



Original Research Article

SPATIAL INEQUALITY AND ECONOMIC VULNERABILITY IN THE UNITED STATES EVIDENCE FROM THE ACS AND CPS FOOD SECURITY SUPPLEMENT

Article History:

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Received: 12-04-2025

Revised: 05-05-2025

Accepted: 20-05-2025

Published: 04-06-2025

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Abstract: This paper discusses how spatial inequality has determined the economic vulnerability in the United States, especially in the context of poverty, income inequality, and food insecurity. The analysis offers a combination of structural and material aspects of inequality on a single empirical platform using nationally representative microdata of the American Community Survey (ACS, 20172023) and the Current Population Survey Food Security Supplement (CPS-FSS, 20172023). We use survey-weighted probity and ordinary least squares models to determine the impact of geographic location, represented by the nonmetropolitan and metropolitan hierarchies, on poverty risk, household income, and food insecurity. The findings reveal that nonmetropolitan households are much more likely to be poor, to have low income, and to be at risk of food insecurity in comparison with metropolitan households, conditioned by the population of demographic features, education levels, labor market, and household structure, controlled by state and year-specific effects. The additional discussion points to labor market instability, especially unemployment, as one of the major mechanisms that drive these differences, and interaction models indicate that the negative impacts of unemployment on food insecurity are stronger in nonmetropolitan regions. On the whole, the results indicate that the concept of spatial inequality goes deeper than income indicators to include material deprivation and falls on a continuum rather than being limited to a rural-urban dichotomy, which supports the significance of the place-based policy intervention and the integrated social protection policies to reduce geographical disparities in economic welfare.

Keywords: Spatial inequality; Economic vulnerability; Poverty; Food insecurity; Rural–urban disparities; Labor market instability; Metropolitan hierarchy; ACS; CPS Food Security Supplement; United States.

INTRODUCTION

The American type of economic inequality has developed a more geographical dimension, with

economic opportunities and resources getting smaller and more concentrated in the city and with nonmetropolitan areas stuck in structural

disadvantage. These inequalities are closely intertwined with disparities in the distribution of the conditions of the labor market, the opportunities to earn income, and inequalities in access to the economic infrastructure, resulting in inequalities in household welfare across geographic space. The recent signs are that these inequalities are not only limited to the aspect of income but can be extended to distinct levels of material deprivation, including the power to access fundamental resources like food (Manetti et al., 2026; Dinku et al., 2026; Blekking et al., 2026). The importance of space patterning of disadvantage in emphasizing the necessity of examining geography as a determinant of economic vulnerability, and not a marginal determinant.

Food insecurity is no longer a better prism to view these disparities through. Food insecurity in comparison with the traditional indicators based on income also reflects the direct restrictions in the consumption of households, and also the feeling of being poor. It is only loosely connected with the instability of income, employment shocks, and more socioeconomic vulnerabilities, in general (Chacon et al., 2026; Kleinman et al., 2026). Furthermore, recent studies on policies hint at food insecurity being a key indicator of material conditions, and more recent ones also suggest that it is sensitive to social protective policies, such as nutrition assistance and income support (Austin et al., 2026; Bao and Kim, 2026; Lee et al., 2026; Roll et al., 2026). Even though the current body of literature has investigated the issue of food insecurity in urban or low-income people, there is a growing recognition of the fact that geographic location is actually part of the accessibility to food and other basic needs among the metropolitan and nonmetropolitan areas (Abdullahi et al., 2026; Mie et al., 2026).

Despite this, a lot is written on the issue of spatial inequity and food insecurity, yet there are loopholes. The differences between rural and urban have been scrutinized by most of the literature as binary without the more sophisticated gradient that is present in metropolitan areas and between them. Moreover, in the past studies, researchers tend to examine either poverty, income or food insecurity in isolation and not in a combined form, which does not allow the researcher to examine how these phenomena of vulnerability interact within a consistent system. The lack of empirical studies that directly assist in testing the ability of spatial inequality to be translated into material hardship, in particular, the role of labor market instability, is also a paucity.

The paper addresses these deficiencies by integrating the structural and material measures of economic vulnerability using nationally representative samples of the microdata on the American Community

Survey and the Current Population Survey Food Security Supplement. Specifically, the analysis establishes disparities in poverty and income outcomes in space, verifies whether the disparities can be further extended to the results of food insecurity, and whether labor market instability, in particular, unemployment, is a significant factor that can be used to bridge the gap between the geographic location and the poor economic outcomes. As a compilation of diverse information sources and the methods applied in order to comprehend the spatial inequality, the study presents an in-depth analysis of the association between spatial inequality and the economic performance and the life experience of deprivation in the United States.

2. Literature Review

2.1 Spatial Inequality and Place-Based Disadvantage

There is a growing body of literature that points to the fact that economic inequality is essentially spatial in nature as income, opportunity, and well-being diffuse unevenly over geographic space. These differences are often theorized in a rural-urban dichotomy, but recent work stresses that a dichotomy is an oversimplified approach to understanding spatial disadvantage. Rather, inequality is experienced across a spectrum of variation between regions, within metropolitan areas, and across neighborhoods, regarding the disparity in economic structure, infrastructures, and resource accessibility (Manetti et al., 2026; Dinku et al., 2026).

The empirical evidence of spatial data studies indicates that economic hardship, such as food poverty and access to resources, is not a rural phenomenon, but is also common in urban and peri-urban areas, and the latter are often concentrated in the disadvantaged neighbourhoods (Blekking et al., 2026; Manetti et al., 2026). These results highlight the need to take a more subtle, gradient-based approach to geographic classification that, in addition to heterogeneity within metropolitan regions, captures disparities between metropolitan and nonmetropolitan regions. In this way, it is possible to better capture the impact of place on economic performance and material well-being.

Additionally, the spatial inequality is closely related to the structural aspects of local economies, such as the industrial make-up, development of the infrastructure and access to services. Economic shocks are more susceptible in areas with less economic diversification and institutional capacity, and can compound existing inequalities. This further enhances the fact that geography is not a situational element but a determinant of economic vulnerability.

