ILLINOIS STATE GOVERNMENT EFFICIENCY: WHERE DOES THE STATE STAND?

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INTRODUCTION

In a recent working paper (Srithongrung 2019), we outlined a methodology for analyzing the efficiency of government service provision using a technique called Data Envelopment Analysis (DEA). DEA measures the efficiency of governments based on the relationship between government inputs (such as budget and staffing) and outputs (such as school enrollment). It finds the most efficient governments by finding those that produce the most output for a given set of inputs. It then calculates a set of relative efficiency scores for the non-efficient governments to show how far from efficiency a government is. In this white paper, we examine Illinois' service production efficiency in many different functions.

DEA produces measures of efficiency in four areas: technical efficiency, scale efficiency, economic efficiency, and allocative efficiency. Economists (Drake and Simpler, 2002, p.1861) define technical inefficiency as the excessive use of inputs in the production of outputs. In the accompanying working paper, we evaluated technical efficiency for all 50 states in eight functional areas. Once we assessed technical efficiency, we next examined scale efficiency, which is one of the possible reasons for technical inefficiency. Scale economy refers to the size of what economists call the production process - the overall amount of investment in an activity.[1] For state governments, if a state balances the size of all of the inputs into an activity with outputs demanded by the public, we say that there are constant returns to scale (CRS). However, if a state has inputs which are too large compared to outputs, it has decreasing returns to scale (DRS) and should cut back the size of agencies. If the size of the inputs is too small, the state will demonstrate increasing returns to scale (IRS) and should increase the size of agencies.

There are two other potential contributors to technical efficiency: economic and allocative efficiency. These efficiencies relate to input prices and the use of inputs given their prices. Economic or price efficiency refers to providing services at the lowest cost per output. Differences in the prices of inputs can create overall economic inefficiency, even though they are out of the control of administrators. Allocative efficiency involves the use of an appropriate mix of inputs given the prices of those inputs.

In this paper, we review the data used in the analysis and the results of the DEA model. We find that Illinois achieves optimal efficiency levels in all measures for two service functions: higher education and infrastructure. In the environment and housing function, they are technically efficient and achieve economies of scale but does not reach economic or allocative efficiency. In the K-12 education and safety functions, Illinois reaches allocative efficiency but is inefficient in the other three measures. Illinois does not attain efficiency in any measure in welfare, health and hospitals, and transportation functions. For the

[1] In technical terms, constant returns to scale is a stage in which a production process reaches its long-run efficiency where fixed costs become variable and hence, a change in output produces an equal size change in cost. This stage may change over time – if the production process becomes too large resulting in decreasing returns to scale causing excess complexity in the production process. When this happens, the state would have to reduce an unnecessarily bureaucratic process or cumbersome chain of command through streamlining the administrative system. A production process could also exhibit increasing return to scale where the production process must become larger to reduce relatively large investment in fixed inputs such as buildings, land and structures. In this situation the state should seek more opportunities to serve the public through expanding services.

efficient functions, we discuss the implications of the results. For the functions that are not efficient, we compare Illinois' inputs and outputs against the average values for the efficient states in that function (referred to as benchmarks in the literature). Using this information, we provide directions that the state can use to improve performance and productivity.

ILLINOIS PERFORMANCE RESULTS BY SERVICE FUNCTION

Table 1 presents Illinois' efficiency measures for the four types of efficiency and eight functions, along with its technical efficiency rank and benchmark states. Column 1 shows the rank of Illinois on technical efficiency in each function. The state is technically efficient in three functions: higher education, environment and housing, and infrastructure; Illinois has a technical efficiency value of 1 in those functions and DEA used Illinois as a benchmark for other states in these three areas. For the other functions, Column 2 shows its technical efficiency value. The closer the value is to 1, the more efficient it is compared to the benchmark states shown in the last column. For example, the Welfare function is relatively close to being technically efficient while Health & Hospitals is the farthest from efficiency. Column 3 shows whether the state is operating with constant returns to scale (CRS), increasing returns to scale (IRS), or decreasing returns to scale (DRS). Columns 4 and 5 show economic and allocative efficiency values, respectively, with the same interpretation as for the technical efficiency value. The last column presents the states that the model evaluates as being the most efficient (called “benchmark states” of “frontiers” in the academic jargon). These states achieve the most output in the respective function while they have similar production profiles (inputs and input costs) as Illinois. The literature on DEA suggests that Illinois might seek to follow these states production profile in order to improve technical efficiency.

