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Understanding European Union international message telephone services demand

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Abstract

This study provides a contemporary understanding of demand relations in European Union (EU) international message telephone service (IMTS) markets prior to full liberalization at January 1 1998. Point-to-point demand equations that relate IMTS demand to prices, income, population and distance are estimated on bilateral market data for ten EU countries from 1990 to 1995. Model estimates suggest price elasticities of outgoing and incoming demand between -0.175 and -0.456, and -0.215 and -0.674, respectively. These elasticity estimates provide an empirical base from which to calculate welfare gains from the full deregulation of EU IMTS markets after 1998.

Keywords: Elasticity; European Union; International telephone demand

JEL Classification: L16; L96

1. Introduction

At the end of the 1980s, the European Commission embarked on an ambitious liberalisation program of European domestic and international telecommunications markets.[1] The main goal was to promote market structures that would enable the exploitation of substantial demand and innovation potentials in the industry. A

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[1] Carriers provide international message telephone service (IMTS) by connecting their domestic networks to international half-circuits. Cost sharing arrangements between countries arranged through the accounting rate system.

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major milestone of this program was 1 January 1998, the date whereby all telecommunications infrastructure and services were open to full competition (Kiessling and Blondeel, 1998).[2] A further transformation in the sector has been the separation of the regulator from the telecommunications operator for all 15 EU countries (International Telecommunication Union (ITU), 1998a). The 1999 Communications Review stresses the positive results of the current telecommunications regulatory framework that has transformed a sector traditionally characterized by state monopolies into a dynamic industry ready to take full advantage of the global market (de Cockborne, 1999).

This study provides an understanding of IMTS demand relations in EU markets prior to full liberalization by estimating the price elasticity of demand for a sample of 11 countries from 1990 to 1995. The analysis provides an empirical base from which to calculate welfare gains from EU IMTS market deregulation. The paper is organized as follows. Section 2 provides a selective review of representative IMTS demand analyses. A point-to-point IMTS demand model, and data used for estimation, are described in Section 3. Section 4 reports estimation results and flow-through demand elasticities, whilst Section 5 provides concluding comments.

2. Received demand analysis

Lago (1970) employs pooled cross-section,time-series data for 26 US markets from 1962 to 1964 to explain US outgoing IMTS traffic. Using ordinary least squares (OLS) to regress traffic on price, trade, foreign investment, tourist expenditure, foreign telephones, and US population with foreign parents, Lago reports a price elasticity of demand of -1.249. Yatrakis (1972) extends Lago's model to include demographic variables such as language commonality, and both tourist and immigrant arrivals. OLS estimation on a cross-section of 46 US markets for 1967 reveals a price elasticity of demand which ranges from -1.030 to -1.135. Rea and Lage (1978) examine US outgoing traffic for 37 bilateral markets from 1964 to 1973, and allow cross-price effects to be measured by the price of telex and telegraph service. Fixed- and random-effects model estimates suggest a price elasticity of demand between -0.548 and -0.725 for the full sample period, whilst corresponding elasticities for 1969 to 1973 are between -1.718 and -1.915.

Larson et al. (1988) propose a point-to-point demand model which allow calls in one direction to affect return calls through reversion and reciprocity. The model is particularly useful for examining the impact of asymmetric pricing and call inter-dependence on IMTS market demand. Appelbe et al. (1988) employ a point-to-point model to estimate Canada–US market demand at 1986. Three-stage-least squares estimation of outgoing and incoming demand equations provide

[2] Greece, Ireland and Portugal were exempted from this date.

flow-through price and reciprocal calling elasticity's of demand which range from -0.43 to -0.53 and 0.24 to 0.47, respectively. Acton and Vogelsang (1992) use a point-to-point model to examine call reversion and reciprocity between the US and 17 Western European countries from 1979 through 1986. Reduced-form equations allow the estimation of cross-country price elasticities of demand, that is, the responsiveness of US (European) demand with respect to European (US) collection rate changes. Two-stage least squares (2SLS) estimates indicate own-price elasticities of -0.49 and -0.36, but insignificant cross-country price elasticities.[3] Finally, Hackl and Westlund (1995) estimate time-varying price elasticities for Swedish outgoing traffic on monthly data for 1976 through 1990. Using a moving-local regressions approach, which fits regression models to a window of data that shifts over the observation period, they provide short- and long-run price elasticities of IMTS demand. Model results suggest a longer sample period is associated with a larger price elasticity of demand.

