

# **FORECASTING DEMAND THROUGH ESTIMATION BY ANALOGY: The Case of the Internet**

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## **ABSTRACT**

Forecasting the future is an important task for any organization. There are a number of traditional methods that are used to forecast. A straight-line projection from historical performance is often used and is relatively accurate in mature industries or countries. Other more sophisticated approaches, to forecasting, involve complex models. One such technique is estimation by analogy.

There are three ways to use this technique. One way is to make cross sectional comparisons, another is to determine and track the input/output elements of a given product. The third way is to use a time series displacement approach.

Utilizing the framework established by the theory on diffusion of innovation, a paradigm can be developed to forecast future demand for new products. In 1994 a study conducted on the cellular industry established the applicability of the time series displacement approach in the international market place. Following are the results of a second study, based on Internet penetration, conducted to validate the time displacement approach as well as test the input/output approach.

## **I - INTRODUCTION AND BACKGROUND**

The worldwide installed base of Internet users approximated 500 million at the beginning of the 21<sup>st</sup> century, with over one third (143 million) of the total being in the United States. A remarkable aspect of this situation is the very high growth rate of the industry to date and the high growth rate forecast into the future. This scenario is very similar to the experience of the cellular and the PC industries.

Forecasting the future has always been tricky proposition. Since we have no crystal ball, and live in a very interdependent complex world, cross geographical and/or cross industry methods may be applicable for forecasting the future. The need for a forecasting model is greatest when foreign markets are involved. In many situations, especially when dealing with less developed countries, resourceful techniques are required. One such technique is using estimation by analogy.

## **II – ESTIMATION BY ANALOGY**

There are three ways to use this technique. One way is to make cross sectional comparisons while another approach is to determine and track the input/output elements of a given product. The third way is to use time series displacement approach. This paper will test the time series displacement and input/output approaches.

### **Time Displacement Series**

Displacing time is a useful method of market analysis when data are available for two markets at different states of development. This method is based on the assumption that an analogy between markets exists in different time periods or, put in another way, that the markets in question are going through the same states of market development though at different times. The method amounts to assuming that the demand level for product X in country A in time period one was at the same stage of demand for product X in time period two in country B. The diffusion of innovation theory postulates that new products or services follow a predictable pattern of penetration based on the sequence of adoption by the different customer segments. This theory was tested on the cellular industry and showed that, after allowing for different starting times in different countries, one could correlate the countries penetration rate and predict the future rate for the lagging country. (Speter, 1995)

### **Input/Output Approach**

This method is based on the assumption that there's an analogy between the relationship of a particular input product with another product. For example if we know the demand for product X in one country A (i.e.  $X_a$ ) and the factor (Y) that correlates with the demand for product X, we can forecast the demand for product X in country A by measuring the input level of factor Y. This correlative approach was tested in the 1970's when printed circuit board consumption (the known input factor) was used to forecast the output of computers (the unknown factor) in various countries. Another effort correlating the availability of color phosphors to the production of color television picture tubes was also completed at the same time. (Speter 1974-1976).

With respect to internet usage, to date, there has been the necessary requirement of a PC with communications capability as the precursor to internet usage. However, in the future, the correlation between PC's and Internet usage will be weaker as other devices (e.g. Personal Digital Assistants) become more widespread.

### III - INDUSTRY EXPERIENCES

#### Cellular

Cellular service was introduced in different markets at different times. At the end of the year 2000 there were about 750 million cellular phones in use worldwide with the largest number (i.e. 124 million) in the United States. Hong Kong had the highest penetration rate at 81%. Among the top ten countries (see table below) the Scandinavian countries Sweden, Finland and, Norway all began offering service in 1981 in a monopoly environment. Competition and advanced technology were introduced in subsequent years and today these countries (plus Iceland) are among the leaders, in terms of cellular penetration, in the world. The countries with the highest penetration today (i.e. Hong Kong and Taiwan) are unique since they began cellular service at a later time, are similar from a cultural (i.e. Chinese) perspective and have a very high population density. The remaining four countries, among the top ten (i.e. Austria, Italy, United Kingdom, and Israel), also have a very high population density.

The United States, where cellular service began in late 1983, had the highest absolute number of cellular phone users and having had the fifth highest penetration in 1994. However, due to a slower growth rate, the U.S. did not make it into the top ten list, in terms of market penetration, in the year 2000.

