income; r is a rate of return (interest rate) to the physical assets (a), w is a return to the stock of labor (t) of a given quality for the household i residing in the area j. The last component (v) is a vector of subsidies, transfers and taxes. Function π^* denotes a real economic profit of a household production, which depends on the interest and wage rates, costs (c) and a vector of prices (k) and other conditions of a region that determine production opportunities of a household. The profit is a result of household utility optimization and is conditioned on a set of household characteristics (h). This component absorbs the majority of the variation in the household incomes within a region, conditional on the stock of labor and capital. Under equal conditions external to a household, and the independent distribution of household characteristics, a real profit for one household becomes a loss for another. For example, a decision of one household to take a particular job closes this opportunity for the other households in the neighborhood, holding the household characteristics equal[7]. The individual characteristics responsible for such choices include entrepreneurial ability, preferences, access to information, etc.

As a next step in the modeling, the household poverty status function (1.1) and the income function (1.2) are aggregated over the population of a small geographic area (d)[8]. In other words, all residents of a small community d ($i \in d$) are represented by a single observation[9]. The aggregated (or community) poverty model takes the following form:

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6 For history of development of the poverty threshold see Fisher (1997).
7 The literature on neighborhood effects (e.g., Ihlanfeldt, 1999) suggests that this assumption is not realistic in cases when endogenous sorting is present or if there is any other sort of interdependencies within a community. We consider relaxing this assumption later in this section.
8 These communities are much smaller than the local labor market j (e.g., neighborhood, Census Block).
9 Which is often a case with the public use datasets (e.g., Census Bureau provides data on Tracts, Counties, States, etc.)

(1.3) $P_d = F_d(Y_d, z(H_d)) + E_d$

(1.4) $Y_d^* = r_j A_d + w_j T_d + \pi_d^*(w, r, k, c, H) + V_d$

where *P, Y, A, T,* π , *V*, *H* and *E* are the distributions of corresponding household characteristics within a community *d.* The functional relationships between the community characteristics and the poverty rate may be different for different communities (e.g., rural and urban). The source of this difference is related to the differences in the unobservable preferences (utility functions) common to a group of communities (e.g., determined by the culture or historical background, or conditions of local markets). So far, the aggregated poverty function (F_d) is allowed to be a community specific. The relationship between the poverty rate and the community characteristics is obtained by substituting the equation (1.4) into the equation (1.3).

The poverty definition (1.1), however, relates the poverty outcomes to the observed monetary income, while the equations (1.2) and (1.4) explain the real economic income. Substituting one for the other introduces an additional source of measurement error due to the unobservable real profit and partially unobservable transfers. Fortunately, the aggregation procedure provides a solution to this and some other problems.

An advantage of the aggregation is that it allows separating the variation in the poverty outcomes caused by common factors from the impact of individual specific factors. Common factors include the characteristics of a region such as the interest and wage rates, while the examples of the individual factors could be an unobserved ability, preferences or measurement error. The impact of the independent individual factors (observable or not) on the community outcomes vanishes with the aggregation (Forni and Lippi, 1997).

Estimation Model

The community poverty model, derived earlier, provides a solid base for the testing the hypotheses of this study. Using the terms of the model, the study evaluates whether the conditions of the labor demand (the return to labor - w) or the characteristics of the community labor supply (the stock of labor – T) have more power in explaining the variation in the community poverty rates. The regional return to labor (w) [10] is controlled by the county level average wage, unemployment rate and occupational structure[11]. The characteristics of the labor force within a community (T) are controlled by the following variables. A quantity (stock) of the labor force is proxied with an average number of adults per household. The quality of labor force is described with a distribution of educational attainments, experience (proxied with the average age of a working cohort[12]), the number of dependent children, and persons with disabilities per household[13].

Another hypothesis is that some community characteristics that affect the income generating behavior may be unobservable to the analyst and stay unchanged for years. Such characteristics may affect the accumulation of the labor force and return to it. This effect is called a persistent poverty (e.g., Partridge & Rickman, 2003; 2005). To control for persistent poverty and to test for the difference in it between rural and urban

10 Goetz (1999) explains poverty and migration outcomes with an expected wage on a local labor market, which equals a product of an average wage and a probability of being employed: *wage*(1-unemployment rate).*

11 County characteristics are assumed to be exogenous to the characteristics of a small community *d.* A possible critique may be that the firms' location decisions are influenced by the characteristics of the local labor force. However, firms consider conditions of the local labor market as a whole, but not a very small portion of it.

12 Adults of an age 16 to 65 are considered as the working age cohort.

13 A more direct measure of health status is not available.

communities, a measure of poverty rate from the Census 1990 is included into the model (P90)[14]. Thus, the estimation model takes the following form:

(1.5) $P_d = F_d(w_j, T_d, P90_d) + s_d + m_d + e_d + e_j$

where *s* and *m* are the vectors of controls and e_d+e_j is a composite error term. The discussion of their use follows. This model becomes a regional analog to the earning capacity model known in the microeconomic literature on poverty (e.g., Triest, 1997).

As follows from the theoretical model, the analysis of the reduced form the poverty model (1.5) rests on several assumptions. First is that the characteristics of the labor market (*wT*) should not correlate with the conditions of the capital market (*rA*). Economic theory treats capital and labor as substitutes in the production function. However, the omission of this term is not harmful to the analysis of the lower part of the income distribution. The poor do not hold any significant production assets, so the return to the assets is expected to have little impact on the poverty outcomes. As a result, this assumption is reasonable.

Second, it is necessary that the household profit does not correlate with the stock of labor. However, Bertrand, et al. (2004) find that poor persons (with lower physical and human capital) pay higher relative price for the individual mistakes (wrong choices) in the production activity. For that reason, the poor may be more risk averse and have relatively lower profit, holding other factors fixed. It follows that the profit and the stock of labor (*T*) should correlate positively. Thus, the omission of the former may cause the upward bias in the parameter estimates for the labor characteristics (*T*). However, if the

14 However, this effect should be distinguished from the lagged response of regional poverty to exogenous

households' unobserved profits are independent within a community, the aggregated community profit (π) tends toward zero conditional on the other factors, and the bias disappears[15].

Third, if the system of taxes and subsidies is in general progressive, the correlation between the transfers and the stock of labor is negative. The omission of the transfer term (v) brings some downward bias in the estimated parameters. However, we tend to think about a reverse causation with respect to the poverty status (poverty causes subsidy, but not vice versa). As a result, the omission of the transfer term does not bias the estimates of the reduced form model.

Aggregation

Since one of the key assumptions of this analysis relies on the properties of aggregation procedure, these properties require a careful treatment[16]. First, the properties of the error term change with aggregation. Second, an independence of the individual errors within the communities is a necessary condition.

The first issue is that the impact of the idiosyncratic error (ε_i) on the community outcome is diminishing with the number of households over which the aggregation is made[17] (Forni and Lippi, 1997). The speed of convergence of the error term to its mean value depends on two factors. The first is the degree of correlation among the shocks common to the households. The second is the explanatory power of the aggregated model. The residual impact of the household idiosyncratic error on the community poverty rate depends on the size of the population over which the aggregation is

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shocks. The latter effect remains in the error term.
15 The independence assumption is explained and relaxed later in this section.

performed. For that reason, the size is controlled econometrically and is denoted by the vector (s). This vector includes the size of the community population and its area. However, if the error term ε_i co-varies among the community residents, the aggregated error converges to some non-zero constant as the size of population increases. The covariation may be due to the common unobservable factors such as conditions of the labor market, local infrastructure, common historical or cultural background, or other neighborhood effects. If the aggregated error is positive, than the community has a poverty generating neighborhood effect, while the communities with a negative value of the error have a poverty reducing unobservable neighborhood effect. This aggregated error term is denoted by e_d+e_j in the equation (1.5). The first term (e_d) represents independent unobservable neighborhood effects. The second term (e_j) is for unobservable covariates in the neighborhood effect common to the local labor markets.

Nonrandom Observations

Selective migration creates a serious difficulty for poverty analysis. Groups of households with common characteristics tend to select common areas of residence causing correlation of the individual observable and unobservable factors over space (Goetz, 1999; Madden, 2003). The effect of these common unobservables does not disappear with the aggregation constituting the neighborhood effect. The problem arises when those unobservable individual factors or the unobservable regional factors impacting migration and residential location correlate with the poverty outcomes. This correlation may cause bias in the estimation results. On the positive side, selective

16 For theoretical treatment of aggregation see Forni and Lippi (1997, 1999).
17 Under the assumption that the individual error has a finite variance.

migration makes the communities relatively more homogeneous, making them an attractive unit for analysis.

To correct for the selective migration effect, Strauss and Thomas (1995) suggest including the factors determining the migration patterns into the analytical model. In this study, those factors are the share of retirees in the local population (to control for the destination of the retirees' migration) and a binary variable for minor civil divisions with a college or university (to control for the migration of students). In the Census data set, migration is partially observed for the Block Groups, thus the share of in-migrants in local population is included into the model as well. The vector of controls for migration is denoted by (m) in the model. As found by Fitchen (1994), most people that change the residential location, tend to stay within the same basic community. This finding is consistent with the endogenous location arguments, but also shows that community characteristics persist over time. Thus, the controls for migration (m), poverty rate in 1990 ($P90$) and conditions of the labor markets (w) would provide a sufficient control for the selective migration.

Omitted Variable Bias

Even though several controls are used for the unobserved covariates, the results may suffer from omitted variable bias due to the unobserved conditions of the local labor market denoted by e_j. To deal with this problem a spatial fixed effect estimation procedure is used. Following this procedure, a set of binary variables for the local labor markets is included into the model. The markets are proxied by the commuting zones (Tolbert and Sizer, 1996). The zones include several counties connected by the commuting patterns of their residents. About 80% of the residents live and work within the same commuting zone. These binary variables absorb the impact of all observable and unobservable factors that are constant within the zones, including the common error term (e_j). These controls absorb also the systematic differences in the price levels (and associated errors in the poverty measurements) across the labor markets. Also, they provide an additional control for the migration.

Endogeneity Bias

The endogeneity of some explanatory variables may bias the estimation results. In particular, the number of adults, dependent children and the share of in-migrants may reflect the outcome of the poverty-coping strategies. For example, in the better-off areas people may have better opportunities to support larger families. On the other hand, an area with a lower poverty may attract wealthier migrants, while poor communities may attract more poor families (e.g., Fitchen, 1995). Thus, the two-stage estimation procedure is applied (Foster & McLanahan, 1996; Wooldridge, 2001, 2003).

Three groups of instrumental variables are used. The first group includes the following characteristics of the neighboring areas[18]: an average age of heads of family households, an average household size and a proportion of females. The second group includes ten-year lag for county-level wage rate, average number of adults per household, and their interaction. The third group consists of a binary variable for the coastal counties. These variables are statistically significant in predicting the instrumented variables and do not belong to the poverty model (see Table 1.5 for more details.)

[18] County average characteristics (excluding one township to which the observation belongs) are taken as characteristics of neighboring area.

Error Structure

The estimation procedure described earlier is designed to obtain the unbiased estimates of the community poverty model. However, the remaining error term (e_d) is not independent across the observations. There are two sources of this correlation. First, a spatial correlation of the poverty rates has been found in the literature (e.g., Partridge and Rickman, 2005; Crandall and Weber, 2004). Second source is related to the construction of the explanatory variables in our empirical model. Some of them are more aggregated than the dependent variable (e.g., the binary variable for the college towns), which may cause a correlation in the error (Moulton, 1986). To account for this autocorrelation and other forms of hetroskedasticity, fully robust standard errors are estimated[19].

Rural/Urban Difference

Another hypothesis is tested by estimating the difference in the poverty function (F_d) among rural and urban communities. This sort of heterogeneity in the model is another possible source of bias. When the response of some communities to the explanatory factors is functionally different from other communities, bundling these responses into a single estimation model produces a function, which is a weighted sum of the responses in these different groups of communities. As Forni and Lippi argue (1997) the simplest solution to this problem is to disaggregate the population to a meaningful number of relatively homogeneous sub-populations and to estimate the model separately for those subgroups. Another approach is to carefully model the heterogeneity of

[19] A less conservative approach is the estimation of the cluster robust errors. However, it also brings a risk of misspecification of the error structure.

parameters within the same econometric model by including interactions of the explanatory variables with the sub-population dummies.

It is found in the literature that the heterogeneity of a poverty model may relate to urban/rural or metropolitan/non-metropolitan differences (Weber and Jensen, 2004). Thus, we disaggregate Michigan communities into those four categories (Figure 1.2) and test for the significance of the functional difference.

The southern part of the State includes metropolitan and metropolitan adjacent areas (Beale Codes 0, 1, 2, 3, 4, 6 and 8). The northern, relatively rural, part includes Michigan non-metropolitan counties. Those two parts have different migration and commuting patterns as well as the structure of the regional economies[20]. Urbanized communities are put in a separate category for each part of the State. A community is considered as urbanized if it is located inside the Urbanized Areas or Urbanized Clusters[21] defined by the Census Bureau. Thus, the first sub-region is the southern urbanized area, which is referred to as **Metropolitan**. This category includes urban communities in all seven Michigan metropolitan areas. The non-urbanized part of southern Michigan is called **Metropolitan Adjacent** and contains farms and sparsely populated residential communities. Next sub-region includes urbanized communities in the northern half of the State. It is referred to as **Rural Towns**. It includes northern cities (none are more than 20,000 population) plus many smaller towns and villages. The rest of the non-urbanized northern part of the State is called **Rural**.

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20 Southern Michigan is heavily industrialized and also contains some of the Michigan's best farmlands. The northern half of the State has poorer soils and a shorter growing season. Forests are the dominant land use. Mining has been a major employer in some northern counties, but has been declining. Tourism plays an important role in northern Michigan. This area is a site for second homes and retirement. The northern part of the State is "very dependent upon unearned income and government earnings [such as public administration, education, social services]" (Erickcek & Watts, 2003), which all together contributed more than 30 percent of the total personal income in 2000.

1.4. DESCRIPTIVE STATISTICS AND PRELIMINARY EVIDENCE

The empirical model derived earlier is estimated using the data from the Census 2000 Summary File 3 for the State of Michigan. Partitions of the Census Block Groups are used as the units of analysis. These units are the smallest geographic areas available for the public use from the Census Bureau, and the only ones that have a clear distinction between the urban and rural areas[22] (U.S. Census Bureau, 2003). The partitions are much more homogeneous by the boundary design than the larger units such as Block Groups, Tracts, counties or states used in the previous literature. The downside of the small geographic units is that the data imputation problem may be more sever. However, this issue is not investigated further in this paper.

The total number of the Census Block Group partitions in Michigan is 13,707. The study sample, however, excludes 530 observations with no land area, 885 units with no population and 274 units for other reasons[23]. The resulting sample includes 12,018 units with the average population of 1,339 in on average 509 households. Out of the total sample, 1871 communities (15.6% of total) are the rural; 517 (4.3%) are in the rural towns; 6775 (56.3%) are the metropolitan; and 2855 (23.8%) are the metropolitan adjacent (Table 1.2).

The size of communities is different across the sub-regions of the state. The rural communities have on average 678 residents hosting altogether about 7% of Michigan

21 See http://www.census.gov/geo/www/ua/ua_2k.html for official Census Bureau definition.
22 Urban/Rural field (UR) of the identification section of Summary File 3 data is used.
23 Among them 26 with no housing units, two partitions with no reported income and one with no household. Also excluded are units with unusual demographic characteristics. Among them, 67 had no adult of working age, 88 areas had no male or female adult of age above 25 years, 34 had average number of working age male or female adults of more than 10 per household and six units had average number of dependents per household more than five. In addition, 50 observations with no worker over 16 years are excluded.

population (Table 1.2). The metropolitan communities are the largest on average – 1,485 residents – hosting about 72% of Michigan population. Spatial distribution of the poverty is different between Michigan sub-regions. Metropolitan adjacent areas have the lowest average poverty rate[24] (6.2%), while the highest rate is in the rural towns (14%). Many rural and central city communities have a long history of poverty.

The characteristics, used to describe the poverty distribution are also different among the sub-regions. The most significant difference is observed in the distribution of the labor demand conditions. The metropolitan communities face the highest average wage rate (about $36.5 thousand), while the lowest average wage (about $23.8 thousand) is in the rural communities. The residents of the metropolitan adjacent communities face the lowest unemployment rate (5.3%), while the rural communities have the highest rate (7.8%). The distribution of the labor force characteristics is less different among the sub-regions, with the education level being slightly higher in the urbanized communities. At the same time, the variables that designed to control for the migration effect display the differences in the distributions. Northern communities (rural towns and rural) have a higher share of retirees and in-migrants, while the urbanized communities (metropolitan and rural towns) have a higher probability of being a part of a college town.

1.5. RESULTS AND IMPLICATIONS

The regional poverty model is estimated using the procedure described earlier[25]. The dependent variable – poverty rate – is measured at the level of the Block Group

24 Percentage of the total households with income below the poverty threshold is used as the community poverty rate.
25 The 2SLS procedure was compared with OLS and GMM with and without the proposed control variables. The 2SLS results are significantly different from the OLS and the estimates with no controls. However 2SLS and GMM estimates are similar.

partitions. The distribution of the poverty rates at this geographic level is skewed. There are more communities with lower poverty rates than the high poverty communities (Figure 1.3). Thus, the dependent variable is transformed with the natural logarithm[26], and the estimates represent the semi-elasticity (a percentage change) of the poverty rate to the changes in the regional characteristics. The results are presented in Tables 1.3 and 1.4.

The major finding of this study is that the responses of the poverty rates are jointly different in each sub-region from the responses in other parts of the state. This difference is tested by computing a joint significance of the interactions of the model parameters with binary variables for the sub-regions (a variation of the Chow test). The results of this test (F-statistics) are reported on Table 1.3. The biggest difference (F-statistics equals 11.63) is found between the rural and metropolitan communities, while the smallest is between the rural and rural town communities (F-statistics is 0.86). This difference is driven by specifics of preferences and unobservable constraints reflected in production decisions. This finding implies that the estimates of the poverty model for the entire state do not represent, as a rule, the behavior of any of the sub-regions. The state-wide estimates would change from a state to state simply because the proportions of the sub-regions would change as well. Another important implication is that poverty alleviation programs and policies have to be, as a rule, sub-region specific and target those factors that are the most significant in a specific area (accounting for the cost efficiency of the program). The question of what effects the variation more – the labor

26 The estimates of the models with the transformed and non-transformed measure of the poverty rate are similar in sign and significance level. However, the transformed model is more efficient as should be expected.

demand or the labor supply conditions – in different sub-regions, becomes even more important.

