

**Financial Benchmarking of
Transportation Companies
in the New York Stock Exchange (NYSE)
Through Data Envelopment Analysis
(DEA) and Visualization**

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Introduction

- **Benchmarking study of industrial transportation companies traded in the New York Stock Exchange (NYSE)**
- **Two distinguishing aspects of our study:**
 - **Using financial data in DEA**
 - **Visualizing the efficiency scores of the companies in relation to the subsectors and the number of employees.**

Introduction

- **Logistics:**
 - **Movements of goods**
 - **Field of operations: Transportation planning, warehousing, inventory management, etc.**
- **Financial benchmarking:**
 - **Comparing companies in an industry based on their financial statements**
- **Data Envelopment Analysis (DEA):**
 - **A nonparametric technique which can be used to compare a set of “decision making units” (DMUs) amongst each other**

Introduction

- **Our study:**
 - **Financial statements for 2005 of the industrial transportation companies traded in New York Stock Exchange (NYSE)**
 - **Benchmarking through DEA**
 - **Results of DEA visualized**
 - **Miner3D**
 - **Detecting patterns**
 - **Deriving useful insights.**

Income Statement

				Horizon Lines, Inc.				
	Year Ended December 25, 2005 (1)			Twelve Months Ended December 26, 2004,00			Period from July 7, 2004 through December 26, 2004,00	
(\$ in thousands, except share and per share amounts)								
Statement of Operations Data:								
Operating revenue	\$	1.096.156		\$	980.328		\$	481.898
Operating income (loss)		46.654			51.589			30.928
Interest expense, net (2)		51.357			29.567			21.770
Net income (loss)		(18.321)			13.561			5.600
Accretion of preferred stock		5.073			6.756			6.756
Net income (loss) applicable to common stockholders		(23.394)			6.805			(1.156)
Net income (loss) per share:								
Basic	\$	(1,05)					\$	(0,07)
Diluted	\$	(1,05)					\$	(0,07)
Number of shares used in calculations:								
Basic		22.376.797						15.585.322
Diluted		22.381.756						15.585.322
Dividends declared		3.690						
Dividends declared per common share (3)		0,11						

