Chapter 8
Forecasting the Demand for Business Communications Services

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For telecommunications and information and communication technology (ICT) providers, analyzing and forecasting the demand for business communication services (BCS) is a critical but not an easy task. Accurate demand analysis and forecasting[1] enables them to: anticipate and meet the market demand and customers' expectations and determine the service level to be provided to companies; determine the size and timing of investments in networks, new technologies, new services; and planning for resources that support its development and growth. In addition, providers continually need to assess and estimate the financial and economic benefits of their offers, and assess the companies' ability and willingness-to-pay for such services.

The focus of this chapter is on estimates of BCS demand and supply in the French BCS market.[2] The chapter first provides a broad overview of the demand for BCS: it briefly describes the scope of BCS products and solutions, their structure, evolution and key drivers. Then, it presents the specification and estimation of the demand and supply models and some illustrative forecasts.

8.1 Introduction/Overview

ICT markets have undergone a profound metamorphosis in the last decades. Factors underlying this evolution include the deregulation and liberalization of telecommunications markets that opened franchised monopoly markets to competition throughout the world (including emerging countries); the development of new technologies and improvements in existing ones; a revolution in service

[1] This chapter uses demand analysis and forecasting interchangeably.
[2] The modeling and forecasting processes were adopted from Hamoudia and Scaglione (2007).

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J. Alleman et al. (eds.), *Demand for Communications Services - Insights and Perspectives*, The Economics of Information, Communication, and Entertainment,
DOI: 10.1007/978-1-4614-7993-2_8,

offerings and innovations in telecommunications and information technology (IT)[3]; the aggressive and strong competition from many emerging countries (Brazil, India, China, …) with competitive products (smartphones, tablets, PBX, …) in search of markets; and the globalization trend of the emergence of new multinational enterprises, which reinforced the standardization of solutions, equipments and services.

Finally, the convergence of IT and telecommunications is driven, in part, by the rivalry of IT providers and telecommunications operators. This rivalry is confounding any demand analysis or forecasts. In particular, telecommunications operators are progressively entering formerly exclusive IT company markets, for example, helpdesk, data centers and business applications. Simultaneously, IT providers are encroaching on activities that are usually reserved for telecommunications operators. Thus, telecommunications operators (e.g., BT Global Services, Orange Business Services and T-Systems) are offering both IT and telecommunications services. They are making strong bids to enter IT service delivery markets. Conversely, IT companies such as Atos, EDS, and IBM Global Services are offering services which overlap with the core domains of telecommunications operators—mainly managed network services.

Further, after a long period of industry stability, in terms of market structure and customer usages, the demand for BCS have moved to more competitive markets where products and services have shorter lifecycles. All of these factors have led to dramatic changes in the ICT industry which has added complexity to demand estimation.

The convergence of IT and telecommunications markets has created more complex behavior of market participants. Customers expect new product offerings to coincide with these emerging needs fostered by their growth and globalization. Enterprises require more integrated solutions for security, mobility, hosting, new added-value services, outsourcing and voice over internet protocol (VoIP). This changing landscape has led to the decline of traditional product markets for telecommunication operators.

8.2 Defining Business Communication Services

For this study, a narrower specification of ICT is applied that is more oriented toward IT and telecommunications services.[4]

[3] In this chapter, IT refers to a sub-set of the ICT sector. In this context IT does not include telecommunication.

[4] The Organization of Economic Cooperation and Development (OECD) and the European Union (EU) define ICT in a broad manner. It includes, for example, telecommunications; consumer electronics; computers and office machinery; measurement and control instruments; and equipment and electronic components.

Table 8.1 Main Business Communication Services products

Telecoms Core	IT Core
Mobile	IT Infrastructure and equipment
Fixed voice	Software and applications
Fixed data	Services related to "infrastructure and equipment" and to "software and applications"

Source the author

8.2.1 Scope of the Business Communication Services

BCS encompasses all products and services dedicated to companies for their professional activities ranging from telecommunication core to the information technology ones (see Table 8.1).

8.2.2 The Telecommunications Core

The demand for core telecommunications products and services consists of the telecommunications network services on fixed and mobile networks—regardless of the technology—for voice and data communication. This part of the network is also referred to as connectivity. The three core telecommunication products and services are as follows: the traditional fixed voice including the public switched telecommunications network (PSTN); the fixed data network; and mobile services.

