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Intrametropolitan Trade: Understanding the Interdependency of the Central- City and Edge Cities

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Abstract. Recent research in urban and regional economics has shown that cities have taken on a polycentric (as opposed to monocentric) form. Much attention has focused on identifying and categorizing the numerous employment centers in a vast number of metropolitan areas. However, these studies have repeatedly demonstrated that well less than half of all employment in a metropolitan area is located within these centers. This paper uses a new approach, the tabulation of current accounts in labor services for municipalities, to examine employment patterns both inside and outside of employment centers in metropolitan Cleveland. Significant specialization is found both inside and outside of centers, and suburbs are labeled as either net importers or net exporters of labor services. Approximately $23.8 billion of labor services were traded between municipalities in the Cleveland metropolitan area in 1994.

1. Introduction

The term "city" implies some sort of static block, a single dense point in space, like the large black dots on maps: Houston, Cleveland, Los Angeles, Minneapolis, etc. Try to imagine these points on the map as giant trading posts and realize that some of them have larger Gross Domestic Products than small countries. These single points then become centers for the export and import of goods and services. They can be viewed as small open economies that specialize and trade with each other. However, cities not only trade between each other, they also trade within themselves. Henderson (1988) estimates that 50 to 60 percent of the labor force in any city must be engaged in the production of goods and services that are presently nontradeable across cities. Because of the high costs of transporting these goods and services across cities, they are locally produced, consumed and traded. At a finer scale, this single dense point is not a single point at all, but many small

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dense points that are constantly interacting with each other. Cities are no longer simply downtowns; they are metropolitan areas that are full of specialized zones of influence.

It is important to avoid picturing an area composed of a nucleus and its satellites. This implies a hierarchy of dependence on the nucleus, an idea that it is somehow more important than the other constituent parts. Rybczynski (1995) states that it is time to stop assuming that the central city necessarily precludes other centers. Anas, Arnott and Small (1998) state that cities have taken a more polycentric form, with a number of concentrated employment centers making their mark on both employment and population distribution. They also cite evidence suggesting that these centers form an interdependent system with a size distribution and a pattern of specialization analogous to the system of cities in a national economy. However, as studies of Cleveland by Bogart and Ferry (1999) and Los Angeles by Giuliano and Small (1991) have shown, only around 30 percent of the employment in metropolitan areas is in these employment centers .[2]

The image of the polycentric city must now be examined closer to reveal the patterns of trade outside of these centers. Despite the fact that intrametropolitan trade is so substantial, there is yet to be any empirical work on the extent and pattern of intrametropolitan trade in labor services among the parts of a metropolitan area. This paper discusses employment patterns both inside and outside of centers and quantifies flows of intrametropolitan trade in labor services by constructing current accounts for municipalities in the Cleveland metropolitan area. Intrametropolitan trade in labor services is simply defined as a worker commuting from where they live to where they work. For example, if a worker lives in a suburb and works in the central-city, the central-city is importing her labor services and the suburb is exporting her services.

Intrametropolitan trade in labor services is substantial, with over $23 billion of labor services traded between cities within the metropolitan area. By comparison, according to International Monetary Fund data, in 1994 Belgium exported $21.8 billion worth of services and imported $21.3 billion. Trade outside of centers is also substantial, with over 66% of all trade occurring completely outside of employment centers, that's over $15 billion.

Employment centers that were identified using employment and density cutoffs are also identified using the current account methodology. Several places that went unidentified as employment centers under density analyses are revealed to import over four times as many labor services as they export, which clearly suggests some degree of specialization and agglomeration. The consistency of the results with an agglomeration and specialization hypothesis implies an ordering to employment outside of the traditional down-

[2] Anderson and Bogart (2001) as well and McMillen and McDonald (1998) and McMillen (2002) demonstrate this for many other cities.

town, which contradicts the traditional urban sprawl story. I find that although the municipality of Cleveland is an important employment center,[3] it also exports over $1 billion worth of labor services to places outside its boundaries. In fact, over $16 billion of labor services are imported by municipalities other than Cleveland, representing over two-thirds of the imports and half of the labor services in the entire metropolitan area. This study provides empirical support for Rybczynski's view of metropolitan areas as an interdependent system of component parts, no one part more essential than the others.

