TELEPHONE DEVELOPMENT - ADJUSTMENT TO EXTERNAL SHOCKS

Lars ENGVALD

Technical Cooperation Department
International Telecommunication Union
Geneva, Switzerland

1. TYPES OF EXTERNAL SHOCKS

External shocks which have an effect on the development process are either of a negative character, such as wars, natural catastrophes, economic crises, etc., or of a positive character with a positive effect, if we interpret the word "shock" in a broader sense.

The sudden wealth acquired by many oil-producing countries through the quadrupling of prices in October 1973 produced a positive shock effect on development trends in those countries, but the negative effect on oil-importing developing countries was particularly hard. A drastic change in the financing allocated to public services, such as telephone or television, will have an effect on their development trends (and, correspondingly, on their demand trend). In the development of international telephone traffic, we experienced many shock effects of a positive nature when the operation of services changed from manual to automatic or when the establishment of satellite communications introduced reliable, often direct connections with other countries.

All these cases represent a type of shock effect which must be considered within the context of the development plan of a country.

The usual pattern for such sudden external effects is either an immediate change in development trends or a change that occurs with a certain time lag. Then, once the situation has become stable, the usual trend will be re-established. This re-established trend may present a profile which is similar or different to that which existed before the shock effect took place.

An early study in which the effects of the Second World War and the economic crisis of the 1930's are shown was presented by R.F. Bogaerts at the ITC-3 in 1961 [1].

In recent years, economists have been particularly interested in analysing the shock effects witnessed in most countries of the world during the 1970's and the present decade.
We are all aware of the quadrupling of petrol prices in 1973 and the further 80% increase in real terms during 1979-80. The industrial market economies experienced two recessions during the past decade, and we may speak of an "interest-rate shock" that resulted from the monetary policies adopted by the major industrial countries in order to combat inflation. The sudden drop in oil prices in 1986 will become apparent in the development trends though the full impact of this change will be felt only in the next two to three years.

Figure 4, below, shows the changes in petrol prices since 1972 as well as the percentage of world production of oil that comes from the OPEC countries. (Figure 1 is published by permission of SBS, Swiss Bank Corporation) [4].

All these shocks to the world economy have created various recession effects throughout the countries of the world and the measures adopted to counteract the negative effects are under intensive study by economists all over the world. The World Bank has a large programme on such research, the results of which have already been published in part during recent years, with several more studies to be published.

The World Bank's "Research News", Vol.4, Number 3 (Fall/Winter 1983) [2], reported briefly on the various research phases being undertaken.

The World Bank classified their research on adjustments into three phases:

1) "to impose analytical order on country descriptions of shock and adjustment; to construct comparators that can place individual country's performance in perspective; and to locate empirical regularities ...;

2) to explore links between a variety of policy instruments and modes of adjustment defined by the comparative analysis with a view to eliciting policy lessons ...;

3) to examine the optimality of different policy responses to external shocks".

In the Conclusions of the above-mentioned World Bank Summary [2], it is stated that:

"The nature of adjustment to external shock in a country is clearly a product of three factors:

(a) the magnitude of shocks;
(b) the economic structure;
(c) the conduct of economic management in responding to those shocks"

and

"the ability to manage any future adjustment depends significantly on present attempts to strengthen economic structure through better management of physical resources and the development of human resources through programmes in health, education, population and nutrition."
2. CROSS SECTIONAL STUDY OF EXTERNAL SHOCKS

The author has studied how the effects of external shocks in more recent years have influenced the development trends of telephone services.

The cross sectional study in Table 1 has been based on the formula showing the relationship between DEL/100 population and GDP/Capita.

\[ y = a \times x^b \]

\[ y = \text{DEL/100 (direct exchange lines per 100 population)} \]

\[ x = \text{GDP/CAP (gross domestic product per capita, in equivalent US$)} \]

\[ a, b = \text{constants (to be determined)} \]

For this formula, the coefficients \( a \) and \( b \) have been calculated through a regression analysis for the individual years between 1969 and 1985, which covers the period during which the world experienced the extraordinary price increases of petroleum products, as well as other shock effects.

The countries of the world have been grouped into three categories, viz:

1) the developing countries (DEV)
2) the main oil-producing countries (OPEC)
3) the industrialized countries (IND)

The results of the regression analysis for these three groups of countries have been listed in Table 1 below, giving the resulting \( -\log a \) and \( b \) coefficients plus the correlation coefficient, \( R \), and the number of sample countries, \( N \), included in each calculation.

The effects of petroleum price increases in 1973 and in 1979 on the telephone development trends of the countries of these groups can probably best be seen from the graphical representations of the \( a \) and \( b \) values against the time function. Figures 1, 2, and 3 represent the results for the country groups DEV, OPEC and IND respectively. In Figure 5, the three groups of countries are presented together for a better overall comparison. How the petroleum prices have varied during the period 1972-1986 is shown in Figure 4, illustrating the critical years when price shocks took place.

