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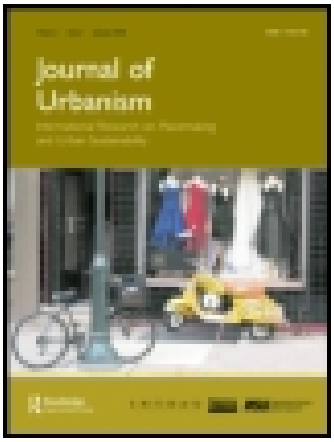

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Elijah Knaap[a], Chengri Ding[a], Yi Niu[b] & Sabyasachee Mishra[c]
[a] Department of Urban Studies and Planning and National Center for Smart Growth Research & Education, University of Maryland, College Park, USA
[b] International School of Economics and Management, Capital University of Economics and Business, Beijing, China
[c] Department of Civil Engineering, University of Memphis, TN, USA
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Elijah Knaap[a]*, Chengri Ding[a], Yi Niu[b] and Sabyasachee Mishra[c]

[a]*Department of Urban Studies and Planning and National Center for Smart Growth Research & Education, University of Maryland, College Park, USA;* [b]*International School of Economics and Management, Capital University of Economics and Business, Beijing, China;* [c]*Department of Civil Engineering, University of Memphis, TN, USA*

We present in this paper an analysis of economic centers and their role in shaping employment development patterns and travel behavior in the state of Maryland. We begin by identifying 23 economic centers in the Baltimore-Washington region. We then examine these centers first in their role as centers of economic activity and then in their role as nodes in the state's transportation system. Finally, we identify the commute sheds of each center, for multiple modes of travel and travel times, and examine jobs–housing balance within these various commute sheds. We find that Maryland's economic centers not only promote agglomerative economies and thus facilitate economic growth; they also generate a disproportionate number of trips and promote transit ridership. These results provide empirical support for policies that promote polycentric urban development, and especially policies that promote polycentric *employment* development. Further, they suggest that polycentrism as a sustainable development strategy requires careful coordination of regional transportation systems designed to balance jobs and housing within a center's transit commute shed. Based on these findings we recommend that the Maryland state development plan, and regional sustainable communities plans across the nation, encourage the concentration of employment within economic centers and encourage housing development within the transit commute sheds of those centers.

Keywords: polycentrism; sustainable development; employment centers; economic development; transit-oriented development

I. Introduction

The spatial structure of human settlements has been a topic of considerable and continuing interest since the seminal works of Christaller (1933), Lösch and Woglom (1954), Park, Burgess, and McKenzie (1925), Berry and Garrison (1958), Alonso (1964), Muth (1969), Mills (1967) and others. The reasons for such sustained interest vary. Some interest is derived from concerns for economic productivity and grounded in the notion that economic efficiency can be enhanced through the efficient spatial arrangement of economic activity. Some interest stems from concerns for social justice and is grounded in the notion that the spatial arrangement of demographic groups reflects and determines social structure and equity. The interest of others is founded in support of environmental preservation and grounded in the notion that the spatial arrangement of human activity can impact the quality and integrity of the natural environment. Today all of these concerns have become subsumed in the notion of *sustainable development*, frequently defined as "development that

*Corresponding author. Email: eknaap@umd.edu

meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland 1987).

How exactly to implement sustainable development remains hotly contested as choices inevitably arise between often competing goals. Few plans or policies simultaneously and equally promote economic growth, social justice and environmental preservation. Such complexities notwithstanding, the pursuit of sustainable development has stimulated a variety of policies at the national, state, regional and local levels of government. In what has become the signature urban policy of the Obama administration, for example, the Sustainable Communities Initiative was launched by the signing of a memorandum of understanding between the US Department of Housing and Urban Development, the US Department of Transportation, and the Environmental Protection Agency. In the memorandum, the three agencies agreed to coordinate their efforts to "to help communities nationwide improve access to affordable housing, increase transportation options, and lower transportation costs while protecting the environment" (US Department of Transportation). Perhaps most prominent among the many Sustainable Communities Initiative programs is the Sustainable Communities Regional Planning grant program, which supports metropolitan and multijurisdictional planning efforts that integrate housing, land use, economic and workforce development, transportation and infrastructure investments.

The state of Maryland has similarly launched a major new initiative to promote sustainable development at the regional scale. Called PlanMaryland and signed by Governor O'Malley in December, 2011, the plan has three specific goals:

- Concentrate development and redevelopment in communities where there is existing and planned infrastructure.
- Preserve and protect environmentally sensitive and rural lands and resources from the impacts of development.
- Ensure that a desirable quality of life in Maryland's communities is sustainable.[1]

Whether the plan will achieve these goals remains unclear. The plan was not derived from a careful analysis of alternative scenarios, but instead defines specific development designations and invites local governments to nominate places for such designations. If the state approves the designation, the state makes funding available from certain state conservation and development programs. To date, five local government submissions have been endorsed by the State Smart Growth Subcabinet, six are being discussed by state and local governments, and five are in some stage of development. There is uncertainly about whether more local governments will identify areas for state endorsement and whether this process will result in a more sustainable development pattern.

To offer new information on how to promote sustainable development at the state and regional scales, we present in this paper an analysis of economic centers and their role in facilitating economic development and sustainable travel behavior in the state of Maryland. More specifically, we briefly review the literature on polycentric development as a regional development strategy. We then define *economic centers* and describe how we identify 23 such centers in the Baltimore-Washington region. We next examine these 23 centers, first with respect to their economic performance (including measures of comparative employment density, wage levels, industrial composition and employment growth), followed by an examination of their performance as nodes in the state transportation system (including measures of trip origins and destinations and mode share). Finally, we identify the commute sheds of each center, for multiple modes of travel and travel times, and examine jobs–housing balance within these various commute sheds.

We find that Maryland's economic centers provide important economic and transportation benefits to the region. Specifically, our analysis suggests that Maryland's economic centers not only promote agglomerative economies and thus facilitate economic growth; they also promote transit ridership. These results provide empirical support for policies that promote polycentric development, and especially policies that promote polycentric *employment* development. In addition, we find that most of Maryland's economic centers contain many more jobs than households within their transit commute sheds but that the jobs–housing ratios are more balanced in automobile commute sheds. Based on these findings we recommend that to promote more sustainable development, state and regional plans encourage the concentration of employment in economic centers. In addition, to maintain jobs–housing balance and to encourage transit ridership, such plans should encourage housing development within the transit commute sheds of those centers.

II. Polycentricity as a regional economic development strategy

The concept of polycentric regional development has been around for a long time both as a normative objective and as the subject of empirical research. Polycentric urban regions not only have been identified as the emergent spatial form of global cities (Hall and Pain 2006) but also have been proposed as a planning solution for achieving efficiency and sustainability goals (Davoudi 2003). According to Talen (2008, 22), the notion of a planned polycentric city has experienced a number of iterations, "starting with Ebenezer Howard's 'Social City', through Patrick Geddes' notion of regional settlement, to Clarence Stein's brand of 'communitarian regionalism', which emphasized the role of communities as the building blocks of a region". Further, claims Talen, polycentricity is implicitly prescribed in the Charter for New Urbanism, under the heading The Region: Metropolis, City, and Town. According to Talen, "Regions are economic 'units' as well as environmentally determined 'finite places' that can contain 'multiple centers' within a metropolis. Edges should be clear, and development patterns should be contiguous, or else organized into towns, villages, and neighborhoods." In a more abstract treatment, Salingaros, Steil, and Mehaffy (undated, 22), drawing on the seminal work of Alexander (1965), prescribe a polycentric region or "multiply-centered-hierarchy" (*sic*) as a remedy for suburban sprawl.