2. Previous Research: Focus on the Center

Much work has been done in the urban economics field studying the spatial characteristics of cities in the United States. These studies have established a set of what are now standard empirical facts. Among the most important of these facts is that cities are polycentric, that is, they consist of many employment centers. Giuliano and Small (1991) examined data for metropolitan Los Angeles and found that the area consisted of over 30 employment centers. McMillen and McDonald (1998) found similar results for Chicago. Bogart and Ferry (1999) and Anderson and Bogart (2001) find numerous employment centers in Cleveland, Indianapolis, St. Louis, and Portland. All of these studies use similar methodology, pioneered by Giuliano and Small (1991), to identity these employment centers. Their methodology involves the choice of arbitrary employment and employment density levels as definitions of employment centers, and then classifying certain geographies as being centers.[4]

Not only are these centers an empirical regularity in every metropolitan area in the United States, they have also been found to be very specialized by type of employment. For example, certain centers feature a disproportionate amount of employment in the legal services sector, while others devote much of their employment to government services. Specialization has usually been identified through the use of location quotients, which identify specialization by contrasting regional and local employment levels.

However, the most important empirical regularity may be that most employment in metropolitan areas is outside of these employment centers. In fact, Anas, Arnott and Small (1998) place this figure at 70 percent! For example, in Cleveland, only 32 percent of metropolitan area employment is inside employment centers (Bogart and Ferry 1999). Although establishing the exis-

[3] Indeed, it contains three employment centers identified by Bogart and Ferry (1999).

[4] Recently, McMillen (2002) has developed a new method for identifying employment centers that involves the use of contiguity matrices. This allows for the identification of employment centers in a much simpler and less time intensive manner. It also requires less location-specific knowledge than the previous methods.

tence of employment centers and examining their formation remains an important component of the study of local economies, these studies are inherently focused on, what remains, a relatively small component of the local labor market and the local economy as a whole.

3. Geography and Trade

Bogart (1998) comments that the development of edge cities (employment centers) as a modern complement to industrial era downtowns can be thought of as a result of decreasing transportation costs of services. The reason for the new concentration is that modern communication devices and decreases in intracity transportation costs combine to make services that were formerly nontradeable, tradable. Garreau's (1991) thesis in his book *Edge City* is that these new "cities on the edge" are exporters of various services such as financial, shopping, university, medical and office services.

The same forces that have caused these very visible employment centers to form may also be working outside of these centers to shape the economic landscape of cities. Constructing current accounts for municipalities allows for the analysis of specialization and agglomeration outside of employment centers. As noted above, previous studies have used employment level and density cutoffs to identify places of agglomeration (i.e., employment centers). These cutoff levels are arbitrary and often even the slightest alteration in these levels will change the number of centers identified and the spatial characteristics of previously identified centers.

The current account approach of identifying intrametropolitan trade in labor services is not a replacement for this method. It offers a different way of examining employment in metropolitan areas that has several advantages and disadvantages over the previous approaches. One distinct advantage is that trade flows between municipalities within a metropolitan area can be examined. The study of these flows can produce a better understanding of the relationships between and among employment centers as well as suburbs and the central city. In addition, the current account method is a straightforward way to examine the substantial employment outside of employment centers without appealing to arbitrary density and employment cutoff levels. A disadvantage is that these trade figures have to be imputed. Although reliable data exist on the extent of commuting and employment, there is no data set that directly assigns a value to the commuting that occurs in terms of wages earned or any other measure.