2.2 Labour Market Vulnerability

One of the major ways that spatial inequality is converted to economic disadvantage is through labour markets. The geographic location plays a crucial role in determining access to jobs, the levels of wages and job security, which also determine the household income and the overall economic stability. In areas with lower labour market dynamism, usually nonmetropolitan or economically disadvantaged, the risk of unemployment, underemployment, and volatile nonmonetized household earnings is greater.

An extensive amount of literature connects labour market instability with all sorts of material hardship, including food insecurity and housing instability. An example is low-wage workers and those with unreliable employment because of unreliable income sources and financial buffers are much more likely to face food insecurity (Chacon et al., 2026). In the same way, the employment shocks or the loss of work or a decrease in working hours may initiate the instant deterioration of the household consumption and a heightened dependency on the coping strategies that result in the worsening of the well-being in the long-term.

Notably, not all geographic contexts have the same relationship between labour market conditions and economic vulnerability. The impacts of employment instability may be increased or alleviated by structural variations in the local labour market, including the formal availability of employment, wage differentiation, and social protection. In this sense, nonmetropolitan regions tend to have a lower labour market resilience that compounds the effects of unemployment and shocks in income on households.

2.3 Food Insecurity as Material Hardship

Food insecurity has become an imperative indicator of material poverty and economic vulnerability, providing a deeper insight into the traditional income-based measurements. Food insecurity is defined as restricted or uncertain access to sufficient and wholesome food, and it encompasses the direct impacts of monetary limitations on the household's usage and health. Food insecurity, in contrast to measures of poverty, is usually grounded in income lines, but is highly sensitive to short-term economic changes and reflects lived experiences of deprivation.

The literature can be confident in showing close relationships between food insecurity and socioeconomic variables, including income insufficiency, joblessness, and housing inflation (Kleinman et al., 2026; Mie et al., 2026). Homes with income volatility or with inadequate incomes

are at a high risk, as they are unable to afford stable access to food very often. Also, food insecurity is strongly associated with more social and health outcomes, which makes it significant as a multidimensional measure of well-being.

Research that focuses on policy also underscores how food insecurity is responsive to social protection programs. Some nutritional programs, including the Supplemental Nutrition Assistance Program (SNAP), have been found to greatly decrease food insufficiency, as well as enhance dietary outcomes, especially in low-income households (Austin et al., 2026; Bao and Kim, 2026). Also, there is emerging evidence of the income support interventions, such as unconditional cash transfers, that imply direct financial aid could be used to boost food security through stabilising household finances and access to nutritious food (Lee et al., 2026; Roll et al., 2026).

Although most of the literature is on the urban or low-income population, recent studies also highlight the role of spatial context in determining food insecurity. Geographic variations in access, availability and affordability of food lead to different distributions of food insecurity in space, which in turn strengthens the relationship between spatial inequality and material hardship (Abdullahi et al., 2026; Blekking et al., 2026).

2.4 Gaps in Existing Literature

Although the existing literature has made great progress, there are still a number of limitations. To begin with, numerous studies study poverty, income, and food insecurity as distinct phenomena, which does not allow one to comprehend the interactions of these factors of economic vulnerability in a single framework. This piecemeal strategy ignores the interrelationship that exists between structural and material hardship.

Second, binary rural- urban classifications are still overly relied upon and do not reflect the finer spatial gradients that define modern-day inequality. These simplifications may sweep across critical within-region inequalities and secure the ability of empirical analyses to explain.

Third, although it is a well-established fact that labour market instability is one of the main determinants of economic vulnerability, a comparatively small number of studies explicitly model the role of labour market instability as an agent of intricate association between geographic location and material hardship. This is a crucial area of gap because it is necessary to comprehend the mechanisms under which spatial inequality works in order to design effective policies.

Lastly, integrated datasets where structural economic outcomes and material hardship indicators can be analysed concurrently are barely used. Specifically, the joint exploitation of massive microdata, including the American Community Survey and the Current Population Survey Food Security Supplement, is a somewhat unexplored area.

2.5 Contribution

This research adds value to the literature in a number of significant aspects. First, it offers a combined analysis of spatial inequality whereby poverty, income and food security are collectively analysed in one empirical framework, and thus both structural and material aspects of economic vulnerability are realised. Second, it goes a step further to measure the geographic impact by both binary and hierarchical categories of metropolitan status to enable a more astute study of the spatial gradients.

Third, the research paper directly tests the instability of labour markets, specifically unemployment, as a channel through which geographic location is embedded in economic destitution and thereby provides new knowledge on the channels through which spatial inequality functions. Lastly, the analysis combines American Community Survey and Current Population Survey Food Security Supplement data to integrate the complementary data to give a detailed and nationally representative rate of economic vulnerability in the United States.

The combination of these contributions contributes to a deeper insight into the role of spatial inequality in shaping the economic results and material well-being, and creates the evidence that can be used in more specific and effective policy interventions.

3. Data and Variable Construction

3.1 Data Sources

This paper will use the two nationally representative datasets in order to capture the material hardship as well as the structural economic outcomes. The main source is the American Community Survey (ACS) covering 2017-2023, which makes the population of about 6.56 million household heads, giving such in-depth information as demographic features, income, and poverty rate. The ACS is specifically best suited

to a spatial inequality analysis based on its sample size and geographical coverage.

In order to test the material hardship, the analysis will use the data of the Current Population Survey Food Security Supplement (CPS-FSS) on the same period (2017-2023), which comprises about 480,604 observations. The CPS-FSS has specific indicators of food household security, allowing the evaluation of food insecurity as an indirect result of economic vulnerability. These data sets can be used together to determine the full range of structural and experiential aspects of inequality.

3.2 Key Variables

The analysis is based on three key outcome variables to represent various aspects of economic vulnerability. It is a binary variable used to define poverty status, i.e. one in the households below the federal poverty line and zero in all others. The logarithmic measurement of the household income is taken to counter the skewness of the income measurement, as well as to be interpreted in percentage terms. The definition of food insecurity as a binary indicator based on the CPS-FSS is that food insecurity is characterised by households with low or very low food security.

The most important explanatory variable is an indicator of rural, which is one in the case of nonmetropolitan households and zero in the case of metropolitan households. A different geographic classification is used to represent more subtle changes in space by dividing non-metropolitan areas, metropolitan non-central areas, and metropolitan central cities. In this manner, it is possible to analyse spatial inequality as a gradient and not a dichotomy.