Across the Atlantic, polycentric development has long been a central tenet of European spatial planning. The European Spatial Development Perspective, for example, counts among its primary goals "strengthening a polycentric and more balanced system of metropolitan regions, city clusters and city networks, through closer co-operation between structural policy and the policy on the Trans-European Networks and improvement of the links between international/national and regional/local transport networks" (European Commission 1999). According to Waterhout (2008), polycentricity deals with functional relationships among towns and rural areas and within metropolitan areas. As a result, the principle of polycentricity has been manifest in the national spatial strategies of several European nations (Nedovic-Budic et al. 2013).

In the United States, normative principles of polycentric regional development are clearly expressed in Portland's pioneering 2040 Plan, which features urban design "building blocks" that include a central city, regional centers, town centers, main streets, corridors, and station communities. As shown in Figure 1, these building blocks prescribe a polycentric hierarchy that serves as the foundation for spatially explicit land use, transportation, and functional plans. Similar polycentric regional development strategies are apparent in the Envision Utah plan for the Wasatch Valley, the Sacramento Area Council of Governments plan for Sacramento, CA, the Chicago Metropolitan Agency for Planning

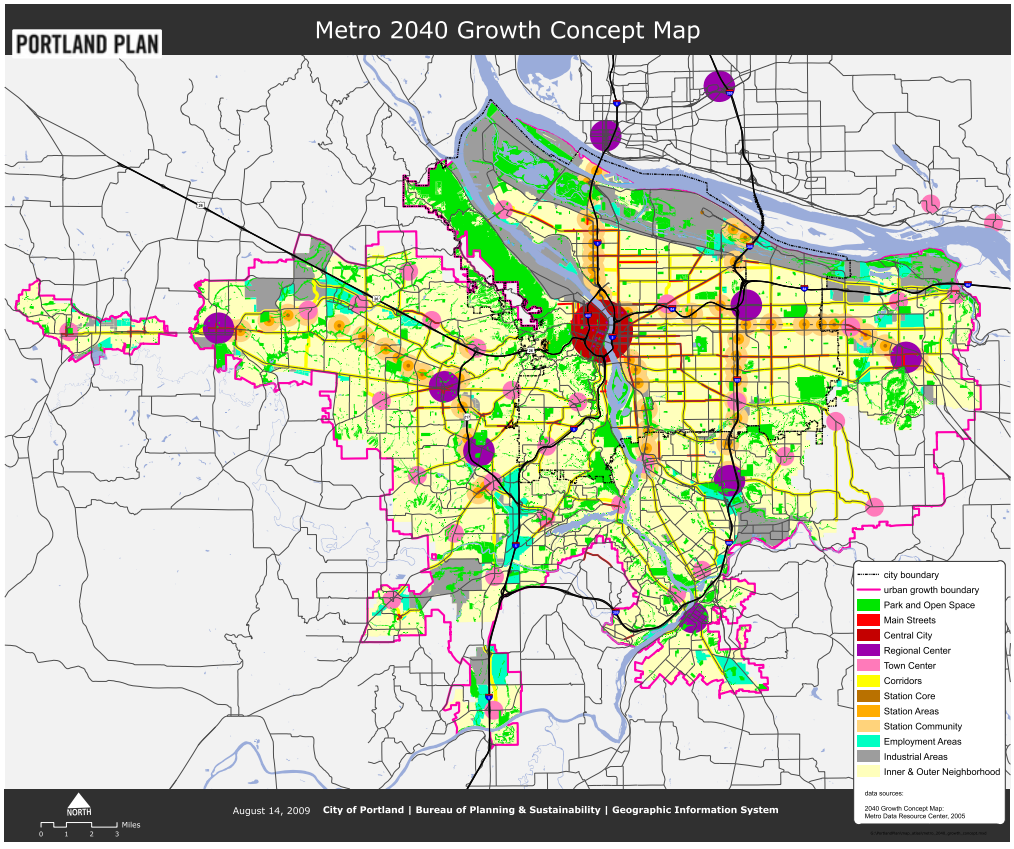

Figure 1. Portland 2040 map.
Source: City of Portland, Bureau of Planning and Sustainability.

plan for metropolitan Chicago, and the Washington Metropolitan Council of Government Region Forward plan for metropolitan Washington, DC. In their review of recent metropolitan planning efforts, Knaap and Lewis (2012) argue that not only have polycentric metropolitan plans become the dominant form of plans for metropolitan areas, they are all but required under HUD's sustainable communities grant program.

From a less normative perspective, economists, geographers and planners have documented the emergence of polycentric urban forms in post-industrial societies in the United States (Bogart and Ferry 1999; Giuliano and Small 1991), the European Union (Cismas et al. 2010), and Japan (Nishimura and Okamuro 2011), as well as in developing economies like China (Chou et al. 2011; He, Rayman-Bacchus, and Wu 2011). From a positive perspective, demographic shifts, economic growth and technological advances have all contributed to the evolution of a new spatial order that is clearly distinct from classic monocentric models of urban structure and function. As firms leave the central business district in response to these fundamental changes, they tend to colocate in well-defined geographic areas, forming new centers of dense employment that are distinct and isolated from the traditional urban core. These centers tend to be characterized by some degree of industry specialization, and are therefore sometimes referred to as *industry clusters* (Anderson and Bogart 2001). When these centers reach sufficient size, they are often

recognized as regional employment clusters. Thus, a major focus in this field of research has concerned the formation and explanation of industry clusters, while another (not entirely distinct) branch has concentrated largely on the identification of regional employment clusters, and their social and economic impacts in a broader context.[2]

According to Michael Porter's (2000, 15) original conception of economic clusters, "Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate." Thus clusters can be conceived as collections of firms, having a proximate relationship, whose common spatial location provides the basis for at least one shared interest. Long-standing economic theory suggests that firms have a natural incentive to form these spatial relationships because they benefit from positive externalities and economies of scale, commonly known as agglomeration effects. Sources of agglomeration effects include labor pooling, input sharing, human capital spillovers, shared infrastructure, and consumption effects (Glaeser and Gottlieb 2009; Kantor and Whalley 2009; Rosenthal and Strange 2004). By convention, the benefits of agglomeration realized via location near firms in the *same* industry are referred to as localization economies, while benefits that accrue as a result of locating near firms in *other* industries are called urbanization economies.

A number of studies provide theoretical foundations and empirical support for both localization and urbanization effects that promote cluster growth. Giuliano et al. (2012), for example, finds that labor-force accessibility is significantly related to cluster growth. Rosenfeld (2005) argues that geographic proximity among firms remains necessary to foster beneficial social networks (localization effects) even in the digital age. Elsewhere, scholars have provided consistent empirical evidence that agglomeration stimulates urban growth. Bodenhorn and Cuberes (2010), for example, find that a strong financial industry presence mitigates constraints on entrepreneurial enterprises, fostering urbanization economies and facilitating urban growth.

Another area of research focuses on the identification of industrial clusters as regional employment centers.[3] This type of study is conducted by selecting a geographic unit of analysis, usually census tracts or traffic analysis zones, and identifying all such areas that meet minimum density and total employment criteria. Adjacent areas meeting the selection criteria are aggregated and considered as a single employment center. Using this approach Giuliano and Small (1991) identified 32 employment centers in the Los Angeles metropolitan area. Subsequently, Bogart and Ferry (1999); Anderson and Bogart (2001) identified employment centers in Cleveland, Indianapolis, Portland and St. Louis using similar procedures. While Giuliano et al. examine employment center proximity to airports and the highway system of Los Angeles, there have been no attempts to analyze the economic impact of centers within the context of a region-wide transportation system.