4. Data

Data used in this study come from the 1990 Decennial Census and from 1994 Travel Diaries published by the NorthEast Ohio Area Coordinating Agency (NOACA). All information on income and population is from the

1990 Census[5] and all commuting data comes from the NOACA diaries. The diaries recorded home to work trips that had their sources and destinations within the counties of Cuyahoga, Geauga, Lake, Lorain, and Medina. The NOACA diaries consist of a stratified random sample of 1,600 households collected in 1994. The survey was designed to describe trips for the entire NOACA region and the survey results were expanded in order to reflect accurately on the entire area.[6] Each trip to work is recorded, so if a worker commutes in the morning and returns home to eat lunch, then drives back to work, this will count as two trips in these data. However, only trips from home to work are counted, so a trip from work to eat lunch somewhere besides home and then a trip back to work, will not be counted as a trip to work. The trips are intended to reflect an average day in the five county area.

Both the census and travel diary data are analyzed at the level of Traffic Analysis Zone (TAZ).[7] The data list a source and a destination TAZ and how many trips were made with this source and this destination. These areas are analogous to census blocks except that TAZs are constructed to have approximately equal employment in each zone (census blocks are constructed to have approximately equal population within each block). Since they are based on employment levels, TAZs will vary in size, with TAZs in highly developed areas being smaller in area than TAZs in more remote places. Both TAZs and census blocks are always inside municipal boundaries and thus never lie within multiple municipalities. Only trips that originated and terminated within the five county NOACA region were considered for this study.[8]

5. Method

A current account was calculated for each municipality in the five county area.[9] In order to do this, each trip from home to work had to be assigned a

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[5] Census Transportation Planning Package (CTPP), urban component.

[6] The Census also published data on commute to work in the CTPP Urban data sets. The travel diary data were matched with the Census Bureau's data and results were both quantitatively and qualitatively similar. Neither of the data sets have any direct information on the income of commuters.

[7] From the US Census Bureau: A traffic analysis zone (TAZ) is a statistical entity delineated by state and/or local transportation officials for tabulating traffic-related census data-especially journey-to-work and place-of-work statistics. A TAZ usually consists of one or more census blocks, block groups, or census tracts.

[8] These trips comprised over 95 percent of all trips in the five county region.

[9] There is also a current account for each TAZ, but this level of geography is nearly impossible to discuss. For example, how does one frame the exports of TAZ number 3 and the imports of TAZ number 346? Looking at municipalities allows the trade figures to be presented in the familiar framework of political boundaries.

value. The travel diary data do not contain any information on the wages or incomes of commuters. The value given each trip was the median income of commuters who reside in the origin TAZ, which is available from the 1990 Census.[10] In other words, the assumption is that each TAZ consists of homogeneous residents. The current account for each municipality is expressed to reflect annual trade in labor services and is in 1994 dollars.

Of course, it would be wonderful if wages for each commuter were listed in the travel diary or census bureau data sets but, alas, they are not available. The other main option would be to assign the median income of workers in a destination TAZ as the value of each trip. However, it seems that although a janitor and CEO may work in the same building (same TAZ), they probably do not live in the same community. This fact makes the choice of origin TAZ median income as trip value seem the best between these two choices.

Trade among TAZs was divided into three categories: trade within a single TAZ, trade between two TAZs in the same municipality, and trade between two TAZs in different municipalities. The first two groups are both included in the "stay value" portion of the trade figures. The last category constitutes exports and imports across municipalities. For example, if a person commutes from TAZ i in suburb A to TAZ j in suburb B and the median income of commuters in TAZ i is $30,000 a year, the current account of A would receive a credit of $30,000 while the current account of B would incur a debit of $30,000. That is, suburb A has exported $30,000 worth of labor services and suburb B has imported $30,000 worth of labor services.

