

A Spatial Analysis of the Formal Childcare Sector in Kansas

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Abstract. The childcare sector has significant economic effects as research has clearly established. But what of the spatial dimensions of childcare? This study focuses on two issues: the spatial variation in the economic effects of the childcare sector in the state of Kansas and its economic spillovers. The paper uses data from Kansas state agencies on the state's formal childcare sector to calculate local effects and interregional spillovers. The result shows that the economic effects of the formal childcare sector vary significantly among regions of the state. The sector differs from region to region due to the variation in cost, mix of facilities, relative importance of the informal sector, and the size of economic multipliers. The study also finds significant spillover effects from rural to urban regions. From this result, we conclude that government support for the childcare sector in rural areas has large economic implications for the entire state.

1. Introduction

Numerous studies have shown that the childcare sector makes significant contributions to the macro-economy. The childcare sector provides short-term benefits in the form of direct and indirect employment and income; medium-term benefits in the form of increased participation in the labor force by parents and caretakers (especially by women); and long-term benefits in the form of children who are better prepared for school.

The childcare sector is often described as local infrastructure which provides families with the circumstances necessary to work. Compared to other sectors that also provide local infrastructure (such as hospitals, job-training programs, and some public utilities and services sectors), the childcare sector has one of the highest output multipliers (Warner and Liu, 2006). This is believed to be due to the unusual purchasing pattern of childcare, which is disproportionately based on wages and other local purchases. That is, childcare generally has fewer leakages and stronger backward local linkages than most other industries within the regional economy.

While national studies show the aggregate impact throughout the U.S. economy, regional studies can highlight regionally unique characteristics, such as

market structures, wage rates, mix of childcare services and other spatial variations. For example, by comparing multipliers for the childcare sector across fifty states, Liu and Warner (2009) found that several states such as Utah, Oregon and New Mexico with small economies showed relatively high childcare output multipliers. They interpreted this to mean that greater geographical isolation leads to smaller leakages, which protects local industries.

Our study hypothesizes that the economic importance of childcare differs significantly between urban and rural areas due to variations in childcare preferences among families over space and because of different degrees of availability and affordability of formal childcare in different regions. Furthermore, the sector may have different input requirements across space, which would lead to further differences in economic effects in each region. We conclude that such differences are important to the development of state policy since programs must be shaped to meet the differences in regional contexts.

Like most economic sectors, the childcare sector has interregional linkages. According to IMPLAN data (Minnesota Implan Group, 2002), childcare in the state of Kansas depends on non-state sources (domestic and

foreign trade) for 44 percent of non-labor inputs.¹ As one would expect, at the sub-state regional level the interregional linkages are even greater. For example, the Wichita Metropolitan Statistical Area (MSA) gets 53 percent of its non-labor inputs from outside the region. These external dependencies are unimportant if we are only interested in the economic impacts of the sector within the region. But, if we are interested in understanding the spatial effects of the sector, and the consequences of regional variations in the structure of the sector, then we should consider the interregional pattern of economic linkages and the interregional feedback effects of the sector (Isard et al., 1998).

The concept of interregional feedback is well known. Regional scientists have noted the result of using regional versus interregional models to estimate regional impacts for many years. However, to our knowledge no previous analysis of the childcare sector has systematically looked at regional differences, the levels of interregional linkages, or the importance of interregional feedbacks.

In this study, we measure the spatial variations in economic effects and the spatial spillovers of the formal childcare sector in Kansas in 2005. We analyze the economic effects of the sector at two spatial disaggregations—seven administrative regions² and the metropolitan statistical areas (MSAs) versus the non-MSA portion of the state. We estimate levels of childcare usage and the yearly expenditures on childcare for each of these regions. We use 2002 IMPLAN (Impact Analysis for Planning) data (adjusted for price changes to the year 2005) to estimate the regional and interregional economic effects. We find significant variation in the size, effects and level of spillovers of the formal childcare sector across space. These differences should be of interest to policy makers who must allocate resources among regions, shape programs, and convince tax payers that these programs are in the interest of all residents.

2. Previous studies of the childcare sector

2.1 Different levels of childcare usage

The childcare sector can be divided into two principal categories: parental care and non-parental care³.

¹ Note that this refers to the location where value is added. For example, the source location for a commodity produced out-of-state but purchased from a retail outlet within Kansas would be split according to the value added by the manufacturer (out-of-state) and the value added by the retailer (in-state).

² The seven regions are the administrative regions of the Kansas Association of Child Care Resource and Referral Agencies.

³ Classification of childcare varies from study to study. For example, Smith (2002) divides childcare into care provided by relatives and that provided by non-relatives. Relative care includes father, moth-

Non-parental care can be further divided into formal and informal childcare. The official distinction between formal and informal childcare differs from state to state. In this study, we adopt the most common definition. Formal childcare, in this study, is regulated by the government and state licensing systems. Informal care is either not subject to registration and regulation or ignores the requirement to register with the state (see Table 1 for a more complete definition of the types of childcare).

This study includes childcare centers, family childcare⁴, Head Start programs, preschools and school age programs. Thus, childcare providers which are exempted from the state’s regulation (informal childcare) and illegal childcare are not considered in this analysis.

Table 1. Types of childcare

Childcare	Sub category	Provider
Parental	n.a.	Father or mother
Non-Parental	Formal	Childcare center Family childcare Preschool Head Start School age program
	Informal	Grandparents Relative Friends/Neighbors Nanny, Babysitters

There are two primary explanations for variation in the magnitude of the economic effects of the childcare sector across regions. First, the size of expenditures on childcare (the demand) may vary. Second, the childcare market structures (the supply) may vary across regions. Structural issues include the relative availability of different types of childcare, the cost of each type, and local linkages of the sector with the local economy.

According to previous research, there are several significant factors that affect the demand for different types of childcare. These include the child’s age, the mother’s employment status (part-time vs. full-time), the mother’s ethnicity, the mother’s education, household income, and childcare costs (Leibowitz et al., 1988; Blau, 2001; Brown-Lyons et al., 2001; Ehrle et al.,

er, siblings, grandparents, and other relatives such as aunts and uncles. Non-relative care is further divided into organized care and in-home childcare. Organized care includes center-based childcare, preschool, and Head Start programs. In-home childcare includes child care provided by non-relatives and outside of the child’s home.

⁴ In Kansas, family childcare refers to childcare services that are based in a provider’s home.

2001; Kimmel and Powell, 2006; Kreader et al., 2005; Kisker and Ross, 1997). For example, Leibowitz et al. (1988) and Brown-Lyons et al. (2001) show that nationally, families with infants and toddlers prefer informal or in-home childcare arrangements over center-based childcare.⁵ Kimmel and Powell (2006), Kreader et al. (2005) and Kisker and Ross (1997) show that low income families are less likely to use paid childcare (formal childcare) than unpaid (informal care) childcare.