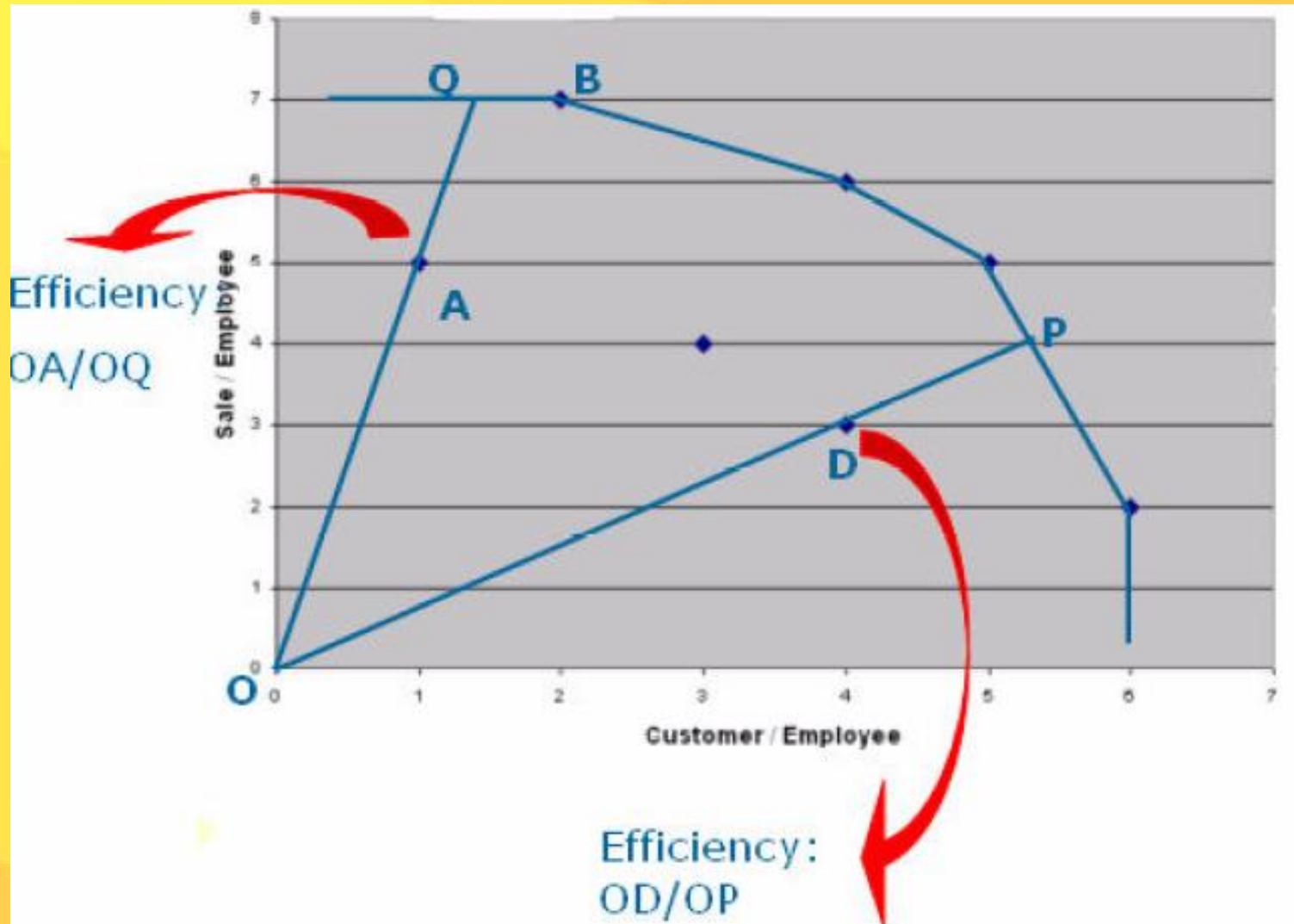
Literature Search

- **Min and Joo (2006):**
 - **A benchmarking study of six third party logistics (3PL) providers using DEA and financial data**
- **Literature on DEA applications in logistics:**
 - **For comparing container ports' efficiencies**
 - **Estimating productivity of the trucking industry in U.S.**
 - **Deriving efficiency scores of urban rail firms**
- **Scatter plot visualizations:**
 - **Efficiency scores of warehouses v.s. warehouse sizes and material handling systems investments**

Methodologies

- **Data Envelopment Analysis:**
 - **Approach to measure efficiency of decision making units (DMUs) in comparison to each other**
 - **“Weights” for multiple inputs and outputs assigned automatically within DEA**
 - **No need to have congruent units**
 - **Determination the “efficient frontier”, “relative efficiencies” and “reference sets”**

Methodologies



Methodologies

- **Data Visualisation:**
 - **Detecting outliers**
 - **Finding patterns**
 - **Coming up with new hypotheses**
 - **Visualizations include:**
 - **Quantile plots, histograms, box plots, symmetry plots, scatter plots, quantile-quantile plots, etc.**
 - **Colored scatter plot**