When polycenters are examined with respect to their transportation characteristics, the focus generally lies in trip generation, distance and duration. Cervero and Wu (1997), for example, studied employment centers in the San Francisco region and found that suburban polycentric development was associated with shorter trip durations and a greater share of automobile trips. Additional work has suggested that polycentrism can lead to substantial increases in vehicle miles traveled, driven at least in part by high housing costs near and inside employment centers (Cervero and Wu 1998). Other scholars, such as Gordon and Richardson (1996), have used transportation characteristics as a means of identifying centers, arguing that employment thresholds are an insufficient criterion for identifying polycentric activity centers. They contend that true polycenters contain a greater diversity of activities than employment alone and thus prefer to identify centers according to trip

generation rates. Using data from the Los Angeles region between 1970 and 1990, Gordon and Richardson's methods showed that employment densities inside centers fell consistently each year – evidence of decentralization rather than polycentrism, leading the authors to question the efficacy of downtown revitalization efforts and major transit investments.

Thus, not all the evidence points to a clear relationship between polycentricity and either economic efficiency or sustainability. Hoyler, Kloosterman, and Sokol (2008) find little evidence of an emergence of polycentricism in the knowledge-based industries of Dublin, Ireland. Hall and Pain (2006) question whether the assumed complementarity of emergent inter-urban and functional relations supports the objective of simple geographical consistency. Further, Vandermotten et al. (2008) suggest that findings do not suggest any clear correlation between more polycentricity and more economic efficiency or even more spatial equity, causing them to ask: Is the foundation for European spatial planning based on polycentric development mere wishful thinking?

While the literature has provided a sound analytical framework for understanding economic centers and clusters, the empirical argument for the virtues of polycentricity remains weak, and there have been few attempts to integrate analyses of economic clusters with a regional transportation context in a way that informs regional economic, housing and transportation planning. That's what we attempt here.

III. Employment centers in Maryland

To gain a richer understanding of the benefits of polycentric development, we conducted an analysis of employment, transportation and housing patterns in the state of Maryland. Located in the middle of the Eastern Seaboard of the United States, the state of Maryland lies just north of Washington, DC, and includes the Baltimore metropolitan area. Although it extends from the Appalachian Mountains to the Atlantic coast, most of its population and economic activity is located in the Baltimore-Washington corridor. Baltimore is an old industrial city that continues to lose population. Washington, DC, just 40 miles south of Baltimore, has gained population in the most recent decade, but most of its growth is also

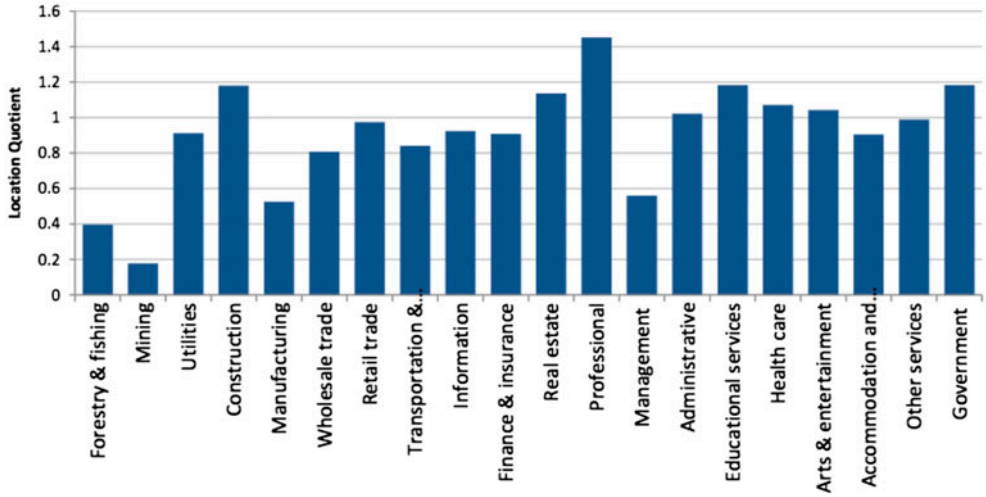

Figure 2. Industry location quotients for Maryland, 2010.
Source: US Bureau of Economic Analysis.

occurring in the suburbs. In general, Maryland is relatively prosperous, predominantly suburban, and closely linked to the economy of Washington, DC.

Because of its proximity to Washington, and the deindustrialization of Baltimore, Maryland's largest industrial sectors include education, construction, professional services and of course government (Figure 2). The growth and performance of these sectors contribute to Maryland's relative insulation from the recent national economic recession. Also, because of its location on the Eastern Seaboard and its proximity to Washington, DC, Maryland has an extensive multimodal transportation system. The system includes 28,000 miles of highways, freeways and roads, 861 miles of intra-metropolitan fixed guideway rail, 187 miles of commuter rail, a large (though declining) seaport, and one of the three main airports in the Baltimore-Washington region. Interstate 95 and the Baltimore and Washington beltways are heavily traveled by passenger cars and by short- and long-haul trucks. In many respects the highway system is built out. There is little space or political appetite for new roads or highways, and the Maryland Department of Transportation is expressly more focused on highway maintenance than on highway construction. The transit system, however, continues to expand. An extension of the Washington Metro system from the District to Washington Dulles International Airport is now underway in neighboring Virginia. New light rail lines are in preliminary engineering for suburban Washington and Baltimore. For these reasons, the planning challenge for the region is how to better utilize the existing system of roads and highways and how best to capitalize on limited new investments in transit.

Identifying economic centers

We begin our analysis by drawing on the conceptual framework outlined by Giuliano and Small (1991), using the 2007 Maryland Quarterly Census of Employment and Wages (QCEW), and by exercising the Maryland Statewide Transportation Model.[4] The QCEW data contain highly detailed information for each employer in the state of Maryland, including total employment, wages paid, and NAICS industry classification. We use data from 2007 to avoid the influence of the recession that began in 2008.[5]

Following Giuliano and Small (1991) and Bogart and Ferry (1999), we define employment centers in terms of contiguous traffic analysis zones with at least eight workers per acre and at least 10,000 total employees. We choose a slightly lower density threshold than that used by Giuliano and Small to reflect overall differences in density between Maryland and Los Angeles.[6] We then aggregate QCEW data to traffic analysis zones, maintaining information on the number of firms, wages, employment and industrial composition. Using this framework, we identify 23 employment centers with a diverse set of characteristics.[7]

The centers identified using the above methods are mapped in Figure 3. Most of the centers are located in central Baltimore and the suburbs that surround Baltimore and Washington. Most also are located along major transportation corridors.[8]

Economic characteristics of Maryland's centers

The characteristics and economic significance of these centers are illustrated in Table 1. Although they represent approximately 1.2% of the state's land area, they contain a quarter of the firms, nearly 40% of employment, 46.1% of total wages and 17.04% of all households. As a result, compared to the rest of the state, the centers have relatively high employment densities, high wages, and high jobs – housing ratios.

Although the centers share many characteristics, they differ in many dimensions as well. As shown in Table 2, the largest center, measured in jobs, is Downtown Baltimore,