The characteristics of the labor supply have a higher impact on the variation of poverty than the characteristics of labor demand for all sub-regions of the state (as measured by joint significance of these two groups of variables - see Figure 1.4). This result confirms the conclusions reached by Weber and Jensen (2004, p.20) in their review of the literature. The effect of the labor supply characteristics is particularly strong in the metropolitan communities (F-statistics is 76.62). Relative to the total explanatory power of the model, the supply characteristics have the lowest effect on poverty in the metropolitan adjacent communities.

In contrast, the labor demand conditions have an insignificant effect[27] on poverty distribution in all parts of the state when the quality of labor is controlled. This counterintuitively implies that better demand conditions (e.g. higher wages, lower unemployment) have limited poverty reduction effects. Most likely, the new jobs are taken by those with better qualifications, leaving the poor behind. It also implies that communities have to improve the quality of the labor supply before they can benefit from stronger labor demand conditions. With that, we turn to the detailed description of the results for each of the explanatory factors in the model. Whether an estimate for a particular sub-region differs individually from the estimate for rural communities[28] is indicated by the boldface font in Table 1.4. For example, more people with disabilities correlates with increased poverty to a greater extent in the metropolitan communities than in the rural counterparts, and the difference is statistically significant.

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27 The estimates of the labor demand effect are similar whether the commuting zone fixed effects are controlled or not.

In Table 1.4, Column 1 presents the estimation results where all communities in the state are used. Columns 2 through 5 present the estimates for the rural, rural town, metropolitan and metropolitan adjacent communities, respectively. Comparing the results among the columns we can see that in most cases the state-wide estimates reflect an average effect in different sub-regions weighted by the number of observations and the level of significance.

Labor Market Conditions

Three variables control for the characteristics of the labor demand in the model. Among them, only the wage rate in rural and metropolitan communities exhibits a significant relationship with the poverty rate (Table 1.4). An increase in the county level average wage rate by 1% (which is equivalent of $238 for rural communities and $365 for the metropolitan communities) decreases the poverty rate by 0.7 percent, conditional on other factors. The estimates of the effect of labor demand conditions (except the occupational structure) are not statistically different among the sub-regions, which probably reflects their lower overall significance.

Labor Force Characteristics

The number of working age adults in an average household is the most important determinant of the community poverty rare in all regions of the state. An additional working age adult is associated with a two to three times decrease in the regional poverty rate (Table 1.4). It implies that an increase in the average income associated with an additional adult is larger than the corresponding increase in the poverty threshold. The

28 Rural sub-region is taken for control group as an example.

highest effect is observed in metropolitan areas where the conditions of the labor demand are better. This result indicates that policies reducing the number of single parent households may have a large poverty reduction effect. Larger families can enjoy economies of scale in the household production not available to single-adult families (e.g., sharing childcare and other duties, improving access to information, employing specialization and distributing risks).

A correlation between the average number of children under 16, and the poverty rate is significant only for rural communities. The positive sign on this effect reflects the quality-quantity trade off in children found in the literature. Families with higher income tend to have fewer children, but to invest more in the quality of their education and health. However, in our study the two stage estimation procedure reduces this circular effect, and what is observed is a reflection of the poverty definition. One additional person in a household with no income lifts the poverty threshold and, thus, the community poverty rate. This result is similar to what is found in the literature (e.g. Levernier et al., 2000).

The educational level of the local population is one measure of labor quality. The effect of it is quite uniform across the sub-regions of the state. A one percentage point increase in the share of people with incomplete high school education[29] increases regional poverty by one to two percent, reflecting relatively lower quality of labor. An increase of share of population with higher levels of education than the high school is associated with some decrease in the poverty rate. However, this effect is statistically and practically small reflecting the fact that the higher level of education affects the distribution of income at the levels higher than poverty line.

The average age of the local working age cohort serves as a proxy for experience. It has different impact on poverty in different sub-regions. Every additional year in the average age of the local working cohort decreases poverty in urban areas at a decreasing rate (the relation has a U-shaped form). The interpretation is that people with more experience can earn more. The relationship between the age and poverty outcomes in non-urbanized areas, however, has a positive sign implying that physical health of youth has a higher return than experience (the relation has an inverse U-shaped form). It implies that people with more experience would be better off moving to urbanized areas.

Average number of people with disabilities per household is another characteristic of the labor force. Every additional person with disabilities corresponds to an increase in the community poverty rate. This effect is particularly strong in the metropolitan areas, where an additional person with disabilities is associated with 0.85 times higher poverty rate. This estimate is much higher than a similar effect in rural communities. This result implies that society does not provide full insurance to the families with disabled members, and people with disabilities cannot fully cover their living costs.

Persistent Poverty

Location in a county with a higher poverty rate in 1990 is associated with higher poverty in 1999, which points to persistence of regional poverty. In rural communities this effect is particularly strong. One percent higher poverty rate in a county 10 years ago is associated with 0.45 percent higher poverty rate in 1999. The results for other regions are not statistically significant. Partridge and Rickman (2005), and Weber and Jensen (2004) find similar evidence for rural areas. However, our results highlight differences in

29 The share of population with complete high school degree is the omitted category.

the persistent poverty across different types of communities. Persistence of regional poverty implies that its sources do not disappear over time constituting a regional poverty trap. Regional poverty traps may happen due to the conditions of local infrastructure, topography, weather or other natural or human made factors. Escaping from the trap often requires collective action and outside help. This result calls for a more active role of government in poverty reduction, particularly in rural areas.

Control Variables

The use of the controls is necessary to obtain consistent results. Even though not all of them have an interpretation besides controlling for the unobservables, excluding these variables would bias the results.

The share of in-migrants is found to be not statistically significant. The result is smaller in magnitude to what has been found in the literature (e.g., Partridge and Rickman, 2005). The share of retirees captures specifics of their migration in Michigan. A higher share of people over 65 is associated with lower poverty, controlling for other factors. It reflects the fact that older people bring non-labor income (pensions, insurance, dividends, etc.) into communities and generate local demand for goods and services. Increasing the share of retirees in a local population by a one-percent point is associated with a reduction in the poverty rate by about seven percent in the urbanized areas[30]. This result is also similar to the finding by Partridge and Rickman (2005) when they control for conditions of labor demand.

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30 Note that adding wealthier people to a region can reduce the percentage of households in poverty without necessarily doing anything for those in poverty. On the other hand, adding an external income stimulates local demand for goods and services, which in turn may have poverty reduction effect. The estimates represent the net effect.

College students represent a special case of temporary chosen poverty. A binary variable for college towns controls for communities with a high share of students. The metropolitan communities with colleges have poverty rates that are 0.34 times higher than in the communities with similar characteristics, but no college. The presence of voluntary low-income students should not be confused with poverty of the working population.

Controls for the aggregation error (population and area size) are found to be significant, indicating that the residual impact of the individual idiosyncratic error (ε_i) is a potential problem. The estimate for population size in metropolitan areas is the smallest (0.12 vs. 0.25 in rural areas). It indicates that the individual unobservables have a lower effect on the community outcomes. The units in metropolitan areas are more populated with relatively more homogeneous residents, which supports our argument. Thus, adding a person to a larger community would have smaller effect on the aggregate characteristics of this community. This result is comparable to previous findings in the literature (e.g., Partridge and Rickman, 2005; Levernier et al., 2000), where the population size effect is much smaller for larger spatial units (county). The positive sign on the population size reflects most likely the effect of the boundary design.

The results of this study show a lot of similarities with previous findings in the literature. However, current analysis shows important differences in poverty responses between urbanized and non-urbanized communities, and articulates that quality and quantity of local labor supply are the most significant determinants of poverty.

1.6. CONCLUSIONS

This paper takes a new approach to the analysis of poverty distribution across small communities that is based on production behavior of community residents. For that purpose, the study relies on the Census 2000 data on partitions of the Census Block Group. The results reveal significant differences in the poverty responses of rural, metropolitan and metropolitan adjacent communities to the characteristics of regional labor demand and supply. It follows that a policy response to community poverty should also be selective and region-specific.

It is also found that the characteristics of the labor supply play a more important role in determining community poverty than the conditions of the labor demand. Thus, the improvements of the labor demand conditions are less powerful poverty reduction instruments than the improvements in the quality of labor.

Among the characteristics of labor supply, the number of adults per household (quantity of labor force) is the most important factor. However, adults have different opportunities to earn income in different sub-regions. Those opportunities are beyond the conditions of labor demand and may reflect varying barriers and costs of labor force participation. Among these barriers could be poor transportation and communication infrastructure, lower availability of childcare facilities, etc. Quality of labor is also important. Communities with higher proportions of people with disabilities have higher poverty. It implies that improvements in the system for support and assistance for the disabled are needed.

A high persistency of poverty is found in rural areas. As the number of people in agriculture, mining and forestry has declined, some small rural communities have lost their reason for being. Some communities have experienced high poverty rates for decades, which calls for a policy intervention.

While many theoretical and estimation issues were considered, the results are not without points for critique. However, the proposed model provides solid empirical and theoretical ground for further regional poverty research and policy analysis. In particular, it allows incorporating factors such as the cost of labor force participation, access to information, etc. into the poverty analysis. Also, further research is needed to determine if the results are valid for institutional environments in other states.

ESSAY 2

Nizalov, D., and S. Loveridge. (2005). "Regional Policies and Economic Growth: One Size Does Not Fit All," *Review of Regional Studies*, 35(3), pp. 266-290.

2.1. INTRODUCTION AND OBJECTIVES

The growth rate and the distribution of personal income are among the major characteristics of well being of a local population. They are also issues of concern for all levels of government. As a result, a large number of federal and local economic development policies and programs are aimed at personal income growth. Such programs include improvement of public infrastructure, job training, grants, loans, tax abatements for business expansion and retention, etc. For example, in the year 2000 Michigan had more than 40 programs and policy tools specifically aimed at economic development (CRC 2001). However, with many states currently facing budget difficulties, the role of state government in economic development is likely to be challenged with increasing frequency. The effectiveness of development policies and programs in raising income is therefore an important question.

There is a large literature on economic development program evaluation, but there is no consistency in the results. Some authors found no significant relationship between policies and growth, while findings of others vary greatly (for reviews, see Bartik 1991; Fisher 1997; Wasylenko 1997; Goss and Phillips 1999; Buss 2001). The reasons for the variation in findings are numerous. Among them are the quality of data (Buss 2001); deviation of true political goals from optimal economic development path of a region (Wolcoff 1992; Dewar 1998; Thornburgh 1998); imperfections in policy evaluation methods (Bartik 1991; Buss 2001) and shortcomings in policy design.

This paper addresses some of the above-mentioned concerns. However, there are some less studied issues that contribute to the lack of consistency in empirical policy assessments. The first of them is that the same policies may have significantly different effects in different geographic areas due to the heterogeneity of local economies. This heterogeneity leads to an aggregation error and non-systematic empirical results (Forni and Lippi 1997). Separate estimation of policy effects in counties with relatively high and low income, different industry structure, and level of urbanization is undertaken to assess the extent of the aggregation error issue.

Some support for the heterogeneity concern can be found in the literature. Loh (1993) finds that effect of development policies on job growth differs across industries. He finds also that the effects of different policies on the same outcome are different, as well as the effect of the same policy on different measures of growth. Similar evidence is found by Dalenberg and Partridge (1995), Luce (1994), and Papke (1991). Fisher (1997) suggests that this heterogeneity can be explained by different marginal return to factors targeted by the policies across industries and sectors. The marginal return may also differ with respect to average income level, and between metropolitan and non-metropolitan areas. Another source of heterogeneity is related to possible differences in the size of the marginal effects of policy under different scales of policy application. If under these circumstances, the intensity of policy application is systematically different among sub-regions of a state, the marginal policy effect should also be different.

Another rarely addressed problem in policy analysis is that a large number of policies and programs are implemented simultaneously. Several of them are either mutually exclusive or additive by design. On the one hand, this fact may lead to mixing the impacts of different policies. On the other hand, programs may have mutually increasing or decreasing effect. To address these issues, we consider the effect of several policies at the same time.

The above-mentioned issues can be restated in the following hypotheses:

- The impacts of development policies vary with respect to an average income level, industrial structure, and degree of urbanization of local economy.
- The policy effects are not linear.
- The effect of any development policy is conditional on presence of other policies in a region.

To test these hypotheses, this article analyzes impacts of Michigan economic development policies and improvements in highway infrastructure on county per capita income and job growth in the 1990s. Focusing on the economy of just one state helps control for unobservable factors such as the legal system, culture, other statewide institutions, and natural amenities. Loh (1993) mentions that such an approach would greatly improve the quality of data on development policies since comparability is no longer an issue. This approach allows excluding variation in macroeconomic factors as a potential source of bias.

Several other issues raised in the literature are also addressed. First, an attempt is made to improve the measurement of policy treatments. Previous studies use the presence or absence of policy treatment in an area (e.g., state) to identify the policy effect. Other studies look at the number of development programs available in a region (for review see Fisher and Peters 1997). In contrast, to quantify the policy shock to a local economy, we use more precise measures. The intensity of policy use is measured by number of businesses receiving a benefit (e.g., tax break) or by area of a zone receiving a policy benefit. This approach allows assessing the effect of marginal change in the treatment on growth outcomes (e.g., providing policy benefits to one additional business) – an issue that has important policy implications.

Second, a policy treatment may have a significant spillover effect on neighboring areas (Bartik 1991; Papke 1993, 1994; Fisher 1997). This effect arises due to regional production and consumption relationships (multiplier effect), migration, and commuting patterns. While policies are applied to small territories of a neighborhood or a township size, a county is used as a unit of analysis[31]. The area of a county captures additional benefits of a policy applied to a small territory within a county.

The rest of the paper is structured in the following way. Part 2.2 provides a brief introduction to the Michigan economy and explains the nature of the economic development policies under consideration. Next, we turn to the justification of the empirical model used for policy analysis. Part 2.4 describes the data. Discussion of the results is presented in part 2.5. Part 2.6 concludes the paper.

2.2. MICHIGAN DEVELOPMENT POLICIES

Michigan is a heavily industrialized state. While its population accounts for 3.5 percent of the U.S total (Census Bureau 2000), the state contribution to the national manufacturing output was 5.4 percent in 2000 (BEA 2005). Motor Vehicles Manufacturing is an important industry for the Michigan economy. While major facilities are in metropolitan areas, the auto companies have outsourced many components to small manufacturers across the state, providing employment outside the metropolitan areas.

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31 One could argue that a county is a too large area to capture the effect of treatment applied to just one business establishment or the effect of a small tax-free zone. However, if anything we would underestimate the policy effect since local commuting zones normally include several counties (Tolbert and Sizer 1996). Supply and demand chains are even more widely distributed than commuting.

During 1990s Michigan real personal income per capita[32] grew at an average annual rate of 1.9 percent, slightly outpacing the national average of 1.6 percent. The job growth was on average 0.9 percent per year, compare to 0.6 percent of the national average (BEA 2005).

Even though the state economy went through structural changes contributing to the growth, this period is also known for an aggressive role of the state and local government in economic development (Bartik et al. 2003; CRC 2001). Those efforts were mirrored in the sharp increase of the state's "Governor's Cup" ranking published by *Site Selection*, an economic development trade publication. The Governor's Cup is an annual ranking of states based on the reported number of major new investments in business re-location and expansion[33]. After placing 15th in 1993, and 22nd in 1994, Michigan recovered to 7th place in 1995 and 6th in 1996. In 1997, Michigan started a string of first place rankings that continued for four consecutive years before it dropped to 4th place in 2001, 2nd in 2002, and 5th in 2003.

However, the contribution of the government to this improvement may be quite limited; the various types of business expansion (jobs created, new buildings or financial investments) included in the ranking may not depend exclusively on the existence of a particular policy. For example, with respect to job creation, Faulk (2002) finds that only around 25 percent of new jobs claimed by policy beneficiaries can be attributed to the policy effect. The rest would have been created anyway. A similar number is presented by Papke (1994). Moreover, Fisher and Peters (1997) argue that a policy effect of the job

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32 Real income is considered throughout this paper.

33 Based on number of new and expanded facilities in terms of jobs, square footage, or dollars invested. The ranking does not control for state population. According to the US Census Bureau, Michigan is the 8th most populous state.

growth can be negative due to factor substitution. Thus, a careful evaluation of policy effects on growth is necessary.

This article focuses on a group of policies initiated during 1990s that have been implemented in a substantial proportion of Michigan counties. The effect of those new policies is compared to a more traditional development tool: road infrastructure. The policies considered for the analysis are the following:

- The **Michigan Economic Growth Authority** (MEGA) program grants eligible businesses with Single Business and Income tax credits for 8 to 20 years. The program targets "large-scale investment and job creation [and retention], as well as attraction of technology-intensive business" (*CRC* 2001, p. 20). The purpose of the program is to support the projects that would not occur without the policy support[34]. There is no targeting of specific geographic area. However, businesses located in federally designated distressed zones have a lower eligibility threshold. Also some industry restrictions apply.

The program started in 1995, and by the end of 2000 there were 107 authorities located in 30 counties which directly and indirectly created 145,542 jobs[35]. The number of MEGAs per 100,000 of county residents measures the treatment. The intensity of this normalized treatment ranges from 0 to 14.3 and averages 0.3 MEGAs per county (see Table 2.1 for more details).

Bradshaw (2002) reports that roughly 70 percent of new jobs generated by expanded or new businesses are created during the first year of the expansion. For that reason we would expect much of the effect of MEGAs on job growth to be short run.

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34 "... applicants mast certify that the project would not occur absent the MEGA grant." (*CRC* 2001, p. 20).

New employment leads to additional labor income, which in turn is partially diverted to neighboring communities by commuters. Thus, it is reasonable to expect MEGA's effect on income growth to be lower than the effect on job growth. However, the consumption linkages of new workers and supply/demand linkages of firms benefiting from MEGAs would amplify the policy effect in the longer run.

Even though county economic conditions do not enter the formal eligibility criteria, endogeneity of MEGA's effects may occur if more of the eligible business establishments are attracted to counties with higher growth potential. If this were true, a simple correlation between number of MEGA and growth would include upward bias. The issue of endogeneity of policy treatment is addressed in more detail in section three of this paper.

- The **Renaissance Zone** (RZ) program provides firms and individual residents of the state's most economically distressed areas with a waiver of virtually all state and local taxes for the purpose of revitalization of those areas (*CRC* 1998, 2001). This program uses Michigan State Housing Development Authority definition of an "economically distressed area" for targeting (*CRC* 1998). This definition is based on an area's average income level and change in real property values.

