ESTIMATING WELFARE GAINS FROM TARIFF REBALANCING IN TELECOM: A CASE FOR UKRAINE

by

Ilyashenko Tatiana

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Abstract

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by Ilyashenko Tatiana

Chairperson of the Supervisory Committee: Professor Serhiy Korablin

Institute of Economic Forecasting at Academy of Sciences of Ukraine

This research aims to estimate the deadweight losses associated cross-subsidization in Ukraine's telecommunications market. For this, elasticities for three markets were estimated: national long-distance calls, international calls to CIS countries and international calls to rest of the world. The loss in economic efficiency is reflected by the gap between marginal cost of telecommunications service and the price consumers pay. Under the monopoly environment in Ukraine, prices for telephone connections, monthly subscriptions, and local calls have traditionally have been set below costs. Resulting deficits have been subsidized by above costs long distance and international calling prices. Empirical study, which is based on the latest data (1998-2001), confirms the expectations about the efficiency gains from tariff rebalancing. A combination of price-cap and sliding scale regulatory regimes is proposed as this mechanism retains the advantages of price cap (tariff structure that will enable dominant operator to compete on the market with new operators. It also provides operator with incentives to cost minimization, investment in new cost saving technologies regulation and allow for greater allocative efficiency.

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GLOSSARY

Call Back Arragements- The type of service, similar to reverse charge calling, enables a customer in one country to connect to an operator or automated system in a second country where the call is received. The automatic dialer (which can be a PBX or code caller) either calls the customer back at a predestinated number providing the customer a dial tone in the second country or patches the customer through to a number in the second or third country

Peak rate Term used for calls made during the busy part of the day, at full tariff. Off-peak refers to calls made at other times, often with discounted tariffs.

Penetration A measurement of access to telecommunications, normally calculated by dividing the number of subscribers to a particular service by the population and multiplying by100.

Price Cap – Is a rules-based form of price regulation that uses a formula to determine the maximum allowable price increases for a regulated operator's services for a specified year or number of years. The formula typically allows an operator to increase its rates annually for a service or basket of services by an amount equal to inflation, less an amount equal to the assumed rate of productivity increases. Other variables may be taken into account in the price cap formula such as

'exogenous factors' outside of the operator's control and the quality of service provided by the operator.

Rate of Return Regulation (ROR) Is a rules based form of price regulation designed to provide the regulated operator with relative certainty that it can meet its revenue requirements and that prices will be adjusted, as required to meet that objective. Under this scheme, the regulated operator's revenue requirement is calculated and then service prices are adjusted so that its overall service revenues cover such revenue requirement.

Rate Rebalancing - It refers to the adjustment of rates charged for different services to more closely reflect their costs. In most countries, this means increasing local access rates and decreasing international, long distance, local usage rates and Internet access.

Refile (hubbing of traffic **) -** is using one country to collect traffic and switch this traffic to other countries (similar to third country calling or call-back services).The difference between refile and call-back services is that the former is usually undertaken on a larger scale, often by PTOs themselves, and often using leased circuits and public switched networks.

Universal Access – A term generally used to refer to a situation where every person has a reasonable means of access to a publicly available telephone. Universal Access may be provided through pay

telephones, community telephone centers, community Internet access terminals or similar means.

Chapter 1

INTRODUCTION

Until recently, telecommunication industry was considered to be a natural monopoly. Today, due to increase in demand for telecommunications services and advance in technologies, costs may be minimized with the entry of more firms into the market. Although, former monopolists are gradually losing market power, the process is rather slow and regulatory intervention is still needed to ensure "level playing field" for all agents.

In Ukraine, under the monopoly environment, prices for telephone connections, monthly subscriptions, and local calls have traditionally been set below costs. Resulting deficits have been subsidized by above costs long distance and international calling prices. The frequently stated objective for such policy is to promote affordability of basic telecommunication services for low-income individuals. Another important reason is that such price structure incorporates the value of the service principle. So business customers are charged more than residential for the same connection and subscription services (ICPS, 2001).

Under competitive environment cross-subsidy mechanism is no longer viable. New entrants will generally enter those markets where profit margins are the highest, forcing incumbent operator to reduce subsidies.

Moreover, this pricing mechanism produces both productive and allocative inefficiency, because of the wrong price signals to the market actors (higher than costs prices encourage uneconomic entry by high-cost inefficient operators, while lower than cost prices discourage economic entry). It also hurts business users of telecommunications infrastructure, since it charges higher price for long-distance and international calls (Church & Ware, 1999, p. 797).

Tariff rebalancing is a current tendency of bringing prices closer to the costs of providing services (OECD, 1999).

In this paper, I am going to attempt to estimate the deadweight loss from cross-subsidizing for basic telecommunications services in Ukraine. Dead weight loss is reflected by the gap between marginal cost of telecommunications service and the price consumers pay. It can be estimated using the price, cost, volume of traffic and elasticity estimates over relevant markets. I will estimate elasticities of demand for two markets (long-distance calls and international calls). Data available do not allow me to estimate elasticity for local calls market, since analogue equipment do not allow operator to measure traffic in minutes and distinguish between voice traffic and data traffic (Internet traffic).

The structure of the paper is following. In the next Chapter the review of the literature on optimal tariff regulation is provided. In Chapter 3 Ukrainian markets, agents and institutions are broadly discussed. Data description and theoretical model for demand estimation are presented in Chapter 4. Chapter 5 provides discussion of results on elasticities and deadweight loss estimation for Ukraine. Chapter 6 contains some conclusions and policy implications.

Chapter 2

THEORY REVIEW

Rationale for Telecommunications industry regulation

Natural monopoly exists where one firm is able to produce the relevant range of outputs at a lower cost than two or more firms. Modern view of natural monopoly rests on the concept of subadditivity of costs. Cost function is subadditive if any division of output between N firms results at greater industry costs when if one firm produces that quantity of output. In the single product case economies of scale imply subadditivity (Baumol, Panzar, Willig, 1982).

There are several sources of natural monopoly in telecommunications industry. First, economies of density arise due to the existence of the cost savings from serving more customers in a given local market. Traditional wire and cable networks involve large sunk and low marginal costs. Once the infrastructure is in place, the costs of services on the wire running from the customer to the local exchange are not traffic-sensitive.

Second factor is existence economies of scope, which are associated with the joint production of different types of services. Examples are provision of local, national long-distance and international network infrastructure or provision of both infrastructure and retail services).

Third possible contribution to natural monopoly in telecommunications is economies of scale derived from single firm servicing many local markets (Viscusi et al,1999, p.460).