2.2 Spatial variations in impact

If we examine childcare at the state level, we see significant variations in usage patterns. In a twelve states comparison, Capizzano et al. (2000) found that 9 percent of families with infants and toddlers depend on center-based childcare in California, while in Minnesota and Michigan the level was almost 30 percent (29 and 28 percent, respectively). In Minnesota, the use of center-based childcare for infants and toddlers is more than twice as high as relative childcare at 14 percent. Furthermore, most states show that higher income families are more likely to use center-based childcare, but in Massachusetts 30 percent of children from low income families are in center-based childcare compared to an average of 24 percent. The authors attribute the interstate variation to different childcare preferences, parental work patterns and childcare policy. Davis and Connelly (2005) added such factors as different zoning restrictions, neighborhoods' average income level and work location relative to residence.

Understanding the nature of regional variations in the choice of childcare arrangements among low-income families is particularly important when analyzing state-level policy, since many states have designed programs to allow parents and caretakers to meet welfare to work requirements (Knox et al., 2003; Meyers et al., 2002; Collins et al., 2000).

In addition, there are significant spatial differences in childcare usage between rural and urban families (Gordon and Chase-Lansdale, 2001; Brown-Lyons et al., 2001). Rural families with young children appear to depend more on home-based childcare (for example, family childcare) or informal childcare (Smith, 2006; Atkinson, 1994) than urban families.

Gordon and Chase-Lansdale (2001), Bailey and Warford (1995) and Maher et al. (2008) explained that the lack of center-based childcare in rural areas is closely connected to the greater geographical dispersion of families. Large scale center-based care facilities in rural areas must draw upon a much larger geo-

graphic area to achieve economies of scale. Thus, facilities must be located farther apart in rural areas. The subsequently high travel costs for rural families (measured in time and actual travel expenses) to transport children to center-based childcare may reduce the demand for center-based childcare in rural areas. Bailey and Warford (1995) point out that government funding for center-based childcare in rural areas is often inadequate if state funding is distributed on the basis of population since this fails to recognize the additional costs in low population density areas.

Maher et al. (2008) pointed out that rural childcare providers more frequently choose an unregulated option as their business is too small to justify the costs involved in attaining a license.

According to Gordon and Chase-Lansdale (2001), home-based childcare (e.g., family childcare) is more common in rural areas than center-based childcare. The authors explained that family childcare requires a relatively low initial investment, and low operating costs allow providers to enter and exit the childcare field easily. This is especially true when people run small and unregulated family childcare services. A greater number of small family childcare providers can be dispersed more widely across larger geographical spaces than center-based childcare in rural areas, perhaps matching population distribution more closely.

Thus, both differences in the demand for and supply of childcare services are likely to result in spatial differences in the role that the childcare sector plays in the economy. Previous research suggests that these differences may be especially obvious when comparing rural and urban regions.

In this study, we are particularly interested in the economic linkages between rural and urban areas. If metro-non-metro linkages are unbalanced as expected, metro economies may benefit significantly from growth in the childcare sector in non-metro areas. This hypothesis has been tested by Hughes and Vaneska (1996). Their argument is that core (metropolitan) sectors have weak backward linkages to periphery (non-metropolitan) regions, whereas periphery sectors have relatively strong linkages back to the metro areas. They examined the rural and urban linkages to the food processing sector in Monroe, Louisiana. The result showed that the spillover from the rural economy to the urban economy was much bigger than the spillover from urban to rural. One of the goals of this paper is to explore this phenomenon in the childcare sector.

⁵ The center-based childcare category includes childcare centers, Head Start, Preschool, Prekindergarten and before- or after-school programs.

3. Conceptual model

3.1 Interregional linkages and feedback effects

The input-output (IO) framework is a useful conceptual basis with which to measure the economic impact of the formal childcare sector on a regional economy. The fundamental macroeconomic identity requires that total supply (production) must equal demand (consumption for all purposes). Total demand is comprised of final demand and intermediate demand (outputs from the economy that are used as inputs by other regional sectors). In its simplest linear form, this identity is as follows:

$$X = AX + Y \quad (1)$$

where:

A = sector by sector technical coefficients matrix,

X = vector of outputs by sector, and

Y = vector of final demand by sector.

Solving for output, X , gives the reduced form solution to the identity:

$$X = (I - A)^{-1}Y \quad (2)$$

where I = sector by sector identity matrix.

The inverted matrix, $(I - A)^{-1}$, is referred to as the multiplier matrix. Multipliers indicate the level of final outputs of goods and services needed throughout the regional economy to satisfy one unit (usually in currency units) of additional final demand for the goods in question (in this case, childcare).

If the vectors and matrices are further disaggregated by region, the reduced form solution produces a set of interregional multipliers. For example, consider the case of two regions, R and S.

$$\begin{aligned} A &= \begin{bmatrix} A^{RR} & A^{RS} \\ A^{SR} & A^{SS} \end{bmatrix} \\ Y &= \begin{bmatrix} Y^R \\ Y^S \end{bmatrix} \\ X &= \begin{bmatrix} X^R \\ X^S \end{bmatrix} \end{aligned} \quad (3)$$

The inverted matrix, $(I - A)^{-1}$, is now the interregional multiplier matrix and includes the impacts of changes in region R on the sectors of region S and vice versa. Using this expanded model, we can define both spillover effects and feedback effects (see Miller and Blair, 1985). Spillover effects are final demands for

products in region S that stem from changes in final demand in region R:

$$\text{Spillover effects from region R to S} = A^{SR} X^R \quad (4)$$

The feedback effect for region R can then be calculated as follows:

$$\text{Feedback on region R} = A^{RS} (I - A^{SS})^{-1} A^{SR} X^R \quad (5)$$

Full interregional models are quite rare and not available to most researchers. Feedback effects have been calculated for those cases where interregional models were available. Most empirical studies find the feedback effects to be very small. In nine such studies reported in Miller and Blair (1985), only two studies found feedback effects larger than 3 percent, and most were less than 2 percent. Furthermore, when comparing multipliers between different regional sectors, these errors will be roughly proportional. Spillover effects, however, are of a much larger magnitude.

In the absence of a full interregional model, it is possible to estimate the aggregate spillover effects between regions. In this study, we calculate and compare spillover effects from each region to the rest of the state. Furthermore, by conducting a second level of analysis—metro versus non-metro—we are able to compare the relative spillover effects from metro and non-metro sectors.

3.2 Using multiple regional models to estimate interregional linkages

National level economic effects analyses typically use aggregated input-output or econometric models to calculate linkages among sectors. These models are based on average technologies, average consumption functions and average intersectoral relationships. Ideally, regional economic analysis is based on regional data which reflect the regionally specific industrial structures, consumption patterns, and other geographic characteristics. In reality, regional analyses often use national data scaled down to the regional level. This adds some error to the estimates, but is inevitable given the paucity of regional data.