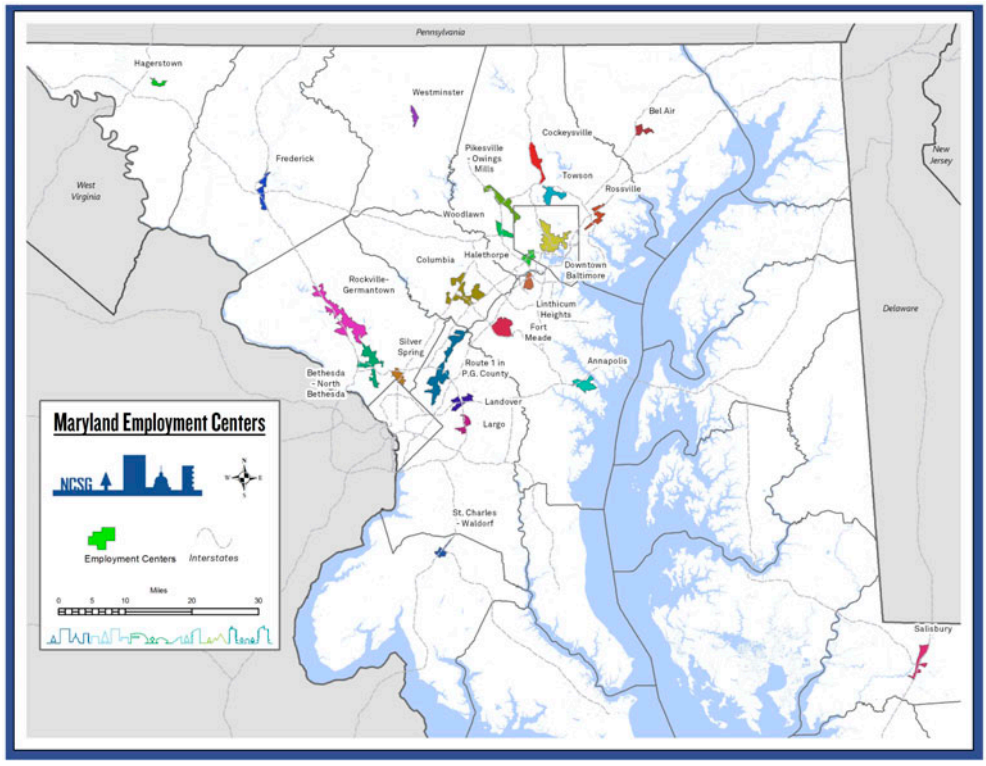

Figure 3. Employment centers in Maryland.
Source: Author's calculation.

Table 1. Economic characteristics inside and outside centers.

	Inside centers		Outside centers		State of Maryland	
	total	%	total	%	total	%
Land area (acres)	75,639	1.18%	6,320,979	98.82%	6,396,618	100%
Employment firms	35,182	26.0%	100,093	74.0%	135,275	100%
Jobs	1,096,482	39.50%	1,679,753	60.50%	2,776,235	100%
Households	362,524	17.0%	1,765,488	83.0%	2,128,012	100%
Total wages paid (billions)	$ 11.93	46.1%	$ 13.94	53.9%	$ 25.86	100%
Average annual wage	$ 43,521		$ 33,195		$ 37,259	
Jobs per firm	31		17		21	
Jobs per acre	14.50		0.27		0.43	
Households per acre	4.79		0.28		0.33	
Jobs per household	3.02		0.95		1.30	

with over 200,000 jobs, although the two centers in the I-270 corridor – Bethesda and Rockville – have a combined total of 366,230. Route 1 is the only other center with more than 100,000 jobs. After Route 1, the number of jobs per center falls rapidly; only four additional centers have more than 50,000. The distribution of jobs among these centers follows a typical central place hierarchy.

Table 2. Economic characteristics by center.

Center	County	Acres	Employment Firms	Jobs	Households	Jobs per Firm	Average Annual Wage	Jobs per Acre	Diversity Index
Annapolis	Anne Arundel	2,720.93	1,590	52,917	10,180	20	$ 37,593	11.94	8.30
Bel Air	Harford	1,474.51	665	10,532	3,555	15	$ 29,076	6.78	9.06
Bethesda–North Bethesda (along M-355)	Montgomery	4,994.33	4,909	124,840	37,727	30	$ 56,522	29.21	10.37
Cockeysville (along I-83 and M-45)	Baltimore	3,316.66	1,270	45,776	1,507	31	$ 46,046	12.01	9.95
Columbia	Howard	6,133.47	1,872	64,033	15,494	32	$ 49,711	9.75	9.31
Downtown Baltimore	Baltimore City	6,599.60	5,461	196,167	66,817	39	$ 44,554	32.39	9.52
Fort Meade	Anne Arundel	4,362.71	45	44,842	2,470	–	$ 2,492	10.08	–
Frederick	Frederick	2,718.20	1,307	47,937	17,660	23	$ 37,839	11.30	10.80
Hagerstown	Washington	857.38	471	19,614	11,433	26	$ 29,038	14.51	6.80
Halethorpe	Baltimore	1,663.67	482	17,084	4,152	31	$ 44,749	8.91	9.72
Landover	Prince George's	2,346.61	665	21,851	6,240	30	$ 75,310	8.43	9.64
Largo	Prince George's	1,611.61	540	18,416	5,177	29	$ 35,742	9.85	9.90
Linthicum Heights	Anne Arundel	1,581.38	192	5,622	1,320	73	$ 88,687	8.81	4.71
Pikesville–Owings Mills (along I-795 and M-140)	Baltimore	3,593.62	1,526	37,625	8,214	25	$ 29,685	10.50	10.61
Rockville–Gaithersburg–Germantown (I-270 and M-355)	Montgomery	9,614.07	4,667	175,124	63,934	32	$ 44,077	15.72	10.50
Rossville	Baltimore	2,021.12	715	15,193	4,437	28	$ 48,562	10.04	9.33
Route 1 in Prince George's County	Prince George's	8,704.31	2,486	82,860	28,665	30	$ 37,782	8.47	9.83
Salisbury (along M-13)	Wicomico	2,696.71	930	30,765	11,899	26	$ 31,125	9.02	10.85

(*Continued*)

Table 2. (*Continued*).

Center	County	Acres	Employment Firms	Jobs	Households	Jobs per Firm	Average Annual Wage	Jobs per Acre	Diversity Index
Silver Spring	Montgomery	1,685.23	1,690	42,174	15,383	23	$ 38,820	23.41	8.22
St. Charles–Waldorf (along M-301)	Charles	1,256.26	572	21,990	22,337	20	$ 24,206	8.92	7.41
Towson	Baltimore	2,830.77	2,270	45,254	12,644	20	$ 52,373	15.82	9.57
Westminster	Carroll	1,072.30	376	21,346	7,272	23	$ 28,579	7.97	7.46
Woodlawn	Baltimore	1,783.64	481	31,095	4,007	66	$ 41,532	17.91	5.30
All Centers	–	**75,639.07**	**35,182**	**1,173,057**	**362,524**	**33**	**$ 43,521**	**14.5**	–

By construction, every center has a job density greater than 8 jobs per acre. Two centers, however – Downtown Baltimore and Bethesda – have over 35 jobs per acre, while Towson and Silver Spring have over 25. The rest have between 9 and 25 jobs per acre. Most centers have industrial compositions that are highly diverse. Fifteen centers have Herfindahl diversity indices greater than 9.[9] Only Linthicum (the location of a large Northrup-Grumman facility) and Woodlawn (the location of a large office of the Social Security Administration) have Herfindal indexes less than 6. The largest center geographically is Rockville–Gaithersburg–Germantown, with over 9000 acres; the smallest is Hagerstown, with just over 850 acres. Annual wages range from a high of $84,500 in Linthicum Heights to a low of $28,600 in St. Charles.

The unique case of Fort Meade warrants a short explanation. The presence of a large military base and the headquarters of the National Security Agency, both of which are large employers whose detailed employment records are suppressed for national security concerns, makes this employment center difficult to compare with others. Industrial diversity indices cannot be computed accurately, and overall employment density cannot be computed precisely due to our inability to measure true employment levels. Nonetheless, the large and dense employment in Fort Meade and its obvious importance in the Maryland economy suggest that it is an essential element in an analysis such as this.

Because of significant changes over time in how they have been collected and geocoded, the Maryland QCEW data are not suitable for time series analysis and thus cannot be used to describe how much each center has grown in jobs over time. Figure 4, however, illustrates the growth of jobs by region. As shown, in 1969 Baltimore City contained over 30% of all jobs in the state; today it only contains slightly more than 10%. The Washington suburbs, in contrast, contained just over 25% of jobs in 1969, while today they contain nearly 35%. Thus, despite the lack of disaggregate time series data, there is clear evidence of job decentralization from places like downtown Baltimore to its suburban subcenters and from the Baltimore region to suburban Washington, DC.