The program was established in 1996. In the first round 11 zones were created in 14 counties for terms ranging from 10 to 15 years. The zone areas were from 110 to 2202 acres. The second round was in 2000 and nine new zones were created increasing the total number of counties with the zones to 29. The creation of new zones ended in December of 2002. By that time 34 Renaissance Zones were functioning. The RZ policy treatment is measured in acres of the zone per 1,000 county residents. Intensity of the

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35 Based on estimates by Michigan Economic Development Corporation.

treatment averages 0.7 acres per 1,000 residents with a range from 0 to 104 (see Table 2.1 for details).

The design of this program benefits primarily small businesses and individual residents (CRC 1998). For that reason, we would expect the policy effect to come through higher income of self-employed residents and property owners. Papke (1994) analyzed a similar program in Indiana, and found that the zone residents take only 4% of all jobs and 15-20% of new jobs in the zone[36]. Thus, the spillover effect of the program is expected to be large.

The estimated effect of RZ on growth may be biased downward. The policy targets areas with lower potential for growth, and counties with larger per capita area of the zone would also have more distressed areas, controlling for population density. However, Wooldridge (2002) considering the example by Papke (1994) argues that the presence of a policy treatment in a county is not conditional on county performance once a zone is designated. Thus, there is no significant endogeneity in policy treatment after controlling for county specific conditions. The same argument can be applied to other policies under consideration.

- The **Brownfield Development Authority** (BDA) program targets re-development of "blighted", "functionally obsolete" and contaminated sites (*CRC* 2001, p. 31). BDAs are allowed to use tax increment for redevelopment of the brownfield sites. In addition there are state bonds "dedicated to brownfield remediation". Also, the BDAs projects are eligible for Single Business Tax credits. Michigan adopted the program in 1996 and by the end of 2000 there were 170 Authorities located in 53 counties. We use the number of

36 For review of literature on Enterprise Zone programs in US, see Papke (1993).

BDAs in a county per 100,000 residents to quantify the policy treatment. Its intensity averages 0.4 authorities per county (see Table 2.1 for details).

The immediate job growth effect generated by the BDA[37] program is expected to be small because it is limited to temporary jobs associated with the environmental remediation phase of the redevelopment effort. However, BDAs bring previously underutilized land into active economic use increasing property value. For that reason the effect of BDAs on income growth is expected to be positive and significant. Two factors operate in opposite directions in terms of bias. More distressed areas would potentially have higher number of brownfields available for redevelopment, but on the other hand higher demand for sites is expected in faster growing areas.

- Improvement in **highway infrastructure** is another development tool. It may lead to a reduction in commuting time and transportation cost, contributing to long-term growth of both income and number of jobs. The effect of highways is measured in terms of miles of federal, state and major county highways and roads per 1,000 residents. Michigan has on average 3.8 miles per 1,000 county residents (see Table 2.1 for details). Construction of major roads follows a long-term plan and is funded primarily through state and federal budgets, reducing the bias in the policy treatment.

The data on the policies come from the Michigan Economic Development Corporation, Citizens Research Council of Michigan and the State of Michigan government. Policy treatment is measured as of January 1 of a given year.

The set of policies under consideration does not include some important programs such as direct incentives, job training, loan guarantees, subsidies, etc. This exclusion is driven by the data availability and spatial scale of policy implementation. However, the policies considered in this study are good representatives of four groups of development incentives widely used in other states. MEGA represents a class of firm-level tax abatements. RZ are akin to a wide range of programs targeting revitalization of economically distressed areas (e.g., Enterprise Zones). BDA represents programs that do not have job growth or business creation/expansion as a primary objective. And finally, highway system expansion is a typical example of infrastructure improvement activity. Moreover, "[of] all the public services examined for an influence on economic development, transportation services, and highway facilities especially, show the most substantial evidence of a relationship" (Fisher 1997, p.54).

2.3. EMPIRICAL MODEL

There are several approaches to the development policy analysis. Among other case studies, simulations and econometric analysis are used most frequently. Each of them has its own benefits and weaknesses (Bartik 1991; Sadoulet and deJanry 1995; Fisher and Peters 1997; Goss and Phillips 1999). Econometric analysis is the most appropriate to use for testing heterogeneity of policy effects with the policy data described above.

Simple correlation analysis of policy treatments and growth will likely to produce biased estimates of policy effects since, as we argue above, some policies target specifically areas with lower growth rate, while some others are likely to be applied more in the areas with higher potential for growth. However, the fact that policy treatments are assigned by state or federal agencies partially reduces endogeneity of policy shock to the current county growth conditions. Other sources of endogeneity are also possible. One is

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37 For discussion see Mayer and Lyons (2000), DeSousa (2000)

due to endogenous migration or sorting[38]. That is that areas affected by policies attract population with some common unobservable characteristic correlated with growth. Another source is due to normalization of policy treatment in our study by population. Since the size of population responds to the growth conditions through migration (Goetz 1999), faster growing regions would experience endogenous reductions in per capita policy treatment, biasing estimates downward.

There are two ways to circumvent the endogeneity problem. First is to estimate the policy effect using instrumental variables (e.g., Goss and Phillips 1999). Second is to control for policy selection criteria within the estimation model. Unfortunately, a plausible set of instruments for the policies under consideration is not available. That leaves us with the second approach, which, however, does not guarantee control for all sources of bias (Besley and Case 2000). Nevertheless, we take several steps to minimize the uncontrolled endogeneity.

First, we eliminate bias in normalized policy treatment created by endogenous population change in the following way. The treatment is normalized by population in a year of implementation of that treatment. This normalized treatment is carried over time with no accounting for change in population in later periods. Any changes in the policy treatment itself (e.g., a new authority or additions to a Renaissance Zone) are normalized by population in a year of that change and added to the amount of treatment from the previous period.

Second, we include into the estimation model controls for policy targeting. The first candidates for the controls would be income and job levels per capita since

38 We do not consider an endogenous sorting as a serious problem. If that sorting (business relocation and population migration) is a response to the treatment, we consider it as a part of policy outcome for a county,

policies target areas with low income and employment. However, those variables are endogenous to the growth by construction of the variables (future level is a function of the current level and the growth rate – which is ruled out for the fixed effect estimation procedure used in our analysis). Instead, we include the following variables that may impact the targeting and influence the growth. The share of people with a bachelor's degree, denoted by *educ* controls for the level of education (or human capital) of a county population. The number of jobs per capita in manufacturing (*manuf*), government (*gov*) and farming (*farm*) serve as controls for the industry structure of each county's economy. Density of business establishments (*dens*) controls for the degree of concentration and urbanization[39]. These variables explain also a large portion of variation in income and job levels.

Design and implementation of the policies takes time. Thus, county economic conditions should be controlled in a year when the policy designation decisions are made. Therefore, the control variables are used with a one-year lag. This also allows avoiding simultaneity bias in the control variables.

The resulting estimation model takes the following form (2.1)[40]:

$$(2.1)\quad GR_{t'-t} = \beta_0 + \beta_1\, policy_t + \beta_2\, educ_{t-1} + \beta_3\, manuf_{t-1} + \beta_4\, gov_{t-1}$$

$$+ \beta_5\, farm_{t-1} + \beta_6\, dens_{t-1} + \beta_7\, year_t + e + u_t,$$

even though no effect may be observed at a macro-level.

39 In particular, the density variable helps control for possible systematic differences in policy application between rural and urban areas.

40 The indexes for counties are suppressed.

where $GR_{t'-t}$ is the growth rate between years t and t' (t'>t). Vector e denotes unobserved county conditions that are fixed over time, and u is an idiosyncratic error.

Policies may have different primary objectives (e.g., growth of large vs. small businesses, growth vs. redistribution of income, etc). Two aspects of policy objectives, income and job growth in a county, are considered in turns. Thus, $GR_{t'-t}$ represents in turn each of the two growth outcome measures.

The timing of the growth response to the policy treatment is an important issue. Some of the responses, such as change in production and employment levels, are relatively fast, while others, such as relocation and changes in business birth rates, may take a long time to occur. Also, some policies may have a short-lived effect, while others impact long-run growth patterns. This timing differs also for different development outcomes (e.g., job vs. income growth) (Papke 1994).

One may argue that short-run fluctuations in a growth rate may be driven primarily by fluctuations in demand and industry specialization. It would be problematic to separate a policy effect if designation of the policy treatment is also driven by these factors. These issues represent a major challenge for our empirical analysis. To address this issue, we first consider two measures of the growth outcomes: over one-year period (annual growth) and three-year average growth rates. The annual measure is designed to capture the most immediate policy effect (if any). The second measure averages out some of the annual fluctuations, and is designed to capture more persistent policy effects. Secondly, to control for demand and industry fluctuations (which are most likely to be common for most of the state) we include a set of year binary variables (*year*) together with measures of industry structure (as described above) into the model. The year dummies control also for common shocks such as inflation, national business activity conditions, etc.

A vector of normalized policy treatments *(Policy)* is of primary interest. To test the hypothesis about the cross-policy effects, the interaction terms among the policy treatments are also included in the base model. Nonlinearity of the growth response is tested by inclusion of square terms for policy treatment. To test for heterogeneity of policy effects, the model is estimated separately for counties with high and low level of per capita income. The difference between counties with high, and low per capita number of jobs in manufacturing, and between metropolitan and non-metropolitan counties are also considered and discussed briefly.

The model omits a number of factors relevant to growth. Among them are local taxes, natural amenities, quality of local government, spatial interdependence of the regions, etc. Most of them can be a source of omitted variable bias since they may determine the application of policy. However, these factors have little variability over time. We assume also, that other conditions that describe county eligibility for the treatment or attractiveness of a county to MEGA eligible businesses stay stable over time, conditional on other controls. Using eight periods of annual data is consistent with this assumption[41]. A county specific effect (e) denotes all time invariant conditions.

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41 In using fixed effect transformation of the data, we have to consider a tradeoff between the number of factors that stay stable and the time horizon. The longer the time span, the fewer the number of factors that stay constant and, thus, are controlled by this estimation technique. The eight-year time period, considered in our analysis, is thought to be a good balance. It is reasonable to assume that unobservable county conditions, which impact an amount of policy treatment are stable over this time period conditional on other variables in the model. On the other hand, Figure 2.1 shows that we have a large variation of, for example, annual income growth around the state average of 1.8 percent per year over 1993-2000. The policy treatment has also a significant variation.

A fixed effect Feasible Generalized Least Squares (FGLS) procedure is used for estimation of the model. The main benefit of the selected procedure is that it helps control for unobserved fixed factors in the growth model (e) and provides efficient estimates of standard errors. Fixed effect estimation reveals how the change in the treatment for the same entity associates with change in the growth rate controlling for other factors. The FGLS procedure is particularly helpful in estimating three-year average growth where a significant serial correlation in error is present. Alternative procedures are mentioned in section five of this paper.

2.4. DATA DESCRIPTION

Local Area Annual Estimates (BEA 2005) is the primary source of the data for the dependent and control variables for 83 of Michigan counties over the years 1993 – 2000, making a total of 664 annual county-level observations. This time frame is determined by the data availability. To get consistent FGLS estimates, the year of 1993 is not used for estimation after fixed effect transformation is performed on the full set of data. Thus, only 581 observations are used by the FGLS procedure.

Four dependent variables are used in our analysis, making a set of four equations. They are annual and three year average growth in personal income and number of jobs. As an example, consider the year 2000. The annual growth for this year is change in income or job levels between years 2001 and 2000. Three-year average growth is computed as the change between the years 2003 and 2000 divided by three. Figure 2.1 depicts the patterns of both growth outcomes in Michigan over 1993-2000 period. There is a 58 percent correlation between annual and three-year average income growth and 71 percent correlation for the job growth measures. There is a 45 percent positive correlation between the annual income and job growth for Michigan counties. Thus, these variables reflect some different aspects of economic growth.

The average annual income growth for Michigan counties was 1.7 percent, varying from minus 11.6 to positive 14.7 percent. Jobs grew at an average rate of 1.1 percent, ranging from minus 15.8 to plus 24.0 percent (see Table 2.2 for descriptive statistics). In our sample, the average share of adults with a bachelor's degree (used to control for education level) is 8.1 percent. There are on average 101.1; 68.1 and 5.6 jobs per thousand county residents in manufacturing, government and farming respectively. The average concentration of business is 25.1 establishments per square mile.

We pay particular attention to potential heterogeneity of the policy effects across different types of local economies. To compare the growth patterns, we have divided the state into counties with above and below the median per capita personal income levels, called "high" and "low" income counties respectively. To avoid artificial truncation, we consider the average income level over eight years for each county for the assignment into the appropriate income group.

The other dimensions of potential heterogeneity are industrial structure of the local economy and degree of urbanization. Counties with more and less than median per capita number of jobs in manufacturing are treated as separate sub-regions for that purpose. The average number of jobs over eight years for each county is considered for this purpose. Counties are also distinguished as metropolitan and non-metropolitan. The metropolitan part includes 41 Michigan metropolitan and metropolitan adjacent counties (Beale Codes 0, 1, 2, 3, 4, 6 and 8). The non-metropolitan part includes other 42 Michigan non-metropolitan, relatively rural, counties.

There is a strong correlation among the different classifications of county economies. For example, 39 percent of metropolitan counties also have a high number of manufacturing jobs, and 45 percent of metropolitan counties are in the high income category. About 55 percent of the high income counties have also a high number of manufacturing jobs. However this correlation is not perfect, which provides an opportunity to use those characteristics as potentially different dimensions of policy effects.

2.5. RESULTS

The estimation results are presented in Tables 2.3 and 2.4. Each table contains fixed effect FGLS estimates of policy treatments and control variables on one and three-year average growth rates[42]. The selected estimation procedure was compared with random effect and first difference estimation procedures, and was more efficient[43]. The results of the first difference and fixed effect estimations are similar, implying that our model provides sufficient control for endogeneity (Wooldridge 2002).

We tested if the inclusion of the control variables is helpful by regressing the treatment by each policy on the controls and on other policies. The results indicate that the controls are statistically significant in explaining the variations in policy treatment. We found a systematic cross-policy relationship (see Appendix 2.1 for details). For that reason, the policy variables are interacted with each other and de-meaned[44]. Thus, the estimates represent marginal policy effects on growth in a county with average treatment by other policies.

42 Stata[tm] 9.0 was used for estimation.
43 As expected when the standard assumptions hold.

2.5.1. Base Model

The estimates of the policy effects for all Michigan counties (the base model) are presented in Table 2.3. The results for the income growth are in Columns 1 and 2, and for the job growth in Columns 3 and 4. Very few individual policy coefficients are statistically significant. The directions of policy effects on income and job growth are somewhat similar.

The effect of highway improvements is positive, but decreasing (the quadratic term is negative) and has a relatively large t-statistic. The results on three-year average job growth (Column 4) imply that one additional mile of highways per 1,000 residents increases the average growth rate by 1.2 percent (for a county with average values of other policy treatments). The effect of every additional mile is decreasing by 0.1 percent. The turning point of 12.6 miles per 1,000 of residents is within the range of values in the sample. However, it is far above the state average of 3.8 miles. It implies that highway improvements have the potential to facilitate job growth in most Michigan counties. The effect of the highways is higher in counties with larger areas in Renaissance Zones (the interaction term between the highway's and RZ's treatments is positive and significant).

Other estimates of the policy effects (which are occasionally significant) do not provide a strong basis for judgment. Policy variables are jointly significant in explaining variations in county growth rate (with exception for one-year income growth – Column 1 – see Chi-square statistics for all policy variables at the bottom of the table 2.3). The joint policy effect comes primarily through a direct policy impact (as opposed to the interactions with other policies). Interaction terms are jointly significant in affecting the

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44 Without de-meaning the estimates would represent the marginal policy effect in a county with no

three-year average growth (Columns 2 and 4 – see Chi-square statistics for policy interactions).

Most of the estimates for the control variables are statistically significant. Since these variables have significant correlation with policy treatments (Appendix 2.1), they provide a strong control for unobservable policy targeting. The model has a sufficient power in explaining variation in growth rates. Both log-likelihood and Wald statistics are high (see the bottom of the Table 2.3).

Even though we found that the policies are jointly significant in explaining income and job growth, and that the interactions of their effects are significant, there is not much to say about the effects of individual policies. This is the point where many researchers would stop further investigation of the issue, blaming downward selection bias, lack of reliable instrumental variables, and multicollinearity. However, we hypothesize that policy effects are heterogeneous and change with the type of local economy. This unaccounted heterogeneity hides statistical and practical significance of the policy effects.

2.5.2. Policy Effect Heterogeneity

What are the implications of the heterogeneity problem? If this heterogeneity exists, but is ignored, the estimation results would present a weighted average of the effects in the separate (relatively homogeneous) sub-regions. The standard error would be also inflated. Moreover, the results will be inconsistent when a larger population is considered and the proportion of the sub-regions changes. To show whether heterogeneity is present, we estimate the model separately for counties with high and low

treatment by other policies (interaction term equal to zero in this case).

income. A summary of the results is presented in Table 2.4. Columns 1-4 contain the estimates of the income growth. The estimates of the job growth equation are presented in columns 5-8. Similar separate equations are estimated for metropolitan/non-metropolitan counties and for counties with above and below the median number of jobs in manufacturing (results are summarized below).

Testing the significance of the difference in the estimation results between the sub-regions involves the following steps. First, we interact the explanatory variables with binary variables for the sub-regions. Second, we insert these new interactions into the model and estimate this augmented model on the full set of observations. Statistical significance of the interactions of the policy variables with the sub-region dummy indicates the significance of the difference in policy effect between the parts of the state under consideration. In the results tables we have denoted with boldface font the estimates that are individually different at 10% significance level between the sub-regions (estimates of the difference are not presented in the paper)[45]. The joint significance of the differences is assessed with Chi-square statistics presented at the bottom of each panel.

Heterogeneity with respect to the income level

Our exploration of heterogeneity in policy effects focuses on the differences with respect to income level. The estimation results in Table 4 indicate that the difference in policy effects is statistically significant jointly for the three-year average growth for both income and job growth outcomes (see Chi-square statistics for the difference). The joint significance of the policy effects on job growth is higher in lower income counties (see

Chi-square statistics for all policy variables – Columns 7 and 8). It implies that difference in income levels is an important source of heterogeneity.