TABLE 1: EFFICIENCY RESULTS BY FUNCTION FOR THE STATE OF ILLINOIS

	Technical Efficiency Rank	Technical Efficiency Value	Returns to Scale	Economic Efficiency Value	Allocative Efficiency Value	Benchmark States
HIGHER EDUCATION	1	1	CRS	1	1	N/A
ELEMENTARY & SECONDARY EDUCATION	30	0.57	DRS	0.57	1	ID, MT, NH, TX
WELFARE	17	0.89	DRS	0.15	0.17	CA, NC
HEALTH & HOSPITALS	26	0.20	DRS	0.20	0.99	AK, ME, OK
TRANSPORTATION	46	0.45	DRS	0.44	0.98	MA, NC, UT, WI
SAFETY	25	0.73	DRS	0.73	1	GA, LA, TX
ENVIRONMENT & HOUSING	1	1	CRS	0.85	0.85	N/A
INFRASTRUCTURE	1	1	CRS	1	1	N/A

EFFICIENT FUNCTIONS: HIGHER EDUCATION, INFRASTRUCTURE, ENVIRONMENT AND HOUSING

Illinois achieves optimal efficiency in the higher education and infrastructure production processes (indicated by a technical efficiency rank of 1 and value of 1.00). It also demonstrates constant returns to scale (CRS) in these functions, meaning that it is effectively balancing the size of its operations with service

demands. These results suggest that: (1) the state budget for these functions is at an optimal level; and (2) the state achieves the maximum output of any state in these functions with the least amount of inputs. Furthermore, the state achieves economic and allocative efficiency in these two functions. This result suggests that the state has the lowest cost per output compared to other states. Economic efficiency results from the state's capacity to allocate an optimal mix between in-house personnel and contractual services in higher education and efficient decisions in choosing the right mix between contractors and in-house services for infrastructure.

The environment and housing function is also technically efficient and achieves constant returns to scale. This result also suggests that the budget for this function is optimal and that the state has minimized its input as much as possible in producing outputs given service demands. However, for this function, the state does not achieve economic efficiency, suggesting that the state can either reduce input prices or reallocate the input mix between personnel and contracts or do both.

ELEMENTARY AND SECONDARY EDUCATION

Illinois ranks 30th in terms of its technical efficiency. The value of the technical efficiency measure is 0.57. This value suggests that the state would need to cut 43 percent of inputs (personnel and outlays) while producing the same level of output. The state achieves allocative efficiency but not scale and economic efficiency in K-12 education. The state also demonstrates decreasing returns to scale (DRS), suggesting that inputs in this function may be too large compared to service demands. This result further indicates that the state may need to reduce bureaucratic processes and management layers. Otherwise, new production processes (or technology) may be required. The state may want to engage contractual services to replace in-house personnel for some activities.[2]

The state does achieve allocative efficiency in K-12 education. However, the state falls far short of optimal on the economic efficiency measure. Given the output that Illinois produces, the state can cut about 47% of inputs. Since our measure of FTE includes only general government administrative employees weighted by budget size, high teacher salaries are not the cause. It is much more likely that cutting employees or salaries in state administration (ISBE) would produce greater efficiencies.

Table 2 and Figure 1 present key efficiency metrics for the elementary and secondary education function. Comparing Illinois to the benchmark efficient states on input and output measures (Table 2), we see several challenges for efficiency. First, the state cost of living is somewhat higher than that of the benchmark state average, as indicated by the state price parity and wage/FTE student variables. Second, Illinois uses more inputs and has higher service demands (e.g., ADA, enrollment) than those of its benchmarks. For example, Illinois has almost twice the percentage of non-native English-speaking students. Meanwhile, the graduation rate output in Illinois is equal to those of the average benchmarks

[2] As detailed in the working paper, we define FTE to include (1) state-hired personnel who directly administer, supervise, and manages school districts, and (2) state-hired personnel in general government administration who are involved with K-12 service delivery through grant administration and budget recommendations. The former group is entirely engaged in producing education outputs, while the latter only partially engages with schools by making decisions in terms of school finance, regulation, and grants. In 2016, Illinois reported zero personnel in the first group; as a result, the FTE employees in this service function are entirely from the second group.

(86%). This combination of statistics suggests Illinois faces more challenges to achieving an efficient level of inputs than its peers. Third, the institutional structure of education delivery may not have a significant effect on the results. Except for Texas, the benchmark states have the same institutional structure as Illinois in that they report zero FTE for state-hired school personnel. Illinois shares a decentralized structure of K-12 educational services with those states.

