INVESTIGATION OF TELECOMMUNICATIONS PROLIFERATION AND OTHER FACTORS ON ECONOMIC GROWTH AND SOCIAL DEVELOPMENT USING LRSA

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Kenya

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Summary of Talk

- Aims
- Background
- Methodology
- Linear Response Surface Analysis
- Interpretation of Findings
- Conclusions
- Future Work

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Aims

- Analyse the relationship between Telecom Penetration, Radio Frequency Planning and other relevant factors.

- In the process, the idea is to determine critical success factors to get maximum social and economic benefits from these technologies.

- One of the research objectives is to investigate some of the links between transaction costs, telecommunications and economic welfare indicators.

- In other words, the paper explores possible links between frequency management strategies, transaction costs and the deployment of telecommunications technology on economic welfare and growth.

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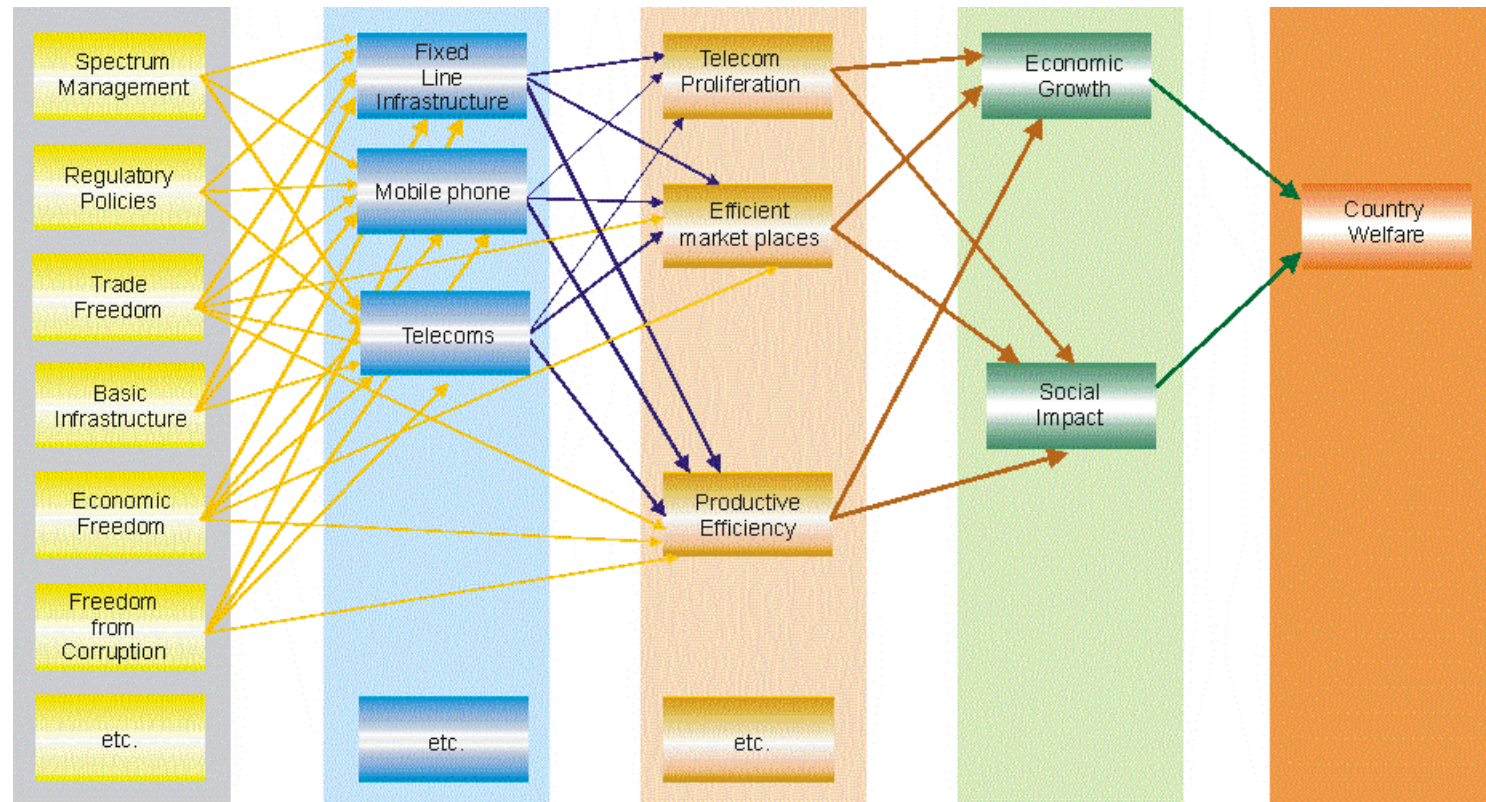NOORDWES-UNIVERSITEIT
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Aims (Cont.)