In regional economic analysis, the regional multiplier is one of the most important determinants of the size of the economic impact of a sector. The size of regional multipliers depends on the degree of linkages among sectors, the size of the regional economy (in terms of GDP or employment), the diversity of the region's sectoral structure, and other geographic differences such as transportation costs (Miller and Blair, 1985; Shaffer, 1989; Liu and Warner, 2009).

As we demonstrate above, an input-output model for a single region (a regional input-output model), measures only the economic impact within the region. Regional multipliers necessarily underestimate the size of true multipliers if the interregional linkages are reciprocal. For most researchers, interregional input-output models are not readily available. With care, however, a great deal of information on interregional flows can be achieved with multiple regional models. In this paper, we describe an approximate but simple method for analyzing regional differences and interre-

gional flows. This method is available to most analysts who use IMPLAN or a similar regional IO model.

Table 2 shows the conceptual interregional leakages of the childcare sector in metro and non-metro areas of Kansas. For example, an increase of final demand for childcare in the Kansas City MSA has an impact on the Kansas City economy as well as on the Lawrence, Topeka, and Wichita MSAs and on the non-metro areas of the state. The spillover impact from the Kansas City MSA is estimated by subtracting the impact on the Kansas City MSA from the overall economic impact on the state of Kansas.

Table 2. Spillover impact between MSA vs. Non MSA

		Destination region					Spillover
		Kansas City	Lawrence	Topeka	Wichita	Non-MSA	
Origin Region	Kansas City	I_{11}	I_{12}	I_{13}	I_{14}	I_{15}	$\sum_{j=1}^5 I_{1j} - I_{11}$
	Lawrence	I_{21}	I_{22}	I_{23}	I_{24}	I_{25}	$\sum_{j=1}^5 I_{2j} - I_{22}$
	Topeka	I_{31}	I_{32}	I_{33}	I_{34}	I_{35}	$\sum_{j=1}^5 I_{3j} - I_{33}$
	Wichita	I_{41}	I_{42}	I_{43}	I_{44}	I_{45}	$\sum_{j=1}^5 I_{4j} - I_{44}$
	Non-MSA	I_{51}	I_{52}	I_{53}	I_{54}	I_{55}	$\sum_{j=1}^5 I_{5j} - I_{55}$

Note: I_{ij} : economic effects of region i on region j ($i=1,2,\dots,5$ & $j=1,2,\dots,5$). If $i=j$ then I_{ij} is the ordinary regional impact.

Regional final demand for formal childcare, Y_i , is defined as total childcare spending on formal childcare within the region. We estimate total childcare expenditures by first estimating the total number of children enrolled in formal childcare and multiplying this by the hourly cost and total hours of formal childcare provided per year.

The interregional spillover impacts are estimated using the multipliers for the state of Kansas and the multipliers for each region. We subtract the economic impact of each region's final demand in that region from the economic impact of that same final demand on the state of Kansas.⁶

$$S_i = (M_K - M_i)Y_i \tag{6}$$

where:

S_i = economic spillover impact from region i to the rest of the state of Kansas due to final demand for childcare in region i ,

M_K = Childcare multiplier for the state of Kansas,

M_i = Childcare multiplier for region i ,

Y_i = Childcare expenditure in region i ,

i = region number ($i=1,2,\dots,n$), and

$n = 7$ in seven regional analysis and $n = 5$ in MSA vs. non-MSA analysis.

This study uses the IMPLAN input-output system to estimate output, total value added, labor income and employment effects and multipliers for the childcare sector in Kansas and its regions. IMPLAN is the most commonly used tool for these purposes. While it is a convenient tool for such purposes, the user should understand its limitations, which include its simplistic

⁶ Note that this assumes that the regional expenditure patterns (the technology) for childcare providers are equal to the state-wide expenditure patterns. But this is equivalent to the implicit assumption in IMPLAN that the expenditure patterns across regions differ only in terms of their RPC. Note that this is a simplification that is true for every study of this kind that uses IMPLAN.

spatial dimension. In the following section we describe a method for approximating the impacts of the childcare sector, recognizing that these estimates underestimate spatial diversity and specificity.

4. Estimating the economic effects of the formal childcare sector in Kansas

4.1 Data

Several types of data are used to estimate the impact of the Kansas childcare sector. First, Kansas population data for 2005 (Institute for Policy and Social Research, IPSR) are used to determine the demographics of the population of children under the age of 13 and percentage of children in each childcare arrangement. Children living with both parents in households where both parents are working and those living with a single parent who is working are summed to get the minimum⁷ number of children who require non-parental childcare. The percentage of Kansas working parents from the 2000 Census Bureau Decennial Data Summary File 3 is used as an approximation for the number of 2005 working parents.

Data from a survey of 2,173 childcare facilities (27 percent of the 8,097 registered facilities in the state) including enrollment and hourly costs in 2005 were provided by the Kansas Association of Child Care Resource and Referral Agencies (KACCRRRA).

There are several counties with missing enrollment data (i.e., counties for which no facilities were surveyed). The authors estimated childcare enrollment for the counties with no enrollment data by extrapolating from childcare enrollment patterns in peer county groups. A "peer county" is a county with similar population density (population per square mile) defined by the Kansas Department of Health and Environment (KDHE) in 2006. The authors assumed that counties in the same peer group would have similar enrollment patterns. Enrollment for counties with missing data was estimated applying enrollment ratios from peer counties to the populations in each of the missing data counties.

Hourly costs for certain types of childcare arrangements were also missing from the KACCRRRA survey data for several counties. In this study, a

weighted average of the hourly costs for each childcare arrangement within each peer group was applied to estimate the cost for non-reporting counties.

4.2 Regional variations

Sub regional economic analyses were based firstly on the seven regions defined by the Kansas Department of Commerce (Kansas Department of Commerce, 2009) and secondly on current MSA versus Non-MSA counties (See figure 1 & 2). In Kansas, there are four MSAs.

There were 478,725 children under the age of 13 in Kansas in 2005. Based on the percentage of working parents from the 2000 Census data, we estimate that 69 percent (328,176) of these children are living with working parents and thus need some type of non-parental childcare. Of these children, we estimate that 42 percent of children (139,432) are enrolled in formal childcare either part-time or full-time.