6. Results

The data illustrate that a tremendous amount of trade in labor services occurs within the five-county area. In 1994 the single municipality of Cleveland exported around $1.4 billion worth of labor services and imported approximately $6.5 billion of labor services. By comparison, according to the IMF, Fiji exported $1 billion worth of goods and services and imported around $1.6 billion. Also, in excess of $2.4 billion of labor services were traded within the city of Cleveland in 1994. Within the five county study area, $23.8 billion worth of labor services were exported. This indicates that although the municipality of Cleveland contains three employment centers and remains very important, it only consists of around 32 percent of the importing of labor services. A summary of these trade statistics is found in Table 1. Detailed current account data for municipalities in Cuyahoga County can be seen in Table 2.

[10] Median earnings information is also available and probably should have been used in this study, as it is a better measure of earnings from work then total income. Hopefully, these data will be used in a future draft of the paper. However, this data choice should not influence the qualitative results of this study.

Table 1. Summary Trade Statistics

Category	Value	% total value	% TAZ trade	% City trade
Total value of labor services	$32.3 billion	100%	-	-
Value of trade between cities	$23.8 billion	74%	-	100%
Total value of labor services, destination not a center	$22.4 billion	69.30%	-	-
Total value of labr services, destination a center	$9.9 billion	30.70%	-	-
Total value of labor services traded between TAZs	$30.4 billion	94%	100%	-
Between TAZ trade has an employment center as a destination	$9.88 billion	-	32.50%	-
Between TAZ trade that is completely outside of centers	$20.1 billion	-	66%	
Value of imports by employment centers	$9.52 billion	-	31.30%	-
Between TAZ trade that has a center as origin and destination	$197 billion	-	0.60%	-
Total value of city exports to employment centers	$7.67 billion	-	-	32%
Labor value in centers other than Downtown	$4.79 billion	15%	-	-

141 municipalities export labor services (all of sample)
129 municipalities import labor services

It is important to note that through the trade data, suburbs can be identified as net exporters and importers of labor services. For instance, Beachwood imported $400 million of labor services in 1994, approximately $300 million more than it exported. This allows for the labeling of Beachwood as a net importer of labor services. In contrast the suburb of North Royalton exported over $350 million of labor services in 1994 and imported only $125 million worth. It is clearly a bedroom suburb: people tend to live there and then commute to work. Another interesting example is North Randall, home of Randall Park Mall. The city of North Randall exports only $9.8 million in labor services. This is a relatively small number compared to the $97 million it imports. North Randall is definitely not a bedroom suburb. North Randall is not identified as an employment center in the Bogart & Ferry (1999) study of Cleveland, but it is clearly identified as a major importer of labor services in this study. The identification of places such as North Randall as net importers of labor demonstrates one of the advantages of the current account approach: The trade figures identify employment centers that are not identified using the density and employment approach used by Guiliano & Small (1991) and Bogart & Ferry (1999). These new centers are usually retail centers where employment density often isn't high enough to be identified under the previous methodology. Other formerly unrecognized employment centers were also identified in this study. An example is Independence, which was an emerging edge city in 1990 and is clearly identified as an employment center by the 1994 trade figures.

The trade figures also demonstrate the interdependence of the different areas in the NOACA region. Although it is the single largest trader, the downtown is not the single dominant force for trade in labor services. Billions of dollars in trade occur in the other centers and municipalities across

the region. The city of Cleveland itself exports almost $1.5 billion in labor services to other municipalities in the area even though it contains three (downtown, University Circle and Metro Westside) of the nine identified employment centers.

Robustness Checks

These trade figures are obviously subject to various inaccuracies since they have been imputed from various data sources. These data results were checked for accuracy in two different ways. The first method was to examine employment to population ratios for each municipality and compare these figures with the trade figures.[11] The idea being that places with relatively high employment to population ratios should be net importers in the trade figures and vice versa for municipalities with relatively low employment to population ratios. In these data, all municipalities with an employment to population ratio less then or equal to .30 are all net exporters of labor. This helps substantiate the more qualitative results from these trade figures.