- The paper describes some empirical analyses based on information given in World Bank reports, ITU reports and others.

- The empirical analysis entails some regression studies and applications of linear response surface analysis techniques (LRSA).

- The results are presented and discussed.

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Background

- A number of researchers have carried out empirical investigations to look at how telecommunications infrastructure affects economic growth and they have discovered a positive relationship between the two.

- Among other developments, they have discovered that an investment in ICT infrastructure provides benefits to the economy.

- Telecom Technology and Cellular Phones are beneficial for Economic Growth.

- Good Spectrum Allocation is beneficial to Social Welfare and Economic Growth.

- The Substitution Effect on the relationship between fixed phone lines and Cellular phones is true for subsets of the population.

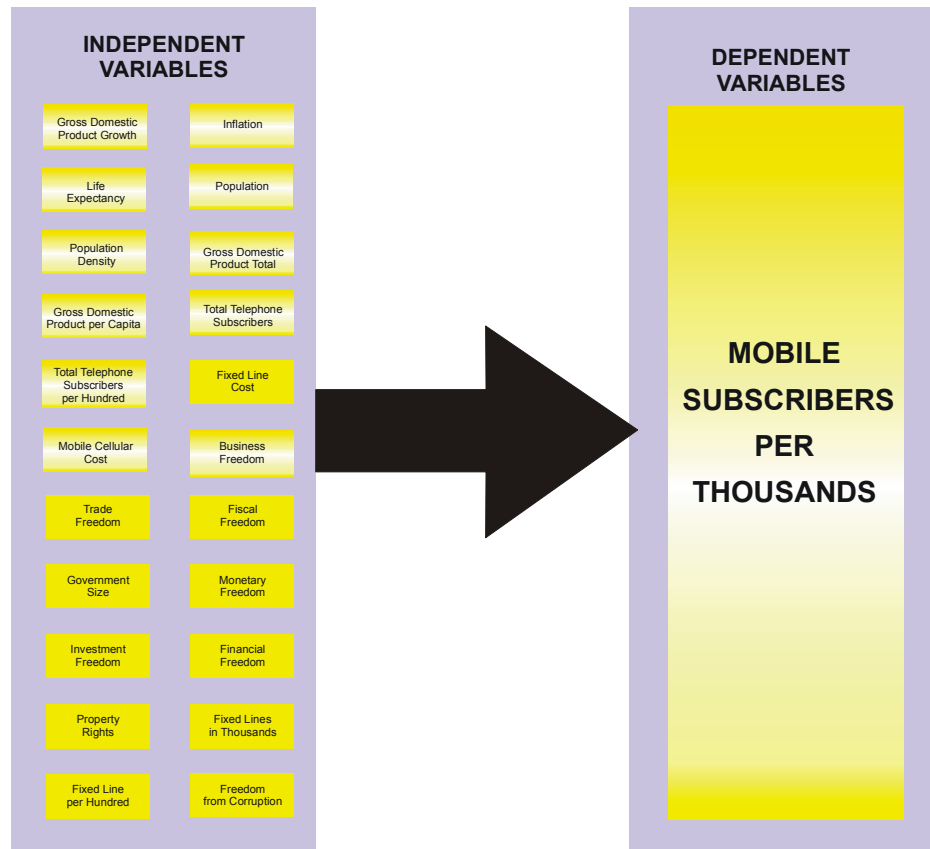- Good spectrum management policies are beneficial to economics welfare and growth.

