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Market Accessibility and Economic Growth: Insights from a New Dimension of Inequality

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Summary. — We modify an AK growth model to allow for households' differential access to markets. Such local production spillovers highlight a new dimension of inequality arising through geographic remoteness and predicts divergent growth patterns among countries with poorly market-integrated households. The model is tested using an instrumental variables approach that takes advantage of the relationship between market accessibility and exogenous geographic features of the landscape as well as spatial data derived from a unique global dataset characterizing country-level market accessibility distributions. Our findings are consistent with production spillovers diminishing concavely across space before tapering off convexly in remote areas. This result suggests that the marginal household exhibiting production spillovers is located approximately five hours from the nearest market center. The policy implications are that governments could adopt pro-growth inequality-reducing policies using targeted infrastructural investments, relocation subsidies, or income redistribution mechanisms. Based on our spillover threshold estimates, these policies would be access-equality enhancing for 5.1 billion people globally and access-equality reducing for 825 million people globally. We also present findings that growth divergence occurs among countries with geographically less pervasive markets. This outcome may explain why wealthier nations exhibit divergent growth paths relative to poorer nations.

Key words — market accessibility, spillovers, inequality, public good provisioning and growth

1. INTRODUCTION

Since the seminal article by Kuznets (1955) relating income inequality to countries' levels of economic development, economists have sought to explain and measure the relationship between initial income inequality and economic growth. The predominant theory, posed originally by Stiglitz (1969), contends that in the presence of credit market imperfections and diminishing marginal product of capital, households are unable to invest optimally, which causes aggregate output and its rate of growth to decrease in the presence of unequally distributed income (Aghion, Caroli, & Garcia-Penalosa, 1999; Banerjee & Andrew, 1993; Benabou, 1996; Galor & Zeira, 1993). The effect of income inequality on growth has been tested extensively with mixed results (Barro, 2000, 2008; Ostry & Berg, 2011; Ferreira *et al.*, 2014; Forbes, 2000). With the exception of asset inequality (Birdsall & Nancy, 1997), less attention has been focused on identifying and analyzing empirically other forms of inequality that may affect growth. Here, we focus on inequality of access that arises through geographic remoteness. [1]

Barriers to market participation create isolated areas of economic disadvantage (Barrett, 2008; Bloom, Canning, & Sevilla, 2003). This disadvantage is exacerbated when remote households become reliant on degradable natural assets, which can perpetuate a poverty trap (Barbier, 2010). Remote households appear to earn a lower return to labor than similarly skilled laborers with better market access (Hering & Poncet, 2010). Such relationships arising through remoteness imply that market access across households, is highly unequal, and could impact aggregate economic growth. This relationship is policy relevant because market accessibility is affected by not just geographic factors (e.g. terrain, navigable waterways, etc.), which policymakers cannot control, but also by institutional factors (e.g. road placement, rail placement, city location, etc.) that policymakers can influence. [2]

Frankel (1962) AK growth model, often used to relate initial income inequality and economic growth (Aghion & Howitt, 2009), is modified to relate market access with economic growth. Indeed, a more sophisticated model could be developed using the new economic geography framework (Krugman, 1991) but we leave theoretical contributions in this line of work, which are many (Martin, 1999; Martin & Ottaviano, 1999, 2001; Yamamoto, 2003), to future work and focus on deriving and examining empirically the relationship between spatial population distributions and cross-country economic growth. In this model, each household is treated as a producer with an exogenous initial wealth. The income-equality version shows that in the presence of diminishing marginal productivity of capital and imperfect credit markets, increased equality of wealth will increase economic growth (Bjrnskov, 2008; Galor & Zeira, 1993; Stiglitz, 1969). Households that would borrow to finance increased capital investment gain in production disproportionately relative to households that would lend and forego some capital investment. The access-equality model relates growth and equality of access through the presence of relocation barriers and production spillovers, which originate in market centers and diffuse across space. We show that the relationship between economic growth and market access distribution is driven by the rate at which production spillovers diminish across space. This geographic exclusiveness of production spillovers also predicts divergent growth patterns among countries with poorly market-integrated households.

To map households located in remote areas, a unique dataset is constructed using a Geographic Information System (GIS) and spatially explicit population and market accessibility data. This dataset quantifies the average time of travel (in

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minutes) of the average household from a market city of 50,000 or more individuals. The distribution of these households across space is used to construct remoteness Lorenz curves and corresponding Remoteness GINI (RGini) coefficients for 204 countries in 2000.[3] A cross-sectional dataset is employed to explain the rate of economic growth from 2000 to 2012 while incorporating a vector of control variables used commonly in inequality analyses. Highway, major road and rail placement are some of the components defining travel time to market cities. Although these data are lagged, it is likely that unobserved institutional characteristics, which determined these investments, persist through the growth period being analyzed. Geographic instruments are constructed that summarize landscape characteristics surrounding city centers (e.g. elevation, slope, and major waterways) that affect inherent levels of market access.[4]

A Generalized Method of Moments (GMM) estimator is employed to investigate the hypotheses that (i) *a higher average time of travel to market centers* and (ii) *unequal distribution of that level of market access* reduce economic growth. Results suggest that market access inequality and the average level of access jointly affect economic growth. Access inequality reduces economic growth when the average distance to markets is sufficiently low but has a growth-enhancing effect when households are particularly remote. These results are consistent with the notion that production spillovers diminish at an increasing rate when sufficiently close to the market center but at a decreasing rate when sufficiently distant from the market center.