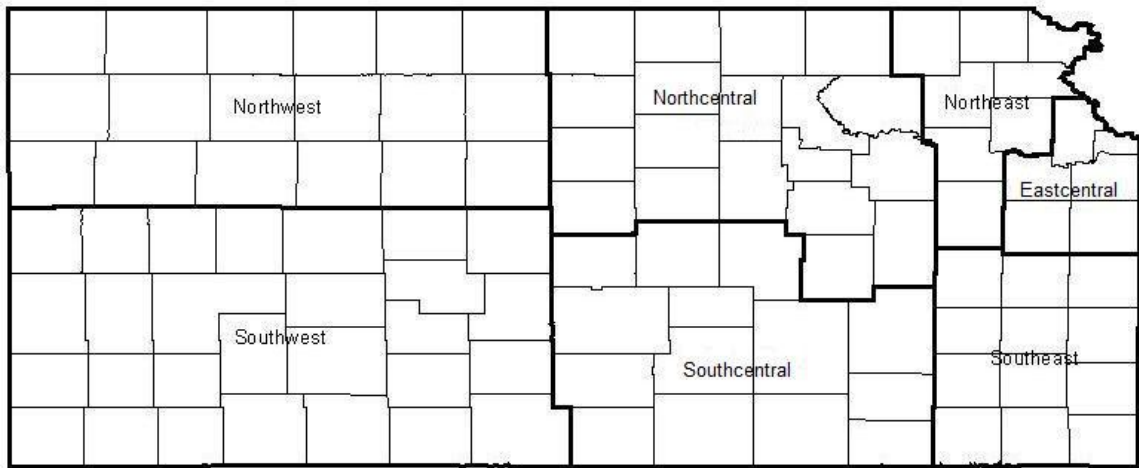
Figure 3 shows the percentage of full-time equivalent (FTE)⁸ enrollment in formal childcare. In 2005, 32 percent of children (105,316) with working parent used formal childcare. Among children using formal childcare, family childcare was dominant (38 percent). Thirty-one percent are in childcare center arrangements; 9 percent are in preschool; 5 percent are in Head Start programs; and 17 percent are in school-age programs.

Table 3 below shows the spatial variation in the use of formal childcare and divides formal childcare into three categories: childcare center, family childcare, and other. The "other" formal childcare category includes Head Start, Preschool and school age programs.

As indicated above, families in rural areas generally rely less on formal childcare. Our analysis, however, of the seven sub regions of Kansas shows significant regional variation. For example, two non-metro regions of the state, the Southwest and the Northwest, have highly different formal childcare usage patterns. The Southwest conforms to the general notion that rural areas rely less on formal childcare, as it has the lowest percentage of children (21 percent) using formal childcare among the regions of the state. In contrast, the Northwest has a very high percentage of children in formal childcare (33 percent). This is higher, in fact, than state average (32 percent).

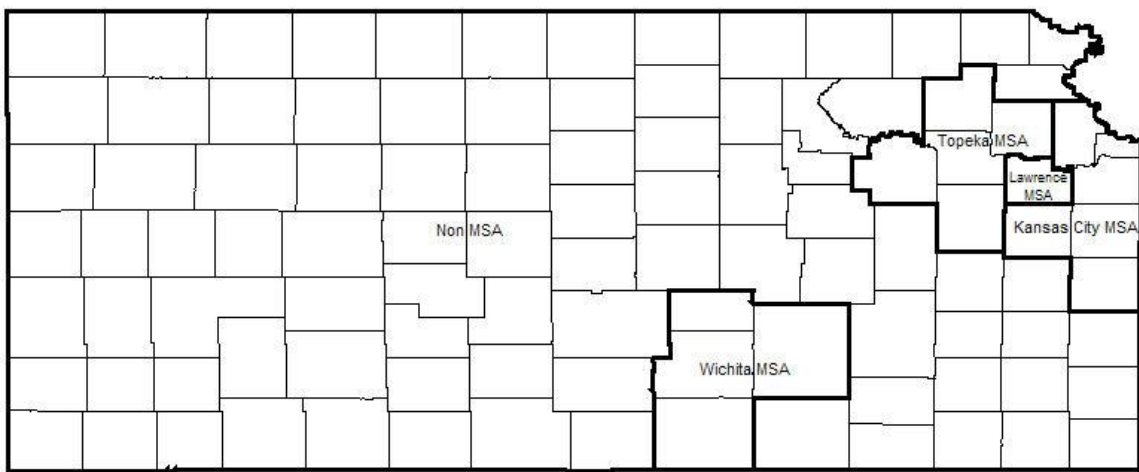
⁷ This is a minimum because some children with non-working parents will also require non-parental care. Non-working parents may need childcare for any number of reasons such as time spent in volunteer activities or job searches, etc. According to Overturf Johnson (2005), about 7 percent of US children under age 6 with non-employed mothers used formal childcare in 2002. These data, however, are not available for the state of Kansas. In this study, we ignore this component of the childcare demand in order to generate a conservative estimate of impacts.

⁸ Here, a FTE childcare enrollment is defined as a child receiving care for 9 hours per day. Part-time enrollments were assumed to equal 0.5 FTEs.



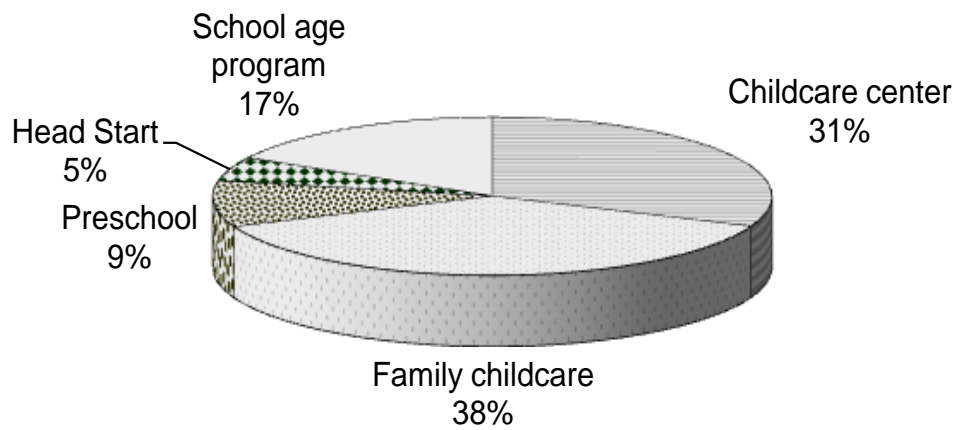
Source: Institute for Policy and Social Research

Figure 1. Kansas Department of Commerce regional definitions



Source: Institute for Policy and Social Research

Figure 2. Kansas MSA vs. non-MSA



Source: Kansas Association of Child Care Resource and Referral Agencies (KACCRRRA)