The individual differences in policy effects can be easily seen when the model is estimated separately for high and low-income counties. The individual difference is observed for most of the variables. Some of these differences are statistically significant. In particular, the BDA effect on the annual growth becomes statistically different between the sub-regions of the state. The effect on annual income growth (Column 1) becomes individually significant in counties with high income. The difference implies that the linear effect is more negative in these areas. The effect becomes positive more quickly than in the low-income counterparts (the quadratic term is positive and larger). The effect on the annual income growth becomes positive in the high-income counties after the point of about nine BDA per 100,000 residents. The effect of this policy on the three-year average job growth (Column 8) is positive and significant in low-income counties. Comparing the results for BDAs with the previous table (where no effect was detected) we conclude that uncontrolled heterogeneity of a county economy with respect to the income level hides the significance of this policy effect.

The effect of highways is also found to be different with larger effect in the high-income counties. Another confirmation to the heterogeneity hypothesis is the fact that the linear effect of the highways on the three-year average income growth differs in sign and magnitude (Columns 2 and 4), while the results from the previous table are insignificant.

Some significant differences in the effects between the high and low-income counties are found for MEGA and some of the policy interactions. However, none of the

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45 This and other results not reported in the paper are available from authors upon request.

RZ effects becomes statistically significant. The direction of policy effects on income and job growth are consistent with the previous table.

The gain from estimation of individual policy effects by separate sub-regions is not always large. The weakness of heterogeneity evidence (for RZ in particular) is due to several possible reasons. First, the primary source of heterogeneity in the policy effects may be different than the income level. Second, the definition of the sub-regions may be imperfect. Alternatively, there may be no heterogeneity or no significant policy effect. We explore some of these issues in turn.

Metro/ Non-Metro Difference

We continue the discussion of heterogeneity by considering the difference in the policy effects between metropolitan and non-metropolitan areas. The difference in the joint effect on income growth is significant (results are not presented). It implies that joint policy impact is different in metropolitan and non-metropolitan counties. It serves as additional evidence in favor of the heterogeneity hypothesis. The job growth model is not different statistically.

The individual difference is most obvious (and significant) for the effect of RZ on income growth, and highways on job growth. The effect of RZ on three-year average income growth in metropolitan counties becomes positive and significant, but with decreasing rate. The turning point is around 26 acres of zone per 1,000 metropolitan residents. This point is within the range of the treatment values, but is far above the average of 0.7 acres. It implies that metropolitan counties can benefit more from application of this policy. Also, an increase in application of this policy in counties with more than 26 acres per 1,000 residents is counterproductive.

The effect of the highways on job growth is higher in non-metropolitan counties. It is positive but with decreasing rate. The turning point is around 13-16 miles per 1,000 non-metropolitan residents for both the annual and three-year average growth. This point stays within the range of the policy treatment values in the sample, but is above the average. This result implies that the highway improvements are an effective tool in stimulating job growth in non-metropolitan areas. Considering this along with the RZ results we can also conclude that the source of heterogeneity is different for different policies, but heterogeneity stays as a significant source of error in estimation results that hides the true policy effect.

Heterogeneity with respect to industry structure

Heterogeneity of policy effects with respect to industrial structure of the local economy adds one more dimension to the analysis. The results are similar to the case of metropolitan/non-metropolitan heterogeneity. However, the policy effects are not significantly different among the sub-regions (with few exceptions).

Even though statistical and practical significance is observed, results should be interpreted with caution. The measures of heterogeneity are far from perfect. For example, Papke (1991) shows that the effect of infrastructure varies significantly across industries within the manufacturing sector. The measure of urbanization used in this study might not capture all the differences between urban, fringe and rural areas. Also, other sources of heterogeneity such as unemployment rate are possible. For example, while Bartik (1991) and other authors (e.g., Goss and Phillips 1999) argue that the policy effect should be higher in regions with higher unemployment rate due to higher social benefits, others argue that when policies stimulate labor demand under low unemployment, more people would be attracted to the labor force and thus the effect should be higher under low unemployment.

Measures of the policy treatment could also be better. Highway miles do not measure all of the changes in quality of the infrastructure. Moreover, selection bias might not be completely excluded. In addition, there are costs associated with the use of the policy tools, which may offset the benefits. Those costs are not controlled for in our model.

The measures of growth also have weaknesses. Averaging reduces all of the short-term effects. If a policy has an effect on, for example, one-year growth but with some time lead, this effect would be underestimated. On the other hand, averaging reveals longer-term effects even if they are relatively small comparative to the short-run noise. Nevertheless, the results provide some insight on how the policy effects change over time and space.

2.6. CONCLUSIONS

In this paper we implemented a quantitative assessment of the impact of Michigan economic development policies and highway infrastructure improvements on personal income and job growth. We find that the policies have significant impact on the growth outcomes. However, the effects vary across different types of local economies. Ignoring this heterogeneity leads to underestimation of the policy effects. Significantly different policy effects are detected between areas with high and low levels of income and different urban structure. The lines along which the individual policy effect may change are different for different policies. For example, Brownfield Development Authority treatment is more beneficial for low-income communities, which may lack sufficient market pressure for redevelopment of underutilized land resources. The highways benefit more non-metropolitan counties where the reduction of transportation cost may be more significant. Renaissance Zones benefit more metropolitan counties. The difference in the Renaissance Zone's effect may be due to the relatively higher benefits provided by the policy in metropolitan areas where businesses and residents may experience higher tax loads, and where agglomeration effects may be higher. While determining the precise sources of heterogeneity requires additional study, it is clear from our results that economic development resources can be used more efficiently if policies target the areas most likely to produce higher returns.

The marginal effects of policies change with the scale of policy treatment, implying that there is a minimum threshold necessary for a positive impact. Also there is a point after which policies become counterproductive. Significant interactions between the policy effects are detected. The results imply that the policies have mutually reinforcing effect in most of the cases.

The policies have little correlation with fluctuations in annual growth. However, they change more persistent growth patterns as measured by the three-year average growth rate.

Some of the results have broader implications. The policy treatment such as a Renaissance Zone can be considered as a change in tax regime external to local residents and businesses. Thus, implementation of the policy can be treated as a "natural experiment"[46]. The results imply that lower taxes stimulate local growth holding fixed other factors (such as quality of infrastructure and public services).

Comparison of policy effects on alternative growth outcomes opens a wide range of opportunities for analysis. Job growth should correspond to income growth trends since wage is a part of personal income. Keeping this in mind, we can look at the difference in policy effects between income and job growth as changes in income distribution patterns. For example, if we observe a positive effect on job growth but not on income growth we can suspect that either part of the jobs go to commuters or that a substitution effect in the sources of income takes place (e.g., unemployment subsidies are substituted with some wage income without raising well-being). The other extreme point would be when we observe a positive effect on income growth without growth or even with decline in the number of jobs. This situation implies that the source of income growth is either an increase in property value, or increase in proprietary income, or substitution of labor for other factors. The ideal policy would have positive impact on

46 Bartik (1991, 1997) argues that taxes and public spending are highly endogenous to growth and without an external shock it is impossible to determine their impact with any precision.

both growth outcomes. Our results show that in general Michigan policies have similar impact on both income and job growth. It implies that Michigan economic development efforts are beneficial to the well being of state residents. However, more rigorous analysis of this issue is required.

In the light of the current trends in economic development when communities, especially in rural areas, are increasingly vulnerable to globalization processes, it is extremely important to tailor the development policies to the specifics of the targeted areas. Our results show that one-size-fits-all approach is not appropriate for regional economic development. The results can be used to set priorities among different policy tools and contribute to better understanding of the development policy effects. They also allow a more accurate expectation of the policy impact.

ESSAY 3. DOES FIRM SIZE DISTRIBUTION MATTER? AN EMPIRICAL TEST OF THE ENTREPRENEURIAL PIPELINE THEORY

3.1. INTRODUCTION

Encouraging entrepreneurship has been a subject of concern in the economic development literature for some time (Birch 1987; Hanham *et al.*, 1999; Johanisson, 1991; Walstad, 1994), but has generally failed to capture the attention of mainstream local economic development practitioners (Loveridge, 1996). The practitioners continue to focus on industrial recruitment and business retention. These traditional approaches must be reassessed as increased competition from lower wage countries in both manufacturing and services makes successful recruitment and even retention ever more difficult. These new challenges are shifting the focus of regional development to the role of amenities in driving job creation (Green, 2001; Florida, 2002), and fostering a renewed attention to the role of entrepreneurship in local development (Von Bargen *et. al.*, 2003; Walzer, 2004).

Much has been written on how to make it easier and less risky to start businesses (Watson *et al.*, 1998; Sohl and Rosenberg, 2003), and on identifying start-ups with high growth potential (Birch and Medoff, 1994). However, whether a community has *enough* of entrepreneurs remains an unanswered question. The expression "too much of a good thing" might well apply to the supply of small businesses in some communities, while other communities rely heavily on employment by a small number of large businesses. Neither of these extremes is likely to be good for sustainable growth in a long run.

Lichtenstein and Lyons (2006) raise this distribution issue. They argue that small, medium-size and large businesses are interdependent within a regional economy, and that there are entrepreneurs at all sizes of businesses. Entrepreneurial development cannot be limited to a small business. Moreover, some small businesses lack entrepreneurial characteristics (Muske and Woods 2004; Lichtenstein and Lyons *op. cit.)*. On the other hand, mid-sized and large firms can be very entrepreneurial (Lichtenstein and Lyons, *op. cit.*). Entrepreneurial development requires a balanced distribution of businesses within local economy. The interdependence of businesses comes from the local production and consumption linkages as well as from various externalities (e.g., small businesses create local amenities, large businesses create a critical mass for many local business services, etc.). Businesses of different sizes have mutual benefits in developing entrepreneurial skills, having successful role models, and training the region's labor force. Illustrations of such interdependences include, for example, the health care industry, where large regional hospitals are often accompanied by a number of small clinics, individual practitioners and medical equipment suppliers. Another example is the automobile industry, where large companies are supported by small subcontractors. Lichtenstein and Lyons suggest that regional entrepreneurial growth depends on how easily local entrepreneurs can improve their skills and expend their businesses. It follows also that an appropriate economic development strategy may differ in response to a business mix in a particular region. Reflecting this fact, Lichtenstein and Lyons (2006) define three groups of strategies: small business incubating, improvement of overall business performance, and selective attraction of large businesses.

This paper explores whether that balanced distribution or, in Lichtenstein and Lyons' (2006) term, a community's "pipeline of entrepreneurs" has an empirical relationship with measures of overall economic growth. An index is introduced that summarizes the distribution of employment across businesses size categories, and then the relationship between the index and county economic growth is estimated.

To make the analysis robust to unobserved interstate variation in growth conditions such as natural amenities, the legal system, culture, or other statewide institutions, the study focuses on only one state, Michigan. This approach also excludes variance in macroeconomic factors as potential source of bias. However, the findings are applicable to other regions of the United States and other countries.

The paper is structured in the following way. Part 3.2 reviews literature on the relationship between business size and economic growth, and provides further motivation. Part 3.3 discusses the issues of measuring business distribution, the empirical model, and describes the data. Part 3.4 presents the results and implications, while Part 3.5 concludes.

3.2. BUSINESS SIZE DISTRIBUTION AND IMPLICATIONS FOR ECONOMIC GROWTH

There is a debate in the literature and among practitioners whether regional economies benefit more from incubating small business start-ups, facilitating expansion of existing businesses, or from attracting large business establishments from other regions. On one hand, there is a common perception that small business is the major contributor to job growth and economic development (*e.g.*, Birch, 1987). Small business is associated with entrepreneurship and innovation – widely accepted engines of growth (Malecki, 1994; McQuaid, 2002). Empirical studies reviewed by Martinez (2005) found positive correlation between output growth and share of small business. Also, a larger share of small and medium-size businesses can make a local economy more flexible and less vulnerable to industry-specific shocks.

On the other hand, Davis *et al.* (1993, 1994) sharply criticize this perception. Looking at business establishment level data for manufacturing, they argue that the association of small business with job growth is driven by endogenous transition of the establishments among the size categories and by disregarding the job contraction, which is also higher among small businesses. They conclude that there is "no strong or systematic relationship between net job growth rates and either firm or plant size [in manufacturing]" (Davis *et al.*, 1993, p.25). This result is similar to earlier findings in the literature (see for review Lucas, 1978). In addition, not every small business is entrepreneurial (Muske and Woods, 2004). Many new small businesses, especially branch plants, franchises, retail shops etc., are replicas of existing business approaches (Malecki, 1994). Moreover, the link between the growth of small business and income growth is even more questionable. Jobs in the small business sector are on average less persistent (Davis, 1993), have fewer fringe benefits, and lower wages (Ettlinger, 1997). These arguments provide a rationale for practitioners to devote substantial resources to attraction of large businesses to their regions.

However, the conclusions by Davis *et al.* are also subject to critique. Changes in employment by individual business establishments are not independent of one another. Outsourcing of jobs by large businesses to smaller counterparts may support the job creation role of small business, while on the economy-wide scale there may be no growth at all. Moreover, business establishments are linked by production process and ownership ties, which make the growth of one establishment conditional on the growth of others. Also, investments into large business attraction may never pay-off since businesses tend to act strategically in requesting the development incentives (Gabe and Kraybill, 2002) and they may move to another state or abroad.

An interesting conceptual reconsideration of the relationship between the business distribution and regional economic development is provided by Lichtenstein and Lyons (2006). They argue that effectiveness of business incubating, improvements of overall business performance, or selective business attraction strategies depends on specific conditions of a business mix in the local economy. To describe this mix, Lichtenstein and Lyons introduce the notion of an "entrepreneurial pipeline": a two-dimensional "map" of business distribution within a community. These dimensions are the life stages and entrepreneurial skill levels of businesses. The pipeline helps describe the interdependences that exist among the businesses within a region that are beyond production and consumption. These interdependences include peer pressure of the businesses at the same level of development, and the role models of businesses at a more advanced stage. It follows that it is not any single part of the pipeline (*e.g.*, large scale plants) that are more important than the other, but rather, the important thing is to have sufficient numbers of businesses in all categories. In other words, communities should have a balanced distribution of businesses. Lichtenstein and Lyons argue that development policies should be community specific and target development of that part of the business distribution that is underrepresented. If, for example, a community suffers a low business start-up and survival rates economic developers should rely more on the incubating strategy, while communities that do not have a sufficient number of more mature medium and large size businesses should put more efforts into selective attraction. Communities that seem to have sufficient proportion of businesses at all life stages and all levels of entrepreneurial skills would benefit from employing development strategies that target overall improvement in business performance such as infrastructure improvements, upgrading of education, communication and public services.

This paper aims at exploring the validity of Lichtenstein and Lyons' "pipeline" conceptual framework through an empirical test. However, to do this test, the notion of the "pipeline" needs to be operationalized. Even though not all the small businesses are new, the life stages of business development are closely linked with the size of businesses. Before getting big, all businesses started as small (Lichtenstein and Lyons, 2006). Even though there are entrepreneurs at business of all sizes, it takes an entrepreneur with a higher level of skills to successfully operate large business (Lucas, 1978). Thus, the size distribution of businesses may reflect both dimensions of Lichtenstein and Lyons' "pipeline", so, the size distribution of businesses within a local economy is used to test the concept. In particular, we test whether there is a significant link between the distribution and two common measures of local economic development: income and job growth rates.

3.3. EMPIRICAL MODEL AND DATA

An empirical test of the pipeline hypothesis faces two challenges – developing a tractable measure of the firm size distribution, and estimating that measure's relationship to local growth. We address each of them in turn.

Measures of the Size Distribution

County Business Patterns (Census Bureau, 2005) provides data on the number of business establishments in nine employment size groups by county. The smallest group includes establishments with one to four employees, while establishments in the largest group employ more than 1,000 workers. Figure 3.1 depicts the shares of business establishments by the size groups for Michigan for the years 1988 – 2000.

As one might expect, the average share of business establishments in each size group decreases with increasing size of the business (Figure 3.1). The range of the county-level values for each group also decreases from 40 percent (44 to 84) for the smallest size group (1 to 4 employees) to a range of 0.5 percent for the establishments with more than 1,000 employees (Table 3.1, Panel A). In each category above 19 employees, there is at least one county with no firms in that size range (minimum share of establishments is zero). This distribution is typical for the Great Lakes region of the United States.

However, the establishment distribution does not reflect the fact that larger businesses have more impact on the local economy. Thus, the number of establishments in each category is weighted by a measure of employment size. This way, the distribution of employment shares across business size categories (groups)[47] is constructed. The resulting employment distribution is surprisingly close to uniform[48] (Figure 3.2). If the employment shares were equal across the nine categories, each group would have 1/9 or 11 percent of total employment. This equal share point is within one standard deviation from the mean for five out of nine groups and within two standard deviations across all groups.

This distribution of employment among the business size categories can serve as the basis for exploring the pipeline theory. A starting hypothesis is that the deviation of the employment shares from a uniform distribution has negative impact on the growth of the regional (county) economy.

To test the entrepreneurial pipeline concept the following steps are taken. First, we regress county growth rates on the shares of employment in each size group. If the pipeline theory is valid, then the measures of the distribution should have significant correlation with the growth controlling for other covariates[49]. If, in addition, the optimal distribution is uniform, we would expect the shares of the underrepresented groups (those with average below the equal share: 1-4, 250-499, 500-999, 1000<) to have a positive association with growth. The shares of the over-represented groups would have a negative association. An alternative way to test the same hypothesis is to look at the

47 The ideal way to construct the weights is to use the average size of a business establishment within each group. However these data are not readily available, so we use the lower size bound in each group as a weight. This makes our employment distribution over-weight the smaller businesses in each size category. The error is larger for the size groups with wider employment ranges. Nevertheless, the reconstructed distribution of employment serves the purposes of the current line of inquiry. Tests involving application of alternative weights did not change our empirical results (alternative results are not reported).
48 The share of the size categories encompassing a wider range of values is underestimated.
49 The study omits the effect of non-employer businesses (establishments with zero employed workers) on regional growth. This group includes self-employed entrepreneurs and non-active businesses. The effects of these two types of non-employer businesses go most likely in opposite directions. If the net effect is positive and the share of this business category correlates positively with share of small business, than the

absolute deviation of each group from the equal share. In this setting a larger deviation is hypothesized to be associated with lower growth.