TABLE 2. ILLINOIS' ELEMENTARY AND SECONDARY EDUCATION FUNCTION COMPARED TO BENCHMARK STATES

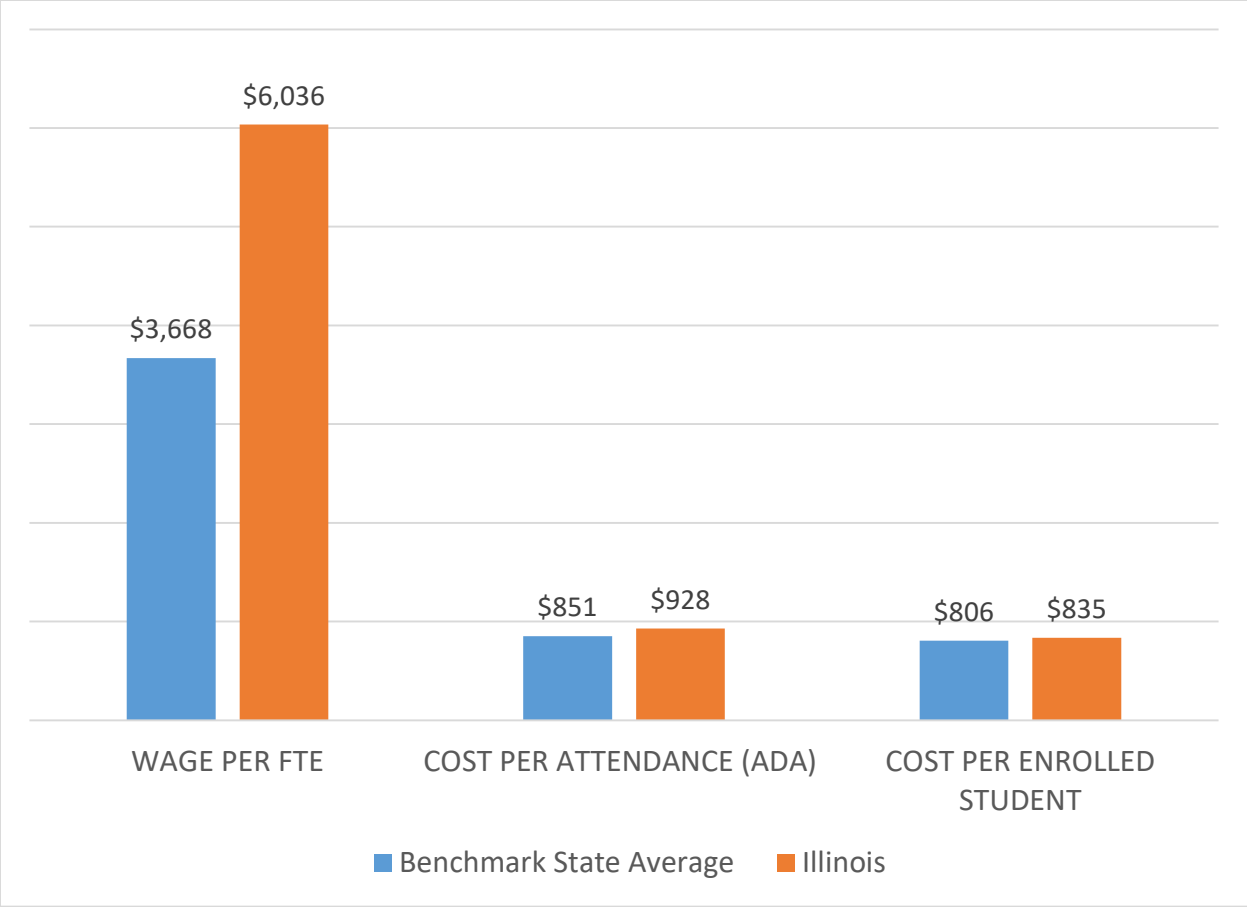
	BENCHMARK STATE AVERAGE	ILLINOIS
STATE PRICE PARITY	97	99
OPERATIONAL OUTLAYS	723,618	1,705,670
AVERAGE DAILY ATTENDANCE	1,377,995	1,838,813
ANNUAL ENROLMENT	1,480,375	2,041,779
% ENGLISH AS A SECOND LANGUAGE*	6	10
GRADE FOUR AVERAGE MATH SCORE	242	238
GRADE FOUR AVERAGE READING SCORE	222	220
GRADE EIGHT AVERAGE MATH SCORE	286	282
GRADE EIGHT AVERAGE READING SCORE	268	267
HIGH SCHOOL GRADUATION RATE (ACGR)	86	86
FTE	206	446

** Not included in the DEA model but shown for illustrative purpose.*

Figure 1 shows average cost per full-time equivalent employee (FTE), average cost per average daily attendance for Illinois public schools (ADA) and average cost per enrolled student. Illinois average costs are larger than those of its benchmarks. This suggest that personnel cost for Illinois may be too high compared to its benchmark states (i.e., ID, MT, NH, TX) who produced similar amount of outputs.

Since the state demonstrates DRS, one way to reduce costs by 43 percent would be to reduce organizational complexity and perhaps to hire operating personnel in critical areas to help districts to cope with challenges like educating non-native speakers. In other words, Illinois may consider becoming more centralized for both quantity and quality of school service. Regional offices may be established to provide shared personnel for critical services. For DRS producers, overspecialization may result in employee burn-out, and a more complex service delivery system may result in inefficiency (Steinemann, Apgar, and Brown, 2005).

FIGURE 1. COST MEASURES FOR ILLINOIS AND BENCHMARK STATES, ELEMENTARY AND SECONDARY EDUCATION



WELFARE

The welfare function in Illinois ranks 17th in technical efficiency. The technical efficiency score suggests that the state can cut 11 percent of its inputs. This excess input is not relatively large. Illinois' operational outlay on welfare is actually smaller than those of the benchmarks' average value (Table 3). However, as shown in Table 1, scale efficiency and allocative efficiency indexes in this function are 0.15 and 0.17, respectively. These results suggest that the main cause for inefficiency in this function is about the relative cost of inputs, rather than the budget allocated to this function.