Figure 3. Formal childcare arrangements

Table 3. Share of formal childcare arrangement

Regions	Children in childcare setting (Estimated)	Informal childcare	Formal childcare	Types of Formal Childcare		
				Childcare center	Family childcare	Other formal childcare
<i>Seven regions</i>						
Eastcentral	105,428	65%	35%	35%	26%	40%
Southeast	23,273	72%	28%	32%	54%	14%
Southwest	27,863	79%	21%	19%	61%	21%
Southcentral	93,988	65%	35%	33%	33%	34%
Northeast	33,400	71%	29%	32%	41%	26%
Northwest	10,179	67%	33%	19%	60%	21%
Northcentral	34,046	71%	29%	22%	60%	18%
<i>MSA vs. Non-MSA</i>						
Kansas city	96,827	65%	35%	34%	25%	42%
Lawrence	9,600	61%	39%	44%	37%	19%
Topeka	28,479	70%	30%	36%	38%	26%
Wichita	74,275	63%	37%	34%	29%	37%
Non MSA	118,996	73%	27%	23%	58%	19%
Kansas	328,176	68%	32%	31%	37%	31%

Notes: The sum of childcare center, family childcare and the other formal childcare may not equal 100 percent due to rounding.
Source: Kansas Association of Child Care Resource and Referral Agencies (KACCRRRA)

In the five metropolitan areas, 30 percent (Topeka MSA) to 39 percent (Lawrence MSA) of children with working parents are in formal childcare arrangements. In contrast, only 27 percent of children (32,107) are in formal childcare arrangements in rural areas. This indicates that, in Kansas, rural children with working parents are less likely to depend on formal childcare than urban children.

There is also spatial variation in the use of different types of formal childcare. Overall, children in Kansas depend more on family childcare (37 percent) than childcare centers (31 percent). By contrast, most urban areas (with the exception of the Topeka metro area) depend more on childcare centers than family childcare. In the Kansas City metro area, for instance, 34 percent of children in formal care are in childcare centers, and only 25 percent are in family childcare. This pattern is reversed sharply in rural areas, where 58 percent of children are in family care—that is well over half of all rural children in formal care. Twenty-three percent of rural children using formal childcare are in childcare center.

There is also variation evident at the regional level. The Eastcentral region (including most Kansas City and Lawrence MSA counties) has higher childcare center use (35 percent of children in formal care) than family childcare (26 percent). In the Southcentral region (including Wichita metro area), formal childcare is split equally among the three types of care, with 33 percent of children using childcare center, 33 percent

in family childcare, and 35 percent using other formal arrangements.

Table 4 illustrates the availability of formal childcare and capacity across regions and for the MSAs and the non-MSA area of the state. The formal childcare sector in Kansas has the capacity to provide care for 40 percent of children with working parents. That leaves 60 percent of children with working parents in informal childcare arrangements. Together, childcare center and family childcare facilities account for most (79 percent) of the formal childcare capacity. Family childcare providers have the largest capacity statewide, providing spaces for 47 percent of children in need of formal childcare. Childcare centers have the capacity to provide care to 32 percent of children with working parents.

Six of the seven sub regions have much higher capacity in family childcare (ranging from 50 to 79 percent) than childcare center. Only the Eastcentral region (which includes most Kansas City and Lawrence metro counties) has more capacity in childcare centers than family childcare.

The variation in formal childcare capacity for rural areas is noteworthy. The rural Northwest region, for example, has the second largest formal childcare capacity proportionately, at 41 percent of the total number of children in the region with working parents. This is higher than Southcentral, which includes the urban area of Wichita, and Northeast, which includes urban Topeka. The Southwest region, on the other

hand, has much lower formal care capacity proportionately than the Northwest and is much more aligned with the expected trend for rural areas. Formal child-

care accounts for only 31 percent of the Southwest's total childcare capacity.

Table 4. Share of formal childcare availability

Regions	Estimated number of children in childcare settings	Total capacity for all types of formal care ¹	Capacity by type of formal care ²		
			Childcare center	Family childcare	Other formal childcare
<i>Seven regions</i>					
Eastcentral	105,428	44%	46%	32%	22%
Southeast	23,273	35%	21%	70%	9%
Southwest	27,863	31%	18%	71%	12%
Southcentral	93,988	39%	27%	44%	28%
Northeast	33,400	39%	29%	50%	22%
Northwest	10,179	41%	12%	79%	10%
Northcentral	34,046	39%	18%	67%	15%
<i>MSA vs. Non-MSA</i>					
Kansas city	96,827	44%	46%	31%	23%
Lawrence	9,600	47%	45%	45%	10%
Topeka	28,479	40%	29%	49%	22%
Wichita	74,275	41%	29%	39%	32%
Non MSA	118,996	35%	19%	69%	13%
Kansas	328,176	40%	32%	47%	21%

Notes: The sum of center-based childcare, family childcare and the other formal childcare may not equal 100 percent due to rounding.

¹In the Eastcentral region, "Total capacity for all types of formal care" refers to 44 percent of the 105,428 children in all childcare settings. Therefore, the Eastcentral region has the capacity to provide care for approximately 46,388 children in formal childcare settings.

²"Capacity by type of formal care" divides "Total capacity for all types of formal care" into the three major formal settings. In the Eastcentral region, for example, 46 percent of the 46,388 slots for children in formal childcare are available through center-based facilities.

Thirty-two percent are available in family care, and 22 percent are available through other formal settings.

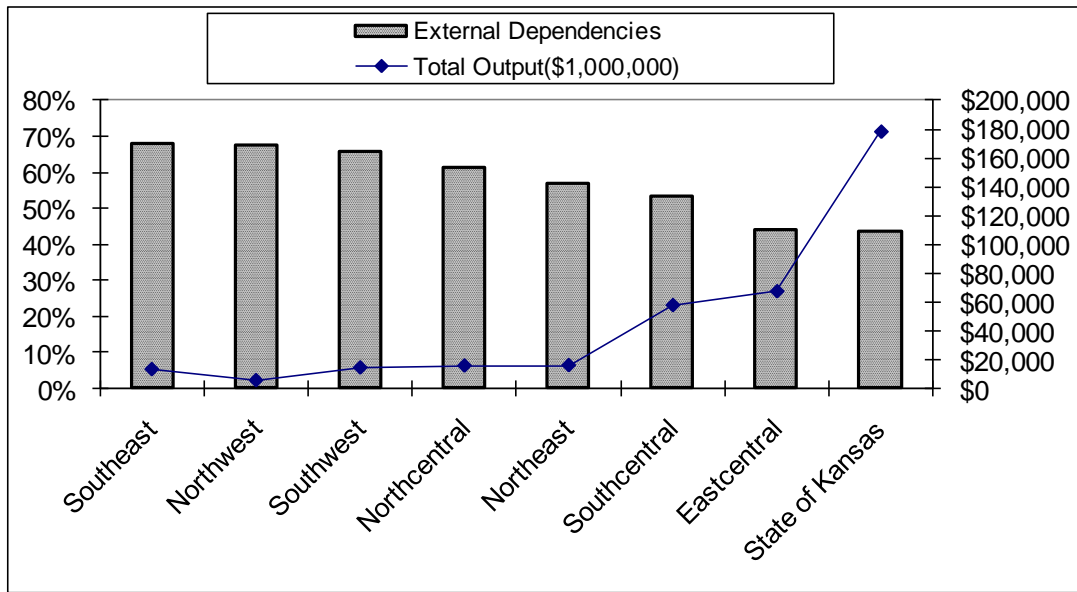
Source: Kansas Association of Child Care Resource and Referral Agencies (KACCRRRA)

Most MSAs (with the exception of Kansas City metro area) have more capacity in family childcare than in childcare center. In rural areas, the difference is substantial. Family childcare has almost 3.5 times the capacity of childcare centers in rural Kansas. Family childcare providers have the capacity to provide care to 69 percent of total childcare needs in rural areas. Childcare centers have the capacity to provide care to only 19 percent. This is consistent with the common perception that in rural areas family childcare is more prevalent than center-based care.