The above sample of studies illustrate that many changes have occurred in statistical techniques employed to examine IMTS traffic. Further, early studies consider aggregate unidirectional and static relationships. Whilst these studies suggest IMTS demand is own-price elastic, point-to-point demand analyses suggest otherwise. In summary, the received evidence indicates that changes in data and statistical techniques used have coincided with a downward revision of reported elasticity estimates.

3. Empirical model and data

Consistent estimation of point-to-point demand requires simultaneous estimation of incoming and outgoing equations, with explicit accounting for the influence of return traffic on originating IMTS (Larson et al., 1988). Estimating equations for EU IMTS are:

$$\ln Q_{AB} = \beta_0 + \beta_1 \ln P_A + \beta_2 \ln Q_{BA} + \beta_3 \ln M^A + \beta_4 \ln POP + \beta_5 \ln DIST + \mu^A \quad (1)$$

$$\ln Q_{BA} = \delta_0 + \delta_1 \ln P_B + \delta_2 \ln Q_{AB} + \delta_3 \ln M^B + \delta_4 \ln POP + \delta_5 \ln DIST + \mu^B \quad (2)$$

where ln denotes the natural logarithm, Q_{AB} (Q_{BA}) is minutes of outgoing

[3] The latter result suggests either the absence of call reversion or reciprocity, or the induced traffic from directions is cancelled out. Acton and Vogelsang (1992) suggest that call reversion occurs only when the difference between outgoing and incoming collection rates is sufficient to cover switching costs. Once this threshold is reached, consumers in high-price countries will re-originate calls from low-price countries.

telephone traffic from A to B (B to A), *P* is the real collection rate (retail price) for a call from A (B) to B (A), *M* is real GDP per capita of A (B), *POP* is the product of the populations of A and B, *DIST* is the absolute distance (kilometers) between the capital cities of A and B, while the μ are a random error terms.[4]

Eqs. (1) and (2) are estimated by 2SLS on annual data for the EU Member States Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Portugal, Spain and the UK for the period 1990 to 1995.[5] Traffic, mainlines, business and residential telephone monthly subscriptions data are from the ITU (1996, 1998b) and TeleGeography (1992–97), whilst collection rates are obtained from the OECD's (1990–97) *Communications Outlook*. Population, real and nominal gross domestic product (GDP) and the consumer price index are from the World Bank (1998). Distance (in kilometers) between capital cities is obtained from Bali Online (2000). Indicators of economic and telecommunications development for the sample countries are provided in Table 1. As expected, main telephone lines per 100 inhabitants (teldensity), income (GDP per capita) and outgoing IMTS minutes are relatively high for all sample countries. Only the United Kingdom (UK) allowed IMTS competition during the sample period 1990–1995, whilst several countries commenced privatization of their dominant carriers. At 1996, three countries had dominant IMTS carriers with majority private control. Note the

Table 1
EU Telecommunications indicators[a]

Country	Teldensity 1995	Income (USD) 1995	IMTS traffic 1996	Competition	Private ownership
Belgium	46	26 570	1166	1998	49.9
Denmark	61	33 135	570	1998	49.0
France	56	26 462	2970	1998	20.0
Germany	49	29 564	5200	1998	20.0
Greece	49	10 934	518	–	8.0
Italy	43	18 979	2124	1998	38.0
Netherlands	52	25 586	1534	1997	55.0
Portugal	36	9 249	340	–	49.3
Spain	38	14 260	1189	1998	79.0
UK	50	18 861	4539	1984	99.0

[a] Teledensity is main telephone lines per 100 inhabitants. Income is real GDP per capita. IMTS traffic is million minutes of outgoing IMTS traffic. Competition is the year competition was introduced into IMTS markets. Private ownership is the share of private ownership for the dominant IMTS carrier. Source: ITU (1998a,b).

[4] Both Q_{AB} and Q_{BA} are endogenous, whilst *P* is deemed exogenous because nine of ten markets had a monopoly service provider during the sample period (as such, price was generally regulated and independent of demand).