Transportation characteristics of Maryland's centers

Maryland's 23 employment centers also play important roles in the state's transportation system, as demonstrated using output from the Maryland State Transportation Model

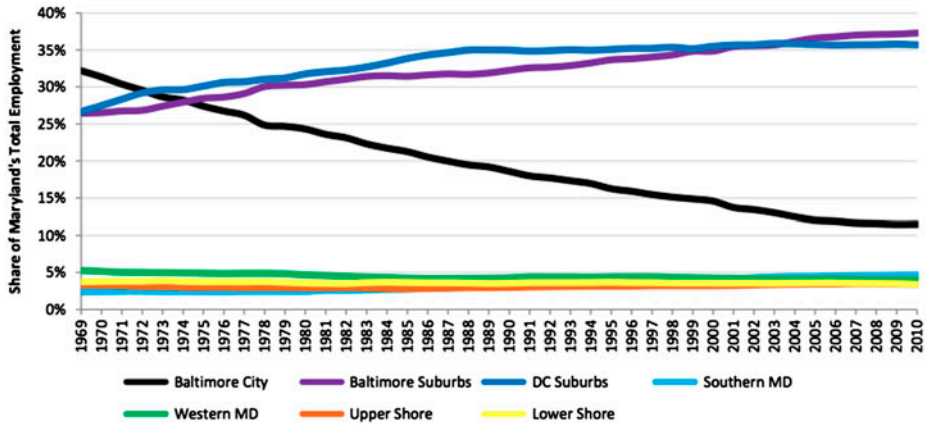

Figure 4. Share of total jobs within each Maryland region, 1969–2010.
Source: U.S. Bureau of Economic Analysis.

(MSTM) for the base year 2007. As shown in Tables 3 and 4, the centers combined, during the peak hour of travel, produced 21.35% of trips in the state and attracted 28.76% of trips. By mode, the centers comprised 20.75% of all automobile trips and 39.38% of all transit (bus and rail) trips. The transit share of trips to the centers is 8.0%, compared to 1.8% for the rest of the state.

The number of trips to each center is closely related to the number of jobs at each center: more jobs, more trips. Downtown Baltimore attracts the greatest number of trips, followed by Rockville and Bethesda. Bethesda, Cockeysville and Silver Spring attract the highest share of transit trips, at nearly 16%. Hagerstown, Frederick and Bel Air, which have very limited transit service, have the lowest transit share, at less than 2%.

Constructing commute sheds

To measure accessibility and jobs–housing balance around each employment center, we construct commute sheds for auto and transit modes for 30-, 45- and 60-minute travel times. In addition to trip-generation rates, the MSTM is capable of computing traffic-adjusted travel times to and from any of the state's 1151 statewide modeling zones (SMZs). Skims (travel-time output) from the MSTM produce a matrix of mean travel time (in minutes) between SMZ centroids for peak (A.M. and P.M.) and non-peak travel periods.[10] Although travel-time estimates based on zonal centroid measures are somewhat coarse when compared to some other GIS-based network analysis tools, we choose this method over others for several reasons.

First, the MSTM is a multimodal travel model that takes into account factors such as detailed transit headways, time spent walking from home or work to transit station or parking lot, and heavily calibrated traffic impedance measures. All of these factors provide precision greater than can be obtained with current network analysis tools. Second, because transit-commute sheds and auto-commute sheds are based on the same zone system, their results are directly comparable. Third, because Maryland falls within the jurisdiction of two major metropolitan planning organizations whose travel-demand models are not integrated, the SMZ system has been used as the geographic unit for statewide scenario-based planning (Chakraborty et al. 2012). For instance, the Maryland Scenarios Project uses SMZs in allocating the state's growth under different possible constraints for the 2030 planning horizon. As result, a number of different growth scenarios that help shape Maryland's land use policies provide employment and household projections at the SMZ level. These data can then be used to extend our analysis to determine which of Maryland's growth scenarios produces the most sustainable results. We plan to explore this question in future research.

Table 3. Transportation characteristics of centers.

	Households	Employment	Trips produced	Trips attracted	Auto trips	Transit trips
Inside centers	17.04%	42.28%	21.35%	28.76%	20.75%	39.38%
Outside centers	82.96%	57.72%	78.65%	71.24%	79.25%	60.62%
Maryland total	100%	100%	100%	100%	100%	100%

Table 4. Transportation characteristics by center.

Employment Center	Productions		Attractions		Auto		Transit		Mode share
	Total	Percent	Total	Percent	Total	Percent	Total	Percent	Auto:transit
Annapolis	164,550	0.72%	271,951	1.24%	160,727	0.75%	3,760	0.38%	43:1
Bel Air	40,504	0.18%	66,406	0.30%	40,096	0.19%	264	0.03%	152:1
Bethesda–North Bethesda (along M-355)	504,203	2.22%	666,285	3.03%	418,930	1.95%	85,059	8.66%	5:1
Cockeysville (along I-83 and M-45)	82,921	0.37%	167,459	0.76%	69,267	0.32%	13,409	1.37%	5:1
Columbia	244,344	1.08%	322,319	1.47%	239,093	1.12%	5,056	0.51%	47:1
Downtown Baltimore	816,717	3.60%	1,076,726	4.90%	716,876	3.35%	99,251	10.10%	7:1
Fort Meade	141,864	0.62%	194,320	0.88%	140,073	0.65%	1,778	0.18%	79:1
Frederick	216,202	0.95%	267,184	1.22%	214,925	1.00%	1,178	0.12%	182:1
Hagerstown	117,908	0.52%	127,562	0.58%	117,747	0.55%	161	0.02%	731:1
Halethorpe	61,178	0.27%	79,099	0.36%	56,095	0.26%	5,032	0.51%	11:1
Landover	91,661	0.40%	124,203	0.57%	86,310	0.40%	5,285	0.54%	16:1
Largo	80,403	0.35%	104,337	0.47%	75,830	0.35%	4,532	0.46%	17:1
Linthicum Heights	21,118	0.09%	25,786	0.12%	19,321	0.09%	1,778	0.18%	11:1
Pikesville–Owing Mills (along I-795 and M-140)	120,804	0.53%	186,776	0.85%	102,523	0.48%	18,078	1.84%	6:1
Rockville–Gaithersburg–Germantown (I-270 and M-355)	780,953	3.44%	935,996	4.26%	721,441	3.37%	59,278	6.03%	12:1
Rossville	63,093	0.28%	89,942	0.41%	60,817	0.28%	2,209	0.22%	28:1
Route 1 in Prince George's County	378,101	1.67%	476,031	2.17%	352,518	1.65%	25,263	2.57%	14:1
Salisbury (along M-13)	149,270	0.66%	177,607	0.81%	149,269	0.70%	0	0.00%	1
Silver Spring	180,722	0.80%	224,499	1.02%	150,054	0.70%	30,582	3.11%	5:1
St.Charles–Waldorf (along M-301)	225,664	0.99%	214,542	0.98%	217,461	1.01%	8,196	0.83%	27:1
Towson	174,667	0.77%	254,716	1.16%	166,165	0.78%	8,297	0.84%	20:1
Westminster	93,576	0.41%	133,212	0.61%	92,205	0.43%	0	0.00%	1
Woodlawn	97,305	0.43%	133,875	0.61%	78,876	0.37%	8,361	0.85%	9:1
All Centers	**4,847,728**	**21.35%**	**6,320,833**	**28.76%**	**4,446,619**	**20.75%**	**386,807**	**39.38%**	**11:1**

To construct commute sheds for each employment center, we select all zones from which the employment center is accessible within a specified time (30, 45 or 60 minutes). Since each employment center is made up of a collection of SMZs – each of which *individually* meets the employment criteria for classification as an employment center – we define each commute shed as the collection of zones from which any of the individual modules that comprise an employment center is accessible. In other words, if any particular zone that makes up an employment center is within the commute of a given SMZ, then that SMZ is within the employment center's commute shed. This definition is not only the most practical for computation with MSTM data, but also covers a larger area than using, for instance, the centroid of each employment center.