From the data in Tables 3 and 4, we conclude that there are significant differences in the childcare market structure between the MSAs and the non-MSA areas and among the seven sub-regions of Kansas. These differences will affect final demand, which determines the regional economic impacts in each region.

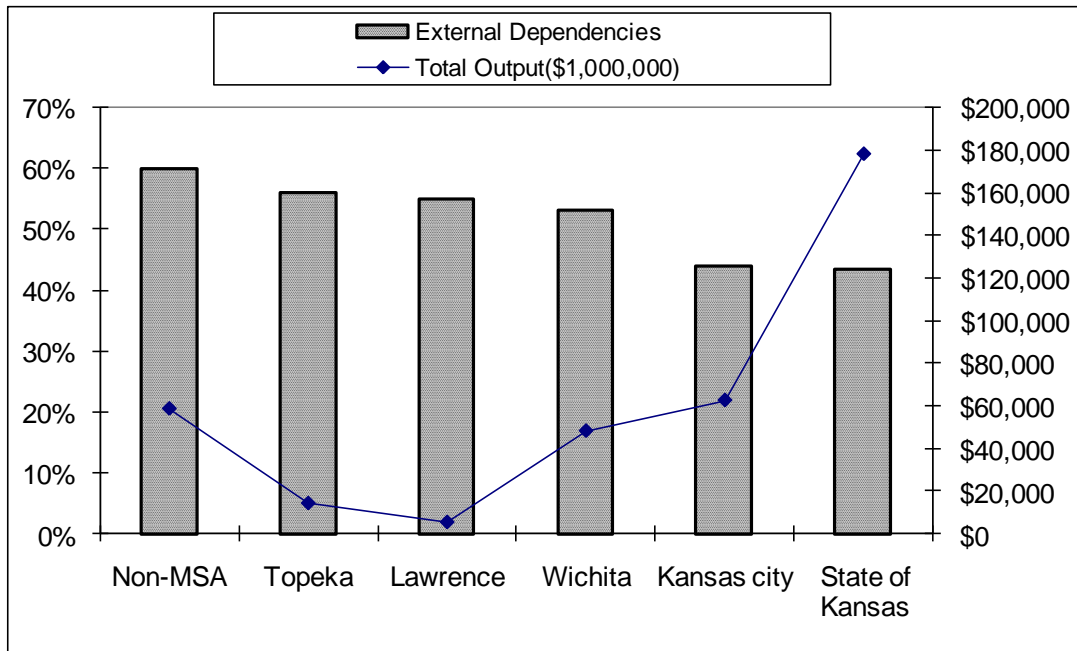
Figure 4 shows the external dependencies of the childcare sectors in each of the seven Kansas regions and the state. We measured the external dependencies

as the percentage of all goods and services (excluding wages, profits and proprietor earnings) purchased by the childcare sector from sources located outside the region (including domestic and foreign sources). We used the direct input requirements estimates from the 2002 IMPLAN database as the source for domestic and foreign imports. The denominator in this calculation is total expenses for non-labor input. The data in Figure 4 support our hypothesis that smaller regions will have higher external dependencies than larger regions. We plot the total regional output in 2002 against the external dependencies in each region to demonstrate this general relationship between economic size and external dependencies. The smallest regions (Southeast and Northwest) have the smallest regional outputs (less than \$20 billion) and the largest interregional linkages (over 60 percent) while the largest regional economy (Eastcentral with \$100 billion in output) has just over 40 percent in interregional linkages.



Source: 2002 IMPLAN Data

Figure 4. External dependency of the childcare sector in Kansas regions



Source: 2002 IMPLAN Data

Figure 5. External dependency of the childcare sector in Kansas

The data in Figure 5 demonstrates that the non-metro area of the state has larger external dependencies than any of the metro areas. This supports the hypothesis that, in addition to the size effect demonstrated in Figure 4, urban areas generate larger internal

linkages. This is because urban areas are larger and have more diverse economies than rural areas. It also demonstrates the asymmetrical relationship between rural and urban economies vis-à-vis childcare. The childcare sector in rural areas has larger spillovers to

urban areas than the urban childcare sector has to rural areas.

4.3 Regional multipliers

Tables 5 and 6 show total effects and multipliers⁹ for the childcare sector in each region of Kansas. These are so-called Type II multipliers and total effects because they are based on direct, indirect and induced impacts of final demand in the childcare sector. The childcare sector multipliers from the IMPLAN-based models are used in these tables.

The relative sizes of these multipliers support our earlier hypothesis. Larger economies generally have larger multipliers than smaller economies, while metropolitan areas generally have larger multipliers than non-metropolitan areas of similar size. The total output effect and output multipliers vary from 1.24 to 1.66 in the seven regions and from 1.34 to 1.65 in the MSAs and non-MSA areas. The Eastcentral region, which includes the Kansas City metro area, has the highest output effects and multipliers among the seven regions. The total effects and multipliers for the non-metro area of the state are lower than for any of the metro areas.

The overall state output multiplier indicates that each dollar spent in the childcare sector generates an additional 76 cents in output within the state.

The total value added effect is an estimate of the total Gross Domestic Product (GDP) in the local economy associated with each dollar of final demand in the childcare sector. In contrast, the total value added multiplier is the total GDP in the economy associated with each dollar of total value added in the childcare sector. The range of total effects is from 0.63 to 0.93 in the seven regions and from 0.71 to 0.93 in metro and non-metro areas. The range of Type II total value added multipliers is from 1.23 to 1.78 in the seven regions and from 1.34 to 1.76 in metro and non-metro areas. The Eastcentral region has the highest multiplier of the seven regions, and Kansas City has the highest multipliers among the metro and non-metro areas. In Kansas, each dollar of final demand in the childcare sector creates 97 cents of GDP in Kansas. Each direct dollar of value added (GDP) from the childcare sector generates an additional 85 cents in GDP in the Kansas economy.