[5] Ireland and Luxembourg are omitted, as complete point-to-point traffic information are not available. Austria, Finland and Sweden are not included because they did not join the EU until 1995.

effect of the EU's telecommunications liberalization program is more pronounced after 1997. At 1998, seven of the 11 sample countries introduced competition in the supply of IMTS calls.

A description of sample country traffic and collection rates is provided in Table 2, Figs. 1 and 2, respectively. Table 2 shows that the France–Germany route has the largest annual average traffic flow in the EU, with an average of 619.7 million minutes per annum (p.a.). The second largest route is Germany–UK with an average of 617.43 million minutes p.a., followed by France–UK with 559.8 million minutes p.a. The least traffic is for Portugal–Greece with 1.29 million minutes p.a. Casual interpretation of Fig. 1 suggests an apparent downward trend in mean collection rates for EU Member States. The average collection rate between member countries declined 27 percent between 1990 and 1995 from 0.81 to 0.59 cents per minute. However, the relativity between countries remained unchanged, with France having the lowest average annual peak per minute collection rate in 1995 and Greece the highest. Fig. 2 shows the deviation of the collection rates for EU Member States contained in the sample. The dispersion of collection rates has fallen substantially since 1992.

Table 2
Annual average bilateral traffic 1990–1995[a]

Route	IMTS traffic (million minutes)	Route	IMTS traffic (million minutes)
Belgium–Denmark	17.40	France–UK	559.83
Belgium–France	420.55	Germany–Greece	164.74
Belgium–Germany	245.20	Germany–Italy	545.92
Belgium–Greece	17.97	Germany–Netherlands	547.45
Belgium–Italy	93.75	Germany–Portugal	69.59
Belgium–Netherlands	389.32	Germany–Spain	254.58
Belgium–Portugal	17.00	Germany–UK	617.43
Belgium–Spain	56.23	Greece–Italy	55.18
Belgium–UK	166.15	Greece–Netherlands	17.83
Denmark–France	39.03	Greece–Portugal	1.29
Denmark–Germany	166.73	Greece–Spain	6.43
Denmark–Greece	5.28	Greece–UK	88.58
Denmark–Italy	21.30	Italy–Netherlands	71.47
Denmark–Netherlands	35.04	Italy–Portugal	17.37
Denmark–Portugal	4.26	Italy–Spain	111.70
Denmark–Spain	17.73	Italy–UK	256.18
Denmark–UK	94.13	Netherlands–Portugal	15.86
France–Germany	619.70	Netherlands–Spain	64.48
France–Greece	35.61	Netherlands–UK	283.33
France–Italy	421.79	Portugal–Spain	65.39
France–Netherlands	172.54	Portugal–UK	58.77
France–Portugal	161.83	Spain–UK	246.32
France–Spain	295.56	**Average**	169.64

[a] Source: ITU (1996), OECD (1990–97), TeleGeography (1992–97).