The actual dollar figures for trade were checked for accuracy by imputing per capita income from the trade numbers and comparing that figure with the per capita income from the 1990 Census. Per capita income was imputed for each municipality by summing the amount of exports and "stay value" and dividing that sum by the population of the municipality in 1989.[12] For Cuyahoga County in 1994 the mean ratio of census per capita income to imputed per capita income is 1.28 with a standard deviation of 0.38. On the average, the trade figures underestimate per capita income, which may indicate that the figures may be too small. Eighty percent of the imputed per capita incomes fall within 50 percent of the per capita income reported by the census bureau. Approximately 40 percent of the municipalities were within 10 percent of the figure reported by the census bureau. Usually when per capita income is grossly underestimated the municipality is a wealthy area. For instance, all four of the imputed municipal per capita incomes that underestimated per capita income by more than 100 percent have per capita incomes of over $30,000.[13] See Figure 1 for a graph of the ratio of real to imputed per-capita income. This figure clearly shows the overall accuracy of the data for relatively low-income municipalities and its tendency to underestimate income in relatively high-income places.

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[11] A superior measure would probably be the ratio of employment to a measure of the working population, such as those between 18 and 65, for example.

[12] "Stay value" is the value of commuting trips within a single TAZ and between TAZs in a single municipality.

[13] One might expect especially wealthy districts to not match the imputed per capita income figures because they have many non-commuters who earn income from sources other than employment of their labor. This would mean that although the imputed values seem to on average underestimate the per-capita income, that they in fact accurately reflect income from working. The Census also has information on mean earnings, but these were not used in this study.

Table 2. Current Accounts for all municipalities in Cuyahoga County, 1994 dollars