Each approach, however, would suffer from multicolinearity among the size groups, and would provide only limited insights into the optimal growth enhancing distribution. To enhance the analysis, the distribution needs to be represented with a single statistic. As an example, we have constructed a business distribution index (3.1), which is the sum of the absolute deviations of the employment shares in each group from the uniform distribution (11%).

$$(3.1)\quad Index = \frac{1}{2}\sum_{i=1}^{9} | x_i - 11\% |$$

where x is the share of employment in each of the nine size groups respectively. By construction, a positive deviation from 11% in one category is offset by an equal negative deviation in other categories. Thus, by summing absolute values, the size of the deviation from a perfectly even distribution is counted twice. We therefore divide the total sum of absolute deviations by two.

The interpretation of the index is straightforward. It represents the share of total employment that would have to be reallocated among the groups to achieve a perfectly uniform distribution of the employment across the business size categories. The larger is the index, the more unequal is the current distribution of employment across the size groups. If the uniform distribution is optimal for growth, the index should have a negative association with measures of growth. However, if the equal distribution is not optimal,

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effect of the latter on growth would be overestimated. However, this omission does not cause any selection bias since the growth outcomes are observed for all counties for each year.

there is a positive value of the index (optimal deviation from the uniform distribution) that maximizes growth.

For Michigan counties the average value of this index is 20.35%. It ranges from 12.88% to 61.47% (see Table 3.1, Panel C). The distribution of the index across Michigan counties (averaged over the study period) is interesting as well. The southern part of the state, which includes all Michigan metropolitan and metropolitan adjacent counties, has a lower value of the index than the northern (primarily rural) counties (Figure 3.3). This map may support the initial hypothesis that more equal distribution of employment (captured by lower values of the index) may be attributable to more dynamic local economies. Whether lower values of the index are associated with a higher growth is tested by plotting the values of the index against two measures of growth: the annual growth of per capita personal income and growth in the number of jobs per 1,000 county residents.

Figures 3.4 and 3.5 show the relationship between the county's distribution index (averaged over the study period) and the two measures of growth. In contrast to the initial expectations these figures demonstrate a positive correlation between the growth and the index. However, the results are biased since the distribution may correlate with industry structure (Davis, 1993), education and other determinants of growth (Barro 1998; Démurger *et al.* 2001; Rupasingha *et al.* 2002). Thus, these covariates should be controlled econometrically.

Estimation procedure

The relationship between the two measures of annual growth rate and the measures of the business size distribution *(size_distribution)* is estimated using the model that includes several controls for the growth conditions of a county economy. These conditions may also affect the distribution of businesses. The two measures of the distribution discussed earlier - the shares of employment and the index – are considered in turn. The model takes the following form[50] (3.2):

$$(3.2) \quad GR_{t,t+1} = \beta_0 + \beta_1 size\_distribution_t + \beta_2 educ_t + \beta_3 \; manuf_t + \beta_4 farm_t + \beta_5 gov_t + \beta_6 denst_t + \beta_7 year_t + e + u_t,$$

where $GR_{t,t+1}$ is the growth rate between years t and t+1 of both per capita income and jobs per 1,000 county residents. The share of population with a bachelor's degree (*educ*) controls for the level of education. Year binary variables (*year*) control for time specific shocks common to all counties (e.g. inflation, national business activity conditions, etc.) and common trends, such as declining number of jobs in manufacturing. The number of jobs per capita in manufacturing (*manuf*), farming (*farm*) and government (*gov*) controls for the industry structure of local economy. The number of business establishments per square mile (*denst*) controls for the degree of concentration and urbanization. This last variable correlates with the measures of business size distribution by construction (they both use the total number of business establishments). However, this correlation is small; for example the correlation between business density and the distribution index is about 0.01.

50 The indexes for counties are suppressed.

The model omits a number of potential covariates. Among them are local taxes, natural amenities, quality of local government, spatial interdependence of the regions, as well as other geographic and institutional conditions. However, most of these factors have little variability over time. Vector *e* denotes this unobserved county specific conditions that are fixed over time. Finally, *u* represents an idiosyncratic error.

One may argue that conditional growth model employed in our analysis should include income and job levels to control for the state dependency. However, those variables are endogenous to the growth by construction of the variables (the future level is a function of the current level and the growth rate – which is ruled out for the fixed effect estimation procedure used in our analysis). Nevertheless, the control variables used in the model explain a large portion of variation in the income and job levels and, thus, control for their effects.

A fixed effect Feasible Generalized Least Squares (FE FGLS) procedure is used for the estimation of the model. The main benefit of the selected procedure is that it helps control for unobserved fixed factors in the growth model (*e*) and provides efficient estimates of standard errors. Fixed effect estimation reveals how the change in the business distribution for the same entity associates with change in the growth rate controlling for other factors. Unrestricted FGLS procedure helps to mitigate the effects of spatial and serial autocorrelation in errors. Even though the estimation approach does not control for all sources of bias (Besley and Case 2000) it is the most efficient among feasible alternatives (see Appendix 3.1 for comparison of alternative procedures). To get consistent FGLS estimates, one year (1988) is not used for the estimation after the fixed effect transformation is performed on the full set of data.

Whether the inclusion of above-mentioned controls improves the estimation can be verified by regression of the measures of business distribution on the control variables. Appendix 3.2 presents the results for the business distribution index and the shares of employment in 1-4, 20-49 and 500-99 employee firms (Columns 1 to 4 respectively). There is a significant correlation between the controls and the measures of the pipeline, which supports the inclusion of the former into the empirical model.

Data

The relationship between the growth and the business distribution is estimated using data on 83 Michigan counties over the thirteen-year period of 1988 – 2000. The total sample includes 1079 observations. However, only 996 observations (years 1989-2000) are used by the FGLS procedure. In addition to the County Business Patterns (Census Bureau, 2005) this study uses Local Area Annual Estimates (BEA, 2005), which provide data on income, jobs, population and most other variables.

The mean value of real per capita personal income growth is 1.29 percent per year (Table 3.2). The average job growth is 1.67 percent per year. There is 0.21 positive correlation between income growth and job growth. Thus, they reflect slightly different dimensions of economic development. This relatively low correlation between the two measures of growth reflects the fact that new jobs, particularly in metropolitan areas, benefit a large pool of commuters from other counties. This fact also explains why the correlation between the index and income growth (Figure 3.4) is lower than the correlation with job growth (Figure 3.5). Also the growth rates of jobs and wages are different for most of industries.

Over the thirteen years under consideration, Michigan's economy went through structural changes contributing to growth. The share of smaller businesses on average decreased while the share of businesses with 50 to 249 and 500 to 999 employees increased by a few percentage points. Cross sectional variation of the shares decreased for groups of 1 to 499 employees. The average value of the business distribution index did not vary significantly, while the range of values trended downward after peaking in 1992 (Figure 3.6). So the employment distribution becomes more similar across Michigan counties over the period of analysis.

Regarding the control variables, the average share of population with a bachelor's degree in our sample is 6.00 percent (Table 3.2). There are on average 76.55 jobs per 1,000 of residents in manufacturing, 13.07 in farming and 73.49 employed by government. An average un-weighted concentration of business is 4.15 establishments per square mile. Additional descriptive statistics and data sources can be found in Table 3.2.

3.4. RESULTS AND IMPLICATIONS

The main estimation results are presented in Tables 3.3 and 3.4. The tables contain FE FGLS estimates of the conditional correlation between the measures of business size distribution and annual growth rate of jobs and per capita income.

The characteristics of the business distribution are significant determinants of income and job growth. For all specifications, the measures of distributions are jointly significant. Table 3.3 presents estimates of the relationship between the growth and the shares of employment by business size categories. Columns 1, 2 and 3 display the effects on the job growth, while Columns 4, 5 and 6 display the effect on the income growth.

Columns 1 and 4 present estimates for all Michigan counties. In addition, the model is estimated separately for metropolitan and non-metropolitan counties (Columns 2, 5 and 3, 6 respectively). The metropolitan part includes 41 Michigan metropolitan and metropolitan adjacent counties (Beale Codes 0, 1, 2, 3, 4, 6 and 8). The non-metropolitan part includes other 42 Michigan non-metropolitan, relatively rural, counties. The reason for this separate estimation is that the growth models are functionally different between these two sub-regions of the state (Nizalov and Loveridge, 2005).

The estimates on the employment shares represent the effect of marginal change in the share in comparison to the omitted category – businesses with more than 1,000 employees. A common feature to both growth outcomes (Columns 1 and 4) is that the effect of the smallest size category (with 1 to 4 employees) is positive, meaning that the effect of micro-enterprises (individual practitioners and family businesses) on growth is higher than the effect of the largest enterprises. The relative effect of each group is decreasing with the size of the business: estimates become less positive (see also Figures 3.6 and 3.7).

An important difference between the job growth and income growth results should be highlighted. The positive effect of smaller business is more distinctive for the job growth, while the regional income growth benefits more from only the smallest businesses as well as the omitted group of the largest enterprises (relative effect of other categories is negative indicating that their effect is inferior). This difference between the two models is consistent with the literature, which questioned the effect of small business on income growth. It follows that there is a conflict between job and income growth enhancing distributions of the business across the size categories. The job growth enhancing distribution would have a larger share of employment in small businesses with size from 1 to 99 employees and smaller share of larger businesses than it is on average. On the other hand, an income growth enhancing distribution would have a larger share of both the smallest (1-4 employees) and the largest (more than 1,000 employees) businesses than we observe in an average Michigan county.

The direction of this relationship is somewhat different from what we hypothesized earlier. We expected that an increase in share of groups that are on average below the equal share (1-4, 250-499, 500-999) would have positive association with growth. That suggestion is true only for the smallest group (1-4).

Many estimates in Columns 1 and 4 of Table 3.3 are imprecise (statistically insignificant) which makes it hard to interpret the results. There are two explanations for the large standard errors. First, there is a large correlation among the parts of business distribution (Appendix 3.1), which leads to inflated errors. A solution to this, as we argued earlier, would be an alternative measure of the distribution (the index considered later). Second, the growth models are functionally different between the metropolitan and non-metropolitan areas (Nizalov and Loveridge, 2005). Thus, a separate estimation of the model for both sub-regions is necessary.

When we consider the job growth model for metropolitan and non-metropolitan areas (Columns 2 and 3), this functional difference becomes obvious. For metropolitan areas, a larger share of the largest businesses (omitted category) is inferior comparing to other categories the later have positive association with growth. The positive effect is largest for the smallest businesses, but is gradually decreasing with increasing business size. It implies that a job growth enhancing distribution would have more employment in smaller businesses than in the larger ones.

In non-metropolitan areas this relationship looks quite different. All business categories, except the smallest one, have a smaller effect than the largest businesses (coefficients are negative). Thus, to facilitate the job growth in non-metro areas the emphasis should be on attracting or growing large businesses and facilitating start-ups of the smallest. This metro/non-metro difference in the growth model may explain the difference in policy effects that target small business development found in the literature (e.g., Nizalov and Loveridge, 2005).

On the other hand, the income growth model does not reveal any important difference between metropolitan and non-metropolitan areas (estimates in Columns 5 and 6 are similar). For both sub-regions it is beneficial to facilitate the start-ups of the smallest businesses and increase the share of the largest.

Regarding the results where the distribution is presented with the index (Table 3.4), the positive coefficient implies that the growth-enhancing distribution of businesses is different from the uniform (11% employment share per size group). The quadratic term for the index is negative, which means that the positive effect of the deviation from uniformity is decreasing, and that there is a point after which a further deviation from the even distribution has a negative impact on growth. The turning point for the job growth is 34.1%, while it is 25.7% for the income growth. These points are above the average value of the index in our sample (20.35%). The results allow splitting Michigan counties into three groups. The first group includes counties with lower than optimal values of the index (below 20-22%). Counties in this group would benefit from having more employment in smaller businesses. The second group includes counties with the index in a range of 22-35%. The distribution in this group is close to being the optimal, controlling for other growth conditions. Finally, the third group includes counties with too high value of the index (above 35%). The distribution in this group is overrepresented with smaller businesses. These three groups can be clearly seen on the map of the index distribution (Figure 3.3).

The groups match well the three development strategies, presented by Lichtenstein and Lyons (2006). In the light of our findings, it seems to be reasonable that the first group would benefit more from a business incubating strategy, while the second and third groups would benefit more from the performance enhancing and the selective attraction strategies respectively. Thus, the results indicate that the majority of counties can do better by focusing effort on managing the "pipeline of entrepreneurs and enterprises" and adjusting the business distribution so that it is closer to the optimal.

Regarding the estimates on control variables, a higher level of education is negatively related to growth. This variable reflects a negative relationship between the initial level of income (with which the education correlates positively) and growth. Other controls are also significant. The estimates are robust to changes in the specification of business distribution variables.

The paper, however, has some limitations. By considering annual growth we are focusing our attention on the short run relationship between the size distribution and growth. The long-run effects may be different and should be addressed separately. Also, the data that we use in this study does not provide us with information on non-employer entities (self-employed entrepreneurs), which make a large portion of all business establishments. This exclusion, however, does not compromise our results. The number of non-employer entities is correlated with the share of the smallest businesses.

The definitions of size groups are taken as provided by the County Business Patterns, without considering alternatives and possible implications. Average size of establishments in each group can be estimated more precisely, and the distribution index can be constructed in several other ways (e.g. sum of square deviations from national averages). Moreover, considering larger areas, such as commuting zones (Tolbert and Sizer, 1996) or states may better capture the interdependences that exist among the businesses of different sizes. Future work may explore these questions, and document whether our findings can be replicated in other states.

3.5. SUMMARY AND CONCLUSIONS

This paper analyzes the relationship between economic growth of Michigan counties and measures of the distribution of employment across businesses of different size. This study uses data on Michigan counties from the County Business Patterns (Census Bureau, 2005) and Local Area Annual Estimates (BEA, 2005), for the years 1988-2000. The distribution is measured by the share of employment in establishments in various size categories and by a distribution index. The index provides a measure of the extent to which the local economy deviates from an equal percentage of employment in each business size category.

The major finding is that there are strong links between the business size distribution and regional economic growth. The results indicate that the growth-optimizing distribution of employment by business size is not uniform. We found also that optimal job and income growth enhancing distributions would have a higher share of the smallest businesses than is currently the average. However, a larger share of businesses with more than 1,000 employees would also facilitate income growth in some counties.

There are several direct policy implications. The appropriate policy actions (e.g., incubating small business or recruiting and growing large businesses) depend on the current distribution of businesses in a particular region, supporting ideas by Lichtenstein and Lyons (2006). In Michigan, most counties (particularly in the southern part of the state) seem to need pay more attention to smaller businesses, given our results. A regional economy needs to maintain sufficiently large share of self-employed entrepreneurs, family businesses and other smallest (micro) enterprises to enhance growth of other parts of local economy. Unlike industrial recruitment or infrastructure-based economic development strategies, policies to stimulate small business formation need not be costly, but may require thoughtful effort to achieve cultural and attitudinal shifts. Some examples of low cost small business-friendly cultural shifts follow.

- Local civic groups could feature the small business of the month, year, etc. that could inspire others to try opening a business. The Edward Lowe Foundation recently began doing this in Michigan with its "Fifty Companies to Watch" awards. Businesses receiving the award report easier access to credit and better networks as a result of the award.
- Communities can work to seed formation of peer-to-peer networks of small business owners (Lichtenstein *et al.*, 2004; Muske and Woods, 2004).
- Small businesses could be featured in K-12 learning experiences as mentors. The Junior Achievement program offers some opportunities but mentoring could be implemented more widely and in a broader set of contexts (Emery *et al.*, 2004).
- Small business examples and role playing could be featured in basic math and social studies in K-12 curricula (Hanham *et al.*, 1999).
- Institutions of higher learning could be encouraged to offer entrepreneurship specializations within a variety of programs of study.

In conclusion, it is evident that in Michigan, the notion of an entrepreneurial pipeline is a concept that is supported by the modeling results, at least in terms of the numbers of businesses in various size categories. The entrepreneurial pipeline should help inform policy as decision makers choose to pursue various competing strategies for local economic development.

The analysis presented in this paper is not without points for critique. One may argue, for example, that counties, used as units of analysis, are too small to capture all the complexity of business interdependencies. Also, the findings presented in this paper may be sensitive to the definition of the index or to the specifics of Michigan economy. These and some other issues are the subjects to the further research.

APPENDIX 1.1. HOUSEHOLD PRODUCTION MODEL

The specification of a model explaining poverty (choice of variables) is informed by the theory of household production. A household is involved in a set of activities using a stock of physical and human assets and investing in them. The purposes of those activities are to reproduce the assets (first of all human), to meet social standards, to enjoy consumption and to increase wealth (the stock of assets). Those purposes are represented by a utility function *U(.)*. Real income is considered as a constraint on utility maximization and it serves as an intermediary of that process. Observed monetary income is often considered as a proxy for real income (though we know that income and happiness are not well correlated after basic needs are met).

A household production model (Singh et al, 1986) describes the interdependence of production and consumption activities of a household. According to the model, a household maximizes utility (equation A1) subject to a set of constraints (equations A2-A4).

(A1) Max $U(X_h, X_m, l, H)$

where X_h is a vector of home-produced and consumed at home goods like agricultural products, housing, childcare etc. A vector X_m is a set of market-purchased consumption goods, l is a leisure time; H, is a set of household characteristics (often referred as taste shifters) such as age, gender, cultural or ethnic background etc.

The constraints are of the following nature. The first one (A2) is a budget constraint – expenditures must equal income including borrowing.

(A2) Budget: $k_m X_m + k_n n = k_h(q - X_h) + wL_o + v$

where k_m is a vector of prices for market purchased goods, k_h is a vector of prices for home produced goods, w is a vector of wage rates for a stock of labor, L_o is number of hours working out of home (in the labor market). Vector v includes non-labor income and will be described later (A5). Vector q is a set of home-production outputs. It is described by a production function (A3). And finally, k_n is a vector of prices for market purchased production inputs n.

(A3) Production: $q=q(L_h, n, A_h)$

where $q(.)$ is a household production function, L_h is a vector of a household labor inputs into a home production, n is a vector of market purchased production inputs, and A_h is a vector of physical assets used in household production.

The nature of the next constraint (A4) is that amount of labor (human) assets have physical (and biological) limits T. Vector T describes those limits, which in turn are an outcome of household characteristics H (e.g., number of adults in a household). The endowment of time can be spent on leisure, home production or on work outside the home.

(A4) Time: $L_h + L_o + l = T$

The last component of a budget constraint – non-labor income v – should be described separately (A5). It includes return on investments $(A-Ah)$. Where r is a rate of return, assuming that all the assets not used in a household production are invested. The other component s is a vector of subsidies, transfers and taxes, which could depend on household characteristics and income.