Jobs–housing balance

To integrate our economic and transportation analyses, we explore jobs–housing balance within each center and within the automobile- and transit-commute sheds of each center. As shown in Table 5, the existing jobs–housing ratio within centers ranges from a low of 0.98 for Charlestown to over 30 in Cockeysville. Because they were selected based on their high employment densities, the jobs–housing ratio for most centers is greater than 2. The existing jobs–housing ratio over all centers is 3.24.

Table 5. Jobs–housing balance (jobs per household) by center.

		Transit commute		Auto commute	
	Inside centers	**30 min.**	**45 min.**	**30 min.**	**45 min.**
Annapolis	5.20	5.20	5.20	1.08	1.25
Bel Air	2.96	2.96	1.20	0.86	0.96
Bethesda–North Bethesda (along M-355)	3.31	2.43	2.89	2.18	1.93
Cockeysville (along I-83 and M-45)	30.38	21.33	2.82	1.41	1.31
Columbia	4.13	4.13	2.40	1.62	1.40
Downtown Baltimore	2.94	2.15	1.47	1.45	1.35
Fort Meade	18.15	18.15	4.93	1.79	1.54
Frederick	2.71	2.71	2.71	1.30	1.34
Hagerstown	1.72	1.72	1.72	1.31	1.17
Halethorpe	4.11	3.36	1.72	1.39	1.36
Landover	3.50	1.74	2.42	1.28	1.84
Largo	3.56	1.31	2.88	1.18	1.87
Linthicum Heights	4.26	5.10	2.45	1.49	1.34
Pikesville–Owings Mills (along I-795 and M-140)	4.58	4.93	1.87	1.38	1.37
Rockville–Gaithersburg–Germantown (I-270 and M-355)	2.74	3.09	2.02	1.47	1.73
Rossville	3.42	1.66	2.12	1.37	1.36
Route 1 in Prince George's County	2.89	2.26	2.25	1.97	1.78
Salisbury (along M-13)	2.59	2.59	2.59	1.28	1.21
Silver Spring	2.74	1.89	2.44	2.23	1.94
St. Charles–Waldorf (along M-301)	0.98	0.98	0.98	0.77	1.06
Towson	3.58	2.23	2.25	1.35	1.33
Westminster	2.94	2.94	2.94	0.98	1.03
Woodlawn	7.76	3.01	2.12	1.51	1.37
All centers	**3.24**	**2.47**	**2.05**	**1.60**	**1.57**
State of Maryland		**1.30**			

Again, because they were chosen for their high employment densities, the jobs–housing ratios within the centers are greater than the metropolitan average of 1.30. This is not surprising. Job-rich centers draw workers from their surrounding commute sheds. To explore how jobs–housing ratios vary by commute shed we construct commute sheds for travel by automobile and by transit for 30-minute and 45-minute commutes. The results are shown in Figure 5 for the Bethesda employment center.

As shown in Figure 5, the 30-minute transit commute shed extends little beyond the boundaries of the employment center. This is because the 30-minute transit commute includes the time it takes to get to the station, the time spent waiting for the train or bus, and the time spent in travel. When all this time is included, it is not possible to travel very far by transit within 30 minutes. As shown, it is not even possible to enter the District of Columbia within a 30-minute transit commute. The 45-minute commute shed is considerably larger; this is because once aboard a transit vehicle, an additional 15 minutes enables the commuter to travel considerably farther. As also shown, the 30-minute automobile commute shed is considerably larger than the 45-minute transit commute. This is because commuting by automobile doesn't require travel to a station or waiting for a bus or train. For obvious reasons, the 45-minute auto commute shed is even larger than the 30-minute commute shed and includes most of the Baltimore-Washington region.

For the reasons described above, the jobs–housing ratio over all the centers is 3.24, but falls to 2.47 within a 30-minute transit commute, and to 2.05 for a 45-minute transit commute. Similarly, because the automobile commute shed is larger than the transit commute shed, the jobs–housing ratio over all the centers falls to 1.60 for a 30-minute automobile commute, and to 1.57 for a 45-minute automobile commute.

It is not surprising to observe the jobs–housing ratio fall as the commute shed expands. As the commute shed expands to include areas with more housing and fewer jobs, the ratio of jobs to households declines. Although not every employee will work at the nearest center, it is interesting to observe that the number of jobs greatly exceeds the number of households within each center and within the commute shed of most centers, but that the jobs–housing ratio for the 30-minute automobile commute is very close to the ratio for the entire region. This suggests that there may be equilibrating market forces that produce jobs–housing balance within the average commute time. We plan to explore this in future work.

IV. Summary and policy implications

In this paper we explored the spatial distribution of jobs and households within the state of Maryland and identified 23 economic centers with large numbers of jobs and high employment densities. Further examination revealed that these centers contain only a very small share of the state's land area but a large share of the state's jobs. We also found these centers to feature a diverse industrial mix, firms that pay high wages, and an environment well suited for economic growth.[11] In an analysis of commuting patterns to and from the centers, we found that the centers create and attract a disproportionate share of trips, and that compared to trips to other locations, trips to the centers were more often taken by transit. These findings offer important insights for PlanMaryland and regional sustainability planning more generally.

For Maryland, and the Baltimore and Washington metropolitan areas, the results strongly support the proposition that policies should be adopted to encourage job growth within the 23 economic centers in the state. Further, while there may be some value in targeting specific industries, it appears as though most of the existing centers are relatively

