INDEX OF EMPLOYMENT-WORKER BALANCE BY TRANSIT STATION MODE

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Manuscript# TRBAM-21-01296

ABSTRACT

Employment-Worker Balance (EWB), a key to economic growth through agglomeration economies is also a key to social equity. This is due to its ability to both **increase workers' access to employment and firms' access to a strong, diverse, and resilient workforce.** Smart Growth advocates frequently identify Employment-Worker Balance as a key metric in compact urban design. Because of its potential synergistic effects with EWB, another key element of Smart Growth, **Fixed-Rail Transit systems (FRT), needs to be studied for its effects on EWB:** is the latter improved by the former, and for which job sectors and which workers? Principle Component Analysis will be used to produce a EWB Index that is able to map EWB across multifarious spatial contexts across the U.S., taking into its scope the multiple types of transit system modes, real estate types, and the many sectors of the economy that surround FRT stations. The **EWB Index will provide a tool for practitioners and researchers** to utilize in regression analysis, and policy and decision support. The paper will follow up on this significant increase of available evidence to work towards further theoretical refinement of EWB.

Keywords: Transit-Oriented Development, income match, employment-worker balance, principle component analysis

INTRODUCTION & LITERATURE REVIEW

How to improve access to employment opportunities?

Mobility: the ability to move about to access needed land uses
Accessibility: "the potential of opportunity for interaction."
Relative accessibility is measured by one's ability to utilize needed land uses.
Employment-worker balance, the balance of jobs and employees in a neighborhood, enhances the linkages between sites, both for the workforce and for the workplace, easing the costs of friction through greater accessibility. TOD enhances the EWB through built environment characteristics and transit node interconnectivity that draws people to utilize the site for both land uses and access to the regional transit network.

Can we directly measure the effect on EWB from transit stations via an index that is sensitive to different kinds and levels of transit across metros?

- **Hypothesis 1:** Different combinations of economic sectors and transit modes will load on different PCs
- **Hypothesis 2:** Different modes of travel will load differently on the EWBI.
- **Hypothesis 3:** These differential loadings will produce a variety of EWB regimes or clusters.

DATA

Variables	Description & Justification
GTFS: Distance to nearest FRT stations by mode / centering intensity (GWR score)	Vector of measures of node and place attributes of neighborhood transit stations.
LEHD: Employment by sector group, age, and income	Categorized vectors of employment, they are a necessary input to capture demographic interactions. Firms compete for location.
LEHD: Workers by sector group, age, and income	Vector of workers. Worker demographics greatly affects commute.
ACS: Housing by tenure and quality	Vector of housing. Renters can move residences easier than owners. Housing quality increases in newer development, with fewer vacancies.
ACS: Commuting mode, time	EWB highly dependent upon commute mode and shed, a vector measured in time or distance. Link between station proximity and mode choice to work.
ACS: Vehicles per Household	Vector proxy for automobile dependency.
GIS: Intersection & Road network density	Measures of urban compactness and walkability.
GIS: Strength of employment density; centering/subcentering	Higher EWB results in lower VMT and VHT and facilitates substitution of other travel modes for the automobile. Facilitates non-auto travel modes.
ACS: Strength of housing density	Clustering of housing should increase EWB.
GIS: Distance to CBD	Regional context of the neighborhood.
GIS: Dissimilarity Index of income match for place-based jobs	Degree to which the neighborhood employment sectors is matched with workers' job sectors.
LEHD & GIS: Internal capture	Workers living and working in the same commute shed as % of total.

METHODS

Cases: Atlanta (SCT, HRT), Cleveland (LRT, CRT), Eugene (BRT), Minneapolis (BRT, CRT, LRT).

Principle Components Analysis:
Proximity between worker residences and workplaces
PCA built upon indicators of EWB by --
income and sector group,
commuter mode and time,
housing tenure and attributes,
centering, and
built environment characteristics.

Centering analysis uses spatial clustering and GWR to identify regional centers.
Spatial autocorrelation measures

Commuter proximity metrics: Internal capture, and income match (housing cost vs. wage level). The commuteshed is derived in GIS by a search from each origin census block group to all CBGs listed as destinations. An origin-destination cost matrix selects all destinations within the 3-mile Euclidean distance threshold.

Analysis outputs include:
- Global Moran's *I* plots
- tables of loadings and explained variance
- scree plots showing variance for each PC
- component significance tests
- thematic maps of component scores

RESULTS & CONCLUSION

- **PC1 : worker residence, PC2: job location.**
- Loadings for residences low when they are high for firms & vice-versa. **This indicates a need for greater EWB.**
- Loadings: transit & walking are highest for PC2: job location.
- Commuting loads highest on PC1: worker residence.
- Short commute times load highest on PC1: worker residence.
- Loadings for homeowners, internal capture, and distance to CBD highest on PC1: worker residence.
- Loadings for centering & density of roads and workers load highest on PC2: job location. Sectors also loaded differently across PCs. Worker clustering is seen in the PC1 score maps (included).
- The transit modes - SCT, CRT, BRT and LRT all have PC loadings at approximately the same intensity, with the exception of Eugene, which had somewhat weaker loadings than the other cities.
- Overall, the main pattern revealed employee residences and firm locations loaded onto different components, indicating a need for greater integration of the two in space and by income.

This project was funded by the National Institute for Transportation and Communities (NITC; grant number #1440), a U.S. DOT University Transportation Center.