⁹ Total effects and multipliers are different ways of expressing the same information. Both are information generated from the reduced form multiplier matrix in equation 2. Total effects always have direct output as their denominator. Multipliers always have the same units in their numerators and denominators (employment for example). Therefore, total employment effects are defined as direct plus indirect plus induced employment, divided by direct output whereas employment multipliers are defined as direct plus indirect plus induced employment divided by direct employment. See Miller and Blair for more detailed explanation of these terms.

The total employment effect shows the total employment generated by each \$1 million of final demand in the childcare sector¹⁰. In Kansas, each \$1 million of final demand in the childcare sector generates about 45 jobs in the state. The employment multiplier indicates how much employment in the Kansas economy can be attributed to each job in childcare. The state Type II employment multiplier indicates that each direct job in the childcare sector generates 0.22 additional jobs somewhere in Kansas. The sub-state employment effect is largest in the Northcentral region and in the Lawrence MSA.

The total labor income effect is the total increase in labor income throughout the Kansas economy resulting from each dollar of final demand for childcare. The total labor income multiplier is the total labor income that results from each dollar of direct labor income in childcare sector.

The total labor income effect ranges from 0.41 to 0.57 in the seven regions and from 0.48 to 0.57 in the metro and non-metro areas. The type II income multipliers range from 1.2 in the Southwest region to 1.61 in the Eastcentral region and from 1.29 in the non-metro area of the state to 1.60 in the Kansas City metro area. Statewide, each dollar of income in the childcare sector creates an additional 59 cents in income.

4.4 Regional variations in economic impact

Table 7 shows the total economic impact of the childcare sector on the state of Kansas and each region. Comparing total economic effects and multipliers is a useful exercise when we want to better understand variations within the sector and spatial variations in the sector's linkages with the larger economy. In 2005, families in the state of Kansas spent \$635 million for formal childcare, which created \$1.119 billion in sectoral output and 27,198 jobs in the state. Additionally, \$375 million in labor income and \$615 million in GDP were generated by the sector. Of the 27,198 jobs, 22,218 jobs (82 percent) were generated within the childcare sector itself.

¹⁰ It is traditional to express total employment effects per \$1 million of final demand rather than per dollar so that the units are more convenient.

Table 5. Type II total effect ratios

Regions	Output	Total Value Added	Labor Income	Employment
<i>Seven regions</i>				
Eastcentral	1.66	0.93	0.57	44.31
Southeast	1.29	0.64	0.42	46.66
Southwest	1.24	0.71	0.45	32.28
Southcentral	1.50	0.80	0.50	44.66
Northeast	1.45	0.79	0.50	42.51
Northwest	1.24	0.63	0.41	43.89
Northcentral	1.36	0.68	0.44	48.24
<i>MSA vs. Non-MSA</i>				
Kansas city	1.65	0.93	0.57	42.80
Lawrence	1.49	0.78	0.48	49.85
Topeka	1.46	0.80	0.50	42.47
Wichita	1.53	0.82	0.50	44.66
Non MSA	1.34	0.71	0.45	40.38
Kansas	1.76	0.97	0.59	45.48

Notes: Childcare sector total effects calculated using 2002 IMPLAN data for IMPLAN Sector 469.

Type II Total Effect= (direct + indirect + induced effects).

Total employment is estimated per million dollars of output for ease of exposition.

Table 6. Type II multipliers

Regions	Output	Total Value Added	Labor income	Employment
<i>Seven regions</i>				
Eastcentral	1.66	1.78	1.61	1.18
Southeast	1.29	1.32	1.27	1.09
Southwest	1.24	1.23	1.20	1.10
Southcentral	1.50	1.56	1.47	1.15
Northeast	1.45	1.51	1.40	1.15
Northwest	1.24	1.27	1.23	1.08
Northcentral	1.36	1.42	1.35	1.11
<i>MSA vs. Non-MSA</i>				
Kansas city	1.65	1.76	1.60	1.18
Lawrence	1.49	1.61	1.44	1.16
Topeka	1.46	1.53	1.41	1.15
Wichita	1.53	1.60	1.50	1.16
Non MSA	1.34	1.34	1.29	1.11
Kansas	1.76	1.85	1.68	1.22

Notes: Childcare sector multipliers calculated using 2002 IMPLAN data for IMPLAN Sector 469.

Type II multiplier= (Direct + Indirect + Induced effects)/ direct effects.

Table 7. Economic effects of the childcare sector in Kansas

Regions	Total Gross Receipts	Output	Total Value Added	Labor Income	Employment
<i>Seven Regions</i>					
Eastcentral	\$204.2	\$340.3	\$189.6	\$116.6	8,529
Southeast	\$31.2	\$40.4	\$20.0	\$13.0	1,375
Southwest	\$24.5	\$30.4	\$17.5	\$11.0	747
Southcentral	\$150.2	\$226.0	\$120.5	\$74.8	6,313
Northeast	\$52.6	\$76.2	\$41.6	\$26.3	2,107
Northwest	\$14.6	\$18.2	\$9.2	\$5.9	604
Northcentral	\$53.6	\$73.0	\$36.6	\$23.4	2,438
<i>MSA vs. Non-MSA</i>					
Kansas city	\$184.6	\$306.2	\$172.4	\$105.9	7,447
Lawrence	\$20.5	\$30.5	\$15.9	\$9.8	965
Topeka	\$46.4	\$68.0	\$37.3	\$23.5	1,861
Wichita	\$136.5	\$209.3	\$112.5	\$69.3	5,747
Non-MSA	\$166.4	\$222.7	\$118.6	\$75.5	6,331
Kansas	\$634.6	\$1,118.7	\$615.4	\$375.9	27,198

Note: Monetary values are in millions of 2005 dollars

4.5 Spillover impacts

The interregional spillover impacts in the seven regions and metro and non-metro areas were estimated and are presented in Tables 8, 9, 10 and 11. In each table, columns 4 and 5 show the actual value of spillover impacts and their rank. Columns 6 and 7 represent the percentage of spillover in total impact on Kansas in each region and its rank.

The overall share of spillovers (including output, total value added, labor income and employment) range from 3 percent (employment spillover in the Eastcentral) to 34 percent (total value added spillover in the Southwest). For example, output spillover ranges from 6 percent (in the Eastcentral) to 30 percent

(in the Southwest) including the seven sub regions and metro and non-metro areas. In all cases of output, total value added, labor income and employment spillover impact, the Southwest region (the most rural) has the highest spillover as a percent of total impacts while the Eastcentral region (the most urban) has the lowest spillovers. When comparing the metro areas with the non-metro areas of the state, the non-metro areas always have the highest spillover, while the Kansas City metro has the lowest spillover. With the exception of employment, the difference between the largest and smallest levels of spillovers is very large, usually a factor of 4 to 7.