The state's benchmarks for technical efficiency include large states like California and North Carolina. The state exhibits decreasing returns to scale and its economic and allocative efficiency values are the lowest among the eight service functions. This combination of results suggests that the state can improve technical efficiency through cost reduction and reallocation of inputs.

In this function, Illinois' cost of living is lower than those of its benchmark states (Table 3). However, Illinois uses more FTE. Meanwhile, Illinois' outputs (Medicaid recipients, TANF recipients, and ACA enrollment)

are smaller. The average cost per service unit for output indicators is higher in Illinois (Figure 2). Also, the average wage per FTE is higher than those of the benchmarks, even though one of the benchmark states, California, has a higher cost of living. This combination of results supports the economic and allocative efficiency challenges identified above. We estimate that the state must cut its cost dramatically to improve its efficiency.

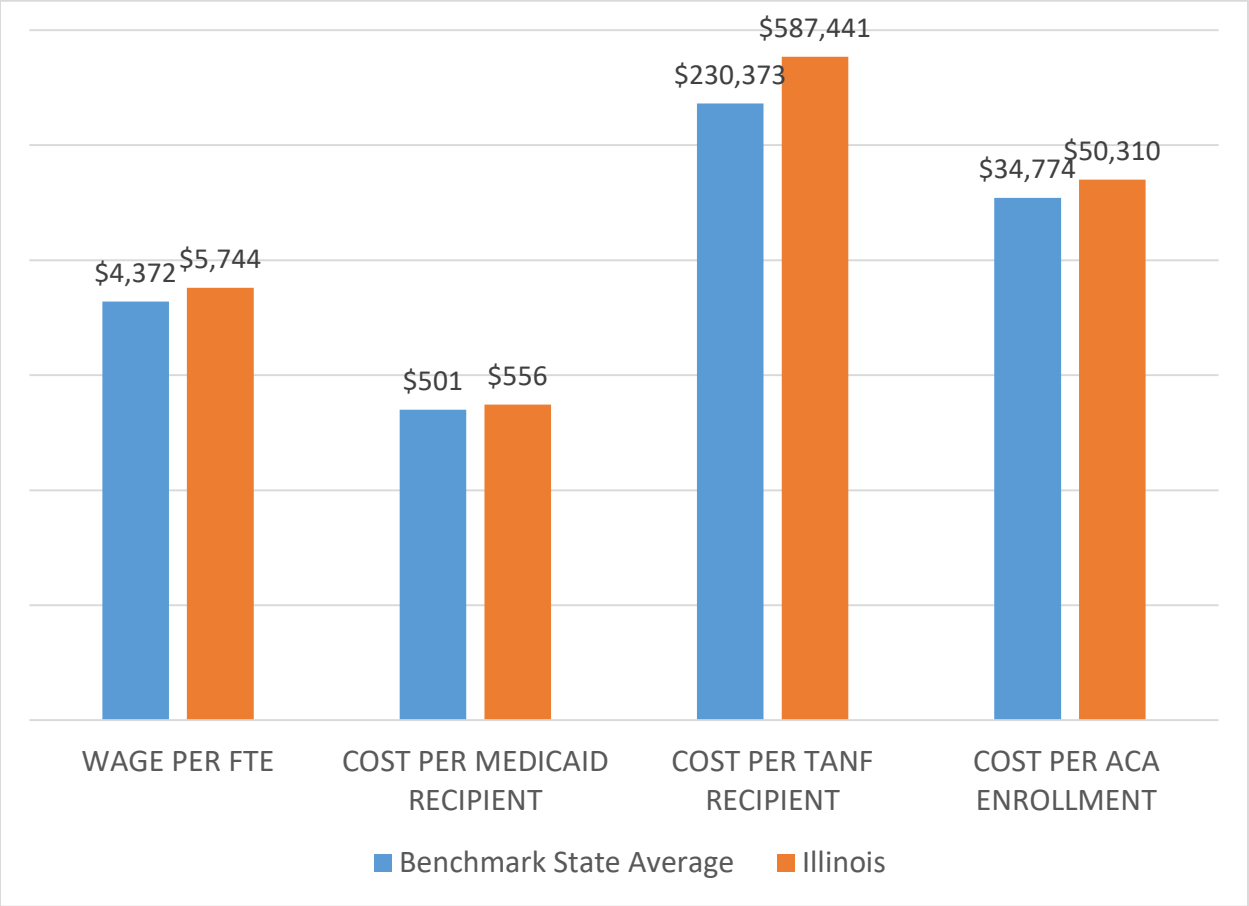
We added two variables to the analysis in Table 3, TANF recipients to poverty ratio (TPR) and percent of TANF closed cases due to employment. These were not entered into the DEA model but are reported in this table to determine if welfare service accessibility influences the relatively low efficiency in this function. It could be that the state has a higher workload and demands than those of its peers, driving the very high cost per output. However, the TPR and TANF Closed Case Statistics suggest Illinois also lags its benchmark states in terms of accessibility and quality. The TPR measure is only 16 compared to 36 in the benchmark states, indicating relatively low accessibility to welfare services. TANF closed cases are only 0.01% of TANF recipients, while the benchmark average is 22%. This result suggests relatively low quality compared to California and North Carolina.