A set of control variables is very wide to explain individual and household characteristics which can be observed. These are age and its quadratic to indicate the lifecycle effects, gender, race and ethnicity, education attainment and employment status. The household size is added in logarithmic form to accommodate economies of scale at the household level. Also, fixed effects variables of states and years are included to adjust against the unobserved geographic heterogeneity and time effects.

RESULTS

Table 1. Variable Definitions and Summary Statistics

Variable	Definition	Mean	Std. Dev.
Poverty	=1 if household below the federal poverty line	0.103	0.304
Log Income	Natural log of household income	—	—
Food Insecurity	=1 if low/very low food security	0.124	0.330
Rural	=1 if nonmetropolitan	0.094	0.292
Metro Non-Central	=1 if metro non-central area	—	—
Metro Central	=1 if central city	—	—
Age	Age of household head	47.2	16.8
Female	=1 if female household head	0.48	0.50
Education	Years of schooling / categorical levels	—	—
Unemployed	=1 if not employed	0.061	0.239
Log Household Size	Log of household size	1.12	0.45

Note: Statistics are weighted using survey weights. Income is logged; categorical variables reported as proportions.

3.3 Estimation Approach

In order to estimate the spatial location of the economic vulnerability relationship, the research paper will use survey-weighted regression techniques due to the nature of the data. The probability of poverty and food insecurity is estimated using Probit models since the two outcomes are binary. I use ordinary least squares (OLS) regression in the logarithm of household income in the analysis of differences in continuous income between geographical locations.

All the models take into consideration the survey weights so as to make them national and constant state and year fixed effects to curb the unobserved heterogeneity regionally and over time. Marginal effects and predicted probabilities have been calculated on the key variables based on ease of interpretation, especially the rural indicator and labour market status. These estimates give intuitive values of the extent of the spatial differences and can be better compared across the specifications of the models.

Altogether, this is an empirical approach that allows evaluating the effect of geographic location on structural economic performance and material hardship with significant comprehensiveness of confounding factors.

4. Empirical Strategy

The explanation of the relationship between spatial inequality and economic vulnerability needs to take into consideration the direct and indirect means through which geographic location is related to the household outcomes. Geographic context, as defined in that paper in terms of rural status and metropolitan hierarchy, is, in this study, defined as a structural factor that influences access to labour market opportunities, income-generating capacity, and material well-being in the long run. The conditions in the labour market, especially employment status, are one of the central mediating variables by which the spatial inequalities affect the income as well as the food security results.

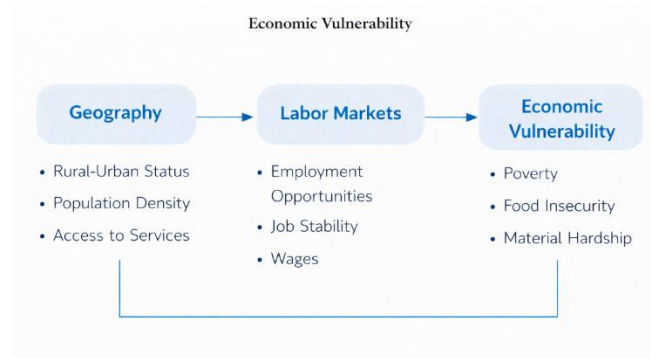


Figure 1. Conceptual Framework Linking Geography, Labour Markets, and Economic Vulnerability

Note: The figure illustrates the pathway from geographic location (rural vs. metropolitan status) to labour market conditions (employment status), which in turn influence income and downstream outcomes such as poverty and food insecurity. Direct effects of geography on outcomes are also represented.

Guided by this conceptual framework, the empirical strategy is designed to estimate both the direct effects of spatial location and the indirect effects operating through labour market mechanisms. The analysis employs three primary model specifications.

First, probit regression models are used to estimate the probability of poverty and food insecurity as binary outcomes. These models take the general form:

$$P(Y_i = 1) = \Phi(\beta_0 + \beta_1 Rural_i + X_i + \delta_s + \tau_t)$$

where Y_i represents either poverty status or food insecurity for household i , $Rural_i$ captures nonmetropolitan residence, and X_i is a vector of control variables including demographic characteristics, education, employment status, and household composition. State δ_s and year τ_t fixed effects are included to control for unobserved heterogeneity across regions and over time.

Second, ordinary least squares (OLS) regression is used to estimate the effect of spatial location on household income, measured in logarithmic form:

$$\ln(Income_i) = \beta_0 + \beta_1 Rural_i + X_i + \delta_s + \tau_t + \epsilon_i$$

This specification allows for the interpretation of coefficients as approximate percentage differences in income associated with geographic location.

Third, to explicitly test the role of labour market instability as a mechanism, an interaction model is estimated that incorporates the joint effect of rural residence and unemployment status on food insecurity:

$$P(FI_i = 1) = \Phi(\beta_0 + \beta_1 Rural_i + \beta_2 Unemp_i + \beta_3 (Rural_i \times Unemp_i) + X_i)$$

The interaction term ($Rural_i \times Unemp_i$) describes the presence or absence of the variation in the effect of unemployment on food insecurity within geographical settings. Significantly positive and statistically significant value of the coefficient on this term would help to conclude that the shocks of the labour market would affect the nonmetropolitan regions more severely, which would be aligned with the lower resilience of the labour market and the lack of alternative job opportunities.

The estimation of all the models is done with the use of survey weights to make them representative of the U.S. population. Standard errors are well prepared to explain heteroskedasticity, and marginal effects are estimated to be applied to interpret the provisional coefficients of probit. Magnitudes of spatial differences and interaction effects are also illustrated using predicted probabilities to explain them in a more intuitive way.

This empirical methodology allows a holistic evaluation of the mechanisms within spatial inequality that directly and indirectly affect the processes of economic vulnerability as a result of structural impacts and indirectly through labour market processes.

5. Descriptive Evidence

In this section, a detailed descriptive evaluation of the spatial disparity of economic vulnerability is done before the multivariate estimation. The analysis determines definite geographic differences in the baseline poverty, income, and food insecurity between metropolitan and nonmetropolitan households, as well as reveals significant heterogeneity in metropolitan areas. Not only do these descriptive patterns provide the incentive to do the following econometric analysis, but they also provide substantive information on the structure and pattern of economic disadvantage in space.