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Summary of Relationships in Literature

Methodology used in Experiments

- Empirical Investigation.
- Collected data from 160 countries of which 48 are from Africa.
- Explored some of the relationships cellular phone rollout (MSPT) and factors like total telephone subscribers (TTS).
- I am going to illustrate the modelling methodology which consists of Multiple Linear Regression and the application of Linear Response Surface Analysis for interpretative purposes.

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Factors Considered for Preliminary Regression

INDEPENDENT VARIABLES

- Gross Domestic Product Growth
- Inflation
- Life Expectancy
- Population
- Population Density
- Gross Domestic Product Total
- Gross Domestic Product per Capita
- Total Telephone Subscribers
- Total Telephone Subscribers per Hundred
- Fixed Line Cost
- Mobile Cellular Cost
- Business Freedom
- Trade Freedom
- Fiscal Freedom
- Government Size
- Monetary Freedom
- Investment Freedom
- Financial Freedom
- Property Rights
- Fixed Lines in Thousands
- Fixed Line per Hundred
- Freedom from Corruption

DEPENDENT VARIABLES

MOBILE SUBSCRIBERS PER THOUSANDS

Data Sources

- World Bank

- ITU

- IMF

- UN

- The Heritage Foundation

- etc.

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Linear Response Surface Analysis (LRSA) Technique

- The Linear Response Surface Analysis (LRSA) technique described by Bruwer and Hattingh in their article "Constrained Regression Models for Optimization and Forecasting" (Orion, Vol.1, No.1, pp. 2-15), tries to interpret regression findings by looking at the space or region of experience defined as the convex hull of the data points (taking the independent variables).

- Thereafter the regression function (Linear in this case) is evaluated over this convex hull by Linear Programming applications.

- The objective is to find points in the convex hull where the regression function attains its minimum/maximum.

- These results are then displayed graphically.

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STEPS IN USING THE LRSA METHOD

- Obtain a regression model that is "satisfactory".
- Determine the area of experience of the regression model by identifying the convex hull of the available points.
- Identify the variable (often a state variable) whose influence on the dependent variable has to be investigated.
- Select a specific level for this variable.
- Optimize the regression function over the convex hull where this variable is at a specific level. Obtain maximum and minimum values. Select another level and repeat the procedure.
- Graph the optimum values (maximum and minimum) of the regression function against different levels of the chosen variable. The points on the graph represent the solution of a linear program in each case.

Illustrative example of Preliminary Investigation Multiple Linear Regression Analysis

- Linear Regression was used to relate MSPT (Mobile Subscribers Per Thousand) to various factors as given below.

- The fit obtained gave a multiple regression coefficient (R^2) of 95.7% and an adjusted R^2 of 95.6%.