TABLE 3. ILLINOIS' WELFARE FUNCTION COMPARED TO BENCHMARK STATES

	BENCHMARK STATE AVERAGE	ILLINOIS
STATE PRICE PARITY	103	99
OPERATIONAL OUTLAYS	45,697,922	19,529,463
MEDICAID RECIPIENTS	87,260,298	35,108,033
TANF BENEFICIARIES	492,873	33,245
TANF RECIPIENT TO POVERTY RATIO (TPR)*	36	16
% TANF CASES CLOSED DUE TO EMPLOYMENT*	22	0.01
AFFORDABLE CARE ACT (ACA) ENROLLMENTS	1,094,414	388,179
FTE	2,611	8,917

** Not included in the DEA model but in the table for illustrative purpose*

FIGURE 2. COST MEASURES FOR ILLINOIS AND BENCHMARK STATES, WELFARE



HEALTH AND HOSPITAL SERVICE

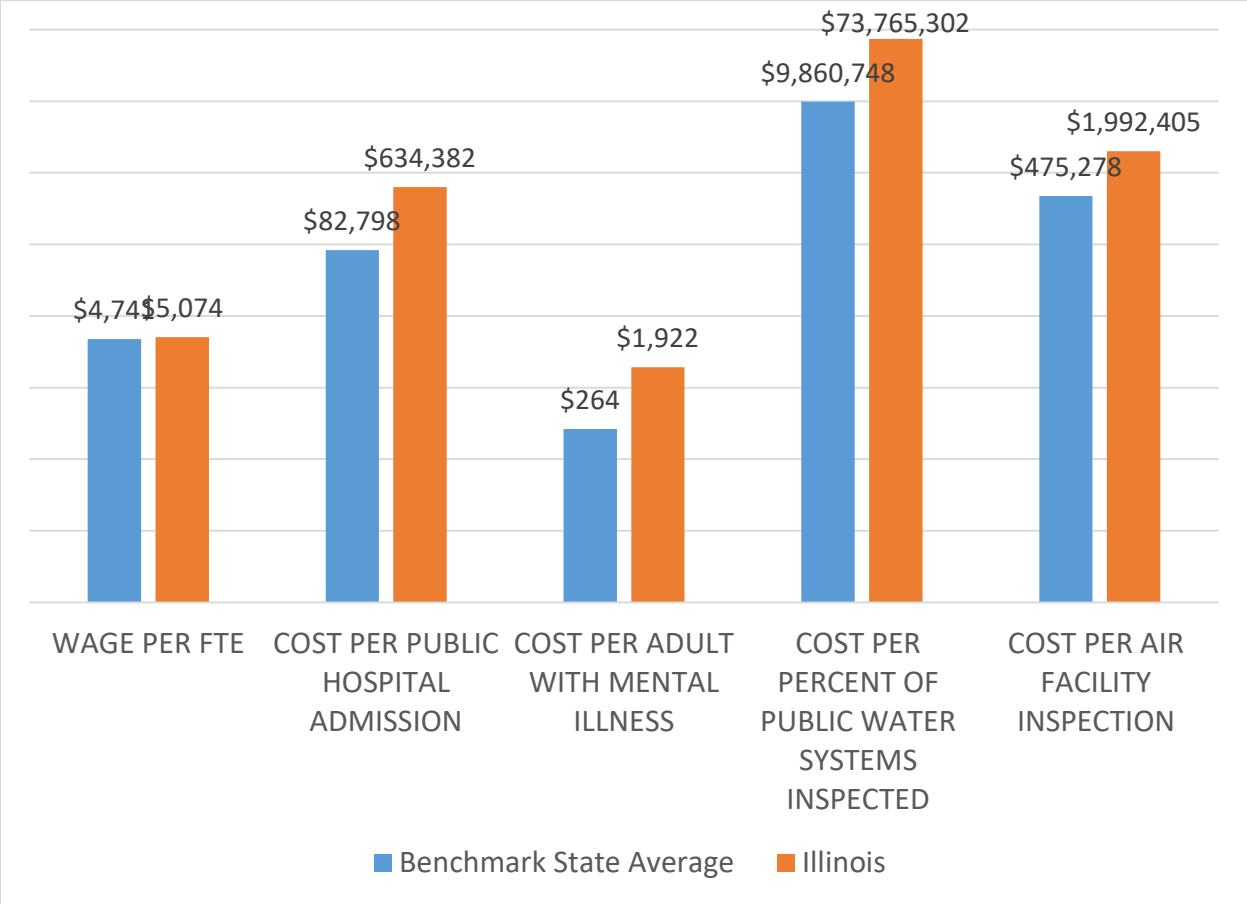
The health and hospitals function ranks 26th among 42 states in our sample. The technical efficiency score of 0.2 suggests the state could cut 80 percent of inputs, given service demands. It appears that economic inefficiency is the primary cause of the overall efficiency problem since its value is the smallest among all efficiency measures. The state scores well on scale efficiency and allocative efficiency measures in this function. Therefore, cost-cutting is the primary way to close the efficiency gap in this function.