Table 8. Output and spillover impacts

Regions	Total impact in the region*	Total impact on Kansas	Spillover		Spillover	
			Value	Rank	Share	Rank
<i>Seven regions</i>						
Eastcentral	\$340.3	\$360.0	\$20	3	6%	7
Southeast	\$40.4	\$55.1	\$15	5	27%	3
Southwest	\$30.4	\$43.3	\$13	6	30%	1
Southcentral	\$226.0	\$264.4	\$38	1	15%	6
Northeast	\$76.2	\$92.7	\$17	4	18%	5
Northwest	\$18.2	\$25.7	\$8	7	29%	2
Northcentral	\$73.0	\$94.5	\$21	2	23%	4
<i>MSA vs. Non-MSA</i>						
Kansas City	\$306.2	\$325.4	\$19	3	6%	5
Lawrence	\$30.5	\$36.2	\$6	5	16%	3
Topeka	\$68.0	\$81.9	\$13	4	17%	2
Wichita	\$209.3	\$240.7	\$31	2	13%	4
Non-MSA	\$222.7	\$293.3	\$71	1	24%	1

Notes: Spillover figures have been rounded. Monetary values are in millions of 2005 dollars

Table 9. Total Value Added and spillover impacts

Regions	Total impact in the region	Total impact on Kansas	Spillover		Spillover	
			Value*	Rank	Share	Rank
<i>Seven regions</i>						
Eastcentral	\$189.6	\$197.1	\$8	5	4%	7
Southeast	\$20.0	\$27.9	\$8	5	29%	3
Southwest	\$17.5	\$26.3	\$9	3	34%	1
Southcentral	\$120.5	\$142.4	\$22	1	15%	6
Northeast	\$41.6	\$51.0	\$9	3	18%	5
Northwest	\$9.2	\$13.4	\$4	7	31%	2
Northcentral	\$36.6	\$47.6	\$11	2	23%	4
<i>MSA vs. Non-MSA</i>						
Kansas City	\$172.4	\$181.2	\$8	3	5%	5
Lawrence	\$15.9	\$18.3	\$2	5	13%	4
Topeka	\$37.3	\$45.1	\$7	4	17%	2
Wichita	\$112.5	\$130.1	\$17	2	14%	3
Non-MSA	\$118.6	\$163.4	\$44	1	27%	1

Notes: Spillover figures have been rounded. Monetary values are in millions of 2005 dollars

Table 10. Labor income and spillover impacts

Regions	Total impact in the region	Total impact on Kansas	Spillover		Spillover	
			Value*	Rank	Share	Rank
<i>Seven regions</i>						
Eastcentral	\$116.6	\$121.9	\$5	3	4%	7
Southeast	\$13.0	\$17.4	\$4	6	25%	3
Southwest	\$11.0	\$15.5	\$5	3	29%	1
Southcentral	\$74.8	\$85.8	\$11	1	13%	6
Northeast	\$26.3	\$31.7	\$5	3	17%	5
Northwest	\$5.9	\$8.2	\$2	7	27%	2
Northcentral	\$23.4	\$29.3	\$6	2	20%	4
<i>MSA vs. Non-MSA</i>						
Kansas City	\$105.9	\$111.6	\$6	3	5%	5
Lawrence	\$9.8	\$11.5	\$2	5	15%	3
Topeka	\$23.5	\$28.1	\$5	4	16%	2
Wichita	\$69.3	\$78.0	\$9	2	11%	4
Non-MSA	\$75.5	\$98.8	\$23	1	24%	1

Notes: Spillover figures have been rounded. Monetary values are in millions of 2005 dollars

Table 11. Employment and spillover impacts

Regions	Total impact in the region	Total impact on Kansas	Spillover		Spillover	
			Employment	Rank	Share	Rank
<i>Seven regions</i>						
Eastcentral	8,529	8,833	304	2	3%	7
Southeast	1,375	1,545	170	4	11%	1
Southwest	747	830	83	6	10%	3
Southcentral	6,313	6,696	383	1	6%	6
Northeast	2,107	2,253	146	5	7%	5
Northwest	604	687	83	6	12%	1
Northcentral	2,438	2,680	242	3	9%	4
<i>MSA vs. Non-MSA</i>						
Kansas City	7,447	7,718	272	3	4%	5
Lawrence	965	1,021	56	5	5%	3
Topeka	1,861	1,984	123	4	6%	2
Wichita	5,747	6,050	303	2	5%	4
Non-MSA	6,331	6,953	621	1	9%	1

Notes: Spillover figures have been rounded. Monetary values are in millions of 2005 dollars

The employment spillovers are much smaller than the monetary spillovers. This reflects the differences in wages, ownership, the predominant types of jobs in rural areas, and the labor intensity of childcare versus the sectors that supply it with inputs. Childcare produces a majority of its total jobs directly, and most of the multiplier effects on jobs are local as well.

These findings support our hypothesis that spillover impacts of the childcare sector are greater for rural areas than urban areas. Thus, much of the benefit of growing the childcare sector in rural areas actually flows to urban areas.

5. Conclusions

In this study, we estimate the economic impact of the childcare sector in Kansas and its sub-regions, with a focus on the spatial distribution of the sector's impacts and its spatial leakages and linkages. In terms of the demand for childcare, this study shows that working parents in rural areas of Kansas use formal childcare less than their urban counterparts. This difference in demand means that the rural sector and its local impacts are relatively smaller than the urban areas of the state.

In terms of the spatial characteristics of the sector, the empirical evidence demonstrates that the spillover effects from the childcare sector are substantial. The empirical evidence supports our hypotheses that childcare's largest intraregional effects occur in larger regions and in more urban regions. This creates a significant asymmetry between rural and urban areas of the state. Rural areas have a larger impact on the economies of urban areas than urban areas have on rural areas. As a result, many of the benefits of the childcare sector in rural areas flow to urban areas of the state.

From a policy perspective, this study provides support for the argument that increased public support for formal childcare in rural areas is in the interest of all state residents. Formal childcare is underdeveloped and under-utilized in rural areas. The costs of providing some types of childcare, such as center-based childcare, are higher in rural areas. The cost of childcare to consumers is sometimes higher in rural areas because of transportation costs (both time and money). This study demonstrates that the cost to urban tax payers may be less than the nominal expenditure because of the rural to urban spillover of economic benefits.

Demand for childcare is significantly different in rural areas than in urban areas of the state. But within rural and urban areas there are also significant differences. Policies to address the special needs of low in-

come families and families in remote areas must be made flexible enough to address the spatial variations in supply and demand. A thorough understanding of the differences in childcare sector supply, demand and economic linkages and spillovers is an important tool in good policy making.

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