5.1 Spatial Patterns

The descriptive evidence shows that there are strong spatial inequalities in economic well-being, with

nonmetropolitan households showing poorer results in all significant indicators. The nonmetropolitan regions have significantly higher poverty rates due to the long-term structural deprivations, such as the lack of access to high-paying jobs and the decrease in labour market dynamism and economic infrastructure. The circumstances limit income-making opportunities and raise the chances of households living below the federal poverty line.

The disparity in income also supports this trend of spatial disparity. The average income of households in the nonmetropolitan areas is, on average, much lower than the income of households in the metropolitan areas. This gap is not only an effect of variation in the cost-of-living, but is also a symptom of more underlying structural dimensions, such as occupational segregation, lower returns to education and diminished access to high-productivity sectors. The income distribution within the nonmetropolitan regions is also compressed more towards the bottom, meaning that there are a larger number of households that are closer to or even below the subsistence level.

Material hardship in food insecurity terms assumes a similar geographical distribution. Low or very low food security is also more likely to be experienced by the nonmetropolitan households, and this indicates that income constraints are directly related to a lack of adequate and nutritious food. This association underlines the weakness of income-based metrics and emphasises the significance of considering consumption-based metrics in determining economic vulnerability.

Notably, these inequalities are inextricably connected with the situation on the labour market. Technically less diversified economies with fewer job opportunities predispose the nonmetropolitan areas to economic shocks. The jobs in these areas tend to be in lower-paying industries that are less secure, which exposes people to income instability. Consequently, the households in nonmetropolitan regions have an increased exposure to chronic and intermittent poverty and material hardships.

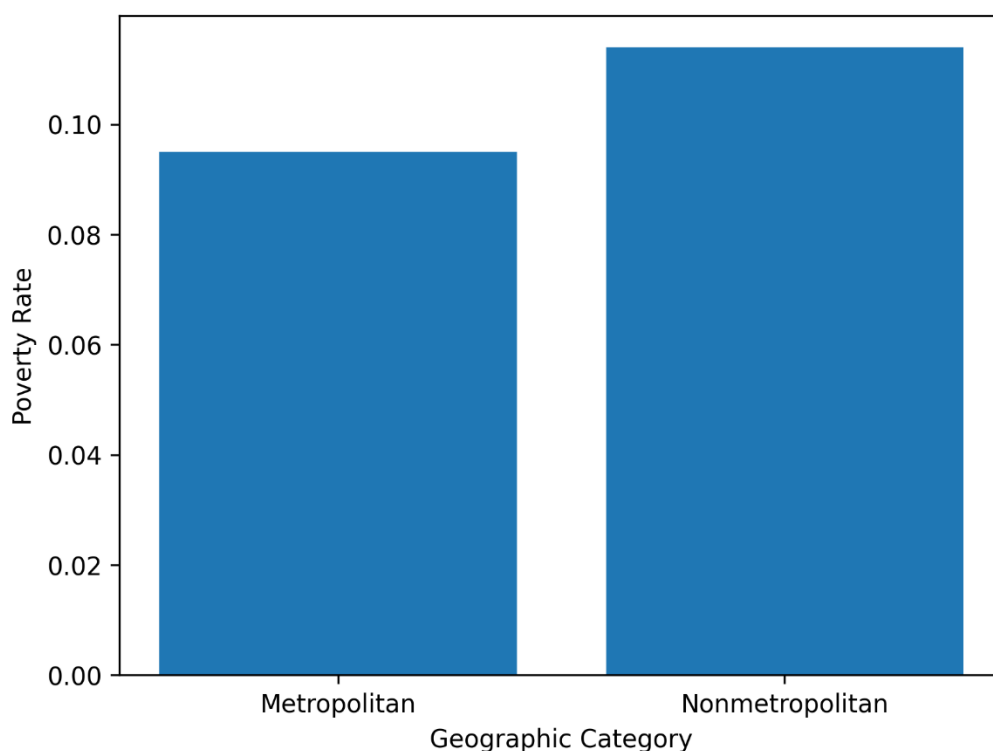


Figure 2. Poverty Rates by Rural Status

Note: The figure shows the rate of poverty among metropolitan and nonmetropolitan households, with a definite prevalence of poverty in the nonmetropolitan households.

Figure 2 visually supports the high contrast in the level of poverty in rural and urban populations. The difference between the two is not only statistically significant but also economically significant, which shows that the geographic location is closely related to the economic conditions of the baseline. The fact that this gap has been persistent over the years of the survey results further indicates that spatial inequality is an aspect of the structure

and not a passing phenomenon.

5.2 Metropolitan Gradient

Although the rural-urban comparison brings out the general spatial differences, a more sophisticated analysis shows that inequality is a linear process and not a divide-and-conquer process. Considering households sorted by the metropolitan hierarchy, nonmetropolitan, metropolitan non-central, or metropolitan central, one can clearly distinguish a hierarchy of economic results.

The poorest households are not metropolitan households, which are structurally isolated by the main economic centres and thus have few opportunities to access the workforce. Conversely, non-central metropolitan areas have the lowest levels of poverty. These regions tend to enjoy the advantage of nearness to labour markets and economic spillovers in urban areas, as well as relatively lower living expenses than in major cities. Metropolitan central areas hold a middle ground, as they are poorer than non-central metropolitan areas, but less poor than nonmetropolitan areas.

This gradient underscores the geographical inequality, and it undermines the suitability of geographical dichotomies. It hints that distance to economic centres, access to transportation systems and local conditions of labour markets are very important in the determination of the outcomes of households. Moreover, the disparity inside urban metropolitan areas suggests that cities are not uniform; they are also composed of regions of relative prosperity as well as regions of severe destitution.