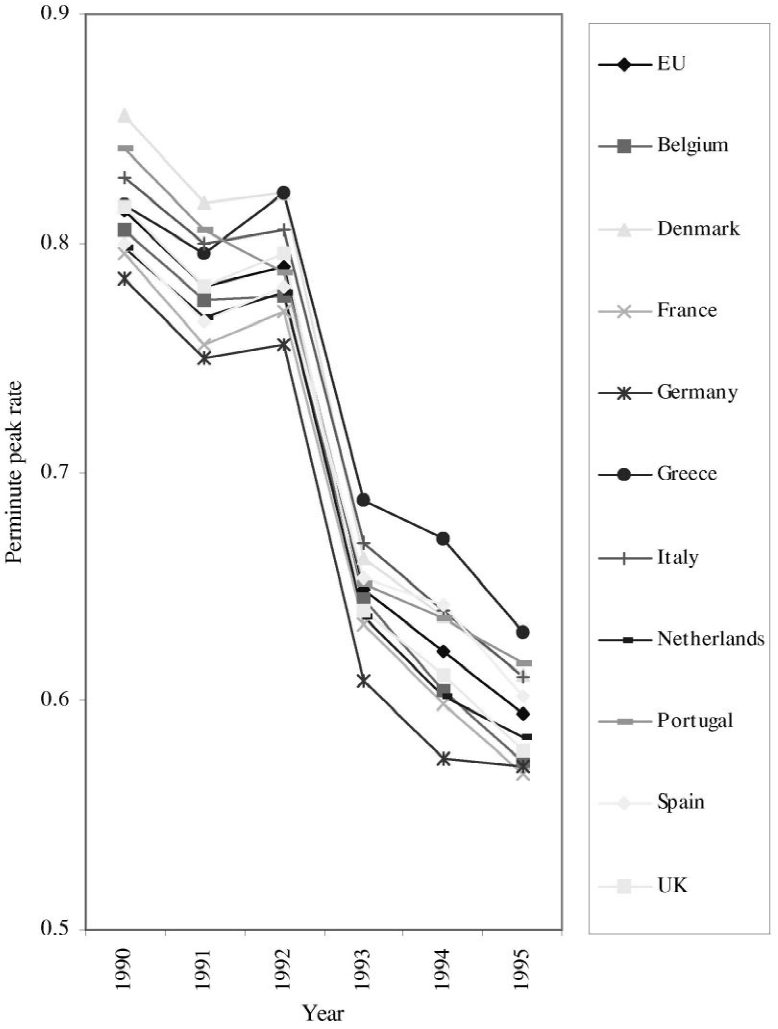

Fig. 1. Average annual per minute collection rate 1990–1995. Source: ITU (1996), OECD (1990–97), TeleGeography (1992–97).

4. Estimation results

Pre-testing indicates the presence of heteroskedasticity and autocorrelation in the 2SLS estimates of Eqs. (1) and (2). Accordingly, a pooled cross-section,time-

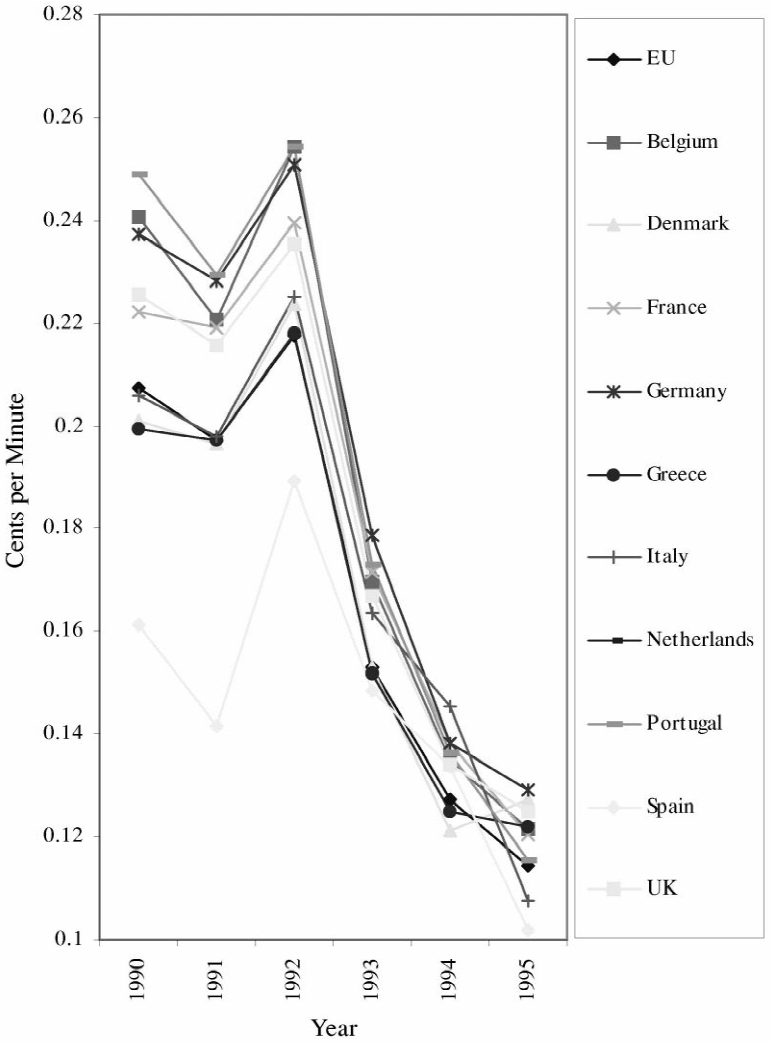

Fig. 2. Standard deviation of collection rates 1990–1995. Source: ITU (1996), OECD (1990–97), TeleGeography (1992–97).

