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MODELLING INTERDEPENDENCE OF SOME NIGERIAN INDUSTRIES USING A NUMERICAL METHOD.

***PETER, ONYEDINMA CHINEDU, *E. N EKAKA-A **N. M NAFO**

**Department of Mathematics, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt*
***Department of Mathematics, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt*

Abstract

While a technological matrix is not a recent construction in the theory of linear algebra, its effective application due to the variation of the demand elements and its impact on the gross productions of agricultural products, steel and coal can be considered as a mathematical problem that requires a MATLAB algorithm solution. The novel results of this study that we have not seen elsewhere are clearly presented and discussed quantitatively.

Keywords: *Modelling, Numerical, Industries, Method, Nigeria*

INTRODUCTION

It is a common Knowledge that industrialization can affect sustainable development either negatively or positively. In the context by three key elements such as agricultural products, steel and coal, the vital research question is on the effect of varying each of these elements on the gross production of agriculture, steel and coal otherwise called the solution of a technological matrix of three (3) – rows and three (3)-columns. To tackle this relatively technological matrix problem, we have proposed to apply a MATLAB algorithm. Other related work to the present study can be found in the contributions of Armstrong and Davies (2003), K. E. (2008), Lial, et al (2002), Goldstein, Schneider and Siegel (2004), Harshbarger and Reyonolds (2000), Gohbery et al (2006), Wiley (1996), Luca et al (2007), Gantmacher and Providence (2000), Tellis, et al (2009).

Method of Analysis

The core method of analysis is based on a MATLAB algorithm with the following technological matrix

$$A = \begin{array}{c} \text{Ag} \quad \text{Steel} \quad \text{Caol} \\ \begin{bmatrix} 0.1 & 0.01 & 0.01 \\ 0.02 & 0.13 & 0.20 \\ 0.05 & 0.18 & 0.05 \end{bmatrix} \end{array} \begin{array}{l} \text{Ag} \\ \text{Steel} \\ \text{coal} \end{array}$$

and the demand matrix

$$D = \begin{bmatrix} 2350 \\ 4552 \\ 911 \end{bmatrix}$$

The technological matrix is solved using the technological matrix equation:
$X = (1 - A)^{-1}D$

We have calculated the gross production, of the three industries to be 2700 tons of agriculture, 5800 tons of steel and 2200 tons of coal.
When the demand elements of 2350 tons of agricultural products, 4552 tons of steel and 911 tons of coal are varied at 100 percent the gross productions of the three industries are calculated to be 2700, for agricultural products, 5800 for steel and 2200 for coal. In this study, we are interested to vary only the first element of the demand matrix which is 2350 tons of agricultural products and study the effect of this variation on the gross products of the three industries.

Results

The key results of this study are presented in the Table 1 and Table 2 as shown below:

Table 1: Evaluating the effect of D (1) modified (from 10 percent to 55 percent) ne solution of 3 by 3 technological matrix

Example	D (1)	D (1) m	D (2)	D (3)	X (1)	X (2)	X (3)	X (1) m	X (2)m	X (3)m	PD (GP) %	PD (Steel) %	PD (Coal %
1	2350	235	4552	911	2700	5800	2200	348	5.714	2060	87	1.48	6.36
2	2350	352.5	4552	911	2700	5800	2200	478	5719	2068	82.30	1.41	6.02
3	2350	470	4552	911	2700	5800	2200	609	5.723	2075	77.4	1.33	5.68
4	2350	587.5	4552	911	2700	5800	2200	704	5.733	2083	72.11	1.24	5.32
5	2350	705	4552	911	2700	5800	2200	870	5.733	2091	67.81	1.16	4.95
6	2350	822.5	4552	911	2700	5800	2200	1001	5738	20988	62.93	1.07	4.59
7	2350	940	4552	911	2700	5800	2200	13132	3743	2107	58	0.98	4.23
8	2350	1057.5	4552	911	2700	5800	2200	1262	5747	2114	53.26	0.91	3.91
9	2350	1175	4552	911	2700	5800	2200	1393	5752	2122	48.41	0.83	3.55
10	2350	1292.5	4552	911	2700	5800	2200	1524	5757	2130	43.41	0.74	3.18

Table2: Evaluating the effect of D (1) modified (from 60 percent to 98 percent) ne solution of 3 by 3 technological matrix