(A5) Non-labor income: $v=r(A-A_h)+s$

Combining equations (A2) to (A5) the budget constraint takes the form:

(A6) $k_m X_m + k_h X_h + wl = rA + wT + k_h q(L_h, n, A_h) - wL_h - rA_h - k_n n + s$

This expression equates a household's real expenditures to a real income. Expression

(A7) $\pi = k_h q(L_h, n, A_h) - wL_h - rA_h - k_n n$

is an equivalent of economic profit of a household production.

Solving a household utility maximization problem we can get the optimal household income y^* as:

(A8) $y^* = rA + wT + \pi^*(w, r, k_n, k_h, H) + s$

The level of household income depends on the initial stock of assets (human and physical), exogenous to the household return to assets (prices and costs), transfers and a household ability to extract income out of its assets (profit).

Our derivation is based on the assumption that a household does not hire out-of-household labor, but rather buys necessary inputs (including labor) on a market. Second, we assume perfect asset markets (both physical and human). In other words there is no cost to participate in labor or capital or other markets, and perfect information about the markets is available. Often it is not true, especially when we are considering regional poverty. This assumption can be relaxed in further projects to evaluate an impact of market imperfections such as costs of labor force participation on regional poverty.

Another issue, not addressed in the model, is factor mobility. Capital does move to utilize low cost labor as witnessed by the textile industry moving first from New England to the south of the US, and then to Asia. But, the process has not been sufficient to eliminate rural poverty either in the south or in Asia. Likewise, labor of a given quality does migrate from low wage areas to higher wage areas as witnessed by the migration of Mexicans and Asians (and others) into the United States and the migration of people from

Appalachia to industrial cities in the north. But, similarly to the case of capital, labor migration has not eliminated poverty at the source of the migration. This suggests there are formal and cultural barriers to the equalization of factor returns. However, it is beyond the scope of this modest research project to investigate these variables.

The model developed here takes the stock of human capital as a given. It does not further inquire into how that stock was produced — how individuals and the broader community reached investment decisions.

APPENDIX 2.1: MODEL SPECIFICATION

Whether the control variables explain non-random variations in policy treatment caused by targeting can be verified. We estimate the correlation between the policy treatment and the controls. Table 2.5 presents the results of this estimation. It shows a significant correlation between the treatment and other variables included in the models, which supports a concern about non-random policy placement. It shows also a systematic relationship among the policy treatments. For example, areas with higher per capita highway mileage have more of BDA per capita (coefficient on highways in the BDA equation is positive – Column 3). On the other hand, there are fewer MEGAs in areas with more RZ (coefficient on RZ is negative – Column 4), holding other factors fixed.

Regarding the controls, a higher level of education associates with fewer applications of MEGA, but more BDA. Characteristics of county industry structure are also significant in explaining the variations in the amount of policy treatment. A negative coefficient on business concentration indicates that the policies systematically target areas with fewer business establishments, holding other factors fixed. Joint significance of the control variables is also high (see Chi-square statistics at the bottom of the table). Thus, the use of the above-mentioned controls improves results of the policy analysis.

APPENDIX 3.1. JUSTIFICATION OF THE ESTIMATION TECHNIQUE

To compare alternative estimation procedures, the relationship between the income growth and the distribution index is estimated using pooled ordinarily least squares (POLS) (Columns 1 and 2, Table 3.5), fixed effect (FE) (Columns 3 and 4), first difference (FD) (Column 5), Arellano-Bond (ABond) (Column 6), and fixed effect feasible generalized least squares (FE FGLS) (Column 7) methods. Results are presented in Table 1.5. Since different estimation methods have different use of the lagged values, the comparison is limited to the period 1990-2000, so that the same number of observation is used. For that reason the FE FGLS estimates in Table 1.5 are somewhat different from the results presented in Table 1.4 of the main part of this paper.

When we compare POLS estimates (Column 1, 2) with FE and FD results (Columns 3-7) we can observe a significant difference both in terms of estimated parameters and a goodness-of-fit. This difference suggests the presence of unobserved fixed effect and makes FE and FD estimates superior relative to POLS. Addition of time varying control variables (education, industry structure, business concentration and year dummies) reduces omitted variable bias further in a significant way. The difference is observed for both POLS (Columns 1 and 2) and FE (Columns 3 and 4) estimates.

Consistency of FE and FD estimates rely heavily on a strict exogeneity assumption. The assumption implies that the explanatory variables have to be exogenous for all time periods (not just contemporaneously). If this assumption holds the results of FD and FE estimation procedures (Columns 4 and 5) should be similar. However, some difference is observed for estimates on education. This difference can be treated as a sign of endogeneity problem (Wooldridge, 2002, Ch.11) or that this variable is predetermined.

A potential remedy for this problem is provided by Arellano-Bond estimation technique (Arellano and Bond, 1991). Result is presented in Column 6. These estimates are somewhat in between of the FE and FD results. However, ABond estimates may be inconsistent due to the presence of serial correlation in errors. Thus, the FE procedure is used as a base for the analysis. Comparing FE and FD, the former is more efficient for two reasons. First bias in FD parameters does not decrease with the number of time periods. Second, with a small serial correlation in error term (which is true in our case) FE procedure is more efficient (Wooldridge, 2002, Ch. 10).

Finally, to improve the efficiency of the FE estimates the standard errors are corrected for spatial and serial autocorrelation by applying FGLS procedure on FE transformed data (Column 7). This step increases the goodness of fit of the model comparing to the original FE procedure.

The results, obtained by these different procedures display significant similarity, which allows to conclude that they are robust to the alternative technique. However, FE FGLS is used for the rest of the paper as the most efficient.

APPENDIX 3.2: MODEL SPECIFICATION

Table 3.6 presents estimates of the association of the control variables with the business distribution index and employment share in selected business size categories. The results imply that a higher level of education reduces inequality in the business distribution (parameter on education is negative in Column 1). A higher share of people with bachelor's degree is also associated with reduction in employment share of the smallest (1-4 employees) and medium (500-999 employees) businesses holding other factors fixed. A higher share of manufacturing and a larger number of business establishments per square mile makes the deviation of business distribution from uniformity larger (coefficients in Column 1 are positive). Employment in the government sector and farming is also a significant determinant of business size distribution. In summary, significance of the control variables in explaining the variations in the measures of business distribution justifies their presence in the estimation model.

Tabulation of business distribution introduces substantial multicolinearity into the model, as was argued above. The share of employment in both the small (1-4 and 20-49 employees) and medium (500-999 employees) businesses strongly correlate with the shares of employment in other size groups. However, some interesting results can be observed. By construction, the estimates on the shares are biased toward minus one. An increase of the share in one group by one percent tends to decrease the share of employment in other group by one percent holding other factors fixed. Results in Column 2 reveal a positive and significant correlation among the shares of employment in the smaller size groups (1-4, 5-9, 10-19 and 20-49 employees). The results imply that growth of smaller businesses is mutually dependent, lending support to Lichtenstein and Lyons' theory. This effect can come through a larger supply and demand base among the businesses, role modeling, experience or other unobserved common conditions. There is no such relationship for the larger business groups.

TABLES

Table 1.1. Distribution of Community Poverty Rates in Michigan

Poverty Rate	Number of Communities	% of Communities
0% – 10%	7,665	63.8%
10.1%-30%	3,527	29.3%
30.1% and above	826	6.9%

Data: Based on Census 2000, US Census Bureau

Table 1.2. Descriptive Statistics of Michigan Communities

Variable*	All State	Rural	Rural Towns	Metropolitan	Metropolitan Adjacent
	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)	Mean (Std. Dev.)
Number of observations [% of total]	12,018 [100.0]	1,871 [15.6]	517 [4.3]	6,775 [56.3]	2,855 [23.8]
Population, 100 person	13.4 (9.1)	6.8 (4.4)	10.1 (5.9)	14.9 (9.8)	10.8 (5.3)
Poverty rate[1], %	10.2 (10.8)	9.7 (6.1)	14.2 (11.0)	11.1 (12.0)	6.2 (5.0)
County Poverty Rate in 1990**, %	12.9 (5.6)	15.4 (4.5)	14.2 (4.2)	12.8 (6.0)	12.0 (4.2)
County Wage***, $,000[3]	34.0 (6.2)	23.8 (2.5)	24.9 (2.2)	36.5 (4.8)	29.7 (4.5)
County Unemployment, %	5.9 (2.0)	7.8 (2.4)	7.3 (2.2)	5.8 (2.0)	5.3 (1.3)
County Occupation Structure[5], %	19.1 (9.9)	19.6 (8.7)	14.9 (9.0)	18.1 (10.0)	23.2 (8.8)
Working Age Adults, persons per household	1.8 (0.6)	1.6 (0.5)	1.6 (0.7)	1.7 (0.7)	1.8 (0.2)
Dependants (children under 16), persons per household	0.8 (0.3)	0.7 (0.3)	0.6 (0.2)	0.8 (0.3)	0.8 (0.2)
People with Disabilities, persons per household	0.8 (0.4)	0.9 (0.3)	0.8 (0.4)	0.8 (0.4)	0.8 (0.3)
Incomplete High School[4], %	16.9 (11.2)	17.6 (8.3)	15.0 (8.2)	17.3 (12.3)	15.1 (7.3)
Completed High School, %	31.3 (11.0)	39.1 (9.0)	34.2 (10.7)	28.8 (10.7)	37.4 (8.9)
Less than College, %	30.3 (7.8)	28.6 (7.3)	30.4 (7.3)	30.1 (7.9)	31.7 (7.1)
Bachelor Degree, %	13.6 (9.7)	9.6 (6.4)	13.2 (8.0)	14.8 (10.4)	10.5 (6.7)
Graduate Degree, %	7.0 (8.9)	5.1 (4.6)	7.3 (6.5)	9.0 (9.8)	5.3 (5.1)
Average Age of working cohort (16 to 65), years	38.6 (3.3)	41.1 (2.9)	38.4 (4.0)	38.1 (3.3)	39.9 (2.2)
In-Migration[2], %	17.3 (12.5)	20.2 (9.7)	23.2 (14.0)	17.0 (13.4)	16.4 (8.5)
Share of retirees (65 and Older), %	12.3 (7.6)	16.5 (8.1)	17.7 (9.5)	12.1 (7.7)	10.7 (5.2)
College Town (dummy)	0.3 (0.5)	0.01 (0.1)	0.4 (0.5)	0.4 (0.5)	0.0< (0.1)

Data: *Census 2000, SF3 is a data source unless indicated otherwise; **Census 1990; ***Bureau of Economic Analysis

[1]Percentage of households in poverty.

[2]As percentage of people 5 years and older leaving outside of county of current residence in 1995.

[3]Average wage per job in a county in 1998 and 1999

[4]Education for population 25 years and over

[5]Share of production, transportation and material moving occupations in total employment in a county

Table 1.3. Test for Difference, F-statistics

	Rural	Rural Towns	Metropolitan
Rural		0.86	11.63***
Rural Towns	0.86		3.31***
Metropolitan	11.63***	3.31***	
Metro. Adjacent	3.59***	1.66**	5.52***

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 1.4. Estimates of regional poverty model

		Poverty+				
		All State	Rural	Rural Towns	Metropolitan	Metro. Adjacent
Labor Demand (w)	County Wage+	-1.25 (0.48)***	-0.72 (0.33)**	-0.41 (1.66)	-0.75 (0.37)**	-0.26 (0.28)
	County Unemployment	0.00< (0.02)	-0.02 (0.02)	-0.01 (0.06)	0.01 (0.07)	0.00< (0.05)
	County Occupational Structure	-0.00< (0.00<)	-0.00< (0.00<)	***-0.01 (0.01)***	-0.00< (0.00<)	***0.00< (0.00<)***
Labor Supply (T)	Adults	-5.05 (1.18)***	-1.82 (0.84)**	-2.58 (0.86)***	-3.36 (0.95)***	-1.93 (1.22)
	Dependents (Children <16y)	0.66 (0.79)	1.16 (0.75)	-1.31 (1.37)	1.02 (0.53)*	-1.38 (1.41)
	Incomplete School (%)	0.02 (0.01)***	0.01 (0.00<)***	0.01 (0.01)	0.02 (0.01)***	0.02 (0.01)**
	Incomplete College (%)	-0.00< (0.00<)	-0.01 (0.00<)*	-0.01 (0.01)	-0.00< (0.00<)	0.00< (0.01)
	Bachelor Degree (%)	-0.00< (0.01)	-0.01 (0.01)	-0.00< (0.01)	-0.01 (0.01)	-0.00< (0.01)
	Graduate Degree (%)	0.01 (0.01)*	-0.01 (0.01)	-0.00< (0.01)	0.01 (0.00<)**	-0.00< (0.01)
	People with Disabilities	0.93 (0.20)***	0.17 (0.11)	0.64 (0.38)*	***0.85 (0.21)******	0.36 (0.19)*
	Age	-1.26 (0.37)***	0.27 (0.11)**	***-0.70 (0.38)****	***-1.34 (0.36)******	-0.02 (0.19)
	Age Squared	0.01 (0.00<)***	-0.00< (0.00<)***	***0.01 (0.00<)***	***0.02 (0.00<)******	-0.00< (0.00<)
	County Poverty Rate, 1990	0.03 (0.13)	0.45 (0.21)**	0.67 (0.45)	-0.01 (0.25)	0.31 (0.19)
Controls	In-Migration	-0.03 (0.02)*	0.01 (0.01)	-0.02 (0.02)	-0.02 (0.01)	0.02 (0.02)
	Share of Retirees	-0.12 (0.03)***	-0.02 (0.02)	-0.07 (0.02)***	-0.07 (0.02)***	-0.07 (0.04)
	College Town (dummy)	0.27 (0.12)**	0.09 (0.22)	0.18 (0.26)	0.34 (0.06)***	0.23 (0.31)
	Population	0.14 (0.01)***	0.25 (0.01)***	0.25 (0.03)***	***0.12 (0.01)******	***0.14 (0.01)******
	Area	0.02 (0.00<)***	0.01 (0.00<)***	-0.04 (0.16)	-0.07 (0.06)	***0.02 (0.00<)******
	Constant	29.58 (8.12)***	-6.61 (2.96)**	***17.21 (8.31)*****	***30.26 (7.74)******	4.41 (6.32)
	Observations	12018	1871	517	6775	2855
	F-statistics	88.63***	58.21***	22.75***	124.85***	87.14***

Robust standard errors in parentheses; + Variable is in a natural logarithm form; *, **, *** significant at 10%, 5%, 1% respectively; Commuting zone dummies are suppressed for the display purposes; Boldface font for the parameters that are different from estimates for rural communities at 10%.

Table 1.5. First Stage Estimation for All Communities

	Number of Adults	Number of Children	Share of In-Migrants
County Wage[+]	-0.14 (0.09)	0.17 (0.09)*	-12.02 (2.90)***
County Unemployment	0.01 (0.005)*	0.02 (0.00<)***	-0.46 (0.16)***
County Occupational Structure	-0.00< (0.00<)*	-0.00< (0.00<)	-0.01 (0.02)
Incomplete School (%)	-0.00< (0.001)**	0.00< (0.001)***	0.10 (0.02)***
Incomplete College (%)	-0.00< (0.001)	0.00< (0.001)	0.02 (0.02)
Bachelor Degree (%)	0.00< (0.001)	0.00< (0.001)	0.26 (0.03)***
Graduate Degree (%)	0.00< (0.001)***	0.00< (0.001)	0.20 (0.03)***
People with Disabilities	0.17 (0.02)***	0.07 (0.02)***	-0.10 (0.41)
Age	-0.21 (0.04)***	0.04 (0.02)**	-7.27 (0.47)***
Age Squared	0.00< (0.00<)***	-0.00< (0.00<)***	0.08 (0.01)***
Share of Retirees	-0.03 (0.001)***	-0.02 (0.00<)***	-0.05 (0.02)**
College Town (binary)	-0.07 (0.01)***	-0.02 (0.01)	-2.55 (0.27)***
County Poverty Rate, 1990	-0.10 (0.02)***	-0.06 (0.02)***	-0.06 (0.65)
Population	0.00< (0.00<)	-0.00< (0.00<)***	0.20 (0.02)***
Area	0.00< (0.00<)***	0.00< (0.00<)	0.05 (0.01)***
Average Size of Household in Neighboring Area	-0.08 (0.07)	-0.16 (0.06)***	20.13 (2.29)***
Coastal County (binary)	0.05 (0.01)***	0.03 (0.01)***	-2.45 (0.31)***
Adults per Household in 1990	0.83 (0.23)***	1.11 (0.22)***	-80.48 (8.19)***
County Wage in 1990	0.00< (0.00<)***	0.00< (0.00<)***	-0.01 (0.001)***
Adults 90 * Wage 90	-0.00< (0.00<)***	-0.00< (0.00<)***	0.01 (0.00<)***

Table 1.5. (Cont.)

	Number of Adults	Number of Children	Share of In-Migrants
Proportion of Females in Neighboring area	0.01 (0.01)	-0.02 (0.01)***	-0.06 (0.18)
Average Age of Family Households' Heads in Neighboring Area	-0.20 (0.09)**	-0.02 (0.07)	7.93 (3.23)**
Average Age of Heads Squared	0.00< (0.00<)**	-0.00< (0.00<)	-0.07 (0.03)**
Constant	8.70 (2.15)***	1.23 (1.77)	29.36 (77.40)
Observations	12018	12018	12018
Adjusted R-squared	0.40	0.32	0.31
F-statistics for Instruments	7.77***	12.22***	25.76***

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 2.1. Summary Statistics: Policy Treatment, Michigan, 1993-2000

Variable	Mean	Std. Dev.	Min	Max
Number of Michigan Economic Growth Authorities (MEGA) in a county[a] per 100,000 residents	0.272	0.634	0	14.271
Area of the Renaissance Zone, acres[a] per 1,000 residents	0.664	5.031	0	104.083
Number of Brownfield Redevelopment Authorities in a county[b] per 100,000 residents	0.396	1.043	0	22.986
Federal, State and major county highways, miles[c] per 1,000 residents	3.807	5.218	0.494	85.995

Data: a) Michigan Economic Development Corporation
b) Victor Land Use Institute, Michigan State University Extension
c) Michigan Department of Transportation

Note: Policy treatment as of January 01 for a given year. Statistics for 664 population weighted county-level observations.