The benchmark states for Illinois in the health and hospital function are Alaska, Maine, and Oklahoma (Table 1). Illinois has slightly higher overall costs for supplies and other inputs compared to those states (State Price Parity - Table 4). DEA controls for this, but still, the state's operational outlays and FTE are much above the benchmarks. Outputs in this function are slightly lower than in benchmark states. Finally, the cost per output in Illinois is much higher for all four output variables (Figure 3). To improve economic efficiency, Illinois might need to reduce FTE employment. Some of the activities in this function, such as document inspection for ACA enrollees, may be contracted out to reduce personnel cost.

TABLE 4. ILLINOIS' HEALTH AND HOSPITALS FUNCTION COMPARED TO BENCHMARK STATES

	BENCHMARK STATE AVERAGE	ILLINOIS
STATE PRICE PARITY	98	99
OPERATIONAL OUTLAYS	515,581	3,171,908
PUBLIC HOSPITAL ADMISSION RATE / 1000 POPULATION	8	5
% ADULT WITH MENTAL ILLNESS	0.20	0.17
% OF PUBLIC WATER SYSTEMS INSPECTED	48	43
AIR FACILITY INSPECTIONS	1,701	1,592
FTE	3,022	13,423

FIGURE 3. COST MEASURES FOR ILLINOIS AND BENCHMARK STATES, HEALTH AND HOSPITALS



TRANSPORTATION

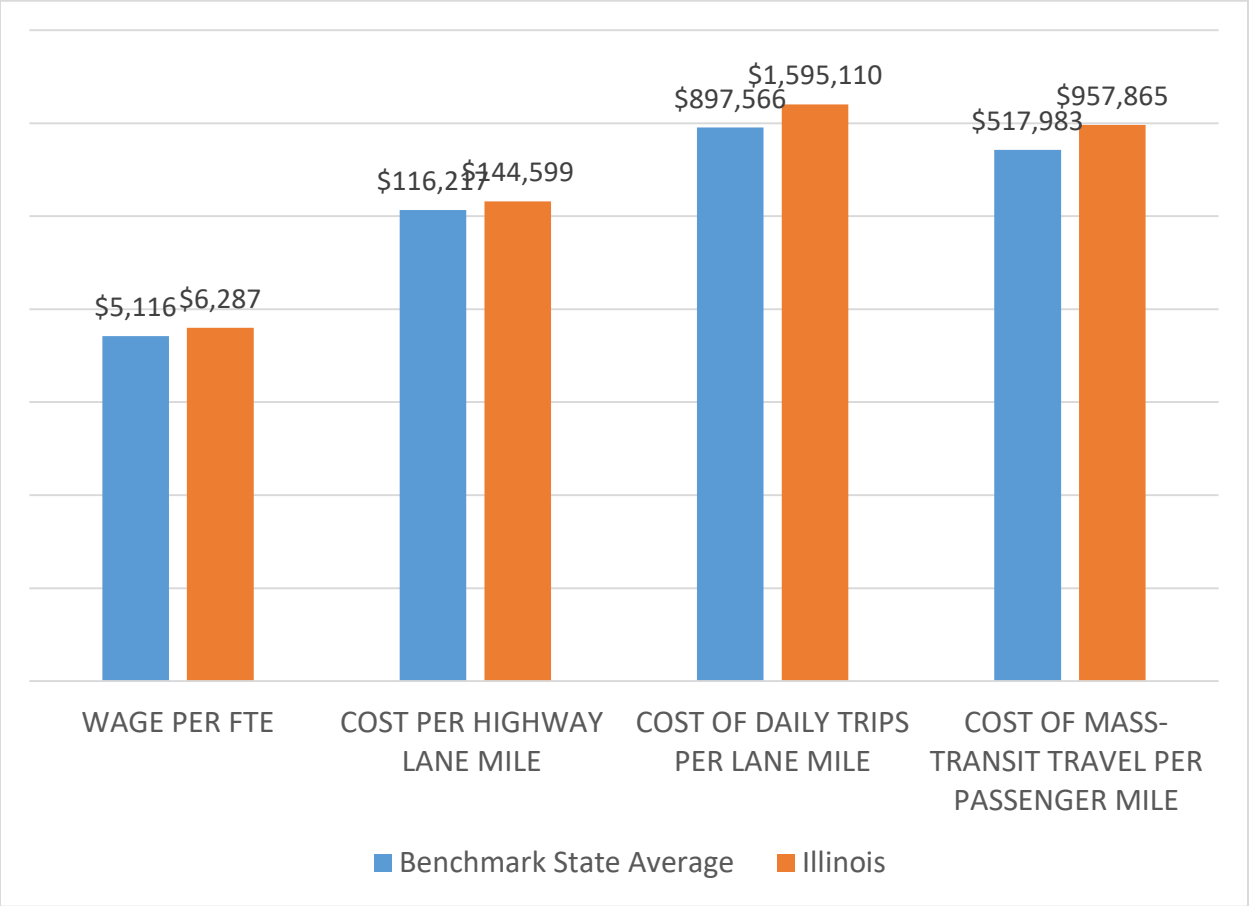
The transportation function in Illinois ranks very low in efficiency (46th out of 49 states - Table 1). The technical efficiency score is 0.45, suggesting that Illinois needs to cut about 55% of inputs to become efficient. Diseconomies of scale and high production costs appear to be the primary causes of inefficiency. The state seems to perform well in allocating its inputs in the production process, with a high allocative efficiency score. These results seem to point to cost reduction as the primary way that the state can improve efficiency.