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Regression Interpretation

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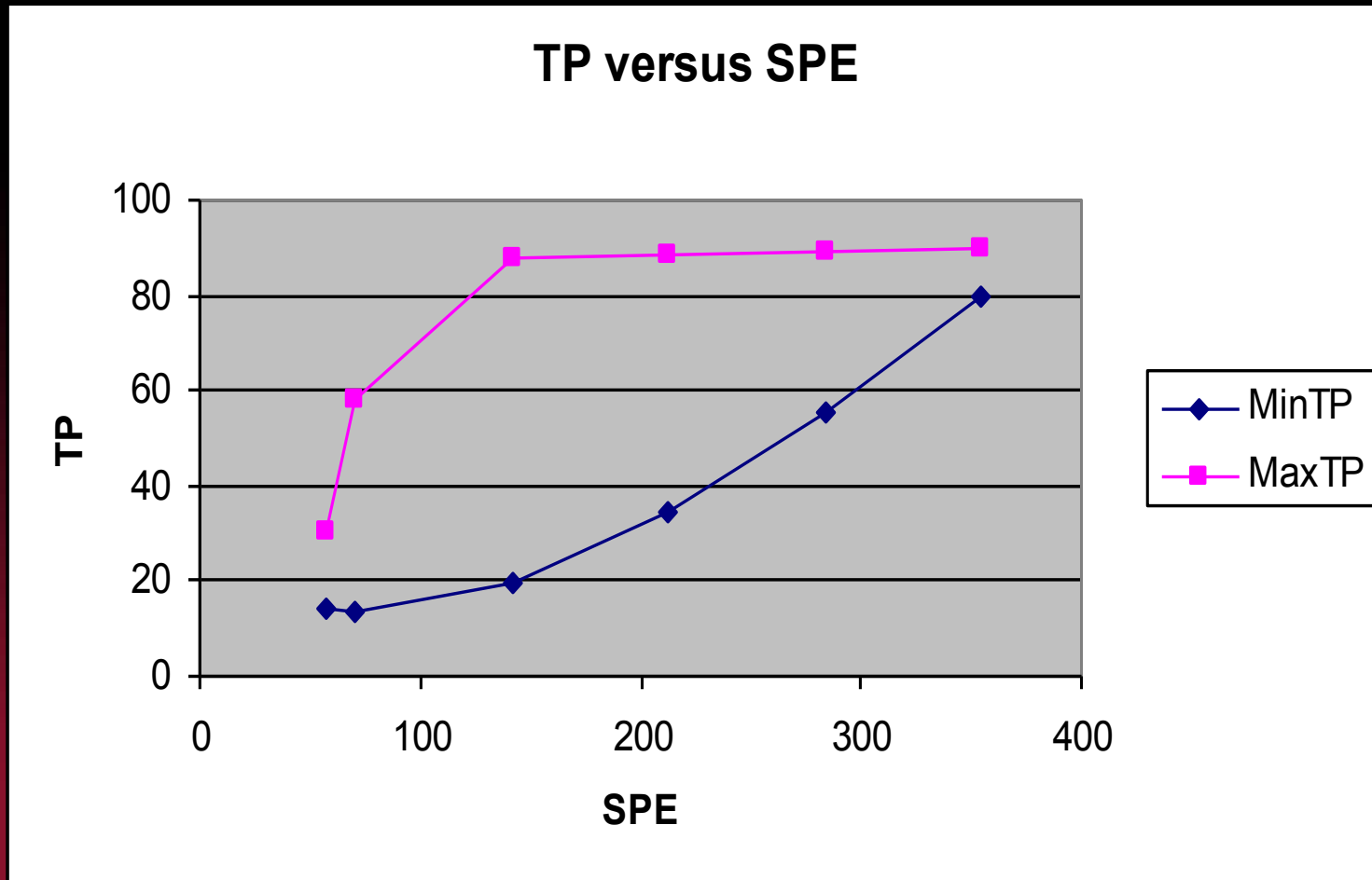
Graph from LRSA
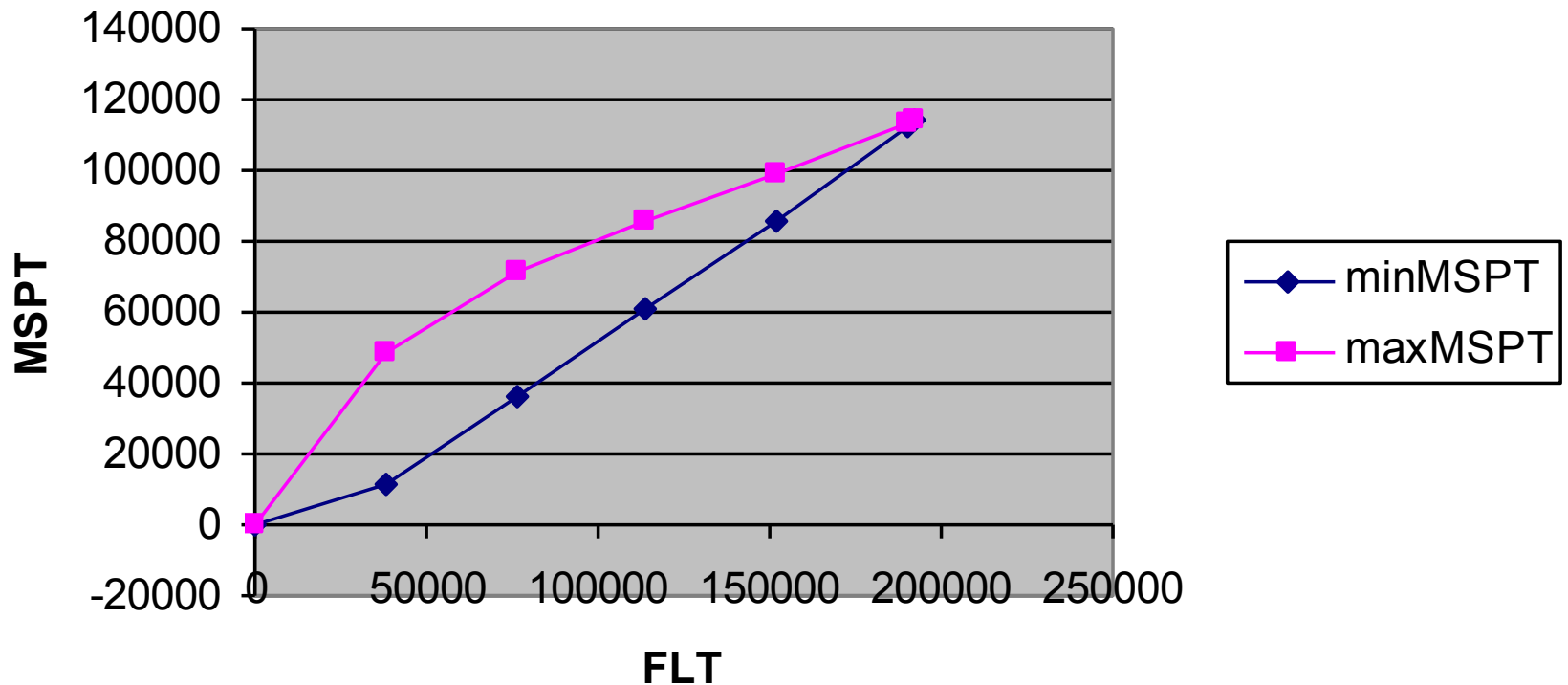
Interpretation of Graph