	D (1)	D (1)m	D (2)	D (3)	X (1)	X (2)	X (3)	X (1) m	X (2)m	X (3)m	PD (GP) %	PD (Steel) %	PD (Coal %
11	2350	1410	4552	911	2700	5800	2200	1654	5762	2135	38.74	0.66	2.95
12	2350	1527.5	4552	911	2700	5800	2200	1785	5766	2146	33.89	0.56	2.45
13	2350	1645	4552	911	2700	5800	2200	1916	5771	2153	29.89	0.5	2.14
14	2350	1762.5	4552	911	2700	5800	2200	2047	5776	2161	24.19	0.41	1.77
15	2350	1880	4552	911	2700	5800	2200	2177	5781	2169	19.37	0.33	1.41
16	2350	1997.5	4552	911	2700	5800	2200	2308	5786	2177	14.52	0.24	1.05
17	2350	2115	4552	911	2700	5800	2200	2438	5790	2184	9.70	0.17	0.73
18	2350	2232.5	4552	911	2700	5800	2200	2569	5795	2192	4.85	0.09	0.36
19	2350	2256	4552	911	2700	5800	2200	2596	5796	2194	3.85	0.069	0.27
20	2350	2303	4552	911	2700	5800	2200	2648	5798	2197	1.93	0.03	0.14

Discussion of Result

When the surpluses of agricultural products is decreased from the value 348 to 1524, we have observed a quantified percentage depletion decreasing from 87 to 43.41 approximately.

While the volumes of steel and coal due to this variations of the surpluses of agricultural products are not more vulnerable to depletion compared to the vulnerability of the gross production of the industries with respect to agriculture

When the surpluses of agricultural products is decreased from the value 1604 to 2648, we have observed a quantified 38.74 to 1.93 approximately while the volumes of steel and coal due to these variation of the surpluses of agricultural products are not more vulnerable to depletion compared to the vulnerability of the gross production of the industries with respect to agriculture.

Conclusion

When 2350 tons of agricultural products is varied from 10 percent to 55 percent, the gross productions of agricultural products is vulnerable to depletion but the proportion that is depleted decreases from the value of 87 percent to 43.41 percent whereas when the same parameter value is varied form 60 percent to 98 percent the proportion that is depleted decreases from 38.74 percent to 1.93 percent.

The overall

References

Anyiaba, A. (2017). *Anyiaba informatics Simulations Database,* Anyiaba informatics Nigeria Limited. Port Harcourt, Nigeria.

Armstrong, B. & Davis, D. (2003). Finite mathematics; Solving problems in Business, Economics and the Social and the social and behavioural sciences, Pearson Education, Inc.

Bamidele, E. A. (2013). Timely compaction of Nigeria iron and steel project: The imperative of manpower development. *Journal of Marketing,* 4(2), 332 – 337.

Barneth, R. A., Ziegler, M.R. & Bylenn, K. E. (2008). *Finite Mathematics: For Business, Economics, Life Science and Social Sciences*, 11th Edition. Person Prentice Hall.

Bellman, R. (1997). *Introduction to Matrix Analysis*. 2nd Ed. Philadelphia. SIAM.

Chatelin, F. (1993). *Eigenvalues of Matrices,* New York: Wiley Interscience.

Dorfman, O. (1948). *Application of the technological matrix*. 3rd Ed. Person Prentice Hall.

Dowling, E. T. (2012). *Introduction to Mathematical Economics.* Schauni Outlines, McGraw – Hill companies.

Gantmacher, F. R. (2000). The Theory of Matrices, 2 vols. Providence, RI, *American Mathematical Society.*

Garvelink, S. (2012). Agriculture a broad-based poverty reduction and food security support in Africa. *Prefectural University Journal,* 6(3), 321-326.

Gohbery, I P. (2006*). Invariant Subsepaces of Matrices with Applications,* New York Wiley.

Goldstein, L. J., Schneider, D. I. & Siegel, M. J. (2004). *Finite Mathematics and its application* 8th Edition Pearson Edition Person Educational Inc.

Gonberg, I. P. (2006*). Invariant Subspaces of Matrices with Applications:* New York.

Greub, W. H. (1975). *Linear Algebra* 4th Edition New York: Springer.

