Ozcan: Chapter 9 Productivity Lecture 2

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Dr. Joan Burtner

Outline

- Productivity Improvement
- Trends in Healthcare Productivity: Consequences of Medicare Prospective Payment System (PPS)
- Productivity Definitions and Measurements
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- Adjustment for Inputs
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- Multiple Dimensions of Productivity:Data Envelopment Analysis(DEA)

Productivity Definitions and Measurements 1 (Review)

- Productivity is one measure of the effective use of resources within an organization, industry, or nation.

- The **classical productivity** definition measures outputs relative to the inputs needed to produce them. That is, productivity is defined as the number of output units per unit of input.

$$\text{Productivity} = \frac{Output}{Input}$$

Productivity Definitions and Measurements 2 (Review)

- **Sometimes, an inverse calculation is used that measures inputs per unit of output. Care must be taken to interpret this inverse calculation appropriately; the greater the number of units of input per unit of output, the lower the productivity.**

- **For example, traditionally productivity in hospital nursing units has been measured by hours per patient day (HPPD). That requires an inversion of the typical calculations: meaning total hours are divided by total patient days.**

$$HPPD = \frac{Total\ Hours}{Patient\ Days}$$

Example 9.1 (Review)

Nurses in Unit A worked collectively a total of 25 hours to treat a patient who stayed 5 days, and nurses in Unit B worked a total of 16 hours to treat a patient who stayed 4 days. Calculate which of the two similar hospital nursing units is more productive.

$$HPPD_A = \frac{Total\ \ Hours}{Patient\ \ Days} = \frac{25}{5} = 5 \qquad HPPD_B = \frac{Total\ \ Hours}{Patient\ \ Days} = \frac{16}{4} = 4$$

Since the HPPD productivity ratio is expressed as input over output, lower is better.

Unit B productivity is better than Unit A.

Multi-factor Productivity

Looking only at labor productivity may not yield an accurate picture.

Newer productivity measures tend to include not only labor inputs, but the other operating costs for the product or service as well.

$$\text{Multifactor Productivity} = \frac{\text{Service Item} * \text{Price}}{\text{Labor} + \text{Material} + \text{Overhead}}$$

Example 9.2 Statement

A specialty laboratory performs lab tests for the area hospitals. During its first two years of operation the following measurements were gathered:

Measurement	Year 1	Year 2
Price per test ($)	50	50
Annual tests	10,000	10,700
Total labor costs($)	150,000	158,000
Material costs ($)	8,000	8,400
Overhead ($)	12,000	12,200

Determine and compare the multifactor productivity for historical benchmarking.

Example 9.2 Solution

$$\text{Multifactor Productivity}_{Year-1} = \frac{10{,}000 * 50}{150{,}000 + 8{,}000 + 12{,}000} = 2.9$$

$$\text{Multifactor Productivity}_{Year-2} = \frac{10{,}700 * 50}{158{,}000 + 8{,}400 + 12{,}200} = 3.0$$

Since the multi-factor productivity ratio is expressed as output over input, higher is better.

Year 2 productivity is better than Year 1.

Commonly Used Productivity Ratios

$$Hours\ per\ Patient\ Day = \frac{Hours\ Worked}{Patient\ Days}$$

inpatient

$$Hours\ per\ Patient\ Visit = \frac{Hours\ Worked}{Patient\ Visits}$$

outpatient

Since these productivity ratios are expressed as input over output, lower is better.

Example 9.3

Annual statistical data for two nursing units in Memorial Hospital are as follows:

Measurements	Unit A	Unit B
Annual Patient Days	14,000	10,000
Annual Hours Worked	210,000	180,000

Calculate and compare hours per patient day for two units of this hospital.

Solution:

$$Hours\ per\ Patient\ Day_{Unit\ A} = \frac{210{,}000}{14{,}000} = 15 \quad Hours\ per\ Patient\ Day_{Unit\ B} = \frac{180{,}000}{10{,}000} = 18$$

Since the HPPD productivity ratio is expressed as input over output, lower is better. Unit A productivity is better than Unit B.

Example 9.4

Performsbetter Associates – a two-site group practice, requires productivity monitoring. The following initial data are provided for both sites of the practice:

Measurements	Suburban	Downtown
Annual Visits	135,000	97,000
Annual Paid Hours	115,000	112,000

Calculate and compare the hours per patient visit (HPPV) for the suburban and the downtown locations of this practice.

Solution:

$$Hours\ per\ Patient\ Visit_{Suburb} = \frac{115{,}000}{135{,}000} = .85$$ **hours or 51 minutes.**

$$Hours\ per\ Patient\ Visit_{Downtown} = \frac{112{,}000}{97{,}000} = 1.15$$ **hours or 69 minutes.**

Conclusion: Suburb productivity is better than Downtown productivity.

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Adjustments for Inputs

Skill-Mix Adjustment weighs the hours of personnel of different skill levels by their economic valuation.

One approach is to calculate weights based on the average wage or salary of each skill class. To do that, a given skill class wage/salary would be divided into the top class skill salary.

Let's assume RNs, LPNs and Nurses Aides are earning $35.00, $28.00, and $17.50 an hour, respectively.