8.2.3 The IT Core

IT core products and services are composed of the IT infrastructure including combinations of IT and telecommunication infrastructures and IT applications. The IT infrastructure consists of transmission networks and associated equipment including computer mainframes/servers and related services. At the edge of the network, a wide variety of equipments is attached. Then, there are numerous layers of applications that drive the usage. All of this must be managed and maintained. Adding to the mix is the proliferation of mobile devices: conventional mobile phones, smartphones, tablets, hot spots, etc. The purpose here is not to enumerate all of the products; software and applications (the "brains" of the IT infrastructure); and services, but rather to illustrate the complexity of the BCS. The sectors are complex and not easily delineated. When one discusses the demand for BCS, what is the objective? Is it forecasting the demand by service, function or equipment?

8.3 Demand Drivers for BCS

There are mainly three basic drivers of BCS revenues: (a) macroeconomic environment, (b) enterprises transformation, and (c) technology and innovation.

8.3.1 Macroeconomic Environment

Telecommunications services and IT market success rely on the immediate macroeconomic and regulatory environments. The principal market growth and risk drivers vary from Western Europe to North America and to Asia Pacific and emerging countries. A few of these drivers include, *inter alia*, gross domestic product (GDP); emerging markets; continued liberalization and deregulation.

These positive drivers are offset by risks to the BCS markets including, among others, the high unemployment rate in the EU (around 10 % in 2010) and the United States coupled with sluggish job creation in 2011.

8.3.2 Enterprises Transformation

Drivers related to "enterprise transformation" are important as the business environment has introduced new enterprise services and globalization. The most important characteristics that emerging are as follows: (a) new relationships with suppliers and customers; (b) new contracts and service agreements; (c) corporate offshore locations; and a variety of other factors.

The growth drivers of the demand related to this transformation include: (a) substantial investment in proprietary areas such as homeland security, healthcare and infrastructure security; (b) ICT sector revival via technological innovation, for example, the LTE (mobile 4G), VoIP and expansion of ultra-broadband and the increasing usage of computer tablets and other mobility means. Among other drivers are: increased company mobility; implementation of new infrastructure technology (e.g., middleware, internet, integration platforms and Open Source); outsourcing, especially infrastructure; emergence and adaptation of new cloud computing business models; as well as emergence of unified communications and collaboration (UC&Cs) to name a few.

8.3.3 Innovation and New Technologies' Impact on BCS Demand

Innovation and new technologies drive the change in demand for IT and telecommunication services. They are reshaping the demand for BCS as the lifecycle of many products and services are shorter and the companies are in a continuous business transformation. Table 8.2 shows the usage evolutions and new technological trends for the demand.

Innovation is not related only to devices, but also to applications, analytics, and processes within companies.

Devices innovations are the smartphone, the tablet PC, and other means of mobility; in terms of applications, the key applications that are fostering the usage innovation are cloud computing, mobility, UC&Cs, and collaborative applications.

Table 8.2 Evolution of usage and new technological trends in the demand for business communication services

Decreasing	Remaining	Increasing
Devices		
Desktop PC	Laptop PC	Smartphones
Netbook PC	Conferencing Phone	Tablet PC
Mobile Phone		Surface Technology
Fixed Phone		
3G Dongle		
Webcam		
Fax		
GPS Receiver		
Applications		
Fixed Voice	SMS	Mobile Voice
Email	Fixed Broadband	Video Communication
		Voice as an IT Service
		Augmented Realty
		Virtual Desktop
		Collaborative Tools
		Social Networks
		Instant Messaging
		Storage Apps
		Mobile Broadband
		Business Apps
		Payment Apps
		Identity Apps
		Unified Communications
		Image & Video
		Mobile Broadband

Source Orange Business Services 2011

In summary, the demand for the BCS will be driven in the near future by mobile devices, including tablets, smartphones and laptops; cloud computing; social network technologies; large data requirements (e.g. "Big Data"); and emerging markets such the Brazil, Russia, India, and China (BRICs).

8.4 Modeling and Forecasting the Demand for BCS

In this section, we specify and estimate a multi-equation model to forecast the demand and the supply of BCS for the French market. This work is based on an earlier study (Hamoudia and Scaglione 2007). A multiple-equation model that integrates supply and demand sides is estimated, since a single equation model cannot capture the interactions among services.