Analysis and Results

Data Collection

Visual Analysis

Marine Transportation Subsector

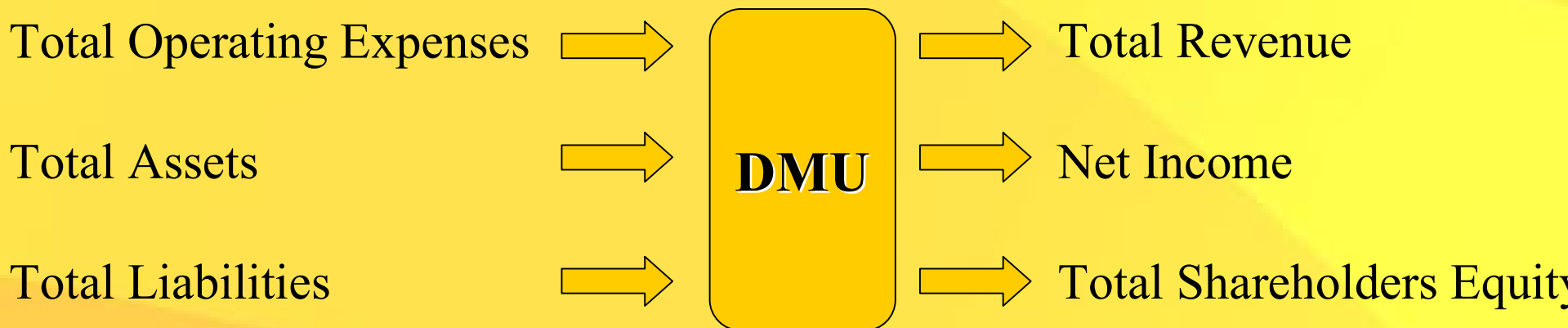
Railroad Transportation Subsector

Data Collection

- **Subsectors:**
 - **Marine transportation (19)**
 - **Transportation (9)**
 - **Trucking (2)**
 - **Delivery (3)**
 - **Railroad (10)**
- **Total of 39 companies benchmarked**

Data Collection

- **New York Stock Exchange (NYSE) and company websites**
 - **Annual reports: the income statements & the balance sheets**