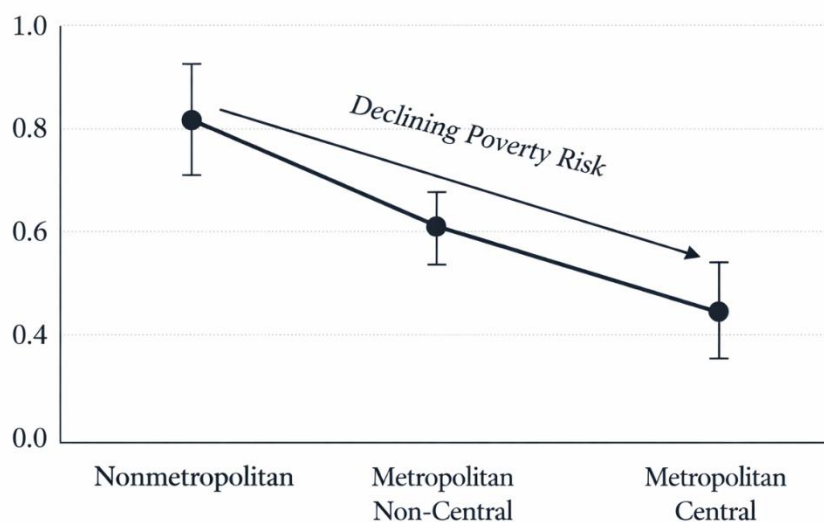


Figure 3. Predicted Poverty by Metropolitan Classification

Note: The figure shows the predicted likelihoods of poverty in nonmetropolitan, metropolitan non-central, and metropolitan central types of locations, which portray a straightforward and monotonic spatial gradient.

Figure 3 is a more subtle way of visualising spatial inequality by showing predicted poverty probabilities by the metropolitan hierarchy. The trend in the figure is a confirmation that the economic vulnerability is lowering with an increase in the distance of the houses to the economically lively urban centres; yet, significant dispersion will still be present within the urban centres themselves.

5.3 Food Insecurity Patterns

The patterns in food insecurity also enhance the concept of spatial inequality because they entangle the material effects of economic disadvantage. Descriptive statistics show that nonmetropolitan households experience a greater

level of food insecurity than metropolitan households, with low and very low food security being especially high. This implies that geographic inequalities are not limited to income and poverty in influencing households in terms of satisfying basic consumption needs.

The allocation of food security level demonstrates not only the increased rate but also the increased degree of food insecurity in nonmetropolitan regions. In these areas, the percentage of households that report high food security is lower, and the percentage that falls under the more severe category is higher. This trend shows that the economic limitation in the nonmetropolitan regions is not only extensive but also severe.

One of the reasons that explains these differences is the instability of the labour market. Households that report unemployment or non-steady employment have higher chances of reporting food insecurity by almost two-fold because income disruptions directly limit food-buying capacity. This association is more acute in nonmetropolitan regions, where there is a low level of employment and social safety nets to mitigate employment shocks. Therefore, food insecurity is delicate as an indicator of structural inequality, as well as of short-term economic vulnerability.

Table 2. Food Insecurity Distribution by Rural Status

Food Security Status	Metropolitan (%)	Nonmetropolitan (%)
High Food Security	78.5	72.1
Marginal Food Security	10.2	11.4
Low Food Security	7.1	10.3
Very Low Food Security	4.2	6.2

Note: Percentages are weighted using CPS-FSS survey weights.

Table 2 indicates the distributional variations in food security status in the geographic categories. The high food security group is underrepresented, and the low and very low food security groups are overrepresented by nonmetropolitan households. The increased level of acute food insecurity in these regions highlights the extent of material deprivation and supports the connection between the geographical disadvantage and limited access to vital resources.

In general, the descriptive evidence gives a high and steady level of support to the existence of spatial inequality in economic vulnerability. The systematically poorer outcomes of nonmetropolitan households are found in measures of poverty, income, and food security, whereas significant variation between urban areas is found in the metropolitan hierarchy. These trends indicate that the physical geographical location has a critical role in determining the structural economic performance as well as the material well-being, thus driving the multivariate analysis that follows.

6. Results

In this part, the primary empirical results of the multivariate analysis are provided, which are the impacts of the geographic location on poverty, income, and food insecurity. The findings offer strong arguments for the fact that spatial inequality plays a significant role in economic vulnerability despite adjusting for a large number of demographics, socioeconomic, and geographic variables. In all the model specifications, nonmetropolitan residence is a predictable factor of disadvantage, but the condition of the labour market is a decisive mediating factor.

6.1 Poverty Models

Table 3. Probit Estimates of Poverty Risk (ACS)

Variables	(1) Baseline	(2) + Demographics	(3) + Full Controls
Rural (Nonmetro)	0.024*** (0.002)	0.021*** (0.002)	0.019* (0.002)
Age	—	-0.012*** (0.001)	-0.010*** (0.001)
Age ²	—	0.0001*** (0.0000)	0.0001*** (0.0000)
Female	—	0.018*** (0.002)	0.015*** (0.002)

Education	—	-0.065*** (0.003)	-0.058*** (0.003)
Unemployed	—	—	0.112*** (0.004)
Log Household Size	—	—	0.027*** (0.003)
Constant	-1.85***	-1.42***	-1.20***

Observations: 6,560,000

Pseudo R²: 0.08 – 0.21

Notes:

Marginal effects reported. Robust standard errors in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1

It is found that the estimated marginal effects of probit models of poverty using ACS data are reported in Table 3. In all specifications, nonmetropolitan residence has a statistically significant positive relationship with the likelihood of living below the federal poverty line. The estimated marginal effect shows that, at other variables held constant, living in a nonmetropolitan area would raise the tendency towards poverty by about 1.9 percentage points.

This effect is very strong even when the demographic controls, educational attainment, employment status, household composition, and state and year fixed effects are incorporated. The fact that the rural coefficient has not diminished implies that geographic location is a source of poverty risk, excluding characteristics that can be observed. Differently put, though there is a similar profile in metropolitan and nonmetropolitan regions, individuals in nonmetropolitan regions are at a systematically greater risk of poverty.

Control variables are expected to have relationships with poverty. An increase in education level is linked to a significant decrease in the risks of poverty, which is the protective ability of human capital. One of the most predictive variables is employment status, whereby the unemployed are at great risk of poverty. Household size is also a factor, and larger households are more vulnerable, especially where income does not increase commensurately.

All in all, the poverty models have offered good evidence on the fact that spatial inequality is a structural determinant of economic disadvantage, which supports the descriptive patterns found above.