**Formula:** \[ y = a \times x^b \]

The linear regression analysis is made from the expression derived from the above formula, i.e.:

\[ \log y = \log a + b \times \log x \]; where \( \log a = a \)

The values for \( a \) and \( b \) are calculated for each year according to the regression analysis method. The proximity of the data to the regression line is represented by the correlation coefficient \( R \). \( R^2 \) varies between 0 and 1 (0 and 100%). At 1 (100%), the correlation is perfect, i.e., the data points coincide with the regression line.

5.3A.1.3
Developing countries

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DEVELOPPING COUNTRIES</th>
<th>O P E C COUNTRIES</th>
<th>INDUSTRIALIZED COUNTRIES</th>
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<td>* a (log a) b R% N</td>
<td>* a (log a) b R% N</td>
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<td>- .249 .463 80.7 16</td>
</tr>
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</table>

TABLE 1 - Regression results

3. COMMENTS ON THE RESULTS

3.1 The developing countries

Figure 1 refers to the developing countries and shows the values of coefficients "a" and "b" for each of the years 1969 to 1985 inclusive.

The development trend, or elasticity, is reflected by the coefficient "b", which appears to have "responded" immediately to the oil-price increases of 1973 and 1979.

This indicates that the developing countries are particularly vulnerable to external shocks, which in our particular case showed that the development trend of investments in telephones (indicated by the increase of main telephone lines), was immediately affected.

We also see that the adjustment effects set in soon afterwards and stability had almost been reached when the second shock occurred in 1979.
Fig. 1 - Developing countries

Fig. 2 - OPEC countries

Fig. 3 - Industrial countries

Fig. 4 - Petroleum countries:
Production & Prices. See Ref. (4)
Formula: \[ y = a \cdot x^b \quad x = \text{GDP/CAP (US$)} \]
\[ y = \text{DEL/100} \quad a^* = \log (a) \]

Fig. 5 – Effects of petroleum price increases on telephone development trend
3.2 The oil-producing countries (OPEC)

Figure 2 refers to the oil-producing OPEC-member countries. In this case, we discover a positive shock effect, as would be expected.

Yet it seems that during the years immediately preceding the 1973 shock, a set-back had appeared for the "b" coefficient which, however, started to increase rapidly some 2 to 3 years after 1973.

The trend continued to improve, with some fluctuations towards the end of the 1970's.

As oil prices on the world market have declined, and the oil-producing countries are limiting their production, we would expect to see a slowing of the increase of the "b" coefficient.

3.3 The industrialized countries

Figure 3 refers to the industrialized countries. For this group, a gradual decrease of the "b" coefficient has been recorded since the data was analysed in 1969.

The shock effect of the 1973 oil price increase was not felt immediately by the industrialized countries, but seems to have occurred in the years 1977 and 1978 in particular, a time lag of about 4 years.

It is clear that the richer, industrialized countries were more able than the poorer, developing countries to withstand the shock effect caused by the quadrupling of petroleum prices late in 1973 both in the immediate short term and over a longer time period.

In the above commentary on shock effects and the countries' reactions, we have mentioned only the effects caused by the increase in oil prices. They were probably the dominating factor, and set in at clearly identifiable dates. Other effects, mentioned in paragraph 1, have no doubt also had an additional impact.

Although the data sources for the above investigation are far from error-free, the results clearly show that external shocks have an impact on telephone development, and that this effect is very different for the developing, industrialized and oil-producing countries.

This cross-sectional study could be improved by including more reliable data for the various countries. This will be possible, for a certain number of countries at least, once the World Bank country studies on this subject have been completed and made available.

It should also be mentioned that for this cross-sectional study, the comparison is based on converting local currencies to equivalent US$ using the current bank exchange rates. It would have been interesting to use the ICP-method [3]. Once a larger number of countries are covered by the ICP-method, as is envisaged, this analysis could be made.
4. A GRAPHICAL INTERPRETATION OF RELATIONSHIPS

When studying the time functions of the "a" and "b" coefficients for the three groups of countries used in this study, it appears that the coefficients of the power-function, \( y = a \cdot x^b \), used in the study of the relationship between \( \text{DEL}/100 \) and \( \text{GPD/CAP} \) can be represented by a "tangent-line" that moves along a logistic-type function. Figure 6 illustrates.

In this pictorial form, the coefficient:

- \( \dot{a} \) is the point on a vertical line where this tangent line meets;
- \( b \) is the tangent at time (T) on the logistic-type function.

The inserted figure indicates the variations of the coefficients "a" and "b" according to time (T).

The trend functions are therefore themselves a function of time, which obviously will be different from country to country. However, it is interesting to see that there is a certain time at which the development trend for telephone (and this is no doubt also valid for many other utilities) reaches a maximum (b(max)), and the trend gradually declines thereafter.

Fig. 6  - Relationship between \( \text{DEL}/100 \) & \( \text{GPD/CAP} \)
REFERENCES


ICP - International Comparison Project (Phase III): The United Nations Statistical Office, the World Bank and the International Comparison Unit of the University of Pennsylvania started this project in 1968. Four reports have been prepared of which the third, Phase III, published in 1982, produced purchasing power parities (PPP) for 34 countries.