The overall cost situation (and subadditivity) is influenced by transaction costs, technological change and size of the relevant market. This means a natural monopoly can be a temporary phenomenon. For example, technological evolution allowed to shift from wire to microwave technology, which greatly decreased fixed costs of providing telecommunications (Viscusi

et al,1999, p.465). Another important technological development, which greatly influenced markets for long-distance and international communication is widespread adoption of digital packet-switched technology, which allow communication traffic to be managed and delivered over multi-purpose platforms and made IP telephony a strong substitute to traditional fixed-line telephony (Intven et al, 2000, p.5-13).

Simultaneously, the demand for telecommunications has shifted for several reasons. First, the advent of technology altered some characteristics of the product itself and allowed telecommunications to be used for a wider range of purposes (in particular, development of fiber optics and digital electronics allowed to transmit data and video as well as voice traffic over the network). Second factor affecting the demand was the development of computers and their widespread use (Viscusi et al 1996, p. 466).

Although, market changes discussed above allowed competition for the market to became viable option for regulation, thus lessening the necessity for intervention, there are still strong arguments as to why this industry may require strong regulatory intervention (Intven et al, 2000, p. 5-26):

1. Large sunk costs of local network construction
2. Network effects that reflect the desire of customers to be able to make calls to and receive calls from anyone
3. Legacy of historical statutory public monopoly in telecommunications services that led to the dominance of the firm in the provision of the customer access network and its subscribers.

There are several solutions to the natural monopoly problem. Traditional view is that market failure requires direct regulatory intervention to achieve first best optimum (Brautigam, 1989, p.1300). First best solution can be achieved by setting uniform prices at marginal cost and providing producer with subsidy necessary to cover fixed cost. Such subsidy, in principle should be financed from the lump-sum tax, levied by the government. This solution

could only be optimal provided that such tax does not introduce distortions on other markets, which is unlikely to happen in practice.

Another way to achieve first-best solution is to allow producer to discriminate between consumers. Such policy will lead to consumers losing their entire surplus and producer gains all, which might be viewed as inequitable.

Since first best optimum is hard to achieve, regulator may opt to achieve second best optimum. Some form of second best pricing rules may still be preferred to government intervention to achieve first best optimum Government intervention to achieve first-best optimum may only be warranted in the case when deadweight loss from second best solution is too large ("intolerable") (Brautigam, 1989, p.1307).

Optimal pricing rules

In case of a single product monopolist the problem of second-best pricing is relatively easy to solve. It is achieved by setting the price equal to the average cost. No greater economic efficiency can be achieved if the break-even constrained is to be satisfied. The problem of second best pricing becomes more complicated when we turn to the case of multiproduct firm. In general the notion of average costs will not be clearly defined for the multiproduct technology. If there are shared costs of production, than there is no unambiguous ways to allocate common costs and, thus, measure average costs for each service. Regulators usually employ some allocation mechanism based on share the service in total revenues or physical output level. Anyway, prices set according to distributed costs will generally be inefficient, since they are set without taking into consideration demand elasticities, which are important for determining deadweight loss from pricing policy (Brautigam, 1989, p.1313-1316).

Ramsey pricing allows covering all variable and non-variable costs through one-part tariffs on different services, with the least overall cost to economic

efficiency. Formally, Ramsey optimal prices will maximize the sum of the consumer and producer surplus, T, subject to a constraint of the non-negativity of profits, $\pi \geq 0$

$$\max_{p} T = \varphi(y) + \overline{p} \times \overline{y} - C(\overline{y}, \overline{w})$$

subject to $\pi = \overline{p} * \overline{y} - C(\overline{y}, \overline{w}) \geq 0$

Assuming independent demand for products (that is, $\partial y_j / \partial p_i, i \neq j$) the conditions for optimality can be expressed in the following way:

$$\left(\frac{p_i - \partial C / \partial y_i}{p_i} \right) \varepsilon_{ii} = \left(\frac{p_j - \partial C / \partial y_j}{p_j} \right) \varepsilon_{jj} = -\frac{\lambda}{1+\lambda}, \forall i, j$$

This relationship represents "inverse elasticity rule", which states that a lower mark-up must be associated with a more elastic demand when the breakeven condition is binding. When the demands are independent, the second best price in each market will be above marginal cost, when the break-even condition is binding and equal to the marginal costs, when the breakeven constraint is not binding. Equation indicates that the Ramsey number in each market must be (Baumol & Bradford, 1970).

It should be noted, that under Ramsey pricing, no allocation of common costs is made on the way to determine economically efficient prices. On the contrary, after the efficient prices are found, it may be possible to determine how the common costs should be allocated to generate second best prices from cost allocation process (Brautigam, 1989, p.1326).

Usually this method is used as a guideline to the regulatory intervention. The direct application of Ramsey principle would result in very high prices for use, in some cases with very high mark-ups on short-run marginal costs Due to with fact two important issues arise. The first issue of cross-subsidization and sustainability of monopoly will be discussed later in this chapter.

The second important concern is impact of Ramsey pricing scheme on income distribution. By construction, Ramsey prices provide the greatest total consumer surplus, while the distribution of this surplus among consumers is not considered. In fact, the distribution that results from Ramsey prices may

be considered inequitable, since it involves prising price of goods, which are relatively inelastic. Typically, goods are inelastic because consumers lack close substitutes, which situation typically arises because of low income. If total surplus is as high as possible, then there is theoretical possibility some way to redistribute income such that all people are better off than at any other price combination. However, generally, regulator cannot effectively implement a redistribution of surplus (Church & Ware, 1999, p. 769).

Issue of cross-subsidization

The question of the cross subsidization is usually raised in connection with the prices charged by a multiproduct firm for its different services. The price structure may be called subsidy free if the provision of any commodity (or group of commodities) by a multicommodity enterprise subject to a profit constraint leads to a prices for other commodities no higher then they would pay by themselves (Faulhaber, 1975). To investigate whether cross subsidization takes place two tests are usually employed.

Incremental cost test sets the lower bound to the revenues generated by services. For the firm that produces N products under a cost structure $C(y) = C(y_1, y_2, \dots y_N)$, the incremental cost test requires that the revenues from any subset of services $S \subseteq N$ at least cover the incremental cost of producing S, holding constant the levels of the outputs in y_{N-S} . Incremental cost is defined as increment to total cost when S is produced as opposed to not being produced. Formally it can be stated as follows:

$$\sum_{i \in S} p_i y_i \geq C(y) - C(y_{N-S}) \equiv IC_S$$

By contrast stand-alone test sets an upper bound on the revenues generated by service in the set S. Formally:

$$\sum_{i \in S} p_i y_i \leq C(y_S)$$

Under break-even constraint, firm passes the incremental cost test for a subset of services S if and only if the remaining subset of services (N-S) passes the stand-alone test (Brautigam, 1989, 1337-1340).