This outcome suggests that there is a critical switching point where market access inequality becomes harmful to growth. Globally, we estimate this point occurs at 297 min of travel time to the nearest market center, which is noticeably close to the threshold travel time of five hours used often to characterize remote households. In developing countries, we estimate this threshold to occur around 343 min of travel time to the nearest market. Our policy proposals, based on these findings, suggest that growth-oriented investments should (i) aim to reduce the average distance of travel of the average household to the nearest market, which can be done by integrating the most remote households to markets while also (ii) focusing infrastructural investments toward the marginal consumers of market access surrounding these spillover-threshold points. In areas with costly barriers to these infrastructural investments, governments may consider subsidizing the relocation of households to areas with more potent spillovers.

We stratify our sample based on the overall level of market access in each country. Robust evidence is presented that growth divergence is characteristic of those countries with geographically less pervasive markets. This divergence disappears in countries with well-integrated markets. These theoretic predictions of growth divergence are supported empirically and warrant a reconsideration of our classic growth divergence and convergence hypotheses.

In Section 2 we present our modified AK growth model that relates the distribution of market access across households to economic growth. We also show the effect that diminishing spillovers has on economic growth. In Section 3 we present the dataset constructed for the market access distribution for a cross-section of countries. In Section 4 we conduct an empirical analysis to test our two main hypotheses concerning market access and growth. The final section presents our conclusions about the role of market access inequality on economic growth and summarize the policy implications based on these findings.

2. A MODEL OF MARKET ACCESS INEQUALITY AND ECONOMIC GROWTH

Following Aghion and Williams (1998), we assume a continuum of overlapping-generation households indexed by $i \in [0, 1]$. Each household maximizes its intertemporal utility by choosing both current (c_t^i) and future (f_t^i) consumption in period t

$$\max_{c_t^i, f_t^i} U_t^i = ln[c_t^i] + \rho ln[f_t^i] \tag{1}$$

where ρ is a constant discount rate. To differentiate the growth implication of market access inequality from that of initial wealth inequality, we assume that each household is endowed with exogenous and constant wealth $\bar{w}$. Perfect wealth equality exists. Each household is an independent producer (Aghion & Williams, 1998; Benabou, 1996; Frankel, 1962; Stiglitz, 1969) and household production (y_t^i) follows the AK production function

$$y_t^i = [k_t^i]^\alpha A_t^i(At, \delta^i) \quad 0 < \alpha < 1 \tag{2}$$

where k_t^i is the household's choice of capital investment, α is a returns to scale parameter and A_t^i resembles a household-specific technology or production spillover. Production spillovers originate in markets for healthcare (Chandra & Amitabh, 2007), education (Moretti, 2004), and research and development (Audretsch & Feldman, 1996; Javorcik, 2004) and are assumed to originate in market centers where hospitals, secondary and higher education institutions, and manufacturing sectors are present and well-functioning. This production spillover is increasing in the level of aggregate technology, $\frac{\partial A_t^i}{\partial A_t} > 0$, where aggregate technology is determined by aggregate production in the prior period $A_t = \int_0^1 y_{t-1}^i di = y_{t-1}$. A_t also represents the strength of the production spillover at the market center. In other words, as the distance of household i from the nearest market center (δ^i) approaches zero, the technology shock approaches its undiminished level ($\lim_{\delta^i \to 0} A_t^i = A_t$).

After substituting in both the household production constraint and exogenous wealth constraint[5] the household chooses capital to maximize intertemporal utility following

$$\max_{k_{i,t}} U_t^i = ln[\bar{w} - k_t^i] + \rho ln[(k_t^i)^\alpha A_t^i(A_t, \delta^i)] \tag{3}$$

where each household's capital choice in equilibrium, $(k_t^i)^* = \frac{\bar{w}\rho\alpha}{1+\rho\alpha}$, depends only on exogenous parameters. Each household therefore allocates a constant share of its wealth to first period consumption and a constant share to capital investment, which creates future consumption. The aggregate output in the economy (y_t) from all households is

$$y_t = \left[\frac{\bar{w}\rho\alpha}{1+\rho\alpha}\right]^\alpha \int_0^1 A_t^i(A_t, \delta^i)di. \tag{4}$$

Growth of output (g_t) is defined as the logged ratio of output in the current period and output in the prior period, $ln\frac{y_t}{y_{t-1}}$, which can be rewritten as

$$g_t = \alpha ln\frac{w\rho\alpha}{1+\rho\alpha} + ln\int_0^1 A_t^i(y_{t-1}, \delta^i)di - ln[y_{t-1}]$$

where the first term on the right-hand side is the share of growth from capital investment. The second term is the actual growth attributed to production spillovers and the third term

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