One hour of a nurse aide's time is economically equivalent to 0.5 hours of a RN's time ($17.50/$35); and one hour of a LPN's time is equal to 0.8 hours of a RN's time ($28/$35).

Calculations: Adjustments for Inputs

$$Adjusted\ Hours = \sum w_i * X_i$$

Adjusted Hours =
1.0*(RN hours) + 0.8*(LPN hours) + 0.5*(Aide hours)

$$\text{Adjusted Hours per Patient Day} = \frac{Adjusted\ \ Hours}{Patients\ \ Days}$$

Adjustments for Inputs

Similarly, in outpatient settings, if one hour of a nurse practitioner's (NP) time is economically equivalent to 0.6 hours of a specialist's (SP) time, and if one hour of a general practitioner's (GP) time is equal to 0.85 hours of a specialist's time, adjusted hours would be calculated as:

Adjusted Hours =
1.0 (SP hours) + 0.85 (GP hours) + 0.6 (NP hours)

$$Adjusted\ \ Hours\ per\ Visit = \frac{Adjusted\ \ Hours}{Patient\ \ Visits}$$

Adjustments for Inputs: Example 9.5

Example 9.5: Using data from Example 9.3, and economic equivalencies of 0.5 Aide = RN, 0.8 LPN = RN, calculate the adjusted hours per patient day for Unit A and Unit B.

Unit A at Memorial Hospital employs 100% RNs.
The current skill mix distribution of Unit B is 45% RNs, 30% LPNs, and 25% nursing aides (NAs).

Compare unadjusted and adjusted productivity scores.

Adjustments for Inputs Example 9.5 Solution

Solution: The first step is to calculate adjusted hours for each unit.
For Unit A, since it employs 100% RNs, adjusted hours = non-adjusted hours.
For Unit B:
Adjusted Hours $_{(\text{Unit B})}$ = 1.0 (180,000*.45) + 0.80 (180,000*.30) + 0.50 (180,000*.25).
Adjusted Hours $_{(\text{Unit B})}$ = 1.0 (81,000) + 0.80 (54,000) + 0.50 (45,000).
Adjusted Hours $_{(\text{Unit B})}$ = 146,700.

In this way, using the economic equivalencies of the skill-mix, the number of hours is standardized as 146,700 instead of 180,000.

$$Adjusted\ \ Hours\ \ per\ \ Patient\ \ Day_{Unit\ A} = \frac{210{,}000}{14{,}000} = 15.0\ \text{hours.}$$

$$Adjusted\ \ Hours\ \ per\ \ Patient\ \ Day_{Unit\ B} = \frac{146{,}700}{10{,}000} = 14.7\ \text{hours.}$$

Using adjusted hours, Unit A, which appeared productive according to the first measure (see example 9.3), no longer appears as productive.

Adjustments for Inputs

Standardized Cost of Labor. Total labor cost comprises the payments to various professionals at varying skills. To account for differences in salary structure across hospitals or group practices, cost calculations can be standardized using a standard salary per hour for each of the skill levels

$$Labor\ Cost = \sum c_i * X_i$$

Labor Cost = RN wages (RN hours) +
LPN wages (LPN hours) +
NA wages (Aide hours).

$$Labor\ Cost\ Patient\ \ Day = \frac{Labor\ Cost\ of\ \ Care}{Patient\ \ Days}$$

$$Labor\ Cost\ \ per\ Visit = \frac{Labor\ Cost\ of\ \ Care}{Patient\ \ Visits}$$

Adjustments for Inputs

Example 9.6:

Performsbetter Associates in Example 9.4 pays $110, $85, and $45 per hour, respectively, to its SPs, GPs and NPs in both locations.

Currently, the suburban location staff comprises 50% SPs, 30% GPs, and 20% NPs.

The downtown location, on the other hand, comprises 30% SPs, 50% GPs, and 20% NPs.

Calculate and compare the labor cost of care, and labor cost per visit for both locations.

Adjustments for Inputs: 9.6 Solution

Based on Annual Visits and Annual Paid Hours listed in Example 9.4

First, calculate "Labor Cost of Care" for each location.

Labor Cost = SP wages (SP hours) + GP wages (GP hours) + NP wages (NP hours),

Labor $\text{Cost}_{\text{Suburban}}$ = \$110 (115,000*0.50) + \$85 (115,000*0.30) + \$45 (115,000*0.20).

Labor $\text{Cost}_{\text{Suburban}}$ = \$110 (57,500) + \$85 (34,500) + \$45 (23,000).

Labor $\text{Cost}_{\text{Suburban}}$ = **\$10,292,500**.

Labor $\text{Cost}_{\text{Downtown}}$ = \$110 (112,000*.30) + \$85 (112,000*0.50) + \$45 (112,000*0.20).

Labor $\text{Cost}_{\text{Downtown}}$ = \$110 (33,600) + \$85 (56,000) + \$45 (22,400).

Labor $\text{Cost}_{\text{Downtown}}$ = **\$9,464,000.**

$$Labor\ Cost\ \ per\ Visit_{\ Suburban} = \frac{10{,}292{,}500}{135{,}000} = \$76.24$$

$$Labor\ Cost\ \ per\ Visit_{\ Downtown} = \frac{9{,}464{,}000}{97{,}000} = \$97.57$$

Lower volume at Downtown location, Higher labor cost per visit