Abstract
This study develops a new concept of economic slope, based on the concept of slope in physical environment. Then the concept is applied to analyze the landscape dynamics in Los Angeles County. It proposes that areas with higher economic slope are more dynamic and less stable than others due to the pressure from the surrounding areas. The hypothesis is tested through detailed studies of Los Angeles County using the 2000 census data. Block groups with high economic slope do demonstrate higher population motility, less stable family and social structures, along with the coexistence of higher average income and poverty level. Further studies at different places and scales are needed to further test the hypotheses proposed in this study.

Key words
Economic Slope, Neighborhood Changes, Los Angeles, GIS

I. INTRODUCTION

During the last few decades, changes of all kinds have put their imprints on the restless urban landscapes (Knox, 1993). Economically, people have observed economic de-industrialization (Alderson, 1999; Crafts, 1993, 1996; Koistinen, 2002; Rowthorn and Ramaswamy, 1999), re-industrialization (Lower, 1982) and globalization (Dicken, 2003; Drucker, 1997; Roberts, 1998; Stryker, 1998) in advanced economies. Other significant changes include political fragmentation (Volkerink and Haan, 2001; Weiher, 1991), social polarization, and consumerism and materialism (Gallaway, 2003) coupled with pursuing of identity in the cultural sphere (Crow, 1996). These socio-economic processes have resulted in significant changes in spatial orders as well: decentralization, recentralization, segregation, edge cities (Garreau, 1992), and outer cities (Muller, 1976). Geographical studies have examined all these topics and examples include The Restless Urban Landscape (Knox, 1993) and Postmetropolis. Critical Studies of Cities and Regions (Soja, 2000). A reoccurring argument in such studies is “geography matters!” despite the inescapable forces that facilitate globalization and digitalization. The importance of geography can be clearly demonstrated by the wide application of concepts such as location, distance and spatial autocorrelation (Lee and Wong, 2001; Rogerson, 2001).

The purpose of this article is to add one more example to demonstrate that space does matter through examining neighborhood dynamics in Los Angeles County, using the concept of economic slope. Economic slope is defined as the change of economic status per unit of ground distance between two locations. Particularly, I will try to address two major questions as follows:

1) Are neighborhoods at areas of high economic slope different from others?
2) If yes, what can characterize such neighborhoods?

The next section will introduce the research background, after which the data and methodology are presented. Then the paper reports the analysis results before it ends with some concluding remarks.

II. ECONOMIC SLOPE AND NEIGHBORHOOD DYNAMICS

In physical geography, slope usually is understood as a ground that forms a natural or artificial incline, though sometimes it also refers to the part of a continent draining to a particular ocean. Slope is an important concept in physical geography and is particularly important in terrain modeling. It has been widely used in studies of hydrology, conservation, site planning, and infrastructure development (Bolstad, 2002). Slope is measured by a change in elevation (a rise) and a change in horizon position (a run) and can be expressed in percentages (the ratio between a rise and a run) or in degrees. In raster-based geographic information systems (GIS), slope for a location is typically measured in the steepest direction of elevation.

In this study, I will develop the concept of economic slope and apply it in urban settings. Similar to physical slope, economic slope can be defined as the change of economic status with a change of unit distance in horizon positions, where economic status can be measured by income, housing price, among other variables. For example, if the housing price at location one is $200 per square meter, $400 per square meter at location two, and the distance between the two locations is 1000 meter, the economic slope between these two points is (400-200)/1000 = 0.2 per meter.

We can use the concept of economic slope to examine...
neighborhood changes, which have been a classical topic in sociology and geography. Numerous studies have tried to understand the underlying dynamics. Theories such as ecological models (Burgess, 1925; Hoyt, 1939) have been developed to account for the changes based on examination of Chicago. Recent studies include those by (Morenoff and Tienda, 1997) and (Winsberg, 1989) on Chicago, (Alba et al., 1995) on New York City and (McConville, Ong, 2003) on Los Angeles. Such studies have greatly deepened our understanding of the patterns and processes of neighborhood changes.