If any subset of services failed to pass subsidy tests, we should expect entry to occur to drive profits to zero. Since any efficient pricing approach does not take into consideration the possibility of competitive entry or alternative means of supply, such regulatory policy aimed to maximize welfare subject to break-even constrain may create a room for competitive entry even though the monopolist is earning normal profit and is a natural monopoly.

Natural question arises as to whether Ramsey pricing scheme would generate sustainable pries free of cross-subsidization. According to Baumol, Bailey and Willig (1977), under assumptions of Weak Invisible Hand Theorem Ramsey prise vectors are sufficient for sustainability. At the same time, Brautigam (1989, p.1341) provides an example, when Ramsey pricing scheme generates prices, which are not subsidy free according to incremental costs test.

According to G. Faulhaber (1975): "the discussion of the welfare maximizing prices and subsidy-free prices suggested conditions under which these two criteria might clash and the necessity of coercive intervention in restricting market entry if that were the case".

Gasmi, Laffont and Sharkey (2000) discuss two different from that proposed by Faulhaber solutions for this problem and compare them in the context of developing countries. They investigate the case of pricing of local telephone services in urban and rural markets. These services are usually priced at a uniform rate for urban and local areas, though costs of such service are considerably higher in rural areas. Unrestricted entry will destroy such cross-subsidization mechanism as new entrants will find it profitable to serve only urban markets, while incumbent will be unable to earn profits to cover the costs of operating in rural market. First solution is to allow free entry of new operators to urban markets and provide the incumbent with a subsidy to cover its losses at the rural market. Second option is to allow yardstick competition between two regions each of which is composed of urban and local area, which will produce cross-subsidization at the firm level. They found, that generally first option, which they refer to, as urban-targeted entry, is less distortionary, than comparing to the second option of territory-

constrained entry option. Under incomplete information assumption distortions from territory-constrained entry rise significantly, again favouring urban-targeted solution. However, high cost of public funds (which is determined by corruption level) makes territory-constrained type solution more attractive.

Regulatory design

Whatever the objectives of the regulator are, when choosing the appropriate regulatory policy, he must take in to account strategic responses the firm might employ to those regulations. Major problem with regulatory option described in the previous section is that it rely on restrictive assumptions about the information regulator possesses. In particular, implementing this concept will produce optimal results only when regulator has full information about monopolist/incumbent cost structure, is able to observe actions of the firm and has the authority to exercise control (Baron, 1989, p.1349).

When choosing the appropriate form of regulatory regime, regulator faces a trade-off between incentives for cost reduction and allocative efficiency (Church & Ware, 1999, p. 854). Cost plus regulation is an example of a profit confiscation rule that aims to achieve allocative efficiency by relating price to reported costs. On the other hand, fixed price regulation allows regulated firm to be a residual claimant to the profits achieved by lowest cost productive efficiency and, thus, represents the polar case of incentive regulation (Burns & Weyman-Jones, 1998). Further in this chapter I will broadly discuss examples of these two polar regulatory regimes employed in practice and one more additional regulatory option that represents the intermediate solution of dilemma.

Rate of return regulation is an obvious example of the confiscating profits approach. Under this regime regulator sets maximum profit monopoly can earn on its capital. The firm is allowed to choose output level and mix of inputs and set prices to meet those restrictions set (Church & Ware, 1999, p.

853). The problem is that such regulation produces both technical and allocative inefficiency. Subject to ROR firm has an incentive to increase its capital stock and inefficiently substitute labour for capital in production process. Because production is inefficient, the price will be too high. This effect may be interpreted as a naive regulator that in effect adjusts price as a function of costs incurred by the firm. More important is however the second interpretation, when described inefficiency is created in the environment of information asymmetry and/or regulator's limited ability to observe actions of the firm (Baron, 1989, p.1355).

One more disadvantage of ROR becomes evident in the context of multiproduct firm, which operates at both competitive and non-competitive markets. In this case, regulator may be concerned with price consumers of non-competitive products pay. Regulated firm has strong incentives to expand in competitive markets and is able to engage in anticompetitive practices such as vertical price squeeze and predation. To assess this issue regulators have typically attempted to apply ROR regulation to non-competitive markets. If the competitive part of the firm is not affiliated, necessity arises to allocate costs between competitive and non-competitive products. This cost allocation rules not only affect revenue requirements for separate markets but also affect the economic viability of rivals in competitive markets (Brautigam & Panzar, 1993).

Because these shortcomings of ROR regulation a new mechanism called price cap was developed. This represents an example of fixed price rule, which allows for regulated firm to retain all profits earned by cost reduction (). In case of multiproduct firm, regulator defines an aggregate cap for a basket of related products. The firm is allowed to change prices for the goods as long as weighted average of prices does not rise. Regulator also specifies how price cap will be adjusted over time by preannounced adjustment factor, which necessarily exogenous to the firm. This is usually index of input prices or index of retail prices and also "X factor". This factor X allows consumers to

share increased efficiencies due to cost reductions, increases in productivity, pricing flexibility and market growth through low prices with regulated firm (Church & Ware, 1999, p. 853).

If changes in price cap are completely exogenous to the firm, the firm will produce cost minimizing input mix, invest in cost-effective innovation and adjust optimally to changes in costs (Church & Ware, 1999, p. 854). Potential problem arises when we consider firm in transition from naïve ROR to price cap regulation. If under ROR regulation the retail price to price of new capacity ratio was growing continuously over time, a move to price cap freezes the ratio. Therefore, under the price cap regulation firm is deprived of return to capital that was anticipated from its previous investment made under ROR regulation. Simultaneously, if price cap is set too high in order to recover historical cost of the firm, price for services will be too high, thus leading to allocative inefficiency (Biglaiser & Riordan, 2001).

If the firm produces more than one good and a price cap is expressed as a Laspeyres index of prices for all outputs, than the firm will adjust outputs and prices in a way that increases profits without decreasing consumer surplus. Thus producer gets proper incentives and ability to rebalance prices and move toward price structure close to prices achievable under Ramsey pricing rule. The speed of adjustment towards Ramsey pricing depends both on X and weights in the tariff basket formula. The closer the initial weights are to the Ramsey quantities the quicker adjustment will be (Bradley & Price, 1988).

Over time regulator will review the price cap mechanism and adjust by altering X factor based on the profits of the firm under existing cap and other factors. On the one hand, if the time period between revisions is exogenous to the firm, price cap regulation has one more advantage to ROR regulation. According to Pint (1992), this institutional setting will lead to welfare increase, since in this case firm cannot manipulate the timing of rate hearing and has fewer incentives to overinvest in capital. On the other hand, possibility of review also introduces the possibility of strategic behaviour by the firm. Depending on what firm expects from regulator, the firm could be induced to

incur higher costs when necessary as a strategic move. The incentives to cost reduction depend on the firm's believe, that benefits of its cost reduction efforts will not be expropriated by regulatory decision. According to Weisman (1993) in this situation firm will refrain from cutting costs and may even induce waste. Biglaiser and Riordan (2001) suggest, that the value of investment in cost reduction and cost minimizing efforts crucially depend on the duration of price cap period. Temporary price cap regime provides the regulated firm with distorted incentives for capacity replacement.