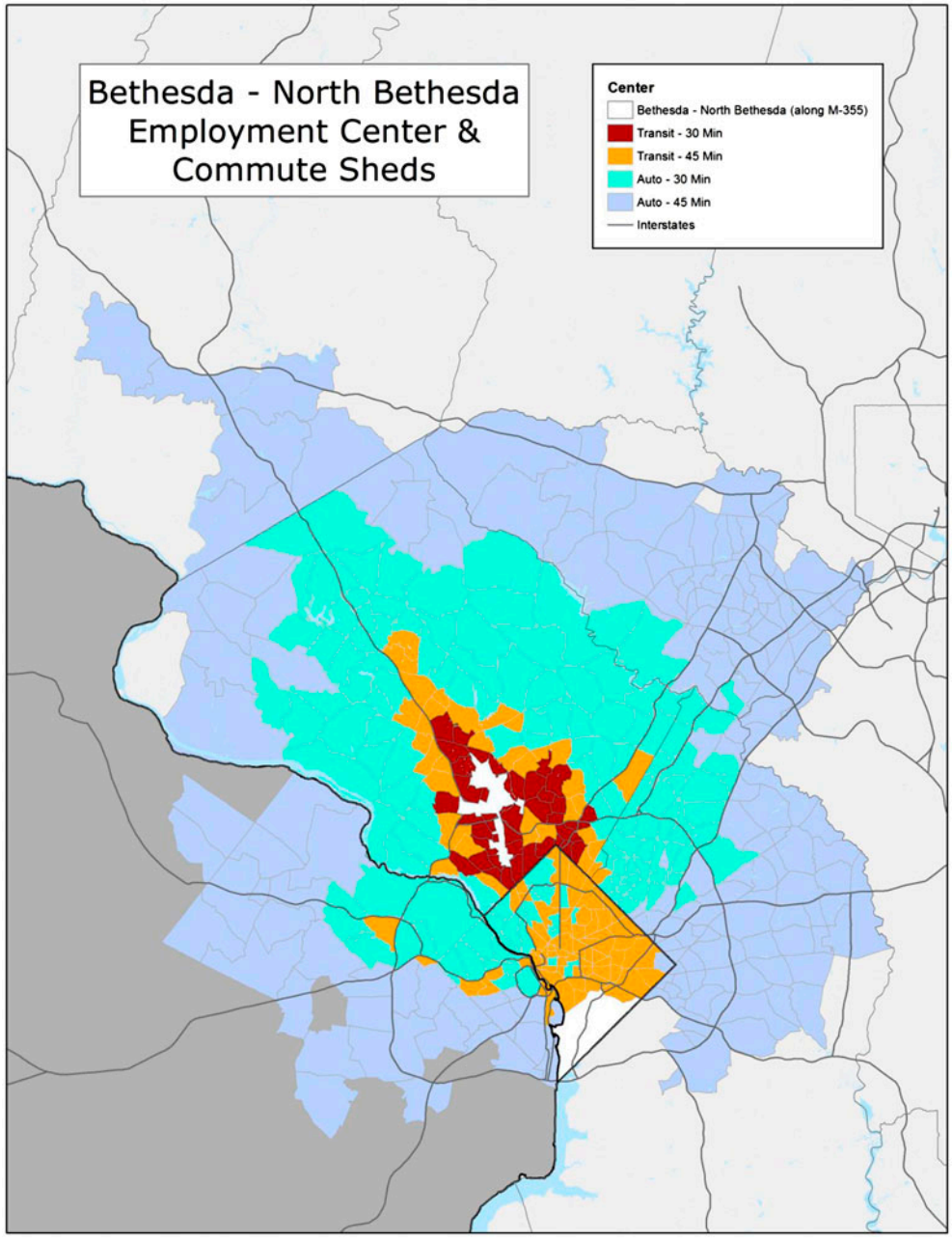

Figure 5. Bethesda–North Bethesda employment center and commute sheds.
Source: Author's calculation.

diverse, so that industry-specific targeting is not necessary. The results also strongly suggest that investments in transit should be strategically targeted to serve employment centers. Columbia and Fort Meade, which feature high employment densities, high shares of high-income and white-collar employment shares, and continuing employment growth, but poor accessibility, appear to be strong candidates for additional transit service. Finally, the

results suggest that the state should pay particular attention to Downtown Baltimore as a strategic employment center. While Downtown Baltimore remains among the largest, most dense, and most highly transit-served centers in the state, the primacy of Baltimore appears to be fading in favor of the suburban centers such as the I-270 Corridor. Further decline in the employment share of downtown Baltimore – the center of Baltimore's radial transit system and home to many of the region's minority and low-income residents – could adversely affect transit ridership, social equity and environmental quality.

More generally, these findings provide empirical support for polycentric regional development strategies. Specifically, they suggest that regional plans and policies should encourage job growth within select economic centers, especially in centers with high levels of transit service. Such concentration of economic activity would simultaneously further the goals of fostering economic growth and increasing transit ridership. To avoid further exacerbating jobs–housing imbalance, however, such economic development policies should be paired with housing policies that encourage housing development within the transit commute shed of these centers. Such policies, combined with simultaneous expansion and coordination of transit service to existing employment centers, would serve to balance jobs and housing within the transit commute sheds and similarly serve the goals of increasing transit ridership. Well-balanced centers may also help reduce vehicle miles traveled by shortening the distance between existing employment and residential centers and possibly converting existing automobile commuters into transit riders. Further research should seek to elucidate the connection between economic development, transportation and polycentricism that we have explored in this paper. If observers like Nelson (2013) are correct, then the housing and transportation preferences of millenials and younger generations, combined with the "built-out" nature of most urban centers, suggests that polycentrism and densification of existing suburban employment centers may dominate spatial development patterns for the next several decades. If this is true, then coordinating efficient transit and balancing jobs and housing inside a reasonable commute shed are paramount for sustainability planning. Finally, although it is hazardous to generalize the findings from a state like Maryland, which is heavily dominated by employment in the public sector and strongly influenced by the location decisions of the US federal government, the results offer empirical support for the normative prescriptions advocated by New Urbanists, and the HUD's Sustainable Communities Initiative.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. For more information on PlanMaryland, see State of Maryland (2011).
2. For a thorough analysis of the history and evolution of employment cluster studies, see Cruz and Teixeira (2010).
3. The term *economic centers* is more commonly used in this line of research as the focus is less on interindustry relationships and more on relative employment density.
4. For more on the Maryland State Transportation model, see Mishra et al. (2013).
5. It is important to note that the QCEW data are derived from unemployment insurance records filed by each employer. This introduces a set of known limitations, including the omission of sole-proprietor firms and incomplete military and government employment information. Since these three groups do not purchase unemployment insurance, they are not accurately represented in the population. However, through a number of adjustment procedures, we estimate total military and government employment by comparing QCEW total employment in each

industry with figures published by the Bureau of Economic Analysis and other trusted sources. We then use proportional allocation to distribute adjusted employment among known firm locations until our estimates are consistent with other sources. This adjustment process could impact our analysis; however, we believe it produces better results than if no adjustment had been made.

6. We choose a lower threshold than Giuliano and Small did because the state of Maryland is, obviously, a much larger geographic area than the city of Los Angeles and contains a broader diversity of development types. Therefore, we expect average employment density to be lower in the state of Maryland than in the city of Los Angeles and we adjust our threshold accordingly.
7. For a discussion of alternative ways of identifying economic centers see Casello and Smith (2008).
8. Because of the large geographic size of the center in the 270 corridor, we define two centers in this corridor based on a natural break in the geography.
9. "The Herfindahl-Hirschman index, better known as the Herfindahl index, is a statistical measure of concentration. It has achieved an unusual degree of visibility for a statistical index because of its use by the Department of Justice and the Federal Reserve in the analysis of competitive effects of mergers. The Herfindahl index can be used to measure concentration in a variety of contexts. For example, it can be used to measure the concentration of income (or wealth) in US households and also market concentration, that is, the degree of concentration of the output of firms in banking or industrial markets." (Rhoades 1993)
10. For more information on MSTM, see Mishra et al. (2011, 2013).
11. In another paper (author suppressed) we conducted a statistical analysis of job growth in the state and found the probability of new firm start-ups to be significantly higher in the 23 employment centers than in other parts of the state, see Niu et al. (2014).

Notes on contributors

Elijah Knaap is a PhD student in the Department of Urban Studies and Planning at the University of Maryland. His research interests include urban sociology, inequality, housing policy, econometric modeling and computational methods. His dissertation research examines the relationship between urban spatial structure and socioeconomic mobility.

Chengri Ding is a professor of urban studies and planning and a research professor in the National Center for Smart Growth at the University of Maryland, College Park. His research areas include urban economics, land policy, urban planning and China.

Yi Niu is an assistant professor in the International School of Economics and Management at the Capital University of Economics and Business. His research interests include urban economics, housing, public finance and urban planning.

Sabyasachee Mishra is an assistant professor in the department of Civil Engineering at the University of Memphis. He has been involved with national and state transportation projects of the Federal Highway Administration, US Department of Transportation, Maryland State Highway Administration, Maryland Department of Transportation and Michigan Department of Transportation. His areas of expertise include travel demand modeling, transportation planning and policy, econometric modeling, and transportation economics and finance.

References

Alexander, C. 1965. "A City is Not a Tree, Architectural Forum, 122,1: 58–6, Reprinted." In *(1988) Design after Modernism*, edited by John Thackara, 67–84. London: Thames and Hudson.

Alonso, W. 1964. *Location and Land Use; Toward a General Theory of Land Rent*. Cambridge: Harvard University Press.

Anderson, N. B., and W. T. Bogart. 2001. "The Structure of Sprawl: Identifying and Characterizing Employment Centers in Polycentric Metropolitan Areas." *American Journal of Economics and Sociology* 60 (1): 147–169.