City Origin	Xports	Mports	Valu_stay	Emp/Pop	Imp_percap	Percapita	Real/Imp	M/X
Bay Village	276,481,554.54	37,931,835.06	50,685,457.15	0.15	19,245.12	23,439.00	1.22	0.14
Beachwood	150,950,963.05	440,863,385.41	37,664,880.12	1.62	17,665.62	29,871.00	1.69	2.92
Bedford	186,073,599.12	126,435,043.10	35,073,364.11	0.42	14,920.18	14,935.00	1.00	0.68
Bedford Heights	167,690,972.28	201,227,044.22	20,013,096.43	0.73	15,473.09	14,234.00	0.92	1.20
Bentleyville	17,756,677.43	277,146.95	591,774.86	0.03	27,304.24	29,260.00	1.07	0.02
Berea	186,108,214.59	178,553,139.49	56,149,852.63	0.47	12,716.29	14,867.00	1.17	0.96
Brantenahl	30,355,865.01	5,086,938.70	2,590,951.81	0.17	24,297.06	45,788.00	1.88	0.17
Brecksville	219,988,635.84	146,434,500.97	52,409,441.13	0.62	23,049.42	25,356.00	1.10	0.67
Broadview Heights	185,688,088.83	77,346,995.14	24,335,940.53	0.29	17,188.32	17,960.00	1.04	0.42
Brook Park	273,849,199.18	400,604,089.43	53,681,245.90	0.33	14,324.53	13,473.00	0.94	1.46
Brooklyn	118,768,477.12	255,271,180.38	29,643,447.18	0.56	12,678.28	13.802.00	1.09	2.15
Brooklyn Heights	20,115,001.50	81,695,359.48	4,357,909.92	2.18	16,877.87	15,395.00	0.91	4.06
Chagrin Falls	61,152,952.42	83,390,304.83	24,704,038.15	0.73	19,874.30	26,235.00	1.32	1.36
Cleveland	1,429,121,848.44	6,422,303,599.58	2,584,891,151.56	0.47	8,005.00	9,258.00	1.16	4.49
Cleveland Heights	636,342,138.80	205,773,834.07	113,551,809.01	0.21	13,873.57	18,228.00	1.31	0.32
Cuyahoga Heights	5,878,455.35	182,878,084.41	3,761,402.33	9.70	14,134.69	13,246.00	0.94	31.11
East Cleveland	165,668,552.65	152,614,130.41	18,481,187.81	0.20	5,564.11	9,020.00	1.62	0.92
Euclid	509,864,700.50	515,490,076.22	170,431,222.79	0.39	12,397.19	14,447.00	1.17	1.01
Fairview Park	228,365,119.94	117,387,478.28	36,990,047.42	0.28	14,719.06	18,768.00	1.28	0.51
Garfield Heights	336,121,334.37	174,794,768.54	77,903,075.69	0.27	13,044.66	12,491.00	0.96	0.52
Gates Mills	58,692,291.82	32,534,045.92	6,471,453.77	0.48	25,982.35	59,447.00	2.29	0.55
Glenwillow	3,466,646.23	8,236,996.53	521,706.90	0.90	8,727.25	14,658.00	1.68	2.38
Highland Heights	82,870,881.03	176,231,588.04	16,109,968.86	1.05	15,839.47	18,796.00	1.19	2.13
Hunting Valley	13,106,931.41	8,307,857.53	3,750,638.90	0.48	25,387.91	60,782.00	2.39	0.63
Independence	98,689,952.65	360,139,948.84	26,701,824.33	2.06	19,291.04	18,796.00	0.97	3.65
Lakewood	690,974,542.27	281,775,823.63	178,263,618.58	0.26	14,555.71	16,258.00	1.12	0.41
Linndale	1,209,830.35	3,433,834.02	47,440.76	0.92	9,453.17	9,638.00	1.02	2.84
Lyndhurst	182,217,328.28	118,125,306.59	28,551,820.31	0.30	13,187.91	21,194.00	1.61	0.65
Maple Heights	309,326,628.06	173,567,021.75	63,770,027.53	0.29	13,772.99	12,792.00	0.93	0.56
Mayfield	53,301,098.72	132,193,613.69	7,749,792.80	1.36	17,634.57	23,837.00	1.35	2.48
Mayfield Heights	246,693,275.94	171,049,389.79	34,653,656.17	0.35	14,175.79	16,099.00	1.14	0.69
Middleburg Heights	198,083,161.38	359,622,531.20	46,991,560.16	0.82	16,669.48	18,158.00	1.09	1.82
Moreland Hills	87,362,187.19	11,184,548.29	10,585,458.64	0.17	29,203.23	50,366.00	1.72	0.13
Newburn Heights	27,235,111.06	27,459,189.95	2,620,460.27	0.46	12,331.92	11,525.00	0.93	1.01
North Olmsted	408,790,656.30	253,425,531.47	114,174,445.23	0.36	15,289.59	16,567.00	1.08	0.62
North Randall	9,873,137.61	96,761,621.59	2,269,337.58	3.87	12,428.33	13,912.00	1.12	9.80
Royalton	350,856,458.71	125,684,824.12	58,791,672.05	0.26	17,659.53	17,262.00	0.98	0.36
Oakwood	41,724,978.52	33,145,531.12	1,950,972.01	0.44	12,876.16	30,436.00	2.36	0.79
Olmsted	107,601,236.50	42,249,525.59	9,248,607.51	0.26	14,156.75	-	-	0.39
Olmsted Falls	101,831,191.67	27,949,101.55	11,418,829.61	0.19	16,800.18	16,252.00	0.97	0.27
Orange	49,746,565.82	29,329,123.80	4,299,054.32	0.37	19,233.32	35,285.00	1.83	0.59
Parma	936,990,706.15	599,714,176.92	262,207,756.41	0.22	13,646.48	14,702.00	1.08	0.64
Parma Heights	237,967,819.80	109,654,889.94	31,036,427.29	0.22	12,542.16	15,051.00	1.20	0.46
Pepper Pike	140,754,656.77	72,550,186.77	12,715,777.57	0.45	24,813.33	54,473.00	2.20	0.52
Richmond Heights	92,091,782.47	109,957,945.48	15,072,917.42	0.47	11,150.21	18,927.00	1.70	1.19
Rocky River	277,083,498.59	200,805,010.58	62,188,932.50	0.41	16,622.85	25,585.00	1.54	0.72