Although, empirical evidence suggest that price cap rule was successful in enhancing productive efficiency (see, for example, Brautigam & Panzar, 1993; Uri, 2001), several researchers have pointed out on potential shortcomings of price cap schemes. In particular, Lewis and Sappington (1989) and Schmalensee (1989) show that advantages of price cap regulation become far less identified if considered in the context of uncertainty about cost and demand conditions.

According to Schmalensee (1989), if appropriate regime is to ensure that firm earns non-negative profits, regulator has to set high enough price cap to cover all possible cost shocks and effectiveness of investment in cost reduction. This means that the greater is uncertainty about distribution of cost shocks the larger price cap should be set to ensure profitability, and the larger is the gap between realized fixed costs and price ex post. He concludes that: "regimes in which price depend in part on actual costs may provide weaker incentives for productive inefficiency, but nevertheless generally perform better in the presence of cost uncertainty and asymmetric information about capabilities of regulated firms. Regimes involving cost sharing are better than price caps at limiting the profitability of regulated firms, and they allow price to track costs more closely".

In turn, Lewis and Sappington (1989) propose that when the firm has the superior knowledge of the environment, gains can be captured for consumers by providing firm with a choice between two regulatory options. They suggest that for the case of low realization of productivity expected, welfare will be

maximized under some sort of surplus sharing regulation with cost auditing, which limits rents firm is able to earn under price cap regulation. This solution comes at a cost of reduced incentives to cost minimization and allocative efficiency. By limiting the surplus accruing to firm with higher productivity (limiting the reward for successful cost reductions, cost auditing and reducing profit earned when cost reduction goes undetected), regulator provides firm with incentives to choose price cap regulation whenever the realization of productivity is high (beyond some threshold level). Firm will anticipate greater profit earnings under price cap regulation and will opt to operate under this regime. Under price cap, realized costs will not be audited and thus incentives for cost reduction will be restored.

Sliding scale plans represent an intermediate option between the two polar regulatory options discussed above. According to Burns and Weyman-Jones (1998), the two conditions under which this form of regulation will be unambiguously preferred to high-powered regulation are 1) uncertain regulator; and 2) dislike of residual profits, which belong to regulated firm. Regulator may be uncertain about the cost structure of the firm and dislike residual profit because of the shadow cost of making transfers to the firm; or, alternatively, he may be uncertain about the acceptance of regulatory decision and dislike profit, because large profits increase the probability of populist demand to switch to cost plus regulation. Both models suggest the optimality of intermediate incentive power regulation.

One version of sliding plan is when regulator specifies extent to which deviations from the specified rate of return will be split between firm and its customers. This regulation discourages technical inefficiency and produces less distortion to shadow price of capital than pure ROR regulation.

Another example of such intermediate regulation is price cap combined with sliding scheme, which involves adjustment for price cap based on realized rate of return. Such combination maintains the incentives for cost reduction, reduces profits of the firm and provides that prices more closely reflect costs.

Price cap combined with sliding scale regulation has an additional advantage over sliding scale rate of return regulation since it does not distort shadow input prices and therefore does not introduce Averch-Johnson effect. Moreover, in a case of multiproduct monopoly, sliding plan may be applied to an index of the firm's prices that would allow it to self-select Ramsey price structure for individual products (Burns & Weyman-Jones, 1998).

Chapter 3

MARKET AND INSTITUTIONS

National telephone network is comprised of 45 long-distance exchanges and has three digital international gateways. Ukrtelecom has also installed a 4,200 km fiber-optic backbone that is connected to four networks (ITUR, TEL, TAE and BSFOCS) providing onward communications to over 200 countries. In years 1989- 1999 number of the fixed telephone lines increased by 50% (or at a rate of 4% per year)[1]. This number is lower that comparing to the performance of the industry in other transitional economies (see chart 1 in Appendix), but better than the performance of any other industry of Ukraine during corresponding period. However, the telecom infrastructure is still far from optimal lagging behind the majority of the Eastern European countries (see chart 2 in Appendix).

Penetration rates are highly uneven in Ukraine both with respect to the geographical distribution and in urban and rural areas (average rate for urban area is 52 lines per 100 households, while average rate for urban are is only 52 lines per 100 households).

Most of Ukrainian telecommunication markets are dominated by Ukrtelecom, which owns all transmission facilities and provides most of the fixed-line telephone services. It has the largest number of subscribers – 8,4917 mln. The company was originally formed as an association of regional telecommunication enterprises from each region of Ukraine. Between 1993 and 1998 all organizations involved in the planning, building and operating public telecommunications network were consolidated into Ukrtelecom. In

[1] Here and further on the data source Ukrtelecom if other is not specified.

2001 Utel (dominant operator at the long distance and international market)[2] merged with Ukrtelecom. Ukrtelecom is still in public ownership, although its privatisation is scheduled at the end of year 2001.

There are seven licensed operators besides Utel and Ukrtelecom, who provide services of international calls. They are: Kiev Star GSM, Ukomline, Telesystems of Ukraine, DCC, International Telecommunications, Ukrainian Telecommunications. International calls market is the most competitive among telecommunications markets in Ukraine, because of modern technologies, which allow operators to lower their prices despite the regulation. This technology involves IP telephony, refile and callback.

The exact number of IP telephony is unknown, since until recently there have been no licensing requirements for this kind of services. According to estimates[3], there are several dozens of IP telephony providers, and 20% of all international traffic is comprised of international calls via IP.

There is only one license for long distance calls granted to Golden Telecom (Source: State Telecommunications Committee).

Market for local calls is fully dominated by Ukrtelecom, its share constitutes 81,9% of the market). Existing private providers (6,9% of market share) provide high value added services to corporate clients who may afford higher prices and generate large volumes of traffic. There are also administrative stations on the market (11% of the market), but they are a legacy of the Soviet past and are usually leased to Ukrtelecom.

Wireless mobile communications is the most active sector in the industry. There five mobile operators: UMC, Kiev Star, Golden Telecom GSM, DCC, Welcom. The share of mobile lines in the total telephone lines has been growing rapidly (according to State Committee of Statistics, there were about 160,000 mobile subscribers in 1999, while in 2001 their amount increased to more than 2 millions). More than 80% of mobile communications customers

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[2] Utel was established in 1992 by 13 state-owned regional companies along with the group of foreign strategic investors (AT&T, KPN, Deutsche Telecom). By 1997 Utel serviced 39% of all long-distance traffic and 100% of international traffic.