Berry, B. J., and W. L. Garrison. 1958. "Recent Developments of Central Place Theory." *Papers in Regional Science* 4 (1): 107–120.
Bodenhorn, H., and D. Cuberes. 2010. "Financial Development and City Growth: Evidence from Northeastern American." *Cities* 1790–1870.
Bogart, W. T., and W. C. Ferry. 1999. "Employment Centres in Greater Cleveland: Evidence of Evolution in a Formerly Monocentric City." *Urban Studies* 36 (12): 2099–2110.
Brundtland, G. H. 1987. *Report of the World Commission on Environment and Development: Our Common Future*. United Nations.
Cervero, R., and K. Wu. 1997. "Polycentrism, Commuting, and Residential Location in the San Fransisco Bay Area." *Environment and Planning A* 29 (5): 865–886.
Cervero, R., and K. Wu. 1998. "Sub-centring and Commuting: Evidence from the San Fransisco Bay Area, 1980–90." *Urban Studies* 35 (7): 1059–1076.
Chakraborty, Arnab, Nikhil Kaza, Gerrit-Jan Knaap, and Brian Deal. 2012. Robust and Contingent Plans: Scenario Planning for an Uncertain World. *Journal of the American Planning Association*, 77(3): 251–266.
Chou, T. L., C. H. Ching, S. Fan, and J. Y. Chang. 2011. "Global Linkages, the Chinese High-tech Community and Industrial Cluster Development." *Urban Studies* 48 (14): 3019–3042.
Christaller, Walter. 1933. Die Zentralen Orte in Suddeutschland. Jena: Gustav Fischer. Translated (in part), by Charlisle W. Baskin, as Central Places in Southern Germany. Prentice Hall, 1966.
Cismas, L., A. Miculescu, and M. Octil. 2010. Current Trends of the Regional Development Policy in the European Union. The Development of Competitive Economic Agglomerations of Cluster Type.
Cruz, Sara C. S., and Aurora A. C. Teixeira. 2010. "The Evolution of the Cluster Literature: Shedding Light on the Regional Studies-regional Science Debate." *Regional Studies* 44 (9): 1263–1288.
Davoudi, S. 2003. "European Briefing: Polycentricity in European Spatial Planning: From an Analytical Tool to a Normative Agenda." *European Planning Studies* 11 (8): 979–999.
European Commission. 1999. European Spatial Development Perspective (ESDP): Towards Balanced and Sustainable Development in the Territory of the European Union, Agreed at the Informal Council of Ministers Responsible for Spatial Planning, Potsdam, May 1999. OOPEC.
Giuliano, G., and K. A. Small. 1991. "Subcenters in the Los Angeles Region." *Regional Science and Urban Economics* 21 (2): 163–182.
Giuliano, G., C. Redfearn, A. Agarwal, and S. He. 2012. Network Accessibility and Employment Centers. *Urban Studies* 49 (1): 77–95.
Glaeser, E. L., and J. D. Gottlieb. 2009. "The Wealth of Cities: Agglomeration Economies and Spatial Equilibrium in the United States." *National Bureau of Economic Research*.
Gordon, P., and H. W. Richardson. 1996. "Beyond Polycentricity: The Dispersed Metropolis, Los Angles, 1970–1990." *Journal of the American Planning Association* 62 (3): 289–295.
Hall, P., and K. Pain. 2006. *The Polycentric Metropolis: Learning from Mega-city Regions in Europe*. London; Sterling, VA: Earthscan.
He, Z., L. Rayman-Bacchus, and Y. Wu. 2011. "Self-organization of Industrial Clustering in a Transition Economy: A Proposed Framework and Case Study Evidence from China." *Research Policy* 40: 1280–1294.
Hoyler, M., R. C. Kloosterman, and M. Sokol. 2008. "Polycentric Puzzles – Emerging Mega-city Regions Seen through the Lens of Advanced Producer Services." *Regional Studies* 42 (8): 1055–1064.
Kantor, S., and A. Whalley. 2009. "Do Universities Generate Agglomeration Spillovers? Evidence from Endowment Value Shocks." *National Bureau of Economic Research*.
Knaap, G., and R. Lewis. 2012. "Metropolitan Planning for Sustainability and the Hegemony of Metropolitan Regionalism." In *American Regional Planning: Practice and Prospect*, edited by E. Seltzer and A. Carbonell. Cambridge, MA: Lincoln Institute of Land Policy.
Lösch, A., and W. H. Woglom. 1954. *The Economics of Location*. Vol. 1940. New Haven, CT: Yale University Press.
Mills, E. S. 1967. "An Aggregative Model of Resource Allocation in a Metropolitan Area." *The American Economic Review* 57 (2): 197–210.
Mishra, S., X. Ye, F. Ducca, and G. J. Knaap. 2011. A Functional Integrated Land Use-transportation Model for Analyzing Transportation Impacts in the Maryland-Washington, DC Region. *Sustainability: Science, Practice, & Policy*, 7 (2), 60–69.

Mishra, S., T. Welch, R. Moeckel, S. Mahapatra, and M. Tadayon. 2013. *Development of the Maryland Statewide Transportation Model and Its Application in Scenario Planning, Compendium of Papers, 92nd Annual Meeting of Transportation Research Board (TRB)*. Washington, DC: National Academy of Science.

Muth, R. F. 1969. *Cities and Housing: The Spatial Pattern of Urban Residential Land Use*. Chicago, IL: University of Chicago Press.

Nedovic-Budic, Z., G. J. Knaap, and D. Joyce. 2013. "Planning for States and Nation/States: A TransAtlantic Perspective." *Town Planning Review* 84 (3): 411–418.

Nelson, A. C. 2013. *Reshaping Metropolitan America: Development Trends and Opportunities to 2030*. Washington, DC: Island Press.

Nishimura, J., and H. Okamuro. 2011. "Subsidy and Networking: The Effects of Direct and Indirect Support Programs of the Cluster Policy." *Research Policy* 40 (5): 714–727.

Niu, Y., C. Ding, and G. J. Knaap. 2014. "Employment Centers and Agglomeration Economies: Foundations of a Spatial Economic Development Strategy." *Economic Development Quarterly*. doi:10.1177/0891242414560813.

Park, R., E. W. Burgess, and R. D. McKenzie. 1925. *The City: Suggestions for the Study of Human Nature in the Urban Environment*. Chicago, IL: University of Chicago Press.

Porter, M. E. 2000. "Location, Competition, and Economic Development: Local Clusters in a Global Economy." *Economic Development Quarterly* 14 (1): 15–34.

Rhoades, S. A. 1993. "The Herfindahl-Hirschman Index." *Federal Reserve Bulletin* 79 (March): 188–189.

Rosenfeld, S. 2005. "Industry Clusters: Business Choice, Policy Outcome, or Branding Strategy?" *Journal of New Business Ideas and Trends* 3 (2): 4–13.

Rosenthal, S. S., and W. C. Strange. 2004. "Evidence on the Nature and Sources of Agglomeration Economies." *Handbook of Regional and Urban Economics* 4: 2119–2171.

Salingaros, Nikos, Lucien Steil, Michael W. Mehaffy. Undated. Growing Sustainable Suburbs: An Incremental Strategy for Reconstructing Sprawl, Downloaded From Http://Www.Academia.Edu/188207/Growing_Sustainable_Suburbs_An_Incremental_Strategy_For_Reconstructing_Sprawl, December 26, 2012.

State of Maryland. 2011. PlanMaryland: A Sustainable Growth Strategy for the 21st Century, Baltimore, MS: Available at http://www.plan.maryland.gov/PDF/plan/PlanMaryland_Final.pdf

Talen, E. 2008. "Beyond the Front Porch: Regionalist Ideals in the New Urbanist Movement." *Journal of Planning History* 7 (1): 20–47.

Vandermotten, C., L. Halbert, M. Roelandts, and P. Cornut. 2008. "European Planning and the Polycentric Consensus: Wishful Thinking?" *Regional Studies* 42 (8): 1205–1217.

Waterhout, B. 2008. *The Institutionalisation of European Spatial Planning*. Amsterdam: IOS Press.