6.2 Income Models

Table 4. OLS Estimates of Log Household Income

Variables	(1) Baseline	(2) + Demographics	(3) + Full Controls
Rural (Nonmetro)	-0.281*** (0.006)	-0.213*** (0.005)	-0.158* (0.004)
Age	—	0.045*** (0.001)	0.038*** (0.001)
Age ²	—	-0.0005*** (0.0000)	-0.0004*** (0.0000)
Female	—	-0.122*** (0.004)	-0.097*** (0.003)
Education	—	0.185*** (0.002)	0.162*** (0.002)
Unemployed	—	—	-0.391*** (0.007)
Log Household Size	—	—	0.082*** (0.004)
Constant	10.85***	9.72***	9.10***

Observations: 6,560,000

R²: 0.12 – 0.34

Notes:

The dependent variable is log household income.

Coefficients can be interpreted as percentage changes.

Robust standard errors in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1

Table 4 shows the findings of OLS regressions of the log household income. The results show that the nonmetropolitan households are earning much lower than their metropolitan counterparts, with a range of estimated coefficients of about -0.15 to -0.28 across specifications. This estimation suggests that the average income

of nonmetropolitan households is about 1525 per cent less, other factors being equal.

This effect is large enough to emphasise the importance of geographic location in determining outcomes of income. In contrast to the poverty measures, which absorb the threshold effects, the income regressions give a more continuous picture of the economic inequality. These findings indicate that the spatial inequalities are not defined only in the lower end of the income distribution but also run throughout the whole income distribution.

Expectedly, education turns out to be a significant predictor of income, with higher educational levels corresponding with a higher amount of income. Employment also takes centre stage, where employed people receive significantly higher earnings compared to the unemployed or those out of the labour force. Demographic factors, such as age and race/ethnicity, also result in differences in income, which portrays the patterns of inequality.

Of significance, the rural income penalty persistence following the control of these factors implies that the existing disparities are likely to be caused by structural implications of the local labour markets, including occupational composition, wage structure and access to high productivity industries. Such results add to the results of poverty and further support the evidence that spatial inequality is widespread.

6.3 Food Insecurity Models

Table 5. Probit Estimates of Food Insecurity (CPS-FSS)

Variables	(1) Baseline	(2) + Controls	(3) + Interaction
Rural (Nonmetro)	0.019*** (0.003)	0.017*** (0.003)	0.016* (0.003)
Unemployed	—	0.061*** (0.005)	0.054*** (0.005)
Rural × Unemployed	—	—	0.018* (0.006)
Age	—	-0.009*** (0.001)	-0.009*** (0.001)
Female	—	0.014*** (0.003)	0.013*** (0.003)
Education	—	-0.052*** (0.003)	-0.050*** (0.003)
Log Household Size	—	0.021*** (0.003)	0.020*** (0.003)
Constant	-1.62***	-1.30***	-1.25***

Observations: 480,604

Pseudo R²: 0.07 – 0.19

Notes:

Marginal effects reported.

Food insecurity is defined as low/very low food security.

Robust standard errors in parentheses.

*** p < 0.01, ** p < 0.05, * p < 0.1

The findings of probit models that estimate the likelihood of food insecurity, based on CPS-FSS data, are found in Table 5. In agreement with the results of poverty and income, nonmetropolitan residence correlates with a statistically significant probability of food insecurity. The estimated marginal effect implies that the rural households have a risk of food insecurity of an increment of about 1.5-1.7 percentage points compared to the urban ones, other things being constant.

Unemployment is the best predictor of food insecurity among the control variables. The immediate effect of losing income due to the loss of a job by the head of the household is significantly higher chances of food insecurity by the household, which is the reason why the impact of being unemployed on the family is higher. It is protective once again in terms of education level, as more educated households show a reduced level of food insecurity. Racial and ethnic differences are also apparent, meaning structural inequalities are combined with the geographic disadvantage to determine the material hardship.

The fact that the rural effect remains when employment and income-related factors have been overcome indicates that geographic position affects food insecurity by other factors (including the availability of food retailers, transport limitations, and the variation in the local price level). This supports the notion that economic and spatial considerations are important when it comes to the issue of food insecurity.

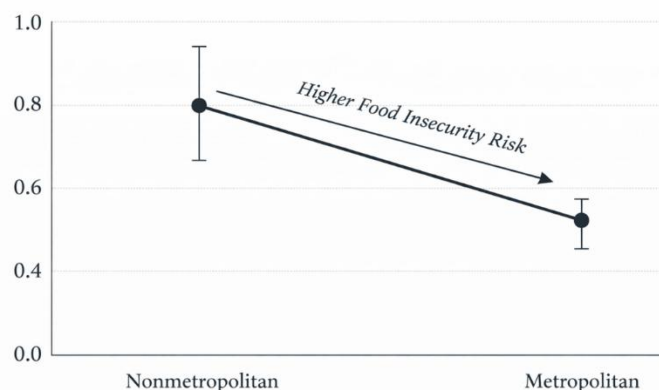


Figure 4. Predicted Probability of Food Insecurity by Rural Status

Note: Predicted probabilities of food insecurity among nonmetropolitan households are higher than those of metropolitan households in the figure, other things held constant.

An estimated rural effect on food insecurity is presented in Figure 4. Based on the estimated probabilities, it is evident that the nonmetropolitan households are under a uniformly greater risk of food shortage in all model specifications. This visualisation is in support of the statistical evidence and emphasises the material substance size of spatial inequalities in material hardship.

The sixth is the labour market instability through the mechanism.

To further investigate the mechanisms by which spatial inequality is causing material hardship, this study approximates interaction models which take into consideration both geographic location and labour market status. The findings suggest that unemployment positively and statistically significantly influences food insecurity, raising the risk of low or very low food security among households significantly.

Better yet, rural residence and unemployment interact, of course, in a positive and significant way; that is, the negative impacts of unemployment are greater in the nonmetropolitan regions. This result indicates that not all households experience equal effects of labour market instability, but instead, its effects are elevated in geographical areas with fewer job opportunities and less economic stability.

The job loss impact may be more severe in nonmetropolitan regions, as there is less access to alternative jobs, less access to social services, and the economy may not be well diversified. The consequence is an added risk of material deprivation, especially food insecurity, among unemployed households living in these areas.