[3] News Agency "Interfax", issue 12/11/2001

are accounted for two operators: UMC (51% of UMC is in the ownership of the Ukrtelecom) and Kiev Star. The market for mobile communications is developing very rapidly in Ukraine and it can be expected that mobile providers will become more serious competitors of Ukrtelecom in the near future.

Regulatory framework for telecommunications industry in Ukraine is established by the Law of Ukraine "On Communications" of 16 May 1995, the law of Ukrainian "On Radio Frequency resource" of 1 June 2000, Law of Ukraine "On Natural monopolies" and acts secondary legislation.

The Law on Communications, which allowed for private operators to enter the market, liberalized telecommunications market in 1995. Up to now, there has been no independent regulatory body established, although the Law on communications stipulates its functions and responsibilities and State Telecommunications Committee performs functions of regulator.

Law of Ukraine "On Natural Monopolies" (2000) states that public telephony is subject of natural monopoly, while services of national long-distance and international telecommunications are adjusted markets, so they are subject to state regulation.

State Telecommunications Committee sets tariffs on basic telecommunication services. Any proposed changes should be reviewed and approved by Ministry of Economy and Cabinet of Ministers. Tariff changes are usually initiated by Ukrtelecom (ICPS, 2001).

Tariff regulation is based on a pure cost-of-service regulation. There are no rules as to the frequency of tariff revisions, which makes the environment unpredictable and causes losses to Ukrtelecom (ICPS, 2001.

Tariffs on local calls and access charges are set below the costs and are subsidized by the profit from long-distance and international calls. For example, access price in Ukraine is 40% of EU price; tariffs for local calls are only 8% of the EU level. Tariffs for international calls except for calls to countries of the former Soviet Union are much higher when the EU level. Moreover Ukrainian tariffs for international calls grow with distance, while in

the EU tariffs for calls to US and within the EU are almost equal. From the technical point of view the distance pays little role for the costs of traffic transmission along the main traffic routes.

Table 1. Ukrainian tariffs for households comparing to EC tariffs, year 2000[4]

	Ukraine			EC		Ukraine/EC	
	UAH	$	$PPC	$	$PPC	$	$PPC
Tariffs for households, peak load hours Access	167	30.3	127	73.5	68	0.41	1.9
Monthly subscription rate	54	9.8	41	135.1	126	0.07	0.33
1000 minutes of local calls	16	3.0	12	34.2	30	0.09	0.41
100 minutes of long distance call within oblast	25	4.5	19	7.7	7	0.59	2.7
100 minutes of long distance call across oblast	50	9.1	38	10.0	9	0.91	4.1
100 minutes, former Soviet Union, less than 300 km	132	24.0	101				
100 minutes Western Europe (for Ukraine) and Ukraine (for EC)	368	66.9	280	65.0	61	1.47	6.6
100 minutes to Northern America	935	170.0	712	29.2	27	1.03	4.6

Data source: McCT/ICEA-EBRD Review of telecommunications industry in Ukraine, 2000

When comparing tariffs for basic telecommunications services in Eastern Europe and Ukraine, it appears, that Eastern European operators are up to 35% less expensive than Ukrtelecom, except for MGTS/Rostelecom, which is 20% higher. National long distance call tariffs are approximately 50% higher than average, while international calls tariffs are the second to the

[4] Tariffs are stated without VAT for both EC and Ukraine, exchange rate used: 5.5 UAH/USD and 1.149 EUR/USD

lowest. One more regularity revealed is that relative position of Ukrtelecom compared to the other Eastern European countries changes significantly with variation is usage. This is the result of lower than average fixed tariffs (access price), but high national usage tariff (Mason Communications, 2001, p.90).

Chapter 4

METHODOLOGY OF EMPIRICAL RESEARCH

Demand for telecom services has several peculiar characteristics that are not shared with demand for other services, which make estimation particularly difficult (Taylor, 1994).

First, network (access) externality arises due to the fact, that access to the network does not provide any utility to the household if there are no other households connected (Taylor, 1994). Most studies reviewed model network externality by including the network size (penetration rate or number of fixed lines installed) as an explanatory variable (see, for example Parck et al, 1983, Lago, 1970, Taylor, 1994). This measure may be suffering from endogeneity problem when modeling demand for national long distance calls, since number of lines (penetration rate) is determined by the volume of local and national long distance traffic (Griffin, 1982). In this case, population is more appropriate as a measure of market size. But for the purpose of estimating the demand for international calls number of lines can be considered exogenous variable (Garin-Munos, & Perez-Amaral, 1999).

Second type of externality, externality at the call level, arises because making a call usually involves the other party and the utility of that party is therefore affected (Taylor, 1994). These specific characteristics make the utilization of conventional consumer demand theory inappropriate, since preferences can no longer be assumed independent across subscribers. Larson et al (1990) deal with this problem by deriving the demand function for telecommunication service from production function of rational individual, based on the assumption that information received through making a call yields utility to individual, not telephone call per se.

There are several hypotheses regarding the substitutability between the inputs of information utility function. The hypothesis of perfectly reciprocal calling

patterns implies that traffic patterns are stabilized in both directions as implicit contracts are observed between economic agents. Thus, incoming and outgoing traffic volumes are perfect complementaries. The alternative hypothesis of "information content" implies that incoming message may alleviate the need for a message to be originated. So that traffic from point A to point B (Q_{AB}) and traffic from point B to point A (Q_{BA}) are perfect substitutes.

This theoretical analysis predicts, that any changes in price will shift the demand curve for Q_{AB} because they provoke changes in $Q_{BA.}$ Failure to account for the indirect effect of price on usage through increased incoming traffic will lead to a serious bias in the effect of the change in price on usage (Larson et al. 1990).

Further complication for modeling arise form the fact, that people typically belong to groups, each of which has a strong community of interest within itself (Rohlfs, 1974). For the most of subscribers the absolute size of the system is probably secondary to the subscriber's individual community of interest (Taylor, 1994). It is expected that the greater is the community of interest between countries the greater is the amount of incoming and outgoing traffic. The natural proxy for community of interest is, than, the amount of incoming traffic by country of origin (Larson et al 1990, p.305). Other variables to describe the community of interest between countries are volume of tourism, volume of trade, number of foreign residents, language communality (see for instance, Taylor, 1994; Lago, 1970; Bewley & Fiebig, 1988; Garin-Munos & Perez-Amaral, 1999).

Demand for international calls

To account for difference in community of interest I estimate separate models for demand for calls to CIS countries and calls to other countries.

The information available allows me to model the demand for international calls to CIS countries using point-to point communication theory.