Harshbarger, R. J. & Reynolds, J. J. (2000). *Mathematical Application for the Management, Life and Social Science*. 6th Edition Houghton Mifelin Company.

Heilbroner, R. L. (1991). *The Worldly Philosophers,* Touchstonebooks: New York.

Herstein, I. N. (1996). *Abstract Algebra* 3rd Edition New York; Wiley.

IDA (2009). Agriculture: Key to global poverty reduction in low income countries. *Journal of Marketing,* 3(1), 64 – 69.

John, I. (1986). *Readings in Input-Output Analysis: Theory and Applications*, New York: Oxford University Press.

Joshi, A. W. (1995). *Matrices and Tensors in physics.* 3rd Edition, New York: Wiley.

Kooros, A. (1965). *Elements of Mathematical Economics.*

Lang, S. (1996). *Linear Algebra* 2nd Edition, New York; Springer.

Leontief, W. (1951). *The structure of American Economy* 1919-1939, The second edition, Oxford University, New York.

Leontief, W. (1966). *Input – Output Economics,* Houghton Mifflin: Boston.

Lial, M. L., Greenwell, R. N. & Ritchy, A. (2002). *Finite Mathematics and Calculus with application* 6th Edition, Person Education Inc.

Luca, L.M.P. & Atualene-Gima, K. (2007). Market Knowledge dimensions and Cross –functional collaboration: Examining the different routes to product innovation performance, *Journal of Marketing,* 8, 825 - 829.

Miiernyk, W. (1965). The Elements of Input-Output Analysis, New York: Random.

Miller, R., Karen, R., P. & Adam, Z. R. (1989). *Frontiers of Input-Output Analysis,* Oxford University Press: New York.

Miller, R. & Peter, D.B. (1985). *Input-Output Analysis: Foundations and Extensions,* Prentice-Hall, New Jersey.

Morishima, M. & Michio, R. (1956). *Introductory Input-Output Analysis,* Sobunnsha, Tokyo.

Net, W. (1998). *Liner Algebra* 2nd Edition, New York; Dover.

Odesola, M., Samuel, I. E. & Olugasa, W. (2012). Coal development in Nigeria (its prospects and challenges). *Journal of Marketing,* 5(1), 324 – 327.

Overby, E., Bharadwai, A. & Sambamurthy, V. (2006). Enterprise agility and the enabling role of information technology*: European Journal of Information.* 3(1), 223 – 227.

Oyakhilomen, A. & Zibah, T. (2014). Production of agriculture of economic growth. *Prefectural University Journal,* 8(2), 231-239.

Parlett, B. (1998). *The Symmetric Eigenvalue problem.* Philadelphia.

Raa, T. (2005). *The Economics of Input-Output Analysis*, Cambridge University Press: United Kingdom.

Shim, J. K. (1993). *Macroeconomics*, Barron's: New York.

Srinivasan, R., Lilien, G.L. & Rangaswamy, A. (2002*). Technological opportunism and radical technology of Marketing*. pp. 90-100.

Stone, R. (1961). Input-Output and National Accounts, Paris: OECD.

Tan, S.T. (2006). *Finite mathematics: For the managerial life and social scienc*e 9th Edition.

Tanaka, F. J. (2005). *Industrial Development.* Koushindou: Nagasaki.

Tanaka, F. J. (2007). *Modern Distribution and Economy* Souseiha: Tokyo.

Tanaka, F. J. (2008). Inter-industry analysis and the condition that ensures nonnegative values for final consumption, Nagasaki. *Prefectural University Journal,* 42(1). 5-6.

Tellis, G. J., Prabhu, J. C. & Chandy, R. K. (2009). Radical Innovation across nations: The preeminence of corporate culture, *Journal of Marketing,* 7, 532 - 539.

UNIDO (United Nations Industrial Development Organization) (1985). Input-Output Tables for Development Counties, Vienna, Austria: UNIDO (United National Industrial Development Organization).

United Nations (1975). Input-Output tables and Analysis, Series F. No. 14 Rev. 1. New York: United Nations.

nited Nations (1999). Handbook of Input-Output Tables Compilation and Analysis, Series F. No. 74 New York: United Nations.

Yotopoulos, P. A. & Nigent. J. B. (1976). Nugent Economic Development: Empirical Investigations. Harper & Row: New York.

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