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자료포락분석을 활용한 지방 R&D사업의 효율성 분석*

A Study on Efficiency of Regional R&D Program by Data Envelopment Analysis

방 민 석** · 정 혜 진***

Bang, Min-Seok · Jung, Hye-Jin

목 차

최근 전 세계적인 정책 환경의 변화로 도시와 지역이 경제활동의 주체로 강조되면서 지역발전과 경쟁력 강화에 주요한 역할을 하는 지방 R&D 사업의 중요성과 사회경제적 파급효과에 대한 관심이 높아지고 있다. 특히 이명박 정부 출범 이후 광역경제권을 기반으로 과학기술기본계획을 추진함에 있어서 새로운 성장 동력의 한 축으로 지방 R&D 활성화에 대한 계획을 수정·보완하고 있지만 아직까지 큰 기여를 하지 못한다는 지적을 받고 있다. 본 연구는 이러한 문제인식을 바탕으로 자료포락분석(DEA)을 활용하여 16개 광역시·도의 국가연구개발사업 효율성을 측정하고, 이와 함께 효율성에 영향을 미치는 요인을 분석한 뒤 정책적 시사점을 도출하고자 하였다. 분석결과 정책적 시사점은 다음과 같다. 첫째, R&D 효율성의 차이가 발생하는 지역격차를 완화시키기 위한 다양한 투자 확대와 지방주도적인 지원으로 제도를 전환할 필요가 있다는 것, 둘째, R&D와 GRDP와의 높은 상관관

* 2010 (2010.6.25.) ·
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** (1)
*** Cleveland State University (2)

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계는 산업경제적인 연관효과를 입증하며 지속적인 예산지원이 유지된다면 중장기적 성과를 보다 많이 창출할 수 있다는 것과 마지막으로 R&D에 있어서 협력연구를 활성화시키기 위한 제도적 개선이 필요하다는 것을 들 수 있다.

□ 주제어: 지방 R&D, 효율성, 영향요인, 자료포락분석

It is notable that there is a rising interest on the importance of regional R&D and the socio-economic effects of its program, as the role of cities and regional has been stressed. One reason of this change is because of the fact that regional economic development is conducted by the local governments, not central government. However, it is said that regional R&D has not yet successfully contributed much to the regional economic development though it has been modified along with the national science and technology plans after the launch of Lee Myung-bak administration. This paper has aimed to address policy implications for improving the regional R&D activities by measuring the efficiency of sixteen regions and analyzing the influence factors of efficiency. The main implications as follows: (1) it is required to expand various investments and to establish an effective mechanism of funding for local governments to decrease the gap of efficiency between regions, (2) the relationship between R&D activities and gross regional domestic product proves inter-industry analysis and it is expected that there will be more desirable results if continuous budget supporting is remaining, and (3) the collaborative research among research institutes should be increased for improving the R&D efficiency.

□ Keywords: Regional R&D, Efficiency, Influence Factor, DEA

Ⅰ. 서 론

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“ ”(577 : GDP R&D 5% 7

7) ,
, (, 2009: 15).
R&D
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R&D .
R&D
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60%
. R&D

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R&D 1990
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R&D
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R&D . ,
R&D , , ,

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R&D . 577
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R&D (, 2011: 304).

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R&D
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DEA . R&D time-lag

(Wang, 2007), 2 2004~2006

2006~2008 .

Ⅱ. 지역별 국가연구개발사업의 효율성평가 논의

1. 지방 R&D[1]와 지역발전

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(, 2006: 13).

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1999

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(· · , 2009: 360).

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(, 2005: 21).

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1) ' R&D' , , , , ,
, R&D
R&D (, 2009: 9-11),
R&D .

. R&D

(Malecki, 1991: 51-53; Markusen, Hall, and Glasmeier, 1986: 57; Andersson, Anderstig, and Harsman, 1990: 6; Goldstein and Luger, 1990: 33; Glasmeier, 1991: 32).

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(Romer, 1986; Kruman, 1991; Grossman and Helpman, 1994).

R&D

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(, 2009: 5).

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2. 연구개발의 효율성과 자료포락분석(DEA)

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(, 2009: 37),

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(DEA) Charnes & Cooper(1985)

. , DMU[2)]

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2) DEA (Decision Making Unit, 'DMU')

. DMU ,

, , (· , 2000).

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Farrell(1957)

. DEA

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. , R&D

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(, 1999).