The model takes the following specification:

$$\ln OUTLIN_{it}^{A} = a_{it} + b_1 \ln PR_{it}^{A} + b_2 \ln INLIN_{it}^{A} + b_3 \ln TRADE_{it}^{A} + u_{it}^{A}$$

Where:

- $OUTLIN_{it}^{A}$ –average traffic per line from Ukraine to country B
- PR_{it}^{A} – real price of the services
- $INLIN_{it}^{A}$ - average incoming traffic per line (by country of the origin)
- $TRADE_{it}^{A}$ - the volume of trade between countries to approximate the size of the market (community of interest).

Such specification implicitly assumes the elasticity of number of lines equals one. This hypothesis was tested and not rejected by the data.

The number of lines and real prices can be safely assumed to be endogenous to the model (the same is true for estimation of demand for calls to rest of the world countries discussed below). But, according to the theory of point-to-point communication, incoming traffic is determined in part by outgoing traffic and thus is endogenous. To control for this endogeneity I use lagged values of incoming traffic as an instrumental variable (Garin-Munos & Perez-Amaral, 1999, p. 993). Thus, for model estimation I employed fixed-effects (within) IV technique.

Data limitations do not allow me to use point-to-point communications theory to model the demand for international calls to rest of the world countries (ROW).

$$\ln TRLIN_{it} = a_{it} + b_1 \ln PR_{it} + b_2 \ln TRADE_{it} + D_i + u_{it}$$

Where:

- $TRLIN_{it}$ –average traffic per line from Ukraine
- PR_{it} – real price of the call
- $TRADE_{it}$ - the volume of trade between Ukraine and corresponding region, used to approximate the community of interest
- D_i is dummy for Eastern Europe region

Dummy variable for traffic outgoing to eastern Europe is introduced to further account for community of interest and market size.

According to the theory of telecommunication demand, I assume, that errors in this model are cross-sectionally heteroskedastic and serially autocorrelated

with AR(1) process in a given cross-section (Larson et al, 1990, p.309) Thus, for elasticity estimation I use cross-sectional time-series FGLS regression.

Data description

For estimation of the demand for international calls to CIS countries I use quarterly data on minutes of conservation in each direction between Ukraine and 11 CIS countries for the period 1998-2001. For estimation of demand for international calls to rest of the world I use quarterly data on minutes of outgoing minutes of talk between Ukraine and 11 regions.

However, the data available it a great aggregation: they include all customer groups (business, households and government) and do not distinguish between the rating period during which the call was made. The price variable used in these estimations is the real price faced by consumers for a minute of call at a standard daytime rate. Deflation is based on consumer price index (CPI), provided by State Committee of Statistics. The volume of trade between countries was constructed by adding the value of export and imports (denominated in hrivnas), provided by State Committee of Statistics and deflated with the CPI. The data on number of fixed lines was provided by Ukrtelecom.

National long distance study

Unfortunately, the information available does not allow me to use the point-to-point communications theory. So, the model presented is based on more conventional theory developed in Taylor (1994) and Griffin (1982).

$$\ln TrLIN_{it} = a_{it} + b_1 \ln INCOME_{it} + b_2 \ln PR_{it} + b_3 \ln(S_{it}(1+S_{it})) + u_{it}$$

Where:

- $TRLIN_{it}$ volume of outgoing traffic from region i at year t
- $INCOME_{it}$ is real per capita income approximated my real wage earnings
- Pr_{it} real price of minute of call at a standard daytime rate
- D_i is dummy to account for structural break in third quarter of year 2000
- S_i is number of subscribers

Assumptions about error structure are defined analogously to the case of international calls demand. Thus, cross-sectional time-series FGLS regression,

assuming across panel heteroskedasticity and autocorrelation with common for all panels AR1 scheme is used.

Data description.

For estimation of national long distance demand I use quarterly data on outgoing traffic (measured as minutes of conversation) for each oblast for the period of 1998-2001. Aggregation level of the data does not allow me to distinguish between consumer groups and between the rating periods during which the call was made.

In the third quarter of 2000 year the price structure changed significantly, since the peak load pricing scheme was introduced. Since than, the calls made between 9p.m and 8a.m. and also calls made during weekends and holidays are priced at much lower rate (0.12 UAH comparing to 0.50 UAH during standard daytime period). Since data available do not allow me to distinguish between calls made during daytime and evening rating period, I used dummy variable to take into account structural break due to this structural break.

I had excluded 5 oblasts from the sample. The reason for this is that in Lvivska, Kharkivska, Odeska and in Kyiv international gateways are situated. Therefore, incoming international traffic received by gateway is than rerouted to national transit switch of Utel and recorded as national long distance traffic. The data available do not allow me to estimate the volume of "truly" long distance traffic for these oblasts. I also exclude Dnipropetrovska oblast, because it is considered to be the major centre of refile in Ukraine. The technology of refile implies that international "illegal" traffic received is rerouted as national long distance traffic to the city of destination. Therefore, recorded volume of traffic includes both incoming international traffic and national long distance traffic generated in oblast[5].

[5] In this oblast there is a great number of alternative to Ukrtelecom operators, which own approximately half of the primary network. This fact and also use of outdated equipment for interconnection of operators to the national network (analogue exchanges, which do not allow to monitor traffic) allowed operators to develop of refile services and disabled Ukrtelecom to stop this practice.

Chapter 5

FINDINGS AND DISCUSSION

The results of econometric estimations are presented in the tables below:

Demand for international calls to CIS countries

Table 2. Regression results for demand for international calls to CIS countries, 1998-2001.
Method: Fixed-effects (within) IV regression

Number of observations = 176		
Number of groups =11		
No. of time periods=16		
R-sq: within =		
between = 0.7448		
overall = 0.7130		
Wald chi2(3) = 373616.74, Prob > chi2 = 0.0253		
Variable	Coefficient	p-value
PR^A	-0.377(0.1221013)	0.002
$TRADE^A$	0. 13 (0.0539869)	0.035
INLIN	0.492 (0.2088432)	0.019
Const	13.0341 (0.521156)	0.000

Demand for international calls to rest of the world

Table 3. Regression results for demand for international calls to ROW, 1998-2001.
Method: Cross-sectional time-series FGLS regression with panel-specific AR(1)

Estimated covariances = 8		
Estimated autocorrelations = 8		
Number of obs = 128		
Number of groups = 8		
No. of time periods= 16		
Wald chi2(3) =174.40, Prob > chi2 =0.0000		
Log likelihood = 20.92647		
Variable	Coefficient	p-value
PR	-0.95 (0.1367063)	0.000
TRADE	0.39 (0.0460384)	0.000
Dumm	0.42 (0.2076428)	0.041
_cons	-6.165 (0.6688187)	0.000

Demand for national long distance calls

Table 4. Regression results for demand for long-distance calls, 1998-2001.
Method: Cross-sectional time-series FGLS regression

Estimated covariances = 27
Estimated autocorrelations =1
Number of observations = 405
Number of groups =27
No. of time periods =15
Wald chi2(3) =166.73, Prob > chi2 = 0.0000

Variable	Coefficient	p-value
Pr_{it}	-0.1313581 (.041799)	0.000
INCOME	0.4245219 (.0418997)	0.000
$INCOME_{it-1}$	0.3035988 (.0449061)	0.000
S_i	0.0006836 (.007532)	0.002
S_i^2	-8.99e-09 (7.52e-08)	0.002
dumm	-0.138027 (.0396308)	0.000
_cons	-559.8291 (188.71)	0.003

All the coefficients are statistically significant at 5% significance level. The signs of all coefficients agree with theory predictions. Lagged price values, though suggested by the theory, turned out to be insignificant, which means that demand for basic telecommunication services accommodates to the change in price during three months.