series approach is employed to estimate the demand system which controls for heterogeneity and autocorrelation. Most estimated equations appear well specified with all the estimated parameters conforming to a priori expectations except the price variable for outgoing demand for Spain. Reverse traffic, income and

population are found to have a positive effect on outgoing demand, whilst price and distance have a negative effect on outgoing demand.[6]

A positive coefficient for incoming traffic suggests that price changes effect traffic flows in both directions. In order to obtain the total effect on demand of a change in any of the explanatory variables it is necessary to eliminate all right-hand side endogenous variables by substituting incoming traffic for the reduced-form equations.[7] Estimated flow-through demand elasticities are reported in Table 3 along with the reverse traffic coefficients. IMTS price elasticities of demand are inelastic and qualitatively similar to recent estimates by Ford and Jackson (1999).[8] From Table 3 there appears no systematic relationship between the magnitude of flow-through price elasticities of demand and national income levels. High- and low-income Member States have an average elasticity of -0.2, whilst the middle-income band report an average elasticity of -0.3. For the incoming IMTS demand equation, whilst inelastic, the relative magnitudes of the

Table 3
Flow-through elasticity[a]

Country	Outgoing traffic			Incoming traffic		
	Price	Reverse traffic	Income	Price	Reverse traffic	Income
High income						
France	−0.157	0.174	2.283	−0.574	0.237	0.178
Germany	−0.255	0.252	0.566	n.s.	0.462	0.706
UK	n.s.	1.037	n.s.	−0.547	n.s.	0.574
Medium income						
Belgium	−0.456	0.363	0.989	−0.258	0.290	0.226
Italy	n.s.	0.691	2.698	−0.215	0.411	0.447
Netherlands	−0.267	n.s.	3.169	−0.287	0.378	n.s.
Spain	n.s.	0.947	0.260	−0.674	0.755	0.446
Low income						
Denmark	−0.175	n.s.	2.326	−0.334	0.597	n.s.
Greece	n.s.	0.814	4.385	−0.501	0.150	2.070
Portugal	n.s.	n.s.	9.083	−0.393	0.553	0.573

[a] n.s. indicates the estimated coefficient is not significant at 5% level.

[6] Severe multicollinearity exists for the German and Portuguese demand equations so dummy variables are used to replace DIST to isolate traffic band effects. Dummy variables for high-income (France, Germany and the UK) and middle-income (Belgium, Italy, the Netherlands and Spain) Member States are also included. Estimation results are available from the authors on request.

[7] For instance, flow-through price and income elasticity of demand measures for A are:

$$\frac{\partial \ln Q_{AB}}{\partial \ln P_A} = \frac{\beta_1}{1-\beta_2\delta_2} \text{ and } \frac{\partial \ln Q_{AB}}{\partial \ln M^A} = \frac{\beta_3}{1-\beta_2\delta_2} \tag{3}$$

[8] Ford and Jackson (1999) estimate US point-to-point demand equations from 1985 to 1994 and report short-run price elasticities for US–Europe traffic which range from -0.13 to -0.26.

coefficients are reversed. The price elasticity of demand is most elastic in the middle-income band, followed by high- and low-income bands. However, there is a clear pattern between the outgoing IMTS demand flow-through income elasticity and national income levels. The lower is national income the more elastic is demand. However, this pattern does not hold for incoming traffic. Demand is mostly income inelastic, but more elastic for the low-income country band.

5. Conclusions

Prior to 1998 IMTS traffic was subject to regulation in EU countries with governments regularly reviewing capacity and IMTS pricing. Given the EU's move to full liberalization after 1998, telecommunications policy would benefit from a better understanding of the structure of demand so as to enable the improved projection of traffic patterns and deficits. IMTS demand elasticity estimates could also provide useful inputs into an examination of alternative pricing policies on use, capacity and economic welfare. Here, outgoing and incoming IMTS demand equations are estimated for ten EU Member States. Estimates of flow-through price elasticities suggest IMTS demand is price inelastic. Accordingly, a reduction in call prices by Member States would not necessarily increase producer surplus in the short-run and only increase consumer surplus marginally. A caveat on the results is that collection rates used for estimation are peak per minute rates, and quite often business is able to negotiate lower rates. Should sample data be dominated by business traffic then the reported elasticity magnitudes may be overstated.

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