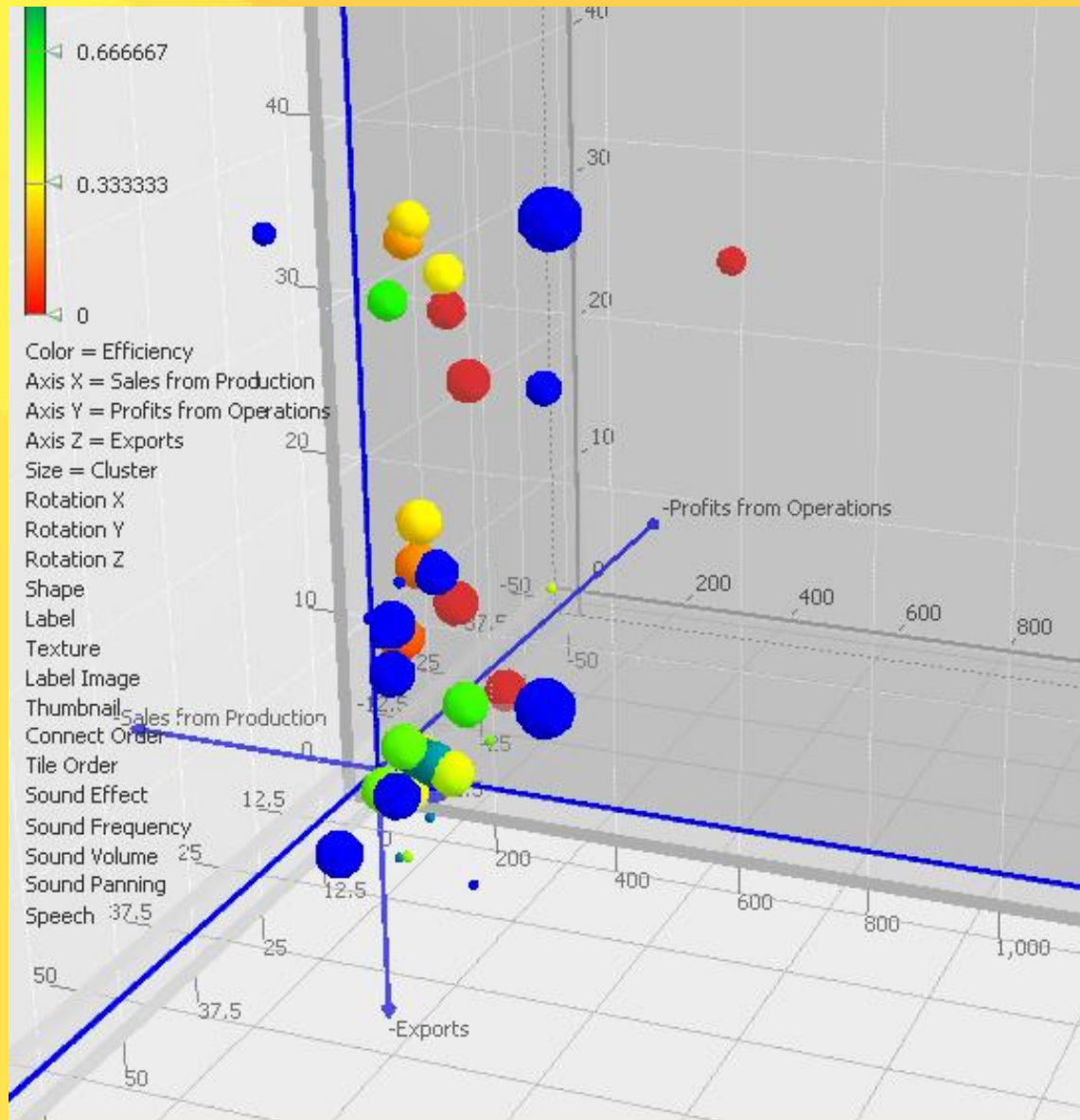


Visual Analysis

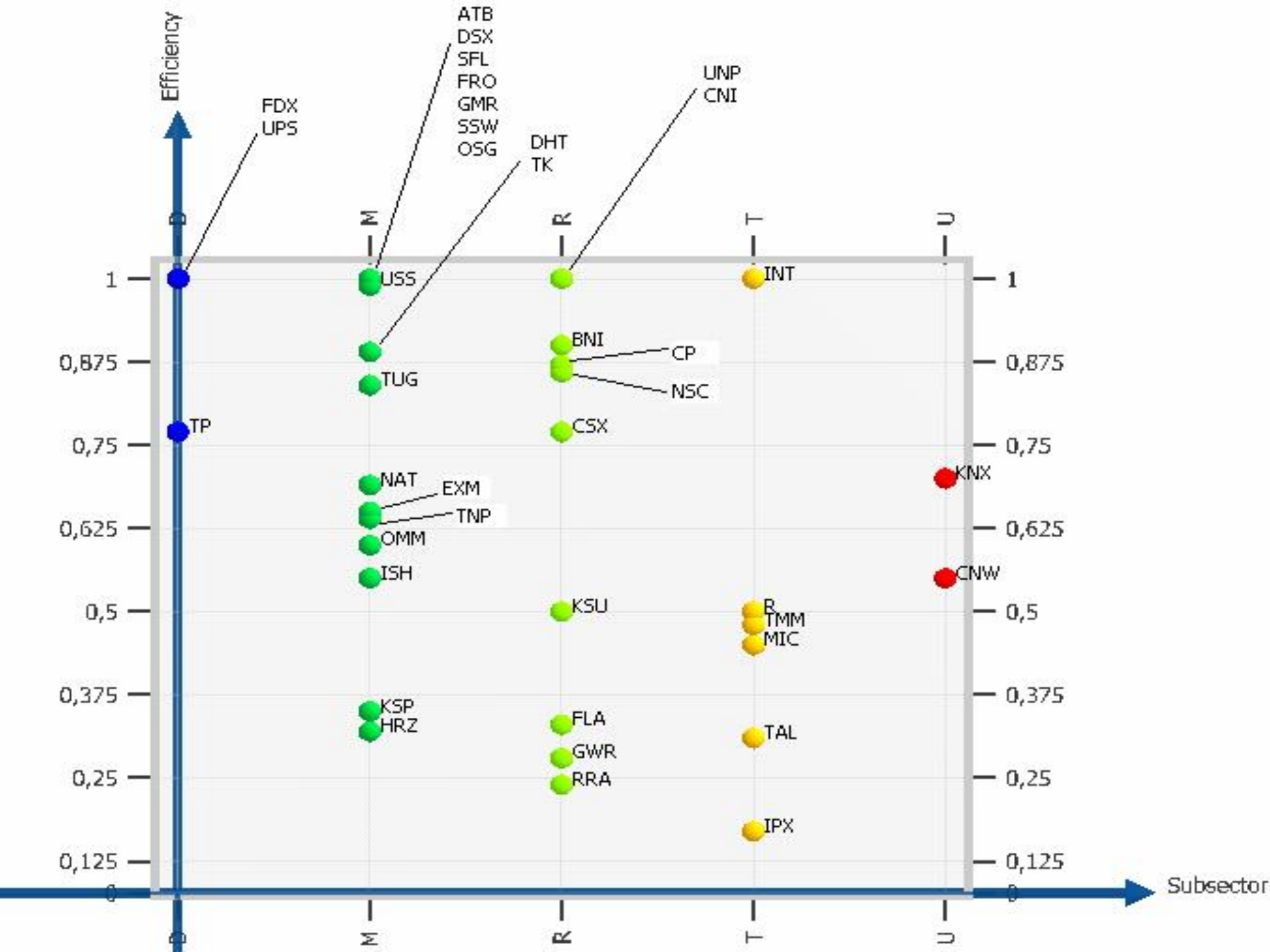
- **Efficiencies of each DMU computed using DEA-Solver software**
- **Visualization of efficiency scores done by Miner3D software**