Incoming minutes of conversation turned out to be significant with a coefficient of +0.42, thus confirming the hypothesis of incomplete traffic substitutability between calls in each direction and suggesting the existence of dominant positive reciprocal calling effect.

It will be useful to compare my results this those obtained by other authors for developed countries. These estimates are provided in table 3 in appendix. Both estimates for long distance calls and international calls are somewhat lower than those estimated for developed countries. I can suggest the following possible explanations to this fact:

1. In the developed countries market for international and long distance services exhibited significant competition during the estimation

period. While, in Ukraine, level of competition is rather low and prices are set at the same level for all firms operating in the market.

2. Data used include both traffic generated by both households and by firms and organization. According to State Committee of Statistics share of revenues form national long-distance services generated by business users and state organization is 61.5%; and share of the revenues from international calls generated by business users and organizations is 54.7%. Estimates for residential demand for both international and national long-distance would show much more responsiveness to price changes.

Estimation of welfare losses from the current tariff structure

To estimate welfare loses I used data for services unit costs obtained from Ukrtelecom. As a proxy for marginal cost long term average costs are used. The welfare loss is measured by the "dead weight loss triangle", given by the equation (Martins, 2001):

$$WL = \frac{1}{2}\varepsilon\left(\frac{P - MC}{P}\right)^2 Y,$$

where ε is the price elasticity for telecommunications services.

Table 5. Deadweight loss estimation result

Service	LR average cost	Price	DW loss (USD)
Long distance national calls	0.27	0.5	667625
International calls CIS countries	0.59	1.8	676902
International calls ROW	0.59	7.35	2181269

Limitations of the study:

Data on costs of corresponding services has several serious drawbacks. First, these are average not marginal costs, thus estimated dead weight loss should

be treated as the lower limit of loss as comparing to the first-best pricing solution.

Second, stated costs of corresponding services are biased due to the methodology Ukrtelecom uses to calculate its service-specific costs. In particular, no allocation mechanism is employed to distribute joint cost of production among services. Thus, the total amount of costs associated with local network is referred as costs of local calls; costs associated with transmission cables and transit exchange switches are attributed to the cost of long-distance calls, etc. This mechanism results in overestimated costs for local services and overestimated costs for national long-distance and, especially, international communications services.

Chapter 6

CONCLUSIONS AND POLICY IMPLICATIONS

Early liberalization of telecommunications industry in 1995 was not supported by important regulatory decisions necessary for increasing social welfare. Due to increase in demand for telecommunications services and availability of new technologies competitive entry became possible. In particular, growing competition on national long-distance and international communications market, which dominant Ukrainian provider Ukrtelecom faces now, undermines the viability of cross-subsidization mechanism used to set prices.

This research aims to estimate the deadweight losses associated cross-subsidization in Ukraine's telecommunications market. For this, elasticities for three markets were estimated: national long-distance calls, international calls to CIS countries and international calls to rest of the world.

Results show that both the demand for national long-distance calls and demand for international calls to CIS countries are relatively inelastic (-0.13 and –0. 38, respectively), while demand for international calls to rest of the world (ROW) is much more responsive to price (-0.95). Such elasticities reflect 1) higher prices for international calls to ROW and 2) more intense competition on this market than comparing to the markets for national long-distance calls and calls to CIS countries. Not surprisingly, total deadweight loss estimated is quite large with the largest part of it is created by high prices for international calls.

These results confirm that tariff policy of cross–subsidization should be abandoned in Ukraine. In order to minimize dead-weight losses, tariffs for basic telecommunication services should be set according to Ramsey inverse

elasticity pricing rule. Application of Ramsey rule will lead to the relative rise of tariffs for local and for international calls to CIS countries and lowering of tariffs for international calls to rest of the world. At the same time, direct regulation by setting prises by inverse elasticity rule in practice is very demanding in terms of data and would be vulnerable to information asymmetry and strategic behaviour of regulated operator.

Moreover, the results of tariff level comparison for Eastern Europe and Ukraine shown, that Ukraine's tariffs are much higher than in Eastern Europe due to inefficient costs. This inefficiency was in turn created by the cost plus rule, which is used to set prices. Therefore, increase in tariffs unless regulatory regime is changed will increase this inefficiency.

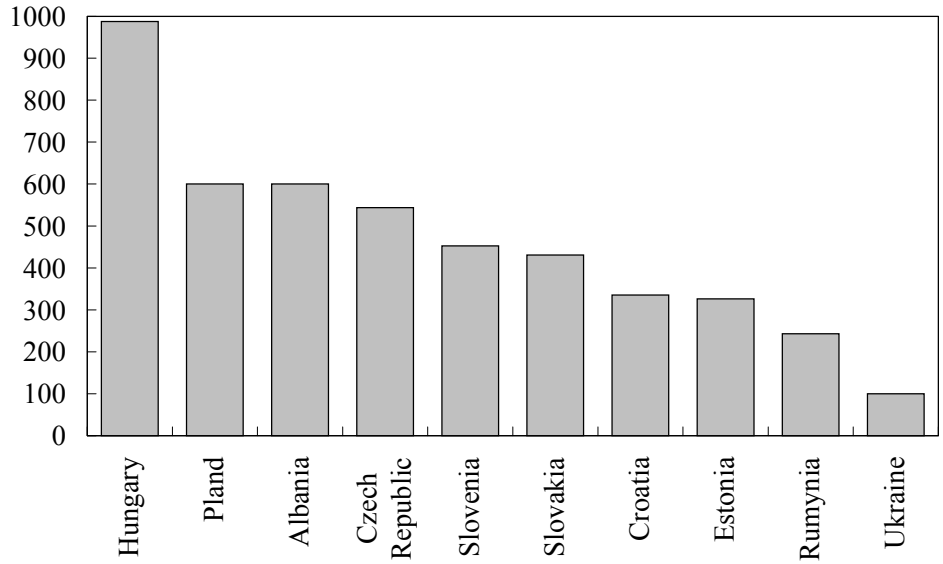
Therefore, some regulatory mechanism should be chosen to 1) produce sustainable under competition prices; 2) guarantee efficient production; 3) minimize the probability of regulatory capture by powerful industrial groups.