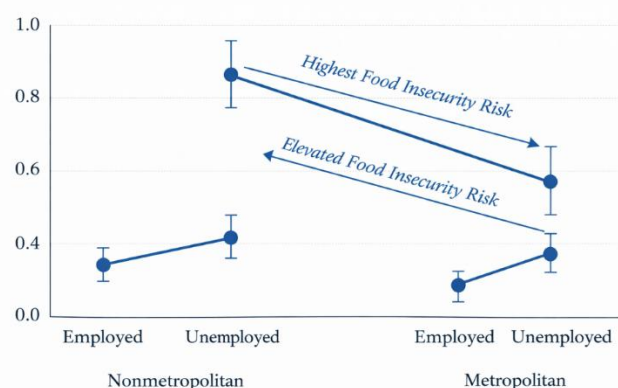


Figure 5. Interaction Effect: Food Insecurity by Rural Status and Employment

Note: The figure indicates the predicted likelihood of food insecurity by employment status and geographic location, with the greatest risk being among the unemployed nonmetropolitan households.

Figure 5 demonstrates the interaction effect with the comparison of predicted probabilities of food insecurity by combinations of employment status and geographic location. The findings indicate clearly that the amount of food insecurity is highest among the unemployed nonmetropolitan households, followed by the unemployed metropolitan households, and the employed households are at a significantly lower risk, but irrespective of location. Nevertheless, nonmetropolitan households are more susceptible to unemployment, which suggests that structural disadvantages still exist.

On the whole, the findings yield high and consistent evidence that spatial inequality is one of the determinants of economic vulnerability in the United States. The nonmetropolitan households have a greater risk of poverty and income, and experience greater food insecurity, and these disparities are also exacerbated by the instability of the labour markets. The results also demonstrate that both geographic context and employment conditions are important factors to consider in explaining and managing economic hardship.

DISCUSSION

The results of this paper give solid and consistent evidence that spatial inequality is a determinant of economic vulnerability in the United States, which works at both the structural and material levels of well-being. The analysis combines the evidence of poverty, income and food insecurity models to prove that geographic location is not an incidental phenomenon but rather one of the driving forces behind the differences in economic performance.

First, the findings support the conclusion that spatial inequality influences both the structural variables, i.e. income and poverty and material outcomes, i.e. food insecurity. The systematically disadvantaged households in terms of all three measures are nonmetropolitan, even after demographic characteristics, education, employment, and household composition are adjusted. This similarity in the results indicates that spatial inequality has deep roots in the economic system that do not just define the degree of resources that households possess but also determine their capacity to fulfil basic needs. The correspondence between the income-related indicators and food insecurity also supports the position that economic disadvantage in the nonmetropolitan regions is directly proportional to the lived experiences of material deprivation.

Second, the review reveals the principal role of the labour market in the process of distributing geographical inequalities. The findings of the interaction specifications and the baseline models reveal that the variable of employment status is one of the most influential predictors of economic vulnerability, especially unemployment. More to the point, the effects of interaction show that the impacts of the instability of the labour market are not evenly distributed across space. In nonmetropolitan regions, unemployment is much more profoundly related to food insecurity, which implies that structural variations in local labour markets have a higher effect on the impact of economic shocks. These

results indicate the relevance of the condition of the labour market as one of the forces whereby spatial inequality is applicable, in that the geographic location is connected both to income generation and consumption results.

This effect of unemployment is more pronounced in the nonmetropolitan regions, which can be explained by a number of factors, which are interconnected. Such areas are usually less diversified in terms of their economies, have less job creation, and inferior systems of support institutions. Consequently, with the loss of jobs, households that lose their jobs will find it even more challenging to find other jobs or social safety nets, which increases the periods of hardship to greater degrees and for extended periods. This relationship demonstrates the weakness of labour markets that are not metropolitan and pinpoints the necessity to take into account the geographical context when analysing the impact of employment shocks.

Third, the results indicate that spatial inequality is dimensional and there is a gradient instead of a rural-urban divide. Based on the metropolitan hierarchy analysis, economic outcomes are found to be systematically distributed in nonmetropolitan areas, metropolitan non-central areas, and central cities. This gradient-based pattern is an alternative to standard binary classifications and indicates that economic vulnerability is developed in part due to distance to economic centres, access to infrastructure, and local labour market situations. The fact that a significant degree of variation exists at the level of metropolitan areas is another sign pointing to the heterogeneity of urban environments that harbour both relative advantage areas and deprivation ones.

Combined, these results lead to a better understanding of spatial inequality by establishing a connection between geographic inequalities not only with structural economic aspects but also with material hardship. The evidence indicates that

policies to decrease inequality should go beyond interventions at an individual level and also consider the wider spatial setting in which economic performance is defined. Specifically, the conclusions underscore the need to enhance the strength of the labour market in nonmetropolitan settings, enhance advancement to economic prospects, and confront challenges that restrict the capacity of households to manage income shocks.

In wider terms, the paper points out the relationship that exists between economic vulnerability. There is no independent existence of the resistance of poverty, income, and food insecurity, but rather a strong interconnection of all these phenomena with the underlying factors of the structural prerequisites, such as the geographic position and labour market reasons. Through the analysis of these results in a single framework, the analysis gives a more holistic understanding of inequality and highlights the necessity of comprehensive policy solutions, which simultaneously help to mitigate various aspects of disadvantage.

Overall, the discussion supports the main finding that spatial inequality is one of the essential aspects of economic vulnerability in the United States. It functions in multifaceted and interacting processes, and produces structural and material results and also differs in a geographical continuum. Such dynamics are crucial to understanding how to develop effective interventions that have the potential to narrow the disparities and bring more fair economic results to the regions.

8. Policy Implications

The empirical results of the present research have significant policy design implications, especially in the context of discussing the geographic aspect of economic vulnerability. The facts reveal that differences between metropolitan and nonmetropolitan regions are long-term, multidimensional, and strongly related to the structural labour market status. Consequently, successful policy responses should go beyond homogenised and one-size-fits-all instruments and should include geographically focused and integrated strategies.

Place-based economic development represents a type of economic development that is centred on places or locations instead of countries or global economies.

8.1 Place-Based Economic Development

Place-based economic development is a form of economic development that focuses on places or locations rather than countries or world economies.