However, most studies have paid less attention to the location of neighborhood changes. It is argued that geography is an important dimension of neighborhood changes. The spatial process is pivotal to understand where and why the changes occur. Economic slope has the potential to contribute to our understanding of such processes. In physical geography, slope affects many properties such as erosion, stability, velocity of flows and others. One would observe more erosion and lower degree of stability at steep locations than flat locations, other things being equal. Similarly, I expect that neighborhoods with high economic slope—economic status changes quickly in the surrounding areas—are less stable, prone to change or “erosion”, because such areas by definition are transitional in nature. They are between high income and low income areas. As such, they are under constant pressures from the surrounding neighborhoods. Therefore, I expect that such areas will exhibit higher mobility, lower levels of home ownerships, and fewer married-couple families. Usually, such areas are less desirable as living space. As such, one may anticipate lower income and higher poverty levels in these areas as well. Such hypotheses will be tested using data from Los Angeles County.

III. DATA AND METHODOLOGY

The data come from the 2000 census SF3 table at the block group level in Los Angeles County. Economic slope in this study is based on per capita income. Three categories of variables are included: mobility, economic status, and stability. Mobility variables include immigrants less than 5 years (%), migrants living in the same county in 1995 (%), migrants from different counties in California in 1995 (%), and migrants living in a different state in 1995 (%). Economic variables include median household income ($), per capita income ($), median house value ($), poverty level (%), and household with public assistance income (%). Stability variables include owner occupied houses (%), and married couple families (%).

Economic slope is defined following the steps in the Figure 1. First, the per capita income map (Pc_Inc) is rasterized based on the census block group data and cell size for the raster data is 305m x 305m (1000 ft x 1000 ft) (PcInc-Grid). Second, the routine “Calculate Slope” from the Spatial Analysis extension of ArcGIS is used to derive the economic slope (in percentages) for each cell (EcSlp_Grid). Third, the routine “Zonal Statistics” in ArcGIS is used to compute average economic slope for cells in each census block group (EcSlp_BlkGp). Finally, the block groups are classified into four categories using the quantile classification method so that each category has the same number of block groups. Economic slope in the top 25 percent is considered to be high and block groups in this group can be considered boundary areas (Boundary_BlkGp): the transitional areas between high income and low income areas. Then we can compare census block groups inside these boundary areas with those outside the boundary areas.

IV. AREA OF STUDY

The area of study covers the Los Angeles County, one of the five counties in the Los Angeles-Riverside-Orange County Consolidated Metropolitan Statistical Area (CMSA) or the Los Angeles CMSA. The County covers an area of 4000 square
miles with more than 100 cities. According to the 2000 census, the population of the County was about 9.5 million, more than half of that for the Los Angeles CMSA. The City of Los Angeles is the largest city in the Los Angeles County with a population of 3.7 million in the 2000 census.

Income in Los Angeles County demonstrates strong spatial disparities, with high income groups concentrated in the foothills and the coastal areas, while low income groups in the valleys (Figure 3). Other social, economic and demographic characteristic variables also demonstrate similar patterns (Figure 4, Figure 5). Banham (1971) summarized the patterns in the Los Angeles into four ecologies: (1) surfurbia; (2) foothills; (3) the plains; (4) the autopia. These four sub-areas represent the different ethnicity groups, income levels, and lifestyles.

Based on per capita income, the economic slope is calculated according to the procedure outlined in Figure 1 (Figure 6). The areas with high economic slope (or the boundary areas) majorly spread along the foothills from Santa Monica to San Gabriel, which separate the Los Angeles River basin and the San Gabriel Valley from the San Fernando Valley. The areas with low economic slope can be observed in different income groups: in the south-central, in the coastal areas, in the San Fernando Valley and in the north part of the County. Figure 7 presents the distribution of economic slope. The average economic slope is $1315 per meter ($400 per ft), and the median is around $1625 per meter (or $495 per ft). Economic slope in the majority of block groups is pretty low, which explains why the median economic slope is much lower than the value for the average economic slope.

V. COMPARISONS OF AREAS WITH HIGH ECONOMIC SLOPE AND OTHERS

In this section I will test the hypotheses proposed in Section 2 to see if areas with high economic slope are less stable and more dynamic than others. To test the hypotheses, the block groups are classified into four categories according to per capita income: low income (bottom 25 percentile), lower-medium income (25 to 50 percentile), upper-medium income (50 to 75 percentile), and high income areas (top 25 percentile). Within each income category, the areas with high economic slope are compared with others. The results are reported in Figures 8–14.