Price cap regulation matches the above stated criteria, since allow the incumbent operator to choose tariff structure that will enable dominant operator to compete on the market with new operators. It also provides operator with incentives to cost minimization, investment in new cost saving technologies (which is very important given the current expensive production) and is based on transparent decision rules.

At the same time, allowing the incumbent operator to earn potentially large profits coupled with rise in prices for services with inelastic demand may result with a high probability in public opposition and pressure to return to the previous regulation rules. Therefore, some combination of price cap and sliding scheme should be employed as this mechanism retains advantages of price cap regulation and allow for greater allocative efficiency.

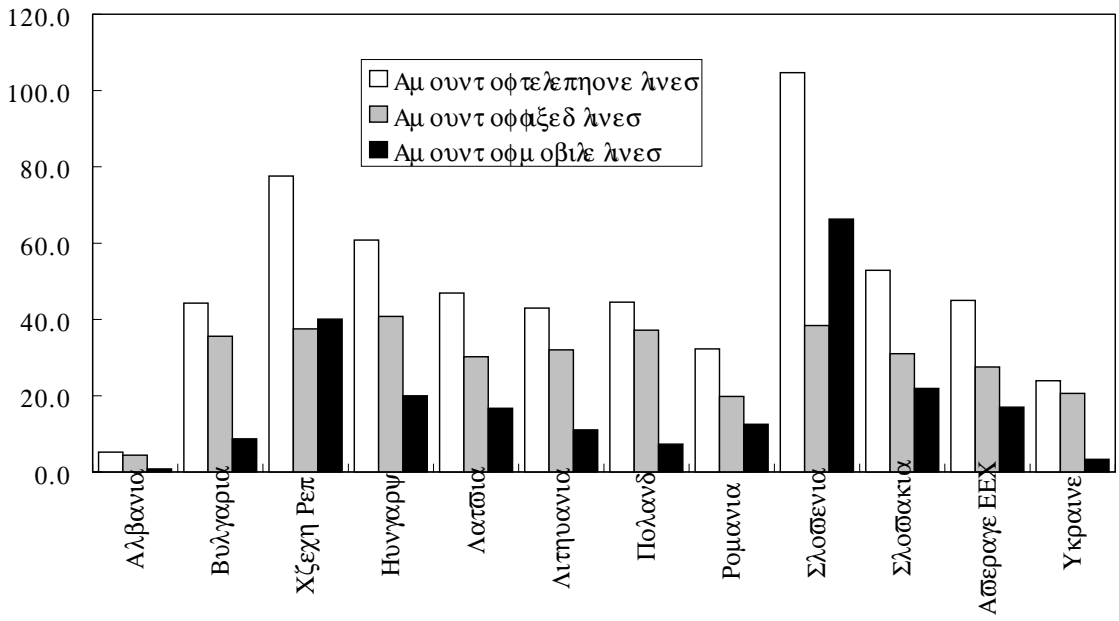
APPENDIX

Chart 1. Growth of penetration rate in transitional economies, % of change from 1998 to 2000.



Data source: State Committee of Statistics, "ESIS II Report: Information Society Indicators in the CEEC countries"

Chart 2. Telephone lines penetration 2000, per 100 inhabitants

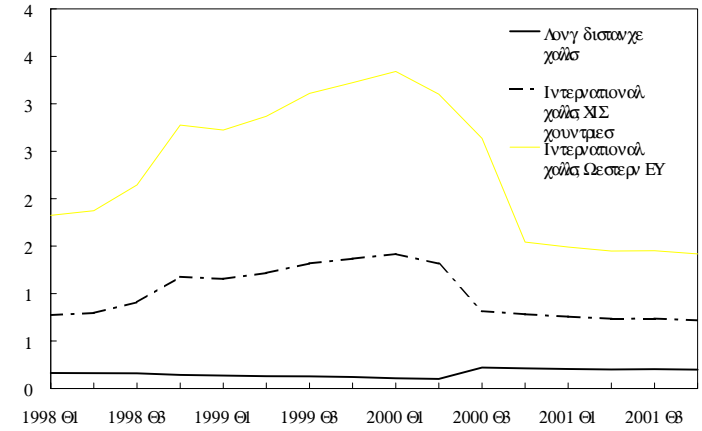


Data source: State Committee of Statistics, "ESIS II Report: Information Society Indicators in the CEEC countries"

Chart 3. Revenues from ccommunication services in Ukraine in 2000, by type, %

Data source: Derzhkomstat

Chart 3. Evolution of real prices, 1998 – 2001



Джерело: Derzhcomzvjazku

Table A1. Price elasticities of international telephone traffic[6]

Study	Dependent variable	Price elasticity	Income elasticity	Type of data
Rea and Lage (1978)	No. of outgoing calls USA	-1.72 (0.26)	2.66 (0.27)	Panel annual 1964-74, 37 countries
Bewley and Fiebig (1988)	No of calls and minutes from Australia	-0.46 (0.13)	-	Time series, quarterly, 1976-83
Curien and Gensollen (1989)	No of minutes, France	-0.82 (0.08)	-	Panel annual 1976-80, 25 countries
Acton and Vogelsang (1992)	No. of mins. USA-Europe	-0.36 (0.09)	1.39 (0.17)	Panel annual 1976-86, 17 countries
Garin and Perez-Amaral (1999)	Mins. Spain to EU	-0.32/-0.81 (0.09)/-		Panel annual 1981-91, 27 countries
Present study	Minutes from Ukraine to CIS countries	-0.37 (0.1221)	-	Panel quaterly,1998-01, 11 countries
	Minutes from Ukraine to rest of the world countries	-0.95(0.136)	-	Panel quaterly,1998-01, 8 regions

Source: Garin and Perez-Amaral (1999)

[6] standard deviations is shown in parentheses

Table A2. Price elasticities of national long-distance telephone traffic[7]

Study	Dependent variable	Price elasticity
Duncan and Perry (1994)	Minutes of use and revenue, US	-0.38 (4.7)
Gatto, Langin-Hooper, Robinson and Tayan (1988)	Minutes of access with respect of minutes of use, US	-0.72 (17.7)
BTCE (1991)	Number of domestic long-distance calls, Australia	-0.93 (6.2)
Martines-Filho and Mayo (1993)		-1.05 to -1.55 for number of calls (4.9 to21.5)
Taylor (1980)	Minutes of conversation	-0.65 (anavailable)
Present staudy	Minutes of conversation	-0.13 (3.54)

Source: Telecommunications Economics and Policy Issues, supporting research prepared by Industry Commission of Australia, 1999.

[7] t-ratio is in parentheses

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