In Europe, France is the third largest market for BCS market in terms of revenue. Only the United Kingdom and German markets are larger. From 2000 to 2010, the French market of the IT and Telecommunications for BCS services reported 6.2 % growth per annum over the period. Total spending reached €38.1 billion in 2010 from €20.1 billion in 2000.

Compared with Hamoudia and Scaglione (2007), this model adds new drivers and explanatory variables that are affecting the demand, such as the increasing role of cloud computing, infrastructure/platform/software as a service (IaaS/PaaS/SaaS); the development of UC&Cs; and the increased adoption of video and image solutions. The volatility of Euro/US dollar of exchange rates is also taken into account. Figure 8.1 highlights the overall framework of the model and Table 8.3 shows the list of variables used in the model.

8.4.1 Supply Variables

The supply variables include:

- *Price of each service*;
- *Network capacity*;
- *Network accesses* provided by telecom and IT providers.

The price variables are expressed as average revenue per user (ARPU) or average price per staff member (€/staff); bundled services catalog prices that represent the negotiated product prices are included. Some prices in the product catalog are 20–30 % below publicly listed prices, for instance.

The capacity variables represent the ability of providers to meet customer needs in terms of bandwidth (broadband, ultra-broadband and wireless broadband) and traffic (e.g., VoIP).

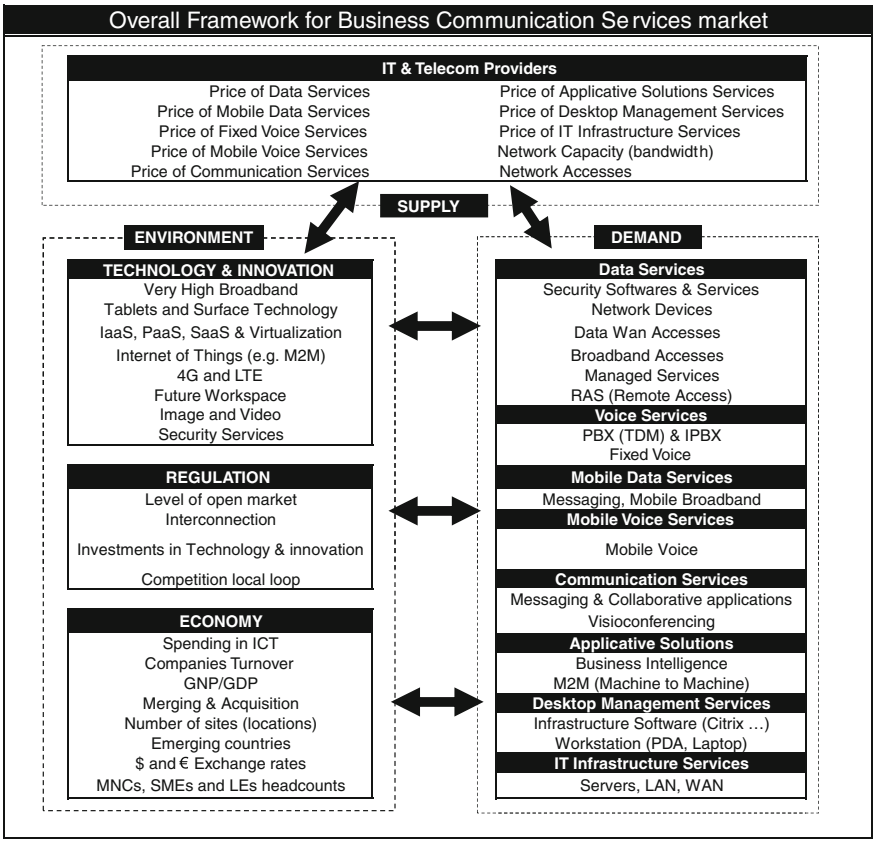

Fig. 8.1 Overall framework for business communication services market updated in 2012

8.4.2 Demand Variables

Demand services are categorized by:

- *Data services* including: security software, network devices, wide area network (WAN) and broadband and ultra-broadband accesses, managed services and remote access services (RAS);
- *Voice services* that are comprised of private branch exchange (PBX) and Internet (iPBX private branch exchange) and fixed voice;
- *Mobile data services* including wireless broadband and new mobile applications;
- *Mobile voice services* which include mobile voice;
- *Communication services* contain SoHo, SMB, and Large Enterprises collaborative applications support, video-conferencing and messaging;