	A	B	C	D	E	F	G
1							
2	Model Name = DEA-Solver Pro5.0/ BCC(BCC-I) Returns to Scale = Variable (Sum of Lambda = 1)						
3	Workbook Name = C:\Documents and Settings\kullaniciadi\Desktop\lojistic_project\analysis_results\data_BCC_I						
4	No.	SYMBOL	DMU	Score	Rank	Reference set (lambda)	
5	1	FDX	Fedex Corp.	1	1	Fedex Corp.	
6	2	TP	TNT N.V.	0,77753336	20	United Parcel Service Inc	0,206625812
7	3	UPS	United Parcel Service Inc.	1	1	United Parcel Service Inc	
8	4	ATB	Arlington Tankers Ltd.	1	1	Arlington Tankers Ltd.	
9	5	DSX	Diana Shipping INC.	1	1	Diana Shipping INC.	
10	6	DHT	Double Hull Tankers Inc.	0,89978047	15	Arlington Tankers Ltd.	0,199835700
11	7	EXM	Excell Maritime Carriers Ltd.	0,65755777	24	Diana Shipping INC.	0,978717188
12	8	FRO	Frontline Ltd.	1	1	Frontline Ltd.	
13	9	GMR	General Maritime Corp.	1	1	General Maritime Corp.	
14	10	HRZ	Horizon Lines Holding Corp.	0,32920133	35	Ship Finance Internationa	0,920553600
15	11	ISH	International Shipholding Corp.	0,55083610	28	Diana Shipping INC.	8.09E+
16	12	KSP	Kirby Corp.	0,35760848	33	Diana Shipping INC.	0,190972744
17	13	TUG	Maritrans Inc.	0,84476066	19	Diana Shipping INC.	0,402552718
18	14	NAT	Nordic American Tanker Shippin	0,69857591	23	Diana Shipping INC.	0,788694187
19	15	OMM	Omi Corp.	0,60232405	26	United Parcel Service Inc	7.25E+
20	16	OSG	Overseas Shipholding Group IN	1	1	Overseas Shipholding Gr	
21	17	SSW	Seaspan Corp.	1	1	Seaspan Corp.	
22	18	SFL	Ship Finance International Ltd.	1	1	Ship Finance Internationa	