As with many other functions, the relative price for inputs used by Illinois (Table 5) is higher than those in benchmark states of Massachusetts, North Carolina, Utah, and Wisconsin (Table 1). The state uses relatively more inputs than those of its benchmarks ($6 million in outlays versus $2.3 million in benchmark states and 7,040 FTE versus 4,209 – Table 5). Two outputs (highway lane miles and AADT lane miles) are smaller than those in benchmark states. One Illinois output is higher than that of benchmark states, average mass-transit passenger length. This measure captures workload demands in mass-transit. This result is not surprising as Massachusetts is the only benchmark state with a metropolitan area containing a significant subway and rail system. This increased workload demand could present challenges for improving efficiency. Illinois' cost per output is much higher than those of its benchmarks in all dimensions (Figure 4). Average wage per FTE is only slightly higher than in its benchmark states, while cost per service of Illinois is significantly higher. Combining this result with the relative capital-intensity of transportation service provision, Illinois should focus on reducing the cost of capital project acquisition rather than on personnel cost.

TABLE 5. ILLINOIS' TRANSPORTATION FUNCTION COMPARED TO BENCHMARK STATES

	BENCHMARK STATE AVERAGE	ILLINOIS
STATE PRICE PARITY	97	99
TOTAL HIGHWAY LANE MILES	56,800	42,187
OPERATIONAL OUTLAYS	2,252,490	6,100,211
ANNUAL AVERAGE DAILY TRIPS (AADT) PER LANE MILE	4,504	3,824
AVERAGE MASS-TRANSIT PASSENGER LENGTH (MILE)	5	6
FTE	4,209	7,040

FIGURE 4. COST MEASURES FOR ILLINOIS AND BENCHMARK STATES, TRANSPORTATION



SAFETY

When examining the results for the safety function, it is crucial to recognize we do not include local government inputs such as FTE personnel and wages for local police and firefighters, and outputs such as the incidence of fires. Instead, we use outputs for the functions that the state delivers. Outputs and inputs reflect the demand for, cost of, and personnel employed in correctional services.

Illinois ranks 25th in terms of its technical efficiency in the safety function (Table 1), with benchmark states of Georgia, Louisiana, and Texas. The state's technical efficiency measure indicates that the state uses 25 percent more inputs than it should, given its level of service demands and the prices that it faces for inputs. Illinois' operational outlays and FTE are smaller than the benchmark state average (Table 6). However, Illinois does not achieve scale and economic efficiencies although it achieves allocative efficiency (Table 1). The state exhibits decreasing returns to scale. Correctional services require large amounts of both personnel and facilities. Since the state exhibits decreasing returns to scale, the state may face a prison overcrowding problem. Therefore, the state will need to invest more in facilities to avoid congestion in service provision.

Table 6 compares Illinois and its benchmark state's average in the safety function. This data, combined with the primary results in Table 1, support the assertion that the state may need to invest more in its facilities in at least three ways. First, the state's outputs are slightly lower than in the benchmark states, but its operational outlay is much higher. Second, the state is efficiently allocating its inputs given the prices they face, with an allocative efficiency score of 1.00. Last, the state uses far fewer FTE employees in this function compared to its benchmarks. Based on this and the previously noted decreasing returns to scale production function, Illinois may need to build more facilities so that it can serve a higher correctional population.

Illinois's average cost for safety is higher than the benchmark state average on all measures (Figure 5). The state's average wage in this function is almost twice the size of the benchmark states. Other output costs including cost per prisoner, cost per jail inmate, cost per probationers and cost per parolee are much higher than those of the benchmarks. These statistics suggest that the state needs to realign budget and service demands through a careful study of the need for public safety services.

TABLE 6. ILLINOIS' SAFETY FUNCTION COMPARED TO BENCHMARK STATES

	BENCHMARK STATE AVERAGE	ILLINOIS
STATE PRICE PARITY	93	99
OPERATIONAL OUTLAYS	2,552,401	1,594,511
PRISON POPULATION	84,337	43,657
JAIL POPULATION	46,303	20,600
PROBATION POPULATION	276,812	122,125
PAROLE POPULATION	55,831	29,629
FTE	24,881	15,395

SUMMARY

Table 7 presents summary results along with recommendations to improve efficiency. We note that these are only initial guidance for state policy makers. The state should perform in-depth efficiency and performance analyses, led by experts in the functions. The results in this study can be used to set forth priorities for these analyses and performance measurement and management by state agencies.