Table 2. Continued

City Origin	Xports	Mports	Valu_stay	Emp/Pop	Imp_percap	Percapita	Real/Imp	M/X
Seven Hills	209,349,460.01	58,467,240.42	15,249,032.95	0.19	18,202.33	17,262.00	0.95	0.28
Shaker Heights	591,978,950.02	129,563,984.62	99,722,837.44	0.21	22,435.27	32,708.00	1.46	0.22
Solon	270,790,576.56	427,903,787.26	124,951,149.09	1.18	21,336.09	22,514.00	1.06	1.58
South Euclid	239,049,218.83	124,518,863.62	40,760,049.89	0.24	11,724.18	16,114.00	1.37	0.52
Strongsville	530,087,866.03	244,506,617.07	112,015,065.46	0.34	18,185.76	20,217.00	1.11	0.46
University Heights	185,825,082.23	77,885,121.20	22,861,996.91	0.26	14,110.01	18,705.00	1.33	0.42
Valley View	30,849,550.34	113,584,620.64	5,033,262.20	2.02	16,791.21	15,657.0	0.93	3.68
Walton Hills	33,148,252.45	79,483,480.52	4,114,111.33	0.97	15,715.89	18,152.00	1.16	2.40
Warrensville	6,803,045.70	191,542,643.76	1,117,648.03	4.38	4,359.22	-	-	28.16
Warrensville Heights	234,237,947.41	225,572,758.40	20,474,801.99	0.56	16,014.63	13,301.00	0.83	0.96
Westlake	394,117,687.21	385,811,809.76	111,828,492.30	0.58	18,726.26	24,00.00	1.28	0.98
Woodmere	10,671,489.20	45,251,060.15	1,225,554.25	1.83	14,544.06	14,540.00	1.00	4.24

"Valu stay" represents the imputed value of those who live and work in the same municipality. "Real/Imp" is the ratio of percapita income reported in the census to that imputed in from these trade data. "M/X" is the ratio of the dollar value of imports to the dollar value of exports in a municipality.

7. Conclusion

The trade figures not only confirm the existence of previously identified employment centers, they also identify employment centers that went unidentified in previous density analyses. These methods may provide local planners and other interested parties with a more complete picture of the metropolitan economy. Centers for employment are identified not only by gross employment and density levels but also by the degree to which they specialize in importing labor services. It is also clear that both the traditional downtown, edge cities and other previously unidentified centers are all important to intrametropolitan trade in labor services. Each of these "centers" imported millions of dollars worth of labor in 1994 and exported millions.