Figures 8–10 present the results on mobility, and the conclusions are consistent to what was expected: areas with higher economic slope do show higher mobility levels. The results are consistent using different measurements (immigrants less than 5 years, migrants from different California counties and migrants from different states). The results are also consistent in different income groups except for California migrants in the top income group (Figure 9).

Figures 11 and 12 report the comparisons between block groups with high economic slope and others regarding their income and poverty level. In general, one can observe that poverty levels are higher in block groups with higher economic slope. It is also interesting to note that such areas also have higher per capita income at the same time and the only exception is in the poorest areas (Figure 11). Such results are counter-intuitive: one would expect that an area with a higher poverty level would have lower average income. I argue that the coexistence
of higher average income and higher poverty levels also indicate that such neighborhoods are less stable and prone to change. The coexistence of higher average income and higher poverty levels implies that such neighborhoods have some wealthy residents, in addition to a large percentage of population in poverty. It is intuitive to expect that these wealthy families/residents are more likely to move out of such areas where poverty concentrates.

Finally, results from the analyses of married-couple families and owner-occupied housing also confirm our expectation: areas with high economic slope have fewer married couple families and lower levels of housing ownerships (Figures 13 and 14). Such results clearly indicate that areas with high economic slope do seem to be more dynamic and less stable than other areas, which have been demonstrated through more recent immigrants and migrants, lower housing ownership levels, fewer married-couple families, and higher income level coupled with higher poverty levels. The coupling of higher income and higher poverty in areas with high economic slope...
This study develops the concept of economic slope and applies it in an urban environment, based on the concept of slope in physical environments. The study hypothesizes that areas with higher economic slope are less stable and more dynamic than others, because such areas are in the transitional zones from areas of high economic status to low economic status. Such areas are prone to change with pressures from the surrounding areas. Stability and degree of dynamics can be represented by population mobility, social stability and other measurements. Through detailed studies of Los Angeles County, the hypotheses are shown to be valid. Areas with high economic slope do show concentrations of more recent immigrants as well as domestic migrants, fewer married-couple families and owner-occupied houses. Interestingly, such areas also demonstrate the co-existence of higher average income and higher poverty levels. I argue that such coexistence also demonstrates that such areas are less stable, since wealthy households are more likely to move out, leaving population in poverty behind. Such a study clearly contributes to our understanding of neighborhood changes.

However, results from this study are preliminary, since this is first of its kind study using the concept of economic slope in examining neighborhood changes. More studies are needed to test the hypotheses. Future studies can examine the hypotheses in different ways. To begin with, one can examine the Los Angeles Metropolitan Area to see if the conclusions hold. Second, one can test such hypotheses in other locales. Third, it is helpful if one can use data at other scales to see if modifiable areal unit problem (Fotheringham and Wong, 1991) is an issue here (for example, what would happen if one choose the data at the scale of census tract instead of block groups?). Fourth, one can look at the temporal change of areas with high economic slope. Do the boundary areas change over time? If so, how do they change? Other questions that can be asked include how the change of economic slope relates to other socio-economic status of neighborhoods. How does economic slope correspond to other social and economic phenomena, such as crime? Finally, how could the concept of slope be applied into other fields? For example, can we develop a concept of social slope? To conclude, a large number of
Figure 9. Comparing areas with high economic slope and others: migrants living in different California counties in 1995

Figure 10. Comparing areas with high economic slope and others: migrants living in different States in 1995

Figure 11. Comparing areas with high economic slope and others: per capita income
Figure 12. Comparing areas with high economic slope and others: population in poverty

Figure 13. Comparing areas with high economic slope and others: percentage of owner-occupied housing

Figure 14. Comparing areas with high economic slope and others: percentage of Married-Couple Families
questions remain to be explored in the future.

This study demonstrates the value of GIS in analyzing some of the spatial problems. The claim that “geography matters” once again is supported by fresh new evidence. More importantly, this study demonstrates the value of creative thinking in integrating the physical and human sides of geography: too often people are locked into the paradigm of observed between human geographers and physical geographers, though more studies start to deal with the thinking in integrating the physical and human sides of their own(sub) discipline, which includes the methods practiced by its followers. Such a schism can be clearly observed between human geographers and physical geographers, though more studies start to deal with the human-environment interface. This study demonstrates that human geographers may benefit from using the methods/concepts from physical geographers. This may also be true for the other way.

REFERENCES