#### Top Ten Countries Cellular Penetration

Country	1994		2000	
	Subscribers (000's)	Penetration Rate (%)	Subscribers (000's)	Penetration rate (%)
Sweden	1,291.8	14.7	6,369.0	71.7
Norway	568.5	13.2	3,367.8	75.1
Finland	649.3	12.8	3,728.6	72.0
Denmark	510.4	9.8		
United States	23,045.3	8.8		
Singapore	248.0	8.7		
Iceland	21.8	8.3	215.5	76.7
Hong Kong	425.0	7.7	5,447.3	80.9
Kuwait	120.0	6.6		
Canada	1,822.5	6.5		
Taiwan			17,873.8	80.5
Austria			6,252.8	77.0
Italy			42,246.0	72.7
United Kingdom			43,452.0	72.7
Israel			4,400.0	70.2

Source: International Telecommunications Union Yearbook, 2002

## Personal Computers (PC's)

Computers had their beginning with a post World War II effort called the ENIAC. Early versions were large and slow. IBM began using integrated circuits in the 1960's in large "mainframes" like the 360 series. New generations of computers were developed with the Personal Computer being introduced in the early 1980's. Advances in chip technology resulted in faster, smaller machines available at lower and lower prices. This resulted in a rapid increase in the number of computers. By the end of 2000 there were almost 450 million PC's worldwide and by the end of 2001 almost 500 million. Additionally, with the introduction of low cost modems, virtually all PC's were communications capable by the year 2001. The market penetration and growth of PC's closely mirrors that of the Internet and lags cellular phones by approximately five years.

## The Internet

The Internet also had its roots in postwar military projects. The US army developed a new communications method called the ARPANET, which broke up messages into packets to make them more difficult to intercept. Various universities were experimenting with the network and in 1969 believe to have started the Internet with some basic emails. However, it wasn't until the early 1990's with the development of easy to use applications that use of the Internet started to take off. Over the last 10 years the number of Internet users has approached 500 million worldwide with an overall penetration rate of 8%. This performance, as noted, is closely to PC's and cellular phones both in terms of numbers and also because in order to use the Internet a computing device (i.e. PC) or communications (i.e. cellular phone) is required.

### Top Ten Countries PC & Internet Penetration (end 2001)

Country	Personal Computers		Internet Users	
	Subscribers (millions)	Penetration Rate (%)	Subscribers (millions)	Penetration rate (%)
United States	178.0	62.3	142.8	50.0
Norway	2.3	50.8	2.7	59.6
Singapore	2.1	50.8	1.5	36.3
Switzerland	3.6	50.0	2.9	40.4
Netherlands	6.9	42.9	5.3	32.9
Finland	2.2	42.4	2.2	43.0
Iceland	0.1	41.8	0.2	67.9
Hong Kong	2.6	38.5	3.1	45.9
United Kingdom	22.0	36.6	24.0	40.0
Japan	44.4	34.9	57.9	45.5

Source: International telecommunications Union Yearbook, 2002

## **IV - CONCLUSIONS**

The Internet industry offers an interesting example of the potential utility of the estimation by analogy theory. As noted earlier, the theory can be used to predict demand in the future, especially in countries where there is little available data. However, any technique is subject to substantial limitations. The following factors should be kept in mind in using this technique:

1. Are the two countries for which the analogy is posited really similar in displaced time? To answer this question the analyst must understand the similarities and differences in the cultural environment in the two countries if a consumer product is under investigation and in the technological systems if an industrial product is being considered.

2. Have technical and social developments resulted in a situation where demand for a particular product or commodity will leapfrog previous patterns, skipping entire growth patterns that occurred in more developed countries?

3. The distinction between potential demand for a product based on underlying factors, and actual sales based on the combination of potential demand, and the offer conditions of the product should be kept clearly in mind. If there are differences among the availability, price, quality and other factors associated with the product in two markets, potential demand in the target market will not develop into actual sales of a product because the offer conditions are not compatible.

## **V – RECOMMENDATIONS**

To further validate the applicability of this forecasting approach the cellular and Internet penetration should continued to be measured. Additionally, other industries should be identified and tested to see if the utility of the estimation by analogy paradigm holds.

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