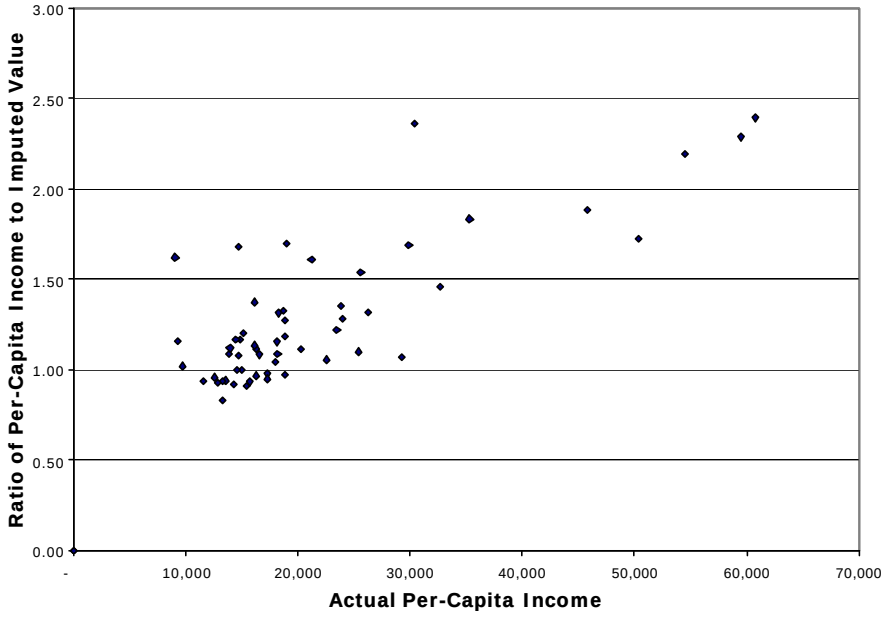

Figure 1. Robustness Check

Several facts from this study point to the interdependence of the central-city and edge cities in a metropolitan economy. Although the central city is a large component of the total value of trade in labor services, it represents less then 50 percent of the total value of trade in Cuyahoga County. The central-city also exports over $1 billion in labor services to other municipalities in the region, representing approximately 11 percent of the total value of exports within Cuyahoga County. From this, it is clear that Cleveland is not a mono-centric city and it should not be modeled as one.

However, the value of trade is still very concentrated in the largest centers. The top 10 municipalities in terms of the dollar value of imports make up almost two-thirds of the total value of imports of labor services. The city of Cleveland makes up approximately 60 percent of the over $10 billion imported in these top 10 municipalities.

The apparent appearance of specialization outside of employment centers is consistent with the increasing returns and transportation costs agglomeration story of Krugman (1991) and Bogart (1998). However, this paper does not offer a direct test of this hypothesis. Even if trade in labor services was completely random, the patterns in the data might still exist. Still, the results are suggestive that the forces of agglomeration are an important component of the economy outside of known employment centers. This implies that there may be some pattern or order to development outside of em-

ployment centers and that the spatial characteristics of cities may not be best described by notions of urban sprawl, often described as an almost random, inefficient drive for more space. If transportation costs continue to be reduced in the future, this provides ideas for what cities may look like 20 years from now.

It is obvious that a large amount of trade in labor services is occurring in metropolitan Cleveland. One interesting economic implication is that because of commuter taxes levied by most municipalities there is a lot of implicit revenue sharing occurring. For example, if you live in Beachwood but work in Cleveland you pay Cleveland income tax on your earnings. One could view this as a grant from Beachwood to Cleveland, because they are sharing tax bases. Reinforcing this idea of revenue sharing is the fact that many municipalities at least partially reimburse their residents for income taxes paid to other municipalities. In this way, cities are transferring tax revenues amongst each other. With over $23.8 billion in labor services traded between cities, even a small tax results in significant revenue sharing. The construction of these current accounts allows for the identification of which suburbs implicitly share the most tax revenue and who they share it with. This revenue sharing may have interesting effects on local government fiscal conditions and policies. The transfer of revenue may also serve to encourage or discourage certain spatial aspects of the local economy.

Once the central city and the suburbs are thought of as small open economies that specialize and trade with each other, several common questions involving trade arise. For instance, do zoning policies and taxes act like tariffs in this context? If this is the case, will it be optimal to have free, frictionless trade or is there an optimal tariff level? Changes in zoning or tax policies will influence the pattern of trade illustrated in this paper. Zoning policies may alter the factor content of trade, making certain places inherently net exporters of labor services. In some cases, such as tax abatement policies, taxes may be too low in certain places and trade may be subsidized. In cases like these, we might have too much trade, which would place an enormous burden on the transportation system. Of course, it is also possible that places are not specialized enough and that more trade would be optimal, making an efficient transportation system all the more essential. It seems clear that jobs being “spread-out” or specialized in certain areas with a metropolitan area is not necessarily an economic harm. As in any traditional trade model, the benefits from trade may be substantial and large enough to compensate those who do, in fact, lose from trade.

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