Table 2.2. Summary Statistics: Michigan Counties, 1993-2000

Variable	Mean	Std. Dev.	Min	Max
Annual Income Growth[a], %	1.731	2.602	-11.565	14.725
Three-Year Average Income Growth[a], %	1.317	1.562	-6.841	5.308
Annual Job Growth[a], %	1.073	2.325	-15.780	23.985
Three-Year Average Job Growth[a], %	0.587	1.644	-8.610	12.234
Percentage of Population with Bachelor Degree[b], %	8.140	3.217	2.977	15.650
Number of Jobs in Manufacturing per 1000 Residents[a]	101.086	34.197	9.462	196.835
Number of Government Jobs per 1000 Residents[a]	68.062	37.082	33.502	230.062
Number of Jobs in Farming per 1000 Residents[a]	5.607	7.351	0.000	43.976
Business Establishment Density[c]	25.107	22.710	0.091	58.876

Data: a) Based on Local Area Annual Estimates (BEA 2005)
b) Based on Census of population 1990, 2000. Data for 1993-99 is imputed by linear extrapolation
c) County Business Patterns (Census Bureau 2005)

Note: Statistics for 664 population weighted county-level observations.

Table 2.3. Base Model

	Income Growth		Job Growth	
	Annual	3-Year Average	Annual	3-Year Average
	(1)	(2)	(3)	(4)
Highway	0.003 (0.795)	-0.053 (0.376)	0.443 (1.190)	1.220 (0.560)**
Highway Squared	-0.055 (0.031)*	-0.031 (0.015)**	-0.084 (0.047)*	-0.097 (0.022)***
RZ	0.056 (0.036)	0.018 (0.017)	0.030 (0.054)	-0.022 (0.026)
RZ Squared	-0.001 (0.000)	-0.000 (0.000)	-0.001 (0.001)	0.000 (0.000)
BDA	0.034 (0.092)	-0.046 (0.043)	-0.106 (0.137)	-0.035 (0.065)
BDA Squared	0.003 (0.006)	0.005 (0.003)	0.000 (0.009)	0.003 (0.004)
MEGA	0.006 (0.324)	-0.263 (0.153)*	0.497 (0.485)	0.096 (0.228)
MEGA Squared	0.016 (0.067)	0.058 (0.032)*	-0.042 (0.100)	0.006 (0.047)
Highway *RZ	0.002 (0.001)**	0.001 (0.000)**	0.003 (0.001)***	0.002 (0.001)***
Highway *BDA	0.002 (0.005)	0.003 (0.002)	0.009 (0.008)	0.007 (0.004)*
Highway *MEGA	0.010 (0.027)	-0.008 (0.013)	0.017 (0.040)	0.004 (0.019)
RZ*BDA	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.002)	-0.001 (0.001)
RZ*MEGA	0.045 (0.049)	0.020 (0.023)	-0.044 (0.073)	-0.010 (0.034)
BDA*MEGA	0.002 (0.051)	0.042 (0.024)*	0.038 (0.077)	0.006 (0.036)
$\text{Education}_{(t-1)}$	-0.662 (0.527)	-0.704 (0.249)***	-0.092 (0.788)	-0.080 (0.371)
$\text{Manufacturing}_{(t-1)}$	-0.034 (0.017)**	-0.036 (0.008)***	-0.040 (0.026)	-0.045 (0.012)***
$\text{Government}_{(t-1)}$	-0.023 (0.015)	-0.027 (0.007)***	-0.042 (0.023)*	-0.057 (0.011)***
$\text{Farming}_{(t-1)}$	0.040 (0.137)	0.020 (0.065)	-0.151 (0.204)	-0.087 (0.096)
$\text{Business Concentration}_{(t-1)}$	0.316 (0.364)	-0.178 (0.172)	0.259 (0.544)	-0.413 (0.256)
Constant	-0.970 (0.310)***	-0.249 (0.146)*	1.326 (0.463)***	0.741 (0.218)***
Direct Policy: Chi2	8.44	12.23*	12.28*	21.87***
Policy int: Chi2	9.81	17.84**	10.09	23.44***
All Policy: Chi2	19.46	40.63***	29.14***	69.11***
Log likelihood	-1185.34	-750.11	-1419.16	-981.62
Wald chi2	232.45***	928.67***	188.17***	419.27***

Standard errors in parentheses. *, **, and *** significant at 10%, 5%; and 1% respectively. Fixed Effect FGLS estimates presented. Year dummies are suppressed for display purposes. Observations: 581. Number of counties: 83

Table 2.4. Michigan Development Policy Effects by Income Level

	Income Growth				Job Growth			
	High Income		Low Income		High Income		Low Income	
	Annual	3-Year Average	Annual	3-Year Average	Annual	3-Year Average	Annual	3-Year Average
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Highway	-0.779 (2.012)	_**2.752**_ _**(1.046)**_***	0.369 (1.081)	_**-0.822**_ _**(0.461)**_*	-3.219 (2.794)	1.994 (1.346)	1.056 (1.776)	2.048 (0.816)**
Highway Squared	-0.100 (0.114)	-0.023 (0.059)	-0.057 (0.042)	-0.007 (0.018)	-0.093 (0.158)	_**0.075**_ _**(0.076)**_	-0.111 (0.069)	_**-0.137**_ _**(0.032)**_***
RZ	1.112 (0.943)	0.293 (0.491)	0.037 (0.041)	-0.002 (0.018)	0.627 (1.310)	0.515 (0.631)	0.047 (0.068)	-0.038 (0.031)
RZ Squared	0.053 (0.049)	0.025 (0.026)	-0.000 (0.001)	0.000 (0.000)	0.024 (0.069)	0.016 (0.033)	-0.001 (0.001)	0.000 (0.000)
BDA	_**-1.074**_ _**(0.603)**_*	-0.352 (0.313)	_**0.160**_ _**(0.137)**_	0.011 (0.059)	-0.655 (0.837)	-0.446 (0.403)	0.062 (0.226)	0.178 (0.104)*
BDA Squared	_**0.120**_ _**(0.043)**_***	0.011 (0.022)	_**-0.005**_ _**(0.007)**_	0.002 (0.003)	_**0.078**_ _**(0.060)**_	0.029 (0.029)	_**-0.006**_ _**(0.012)**_	-0.005 (0.005)
MEGA	4.605 (3.082)	1.799 (1.603)	-0.271 (0.364)	-0.348 (0.155)**	0.429 (4.279)	1.168 (2.062)	0.556 (0.599)	0.036 (0.275)
MEGA Squared	_**-0.415**_ _**(0.217)**_*	_**-0.206**_ _**(0.113)**_*	_**0.054**_ _**(0.081)**_	_**0.079**_ _**(0.034)**_**	0.076 (0.301)	-0.063 (0.145)	-0.072 (0.133)	0.001 (0.061)
Highway *RZ	0.072 (0.070)	0.008 (0.036)	0.002 (0.001)**	0.001 (0.000)*	0.094 (0.097)	0.051 (0.047)	0.004 (0.002)**	0.003 (0.001)***
Highway *BDA	-0.030 (0.020)	0.007 (0.011)	-0.000 (0.006)	0.001 (0.003)	-0.007 (0.028)	0.001 (0.014)	0.007 (0.010)	0.003 (0.004)
Highway *MEGA	0.095 (0.054)*	0.014 (0.028)	-0.008 (0.035)	-0.021 (0.015)	-0.015 (0.075)	0.002 (0.036)	0.037 (0.057)	0.007 (0.026)
RZ*BDA	-0.261 (0.232)	-0.108 (0.120)	-0.002 (0.001)	-0.001 (0.001)	-0.024 (0.322)	-0.055 (0.155)	-0.001 (0.002)	-0.001 (0.001)
RZ*MEGA	1.157 (1.211)	0.515 (0.630)	0.023 (0.051)	0.018 (0.022)	0.328 (1.681)	_**0.368**_ _**(0.810)**_	-0.040 (0.084)	_**-0.004**_ _**(0.039)**_
BDA *MEGA	-0.036 (0.090)	_**0.089**_ _**(0.047)**_*	-0.062 (0.065)	_**-0.004**_ _**(0.028)**_	0.224 (0.124)*	_**0.109**_ _**(0.060)**_*	-0.040 (0.107)	_**-0.067**_ _**(0.049)**_
All Policy: Chi2	19.31	25.86**	13.98	34.42***	9.94	17.62	25.30**	62.99***
Difference: Chi2	19.33	29.66***			10.58	25.34**		
Log likelihood	-554.08	-361.81	-594.35	-349.96	-650.54	-435.85	-736.99	-513.79
Wald chi2	239.30***	704.74***	109.36***	433.34***	112.18***	297.68***	111.71***	211.09***
Observations	294	294	287	287	294	294	287	287
Number of Counties	42	42	41	41	42	42	41	41

Standard errors in parentheses. *, **, and *** significant at 10%, 5%; and 1% respectively. Fixed Effect FGLS estimation procedure is used. Control variables are suppressed for display purposes. Estimates in boldface font indicate that difference between areas with higher and lower per capita income is individually significant at 10% level.

Table 2.5. Intensity of Policy Application

	(1) Highway	(2) RZ	(3) BDA	(4) MEGA
Highway		3.856 (2.354)	0.748 (0.409)*	-0.214 (0.209)
RZ	0.001 (0.001)		0.038 (0.007)***	-0.010 (0.004)***
BDA	0.008 (0.004)*	1.240 (0.233)***		0.042 (0.021)**
MEGA	-0.008 (0.008)	-1.252 (0.465)***	0.162 (0.081)**	
$Education_{(t-1)}$	0.047 (0.041)	-1.338 (2.361)	1.918 (0.403)***	-0.458 (0.208)**
$Manufacturing_{(t-1)}$	0.006 (0.001)***	-0.269 (0.076)***	0.029 (0.013)**	0.001 (0.007)
$Government_{(t-1)}$	0.005 (0.001)***	-0.047 (0.065)	0.047 (0.011)***	-0.032 (0.006)***
$Farming_{(t-1)}$	0.015 (0.011)	1.373 (0.611)**	0.187 (0.106)*	0.128 (0.054)**
Business $Concentration_{(t-1)}$	-0.083 (0.029)***	-3.748 (1.630)**	-0.778 (0.283)***	-0.076 (0.145)
Constant	-0.034 (0.024)	-4.785 (1.356)***	0.246 (0.238)	-0.629 (0.119)***
Controls: Chi2	50.44***	31.85***	60.77***	50.50***
Log likelihood	279.45	-2068.17	-1052.03	-660.16
Wald chi2	180.19***	119.53***	366.70***	165.56***

Standard errors in parentheses. *, **, and *** significant at 10%, 5%; and 1% respectively. Fixed Effect FGLS estimation procedure is used. Year dummies are suppressed for display purposes. Observations: 581. Number of counties: 83.

Table 3.1. Business Size Distribution: Descriptive Statistics

A. Establishment share, %				
Size Group (employees)	**Mean**	**Std. Dev.**	**Min**	**Max**
1-4	57.65	6.86	44.55	83.93
5-9	20.51	2.60	7.55	26.76
10-19	11.59	2.22	3.57	16.01
20-49	6.58	1.91	0	11.62
50-99	2.07	.87	0	4.59
100-249	1.17	.55	0	2.82
250-499	.29	.21	0	1.12
500-999	.10	.12	0	.59
1,000<	.04	.07	0	.49

B. Employment share, %				
Size Group (employees)	**Mean**	**Std. Dev.**	**Min**	**Max**
1-4	5.94	3.08	2.03	25.14
5-9	9.84	2.97	4.54	31.40
10-19	10.87	3.00	5.56	38.96
20-49	11.89	2.59	0	25.69
50-99	9.02	3.07	0	24.27
100-249	10.02	3.94	0	43.29
250-499	5.81	4.14	0	22.08
500-999	3.69	4.40	0	20.68
1,000<	2.68	4.60	0	34.55

C. Size Distribution Index, %				
	Mean	**Std. Dev.**	**Min**	**Max**
Index	20.35	5.28	12.88	61.47

Note: Statistics not weighted, based on 1079 observations for 83 Michigan counties.
Data: County Business Patterns, U.S. Census Bureau, 1988-2000.

Table 3.2. Summary Statistics: Michigan counties, 1988-2000

Variable	Mean	Std. Dev.	Min	Max
Income growth[a], %	1.29	2.70	-11.56	14.72
Job growth[a], %	1.67	6.84	-39.28	65.29
Population with BA/BS degree[b], %	6.00	2.38	2.28	15.65
Jobs in manufacturing[a], number per 1000 residents	76.55	40.93	7.96	196.83
Jobs in government[a], number per 1000 residents	73.49	36.12	35.50	230.06
Jobs in farming[a], number per 1000 residents	13.07	9.12	.10	45.70
Business establishment density[c], number per per square mile	4.15	8.96	.09	58.88

Data: a) Based on Local Area Annual Estimates, Bureau of Economic Analysis. Farm employment is the number of workers engaged in the direct production of agricultural commodities, either livestock or crops; whether as a sole proprietor, partner, or hired laborer. The manufacturing as the SIC division. Government includes Federal civilian, military, and state and local.

b) Based on Census of population 1990, 2000. Data for 1988-89, 1991-99 is imputed by linear extrapolation

c) Based on County Business Patterns, Census Bureau

Note: Statistics for 1079 un-weighted observations

Table 3.3. Estimation Results

	Job Growth			*Income Growth*		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Metro	Non-Metro	All	Metro	Non-Metro
Employment Share in 1-4 Employee Businesses	1.83 (0.31)***	3.11 (1.06)***	1.69 (0.37)***	0.12 (0.12)	0.05 (0.43)	0.18 (0.13)
Employment in 5-9	0.02 (0.16)	1.13 (0.41)***	-0.08 (0.19)	-0.09 (0.06)	-0.10 (0.17)	-0.08 (0.07)
Employment in 10-19	0.20 (0.16)	1.68 (0.34)***	-0.13 (0.20)	-0.07 (0.06)	-0.06 (0.14)	-0.06 (0.07)
Employment in 20-49	0.39 (0.14)***	0.53 (0.28)*	0.27 (0.18)	-0.03 (0.06)	-0.15 (0.11)	0.02 (0.06)
Employment in 50-99	0.15 (0.12)	0.26 (0.23)	0.06 (0.15)	-0.04 (0.05)	-0.32 (0.10)***	0.03 (0.05)
Employment in 100-249	-0.23 (0.10)**	0.25 (0.19)	-0.40 (0.13)***	-0.04 (0.04)	-0.09 (0.08)	-0.00< (0.04)
Employment in 250-499	-0.08 (0.09)	0.53 (0.14)***	-0.33 (0.12)***	-0.06 (0.03)*	-0.13 (0.06)**	-0.02 (0.04)
Employment in 500-999	-0.16 (0.08)*	0.20 (0.12)	-0.25 (0.11)**	-0.06 (0.03)*	-0.08 (0.05)	-0.05 (0.04)
Education	-0.69 (0.69)	-0.44 (0.95)	-0.48 (1.03)	-0.05 (0.26)	-0.20 (0.39)	-0.01 (0.36)
Manufacturing	0.00< (0.03)	0.09 (0.03)***	-0.03 (0.05)	-0.04 (0.01)***	-0.02 (0.01)	-0.08 (0.02)***
Government	-0.01 (0.02)	-0.09 (0.06)	-0.03 (0.02)	-0.02 (0.01)**	-0.01 (0.02)	-0.03 (0.01)***
Farming	0.02 (0.22)	0.59 (0.29)**	-0.22 (0.38)	-0.15 (0.08)*	-0.04 (0.12)	-0.32 (0.14)**
Business Density	-0.09 (0.54)	-0.62 (0.60)	-1.53 (2.58)	0.26 (0.21)	0.33 (0.24)	-0.60 (0.91)
Constant	-0.94 (0.86)	-2.10 (1.02)**	0.14 (1.38)	-2.76 (0.33)***	-3.36 (0.42)***	-2.50 (0.48)***
Observations	996	492	504	996	492	504
Number of counties	83	41	42	83	41	42
Log likelihood	-3123.85	-1417.69	-1644.57	-2161.81	-975.28	-1117.16
Wald chi2	299.60	209.83	174.47	519.26	661.69	155.33

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; Time dummies are suppressed for display purpose

Table 3.4. Distribution Index and County Economic Growth

	Job Growth	*Income Growth*
Index	0.68 (0.26)***	0.26 (0.09)***
Index Squared	-0.01 (0.005)**	-0.005 (0.002)***
Education	-0.29 (0.73)	-0.03 (0.26)
Manufacturing	-0.03 (0.03)	-0.04 (0.01)***
Government	-0.00< (0.02)	-0.02 (0.01)**
Farming	0.03 (0.23)	-0.16 (0.08)*
Business Density	-0.05 (0.57)	0.27 (0.20)
Constant	-0.49 (0.90)	-2.71 (0.32)***
Log likelihood	-3188.70	-2161.35
Wald chi2	141.41	520.66

Standard errors in parentheses; 996 annual observations in 83 counties; * significant at 10%; ** significant at 5%; *** significant at 1%; Time dummies are suppressed for display purpose

Table 3.5. Alternative Estimation Methods

	Income Growth						
	POLS	***POLS***	***FE***	***FE***	***FD***	***ABond***	***FEFGLS***
Index	0.002 (0.068)	0.059 (0.060)	0.110 (0.118)	0.205 (0.102)**	0.079 (0.160)	0.234 (0.098)**	0.215 (0.096)**
Index Squared	-0.000 (0.001)	-0.001 (0.001)	-0.002 (0.002)	-0.004 (0.002)**	-0.001 (0.003)	-0.005 (0.002)***	-0.004 (0.002)**
Education		0.082 (0.034)**		0.001 (0.326)	-1.853 (0.599)***	-0.902 (0.559)	-0.051 (0.292)
Manufacturing		-0.005 (0.002)***		-0.043 (0.012)***	-0.131 (0.019)***	-0.105 (0.015)***	-0.042 (0.011)***
Government		-0.007 (0.003)**		-0.018 (0.008)**	-0.092 (0.022)***	-0.057 (0.013)***	-0.018 (0.008)**
Farming		0.003 (0.007)		-0.059 (0.095)	-1.314 (0.325)***	-0.689 (0.226)***	-0.076 (0.088)
Business Density		-0.004 (0.005)		0.321 (0.245)	0.244 (0.448)	0.103 (0.493)	0.323 (0.222)
Income Growth, one year lag						-0.106 (0.038)***	
Constant	1.507 (0.897)*	-0.650 (0.973)	0.181 (1.572)	1.189 (2.692)	1.534 (0.472)***	0.515 (0.407)	-1.753 (0.299)***
R-squared	0.00	0.27	0.00	0.29	0.24		
Total F-statistics	1.34	22.77	0.69	19.27	24.38	26.94	21.36
Log likelihood							-1985.89