DEA Charnes, Cooper, and Rhodes(1978) CCR Banker, Charnes, and Cooper(1984) BCC

. ,

(, 2008: 52-53). CCR

DMU 1 ,

0 DMU

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Banker et al.(1984) (1)

.

$$
\begin{aligned}
&Min\ h_0 = \theta \\
&s.t.\ \sum_{j=1}^{n} \lambda_j x_{ij} + s_j^- = \theta x_{i0}, i = 1, ..., m \\
&\quad \sum_{j=1}^{n} \lambda_j y_{ij} - s_r^+ = y_{r0}, r = 1, ..., s \\
&\sum_{j=1}^{n} \lambda_j = 1 \qquad \cdots\cdots\cdots\cdots \quad (1) \\
&s_i^-, s_r^+, \lambda_j \geq 0
\end{aligned}
$$

BCC $\sum_{j=1}^{n}\lambda_j = 1$ DMU

. DEA

(, 2004). , DMU 0 1 ,

1 DMU DMU

1 DMU .

, DMU

DMU . , DMU

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3. 선행연구 검토

R&D

(Grupp, 1996),

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. (2009)

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SCI ,

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, 2007

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(2009) 16 R&D R&D

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(DEA) (SFA) .

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. · (2008)

DEA . , ,

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, (2005) OECD

1995 2001 (OLS: Ordinary least square) .

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, Hsu & Hsuech(2009) 110 R&D

3 DEA ,

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. , Wang & Huang(2007) 30 R&D

, , SCI , EI

R&D . Eliat et al.(2006)

, , (balanced portfolio)

DEA . DEA BSC(Balanced Scorecard)

. Lee & Park(2005) DEA 27 R&D

, ,

. Revilla et al(2003) ,

R&D , ,

- DEA .

. , DEA

R&D

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DEA

R&D , DMU

. R&D

(time-lag)

. , Lee & Park(2005) 1994~1998

, 1999 . , (2009) 2003~2004

2006~2007 ,

R&D

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Ⅲ. 연구설계

1. 분석의 틀

R&D < 1> .

, , R&D SCI

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R&D

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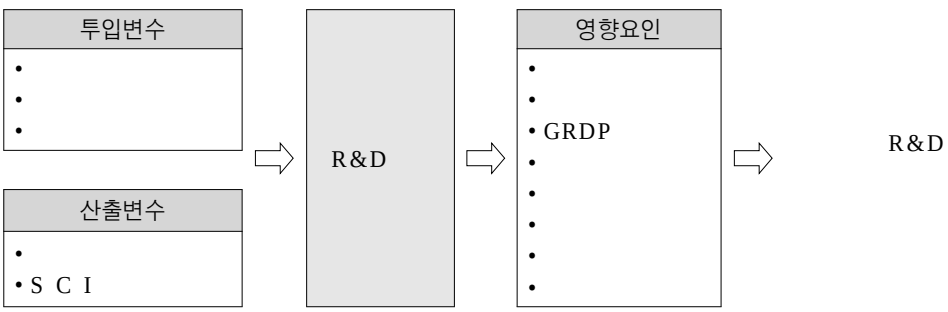
<그림 1> 분석의 틀



2. 변수의 선정

1) 투입변수

. R&D

(Serrano-Cinca, et al., 2005). ,

(Goto & Suzuki, 1989: 556)

.

(, 2007: 139). ,

(Leoncini, et al, 1996).

, , , · ,

, ,

(· , 2009b: 95). (flow)

, (stock) .

(· , 2006: 478).

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R&D 2004~2006

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, .

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2) 산출변수

3)

. ,

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· (, 2007: 153). ,

(Griliches, 1990), (Eaton

3) , R&D

. R&D

(Schmookler, 1966).

(Girliches, 1990).

and Kortum, 1995).

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(Autant-Bernard, 2001: 1072). ,

.[4]

, SCI Impact Factor (· , 2009a: 63).[5]

[6],

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. < 1>

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R&D

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4) 1, 2
· . (2006)
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5) SCI .

$$rnIF = \frac{N - R_{JF} + 1}{N_{\Gamma}}$$

$$mrnIF = 100 \times \frac{(N \times mIF - 1)}{N - 1_{\Gamma}}$$ (N: , R_{Γ}:)

6) R&D
, R&D ,
(Grief, 1995).
(Comanor & Scherer, 1969), .

<표 1> 투입-산출 요소별 내용과 측정 지표

구분	요소	측정지표	자료출처
		R&D ( )	
		+ + ( )	
		( )	NTIS
		( )	
	SCI		

3) 영향요인 변수의 선정

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(, 2003)

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R&D , [7]

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R&D R&D

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R&D ,

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R&D .

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[7] , .

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R&D .

R&D . . ,

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Ⅳ. 분석결과

1. 투입지표와 산출지표의 기술통계

. < 2> .