- The graph shows the range of expected values of MSPT over the range indicated for FLT.

- Both the maximum expected values and the minimum expected values are indicated.

- The difference between the two graphs can be attributed to the other factors in the model.

- It is clear that FLT have a very strong positive influence on MSPT. (The tendency shows a positive correlation and the other factors are relatively less influential especially of higher values of FLP since the graphs are relatively close to each other).

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Further Application

- Further Linear Regression was used to relate TP (Telephone Proliferation) to various factors such as Free market index (FMI), Spectrum allocation for wireless telephony (SPE) etc.

- Applying the LRSA method, the following illustrative graph was obtained.

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Graph from LRSA

Interpretation of Graph

- The graph (TP versus SPE) shows a slightly weaker correlation.

- However it shows that very low values of SPE impact negatively on TP.

- The relatively large difference between the graphs shows that the other factors (like GDPC) has a relatively large influence. GDPC (Gross Domestic product).

- The idea that more SPE allocation has a beneficial effect on TP (and thus on welfare) is supported by this data.

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Preliminary Conclusions

- The idea that countries with weak infrastructure in the sense of fixed telephone lines can leapfrog by going to mobile technology is only partly supported by this data.

- The methodology applied (Multiple Regression/LRSA) seems to add value to the analysis and shows good results.

- The methodology is also a useful technique to clarify complex relationships.

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Future Work

- To apply these methodologies to the available international data to obtain a more holistic model.

- Evaluate specific countries by benchmarking and performance improvement proposals.

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Value of the Paper

- Our methodology tries to answer the following questions that are not answered by the models and relationships considered in the literature:

1. What is the effect of a variable?

2. How strong is the effect relative to other indicators?

3. There is no classification of variables into state and decision variables since there is a spectrum of variables difficult to change and ones that can be considered to be decision variables.

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