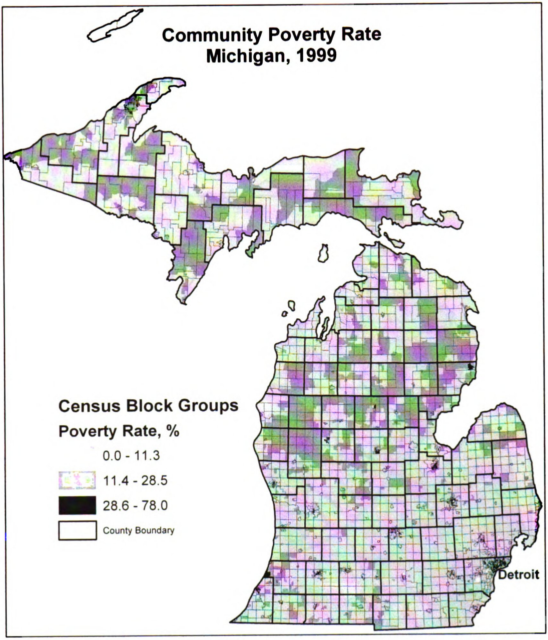
Standard errors in parentheses; 913 annual observations in 83 counties; * significant at 10%; ** significant at 5%; *** significant at 1%; Time dummies are suppressed for display purpose

Table 3.6. Correlation of Business Size Distribution Measures with Control Variables

	(1) *Index*	(2) *Employment 1-4*	(3) *Employment 20-49*	(4) *Employment 500-999*
Education	-0.47 (0.26)*	-0.05 (0.07)	0.44 (0.15)***	-0.38 (0.27)
Manufacturing	0.05 (0.01)***	-0.00< (0.00<)	-0.04 (0.01)***	-0.02 (0.01)**
Government	-0.01 (0.01)	-0.00< (0.00<)	0.00< (0.00<)	-0.02 (0.01)**
Farming	0.00< (0.08)	0.08 (0.02)***	0.01 (0.05)	0.14 (0.09)
Business Density	0.50 (0.20)**	0.21 (0.06)***	-0.30 (0.12)**	0.03 (0.21)
Employment Share in 1-4 Employee Businesses			0.43 (0.07)***	-0.26 (0.12)**
Employment Share in 5-9		0.15 (0.02)***	0.00< (0.03)	-0.28 (0.06)***
Employment Share in 10-19		0.13 (0.02)***	-0.40 (0.03)***	-0.43 (0.06)***
Employment Share in 20-49		0.10 (0.02)***		-0.48 (0.05)***
Employment Share in 50-99		0.01 (0.01)	-0.40 (0.02)***	-0.48 (0.04)***
Employment Share in 100-249		-0.06 (0.01)***	-0.30 (0.02)***	-0.50 (0.04)***
Employment Share in 250-499		-0.03 (0.01)***	-0.23 (0.02)***	-0.51 (0.03)***
Employment Share in 500-999		-0.02 (0.01)**	-0.15 (0.02)***	
Constant	-0.46 (0.32)	0.21 (0.09)**	-0.07 (0.19)	-0.49 (0.34)
Observations	996	996	996	996
Number of fips	83	83	83	83
Log likelihood	-2153.05	-869.17	-1618.09	-2189.23
Wald chi2	87.21	768.40	695.83	429.99

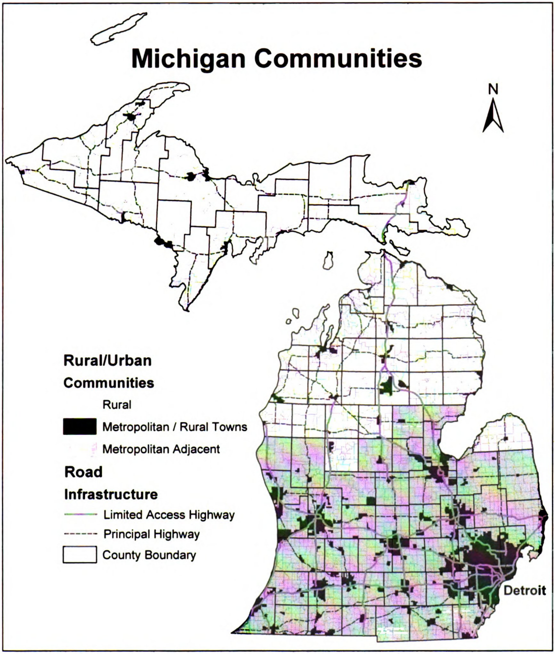
Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%
Fixed Effect FGLS estimation procedure is used. Year dummies are suppressed for display purposes. 913 annual observations for 83 Michigan counties over 1989-2000 time period are used for estimations.

FIGURES



Data: Based on Census 2000, US Census Bureau

Figure 1.1. Poverty Rate, 1999



Data: Based on Census 2000, US Census Bureau

Figure 1.2. Michigan Urban/ Rural Areas by Census Block Groups, 1999

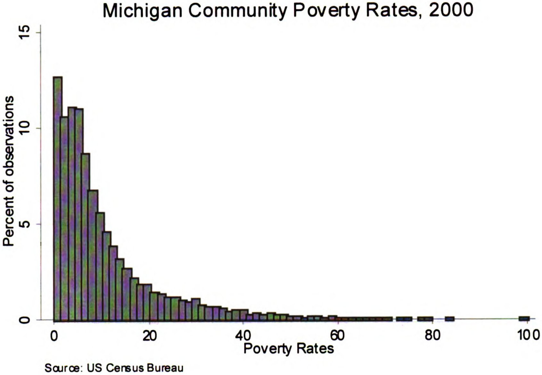
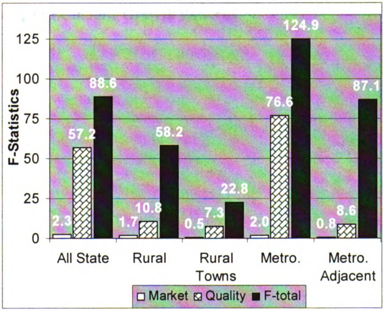
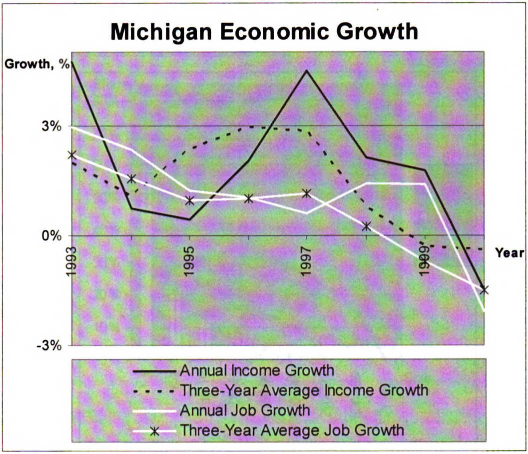


Figure 1.3. Distribution of the Community



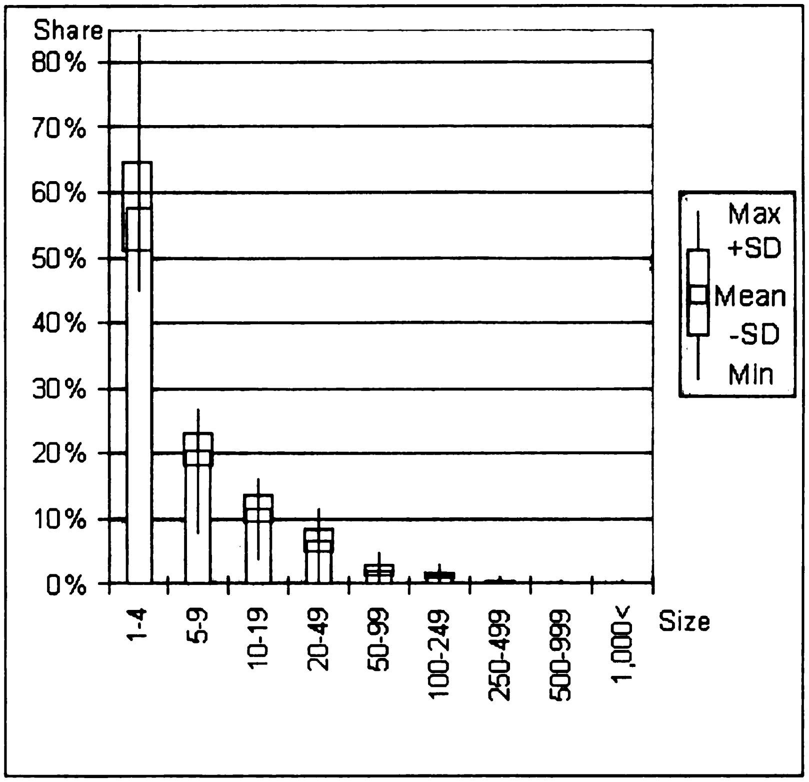
Source: Based on the estimation results

Figure 1.4. Joint Significance of the Labor Demand and Labor Supply Characteristics



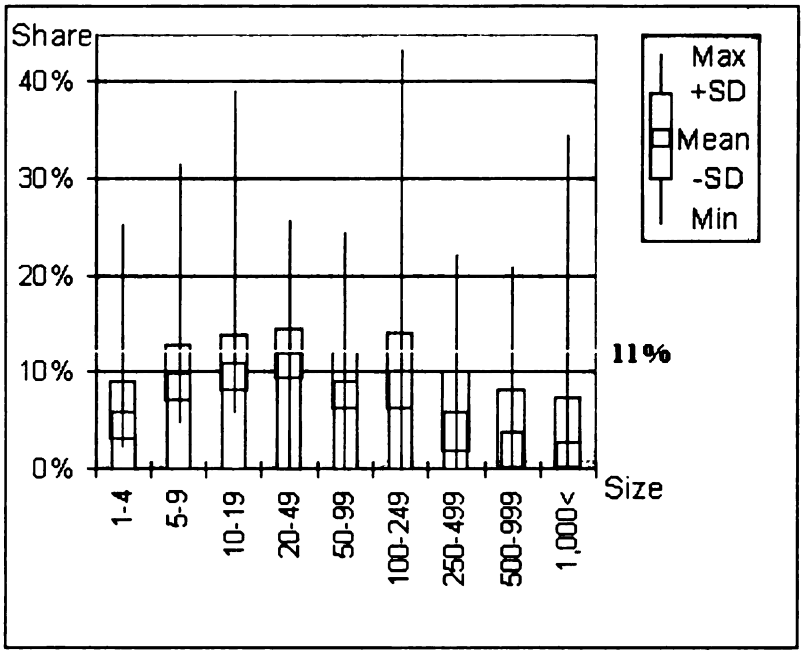
Data: Bureau of Economic Analysis; Inflation Adjusted.

Figure 2.1. Michigan Economic Growth Patterns



Data: County Business Patterns, U.S. Census Bureau, 1988-2000.

Figure 3.1. Share of Business Establishments by Size Category for 83 Michigan Counties.



Data: County Business Patterns, U.S. Census Bureau, 1988-2000.

Figure 3.2. Distribution of Employment across the Business Size Categories for 83 Michigan Counties.

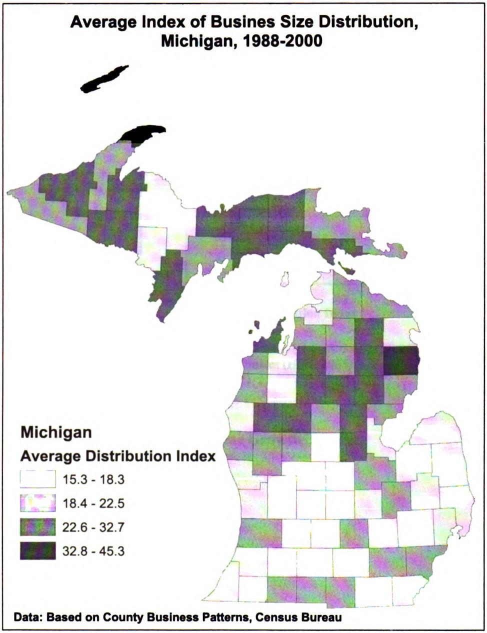
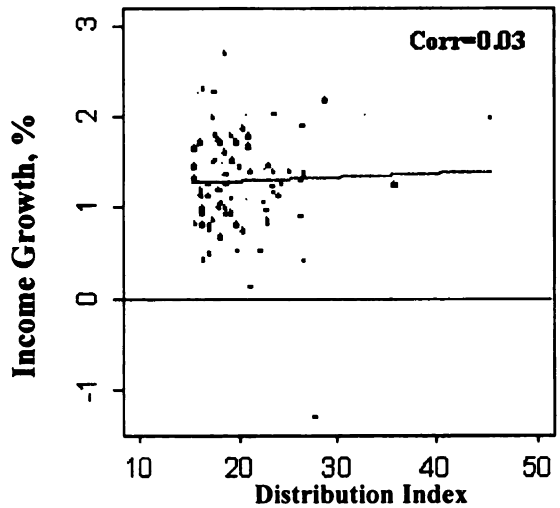


Figure 3.3. Distribution of the Business Size Index across Michigan Counties

Entrepreneurial Pipeline Theory

Business Size Distribution and Income Growth, Michigan, 1988-2000

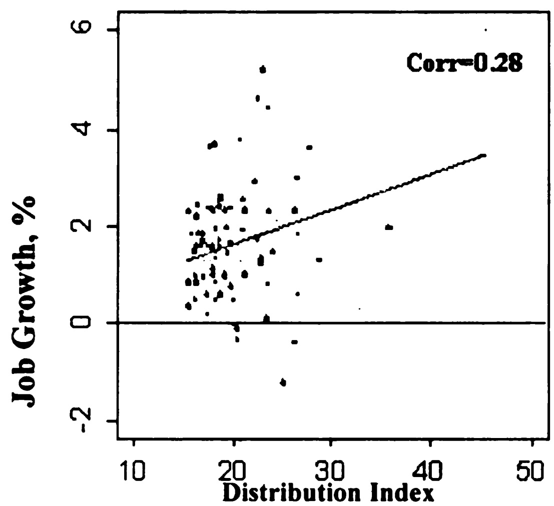


Note: For average values by county
Data: Based on County Business Patterns (Census Bureau, 2005) and Local Area Annual Estimates (BEA, 2005)

Figure 3.4. Distribution Index and Income Growth

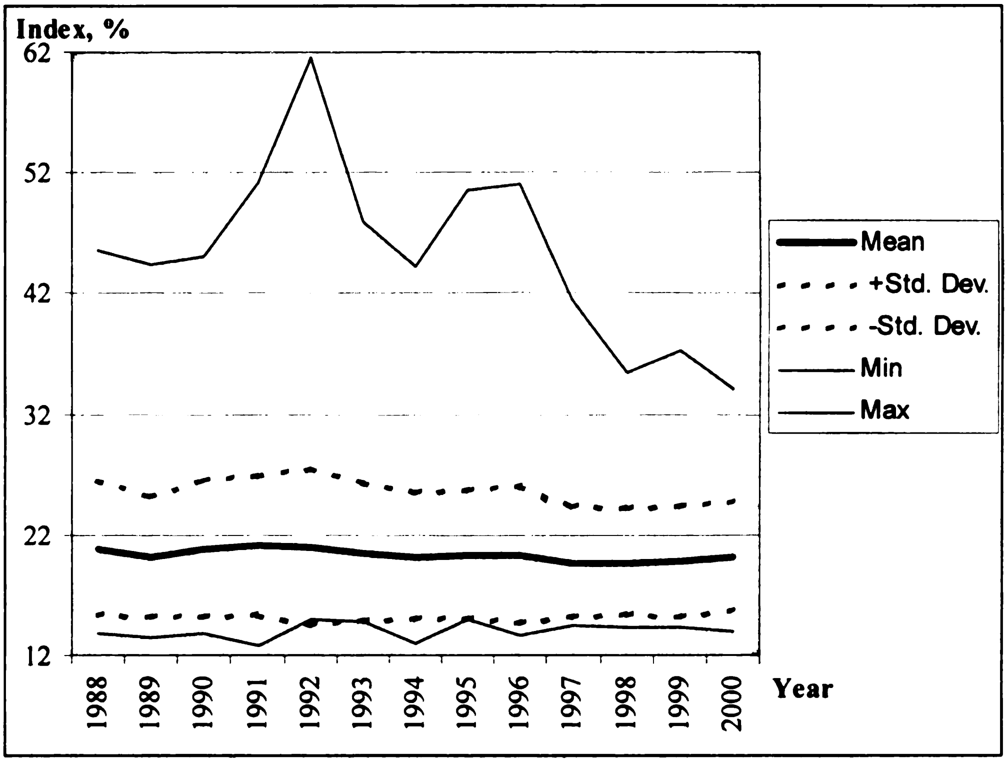
Entrepreneurial Pipeline Theory

Business Size Distribution and Job Growth, Michigan, 1988-2000



Note: For average values by county
Data: Based on County Business Patterns (Census Bureau, 2005) and Local Area Annual Estimates (BEA, 2005)

Figure 3.5. Distribution Index and Job Growth



Data: Based on County Business Patterns, U.S. Census Bureau, 1988-2000.

Figure 3.6. Index for Business Size Distribution, Michigan Counties.

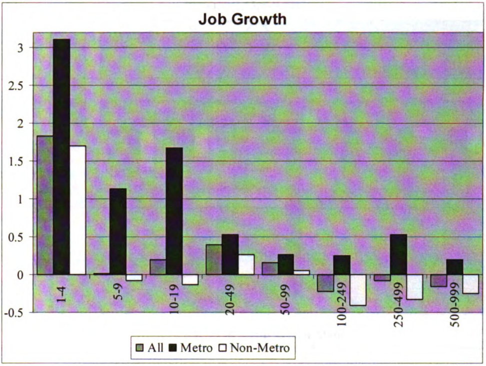


Figure 3.7. Distribution of Employment and Job Growth

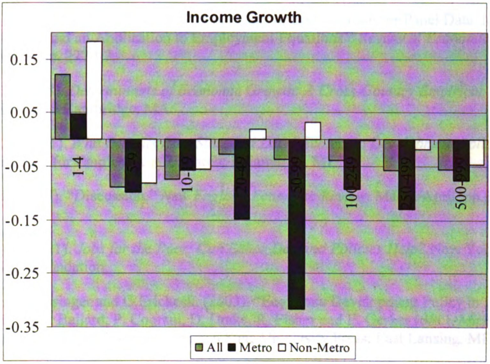


Figure 3.8. Distribution of Employment and Income Growth

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