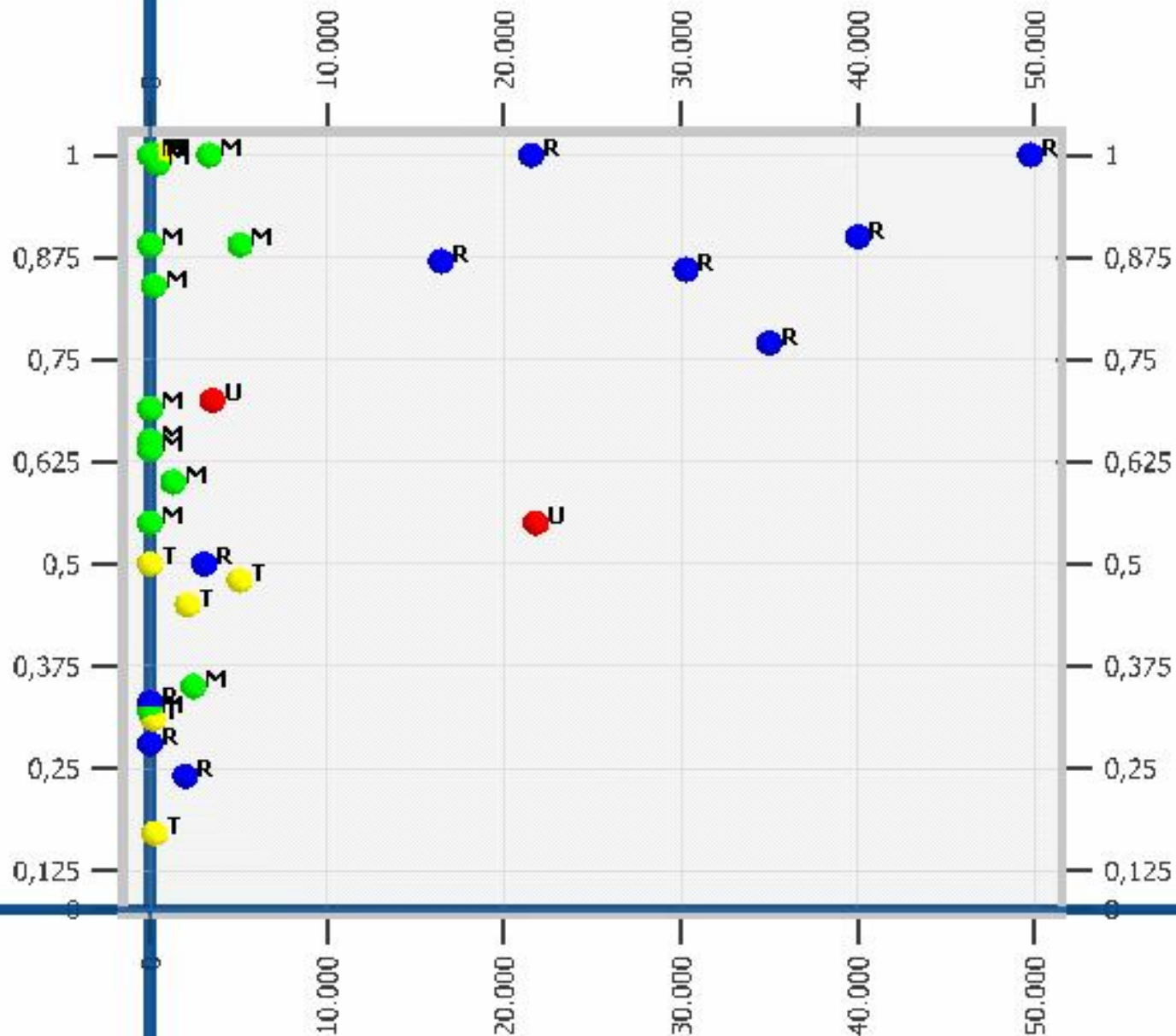
DEA-Solver Cooper et al. (2006)



Miner3D
www.miner3d.com



Efficiency



Number of Employees

Marine Transportation

- **Considered 18 companies**
- **Better understanding of this subsector's own boundaries for being efficient**
- **Possible to see the companies that should be taken as role models by the inefficient companies**
- **Reference sets found by DEA enable us to identify such patterns**

Marine Transportation Reference Sets

USS	DSX	0.34	SFL	0.66						
DHT	ATB	0.20	DSX	0.77	SFL	0.03				
KSP	GMR	0.35	HRZ	0.46	SFL	0.17	TK	0.02		
TUG	DSX	0.40	SFL	0.60						
NAT	DSX	0.79	SSW	0.08	SFL	0.13				
EXM	DSX	0.93	GMR	0.04	SSW	0.03				
OMM	FRO	0.06	GMR	0.14	OSG	0.08	SFL	0.66	TK	0.06
TNP	DSX	0.34	GMR	0.47	SFL	0.19				
ISH	DSX	0.08	SFL	0.92						

Railroad Transportation Reference Sets

RRA	BNI	0.00	CP	0.01	GWR	0.99		
NSC	BNI	0.20	CNI	0.73	CP	0.03	UNP	0.04
CSX	BNI	0.36	CNI	0.30	CP	0.31	UNP	0.02
KSU	BNI	0.05	CNI	0.02	CP	0.17	GWR	0.76

Conclusions

- **Methodological contribution:**
 - **Using colored scatter plots to visualize the DEA results**
- **Applied Contributions:**
 - **Analysis of the subsectors of industrial transportation sector**
 - **Compared efficiencies of different subsectors with each other**

Future Research

- **Statistical tests to prove or disprove the hypotheses proposed by observing the visualizations**
- **Investigation of what other types of visualizations can be developed or adopted for analyzing DEA results**

Thank You!

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