FIGURE 5. COST MEASURES FOR ILLINOIS AND BENCHMARK STATES, SAFETY

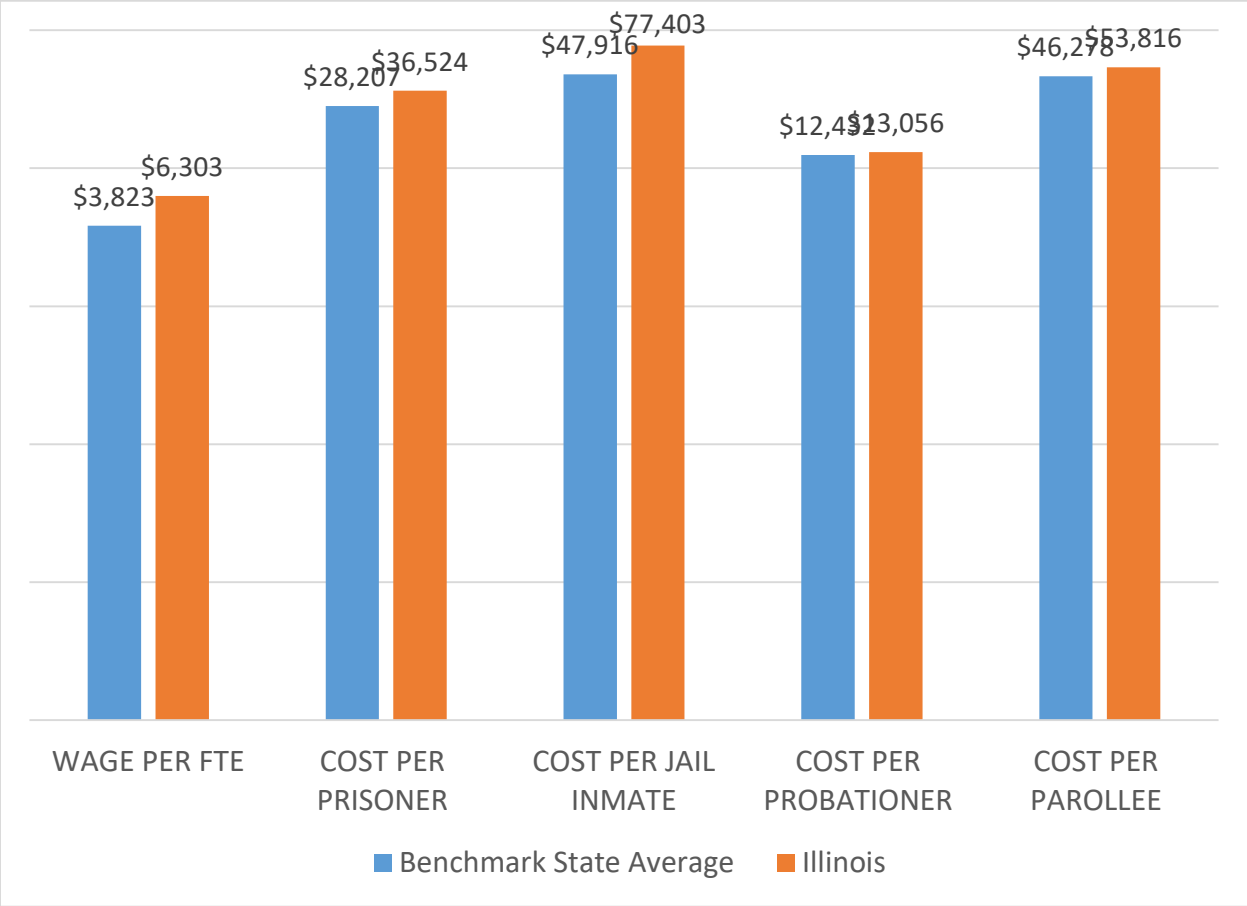


TABLE 7. SUMMARY OF ILLINOIS EFFICIENCY RESULTS AND RECOMMENDATIONS

	EFFICIENT?	PRIMARY CAUSE OF INEFFICIENCY	RECOMMENDATION	NOTES
HIGHER EDUCATION	YES	N/A	N/A	N/A
ELEMENTARY & SECONDARY EDUCATION	NO	Diseconomies of Scale (DRS)	43% input reduction; otherwise adopt centralized services by having state-hired instructional staff to help local schools	Relatively high number of non-native English-speaking students
WELFARE	NO	Economic and Allocative Efficiency	11% input and 85% cost reduction through cutting operational outlays	Relatively low accessibility to welfare services
HEALTH & HOSPITALS	NO	Economic Efficiency	80% input and cost reduction through personnel size reduction; average wage is already efficient	New technology and equipment may be needed.

TRANSPORTATION	NO	Diseconomies of Scale (DRS) and Economic Inefficiency	55% input and 56% cost reduction through reducing capital project acquisition cost	Consider financial management approaches to enhance credit rating to cut long-term borrowing cost
SAFETY	NO	Diseconomies of Scale (DRS)	27 % input and cost reduction through reduction in operational outlays, otherwise consider expanding service facilities to utilize excess personnel and operational outlay	N/A
ENVIRONMENT & HOUSING	YES	N/A	N/A	N/A
INFRASTRUCTURE	YES	N/A	N/A	N/A

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