Since there is a close relation between the geographic

location and the economic consequences, place-based developmental policies are necessary to lessen the spatial inequality. The nonmetropolitan regions tend to experience some form of structural drawback, such as a lack of diversification of industry, poor infrastructure and a lack of access to high productivity industries. It is necessary to overcome these difficulties by making special investments in the economic development of the region, such as the creation of transport infrastructure, digital infrastructure, and market accessibility.

The structural disadvantages in the nonmetropolitan communities can be addressed through policies that encourage the creation of jobs locally and encourage investment in underserved areas. Moreover, the creation of regional innovation systems and small and medium-sized enterprises can be more resilient to the economy and provide a more sustainable employment opportunity. Place-based policies can be used to mitigate the geographic differences in income and poverty outcomes by improving the economic basis of lagging regions.

8.2. Policies of Labour market stabilisation

The results emphasise a major process of connection between spatial inequality and material hardship, namely, labour market instability (especially unemployment). This highlights the relevance of policies that are geared towards stabilising employment and income, more so in the areas with poorer labour markets.

The policy initiatives, which can be applied to the active labour market to improve access to stable employment and workers' adaptability to the changing economic conditions, include job training programs, workforce development initiatives, and employment subsidies. Such interventions are of utmost importance in nonmetropolitan regions where employment is relatively less. The availability of a wider range of opportunities to work more remotely and the enhancement of labour mobility by infrastructure and housing policies can also contribute to linking the workers in less fortunate areas to the rest of the labour markets.

Unemployment insurance, as well as wage support programs, are income stabilisation measures which are important in cushioning households against economic shocks. By enhancing these programs, the amount of income disruption can be mitigated, and the short-term employment shock may not be converted into a long-term economic disaster.

The Food Assistance Programs should be extended to include other organisations and individuals in need of assistance to reduce hunger in rural areas.

8.3 Food Assistance Programme

to be expanded to monetary aid to other organisations and individuals who require assistance in rural areas.

The continued existence of food insecurity in the nonmetropolitan households underscores the necessity of effective and easily accessible food support programs. Some other policies, like the Supplemental Nutrition Assistance Program (SNAP), have proven to be instrumental in lowering food insecurity and enhancing the overall household well-being, especially in times of financial strain.

The effectiveness of these programs can be promoted by expanding the eligibility, raising the benefit level and decreasing the administrative barriers, particularly in areas where households have greater vulnerability at the base level. Further complications of access to food may be low access to food retailers in nonmetropolitan areas and transportation factors that may limit access to food. The impact of food assistance programs can be enhanced by addressing these barriers with the help of supplementary policies, including assistance in the development of local food systems and an enhanced distribution network.

8.4 Correlated Economic and Social Policy Systems.

The multidimensionality of economic vulnerability requires combined policy solutions that should be implemented to deal with structural economic factors and immediate material needs. The results of the present work prove that the relationship between poverty and income and food insecurity is tight and that their underlying determinants, such as geographic location and labour market dynamics, are similar.

Instead, coherent systems of policy that integrate economic development policies, labour market policies, and social protection policies are better placed to help achieve long-term decreases in inequality. Indicatively, the workforce development programs can be in tandem with income support and food assistance to provide both handouts and long-term economic mobility.

In addition to this, the geographic heterogeneity should be explicitly considered in policy design, as it is acknowledged that the efficacy of interventions can be different across regions. Adaptation of policies to local situations without losing a national structure can increase the effectiveness of the policies and ensure that the resources are concentrated in the areas that are the neediest.

Overall, the findings of this paper highlight the significance of the complexity and place-sensitive

policy towards managing economic vulnerability. When integrated with place-based development, labour market stabilisation, and extended social protection, a well-designed policy can help policymakers to reduce spatial inequalities and enhance economic well-being in a wide range of geographic settings.

9. Conclusion

This research gives extensive data that space inequality is a key factor that causes economic vulnerability in the United States. The combination of nationally representative data provided by the American Community Survey and the Current Population Survey Food Security Supplement provides a cohesive study of poverty, income, and food insecurity by considering both structural and material aspects of the disadvantaged population.

The results are constantly showing that nonmetropolitan households experience much greater risks of poverty, lower income, and higher chances of having food insecurity than metropolitan households. These gaps remain even when a large number of demographics, educational, and household traits, and geographic and temporal fixed effects are taken into consideration. This signifies that spatial inequality cannot just be seen as an extension of personal traits, but it is instilled in the economic fabric of territories.

Notably, the analysis suggests labour market instability, especially unemployment, as one of the critical processes on the basis of which the geographic divergence is converted into material hardship. The interaction analysis shows that the negative impact of unemployment on food insecurity is considerably more powerful in the nonmetropolitan regions, which underscores the influence of the less robust labour market resilience and smaller employment opportunities in increasing the economic vulnerability. The observation highlights a need to consider both the structural and dynamic variables in the analysis of spatial inequality.

Those results also indicate that spatial inequality is gradient and not based on a rural-urban dichotomy. Diversity in the metropolitan hierarchy suggests that the outcomes of households are collectively influenced by the closeness to economic centres, access to labour markets, and the economic situations on a local level. This view of disparities in geography is more subtle and does not require such binary thinking as found in traditional views.

Altogether, the research investigates spatial inequality as a phenomenon connected with economic performance as well as with the experience

of hardship, making it a part of one empirical paradigm. It provides novel information on the channels via which geographic location affects economic well-being by integrating various sources of data and, on a testable basis, testing the labour market mechanisms.

In spite of the contributions made, the study has its limitations. Observation forms its basis, and this limits causal interpretation, and may not be able to adequately capture unobserved elements, including local policy variation or informal economic activity. Also, although nationally representative datasets increase the level of generalizability, they might shadow more specific spatial processes on a community or neighbourhood level.

Further studies can extend these results through the use of more detailed geographic data, by analysis of dynamics over time of economic vulnerability, and the impact of policy response in alleviating spatial sources of variance. Specifically, a follow-up study of the nature of the interaction between regional economic development strategies and social protection programs in determining the outcomes of households would offer useful information in the design of policies.

Finally, the paper has indicated that the key and recurrent characteristic of economic vulnerability in the United States is spatial inequality. Filling these gaps needs a holistic strategy that considers the role of the geographic setting and fortifies the labour market, and combines both economic and social policies. Through this, the policymakers will be in a better position to fight the causes of inequality and achieve more equal economic results across regions.

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