'04 73.8%, '05 67.1%, '06 66.0%

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. 2004 2006 60~65%

, 5%

. ,

60%

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<표 2> 요소별 기술 통계 값

요소	연도	최대값	최소값	평균	표준편차
( )	2004	14,204	289	4244.6250	6333.42328
	2005	15,749	379	3984.5625	5038.83121
	2006	17,079	468	4074.2500	5028.21866
( )	2004	70,211	404	13123.69	19832.372
	2005	77,797	398	14670.13	22274.061
	2006	87,246	560	16037.38	24764.999
( )	2004	4433.93	88.85	969.3381	1181.04389
	2005	1336.6	25.9	389.203	365.6107
	2006	1504.33	14.09	361.3794	425.43802

요소	연도	최대값	최소값	평균	표준편차
( )	2006	1080	18	290.06	345.587
	2007	2262	53	618.69	708.083
	2008	3899	67	842.19	1059.967
SCI ( )	2006	1.05	0.81	0.9148	0.6277
	2007	1.03	0.80	0.9063	0.6233
	2008	1.02	0.80	0.9031	0.0605

SCI

. SCI

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2. 연도별 각 지역의 효율성 추정

< 3> BCC R&D

. DMU , .

2006 2008 R&D 2006 0.7331

2007 0.7208 , 2008 0.6248

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2006 , , 2007 ,

, 2008 , , .

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<표 3> 지역별 효율성 추정치

	2006			2007			2008		
	기술 효율성	규모 효율성	참조 횟수	기술 효율성	규모 효율성	참조 횟수	기술 효율성	규모 효율성	참조 횟수
	0.5028	0.5028	0	0.5946	0.5946	0	0.7443	0.7443	0
	0.4468	0.4974	0	0.865	0.994	0	0.4573	0.5416	0
	0.45	0.45	0	0.7846	0.839	0	0.5061	0.5532	0
	0.9386	0.9386	0	1	1	12	1	1	2
	0.4793	0.5546	0	0.541	0.632	0	0.4285	0.4817	0
	0.8723	0.8723	0	0.9242	0.9943	0	1	1	3
	1	1	6	0.7531	0.7906	0	0.8536	0.8536	0
	1	1	5	1	1	12	0.3162	0.3162	0
	0.8257	0.8356	0	0.5139	0.6069	0	0.678	0.7207	0
	1	1	2	0.7887	0.9459	0	0.7344	0.7956	0
	0.8065	0.8307	0	0.7193	0.8255	0	0.5142	0.5924	0
	0.5409	0.6032	0	0.6038	0.7044	0	0.5037	0.524	0
	0.6843	0.7577	0	0.475	0.4958	0	0.3011	0.3396	0
	0.5641	0.5641	0	0.545	0.5466	0	0.6756	0.6756	7
	0.6183	0.6744	0	0.4242	0.4949	0	0.283	0.324	0
	1	1	2	1	1	2	1	1	4

3 R&D

. R&D 40%

R&D

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. R&D

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R&D

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, R&D

R&D .

3. 효율성에 대한 영향요인 분석

R&D

0.742

0.331, 0.311 . , GRDP R&D

. R&D

, GRDP R&D

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GRDP R&D

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R&D .

R&D .

R&D

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<표 4> 장비구입금액과 공동활용률

지역	장비구입금액	공동활용	지역	장비구입금액	공동활용
	150,432,558,273	19.31%		1,409,189,911	67.66%
	98,863,085,586	26.14%		2,740,677,151	33.25%
	95,515,259,059	32.63%		3,329,542,575	47.67%

, R&D

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. . SCI

. < 5>

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<표 5> 효율성과 변수간의 상관관계 분석

변수	평균	표준편차	상관계수							
			1	2	3	4	5	6	7	8
	0.628	0.250	1							
	84.191	13.073	.331	1						
GRDP	49196.3	50037.2	.742**	.231	1					
	104.85	4.2943	.311	-.043	.242	1				
	984.19	1249.4	.677**	.022	.794**	.116	1			
	2072.2	2613.0	.535*	.378	.845**	-.047	.684**	1		
	38.047	12.095	-.388	-.292	-.326	-.010	-.392	-4.67	1	
	61.047	8.166	0.307	-.158	-.074	.042	.283	-.198	-.38	1

**0.01 , * 0.05

Ⅴ. 정책적 함의

R&D

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R&D

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R&D
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(Chesbrough, 2003),
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9)
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.(, 2010.11.22.)

Ⅴ. 결 론

R&D

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R&D

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R&D .

R&D 0.6~0.7 .

GRDP, ,

R&D

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R&D (·

, 2010) . R&D

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R&D

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R&D .

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【참고문헌】

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. (2006).『 R&D 』.

. (2010).『2010 R&D 』.

. (2007).『 』. : .

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.「 」, 12(1): 70-87. .

· · . (2007).『 』. : .

. (2008).「 」. : .

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.「 」, 14: 105-127. .

· · . (2009). .「

」, 43(4): 359-380. .

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303-326.

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_____. (2005).

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