Table 8.3 Variables used in the models

Variables	Variables Code	Units
1- ICTs Providers Supply		M€
Price of Data Services	P_D	€
Price of Mobile Data Services	P_MD	€
Price of Fixed Voice Services	P_FV	€
Price of Mobile Voice Services	P_MV	€
Price of Communication Services	P_COM	€
Price of Applicative Solutions Services	P_APL	€
Price of Desktop Management Services	P_DK	€
Price of IT Infrastructure Services	P_ITINF	€
Network Capacity and braodband	NC	Mbits
Bundles and Catalogue of Services	BUNCAT	%
Network Accesses	NA	Thousands
2- Technology & Innovation		
VoIP	VoIP	Dummy Variable
WLAN	WLAN	Dummy Variable
IP Transformation	iPTRANS	Dummy Variable
IP PBX	iPBX	Dummy Variable
3G/3G+ Wireless	3G_WIRS	Dummy Variable
Cloud computing (IaaS, SaaS and PaaS)	CC	Dummy Variable
3- Regulation		
Level of open market	OPEN_MKT	1 to 5
Interconnection	INX	Dummy Variable
Investments in ICTs & Innovation	INV	M€
Competition local loop	COM_LLOOP	Dummy Variable
4- Economy and Business		
Spending in BCS	SPEN	M€
Customers Turnover	TURNOV	M€
GNP/GDP	GDP	M€
Merging & Acquisition	MERGE	M€
Number of sites	SITES	Units
Business segment	BUS_SEG	Dummy Variable
€/$ exchange rate	EXCH	
Competition in BCS services	COMP_BCS	%
MNCs, SMEs and LEs Headcount (staffing)	EMP	Thousands
5- Demand of IT/Telecom Services		
5.1- Data Services	**DAT_SER**	M€
Security softwares & Services		M€
Network Devices		M€
Data Wan Accesses		M€
Internet Accesses		M€
Managed Services		M€
RAS (Remote Access)		M€
5.2- Voice Services	**V_SER**	M€
PBX (TDM) & IPBX		M€
Fixed Voice		M€

(continued)

Table 8.3 (continued)

Variables	Variables Code	Units
5.3- Mobile Data Services	**MD_SER**	M€
Workstation (PDA, Laptop)		M€
5.4- Mobile Voice Services	**MV_SER**	M€
Mobile Voice		M€
5.5- Communication Services	**COM_SER**	M€
Messaging & Collaborative applications		M€
Visioconferencing		M€
5.6- Applicative Solutions	**APL_SER**	M€
Business Intelligence		M€
M2M (Machine to Machine)		M€
5.7- Desktop Management Services	**DESK_SER**	M€
Infrastructure Software (Citrix …)		M€
Workstation (PDA, Laptop)		M€
5.8- IT Infrastructure Services	**IT_SER**	M€
Servers, LAN, WAN		M€

(1): As some statistics were based on US$, the exchange rate is provided by IMF source

- *Applicative solutions and services* are related to new services such as business intelligence and machine-to-machine transmission;
- *Desktop management services* that include infrastructure software (Citrix) and workstation (PDA and laptop) services; and
- *IT Infrastructure services* that include servers, LAN, and WAN.

8.4.3 Independent Variables

- *Technology and innovation* variables represent the availability and intensity of new services deployment such as VoIP, iPBX, high broadband and 4G/LTE. Also included is ICT investment by manufacturers;
- *Regulation* variables relate to policy levers, market openness (which has a significant impact on ICT markets), connection among rules, and fees and obligations, that is, the obligation to invest in new technology and innovation, and universal service obligations; and
- *Economy* variables including GNP, exchange rates (to take into account the impact of the volatility of Euro/USD), *Small office/home office* (SoHo), small to medium enterprise (SME) and large enterprise (LE) employment, company turnover, and company locations. Also included are the customers' expenditure (e.g., access fees and licenses);

Dummy variable are used to represent qualitative effects, that is, market openness. For instance, market openness is scaled on a 5-point Likert scale indicating low openness to complete openness.

Obviously, data series are of limited length for many new and innovative services such as VoIP and 4G/LTE for mobile.

8.5 Data Set and Sources

The forecasts were estimated based on quarterly data from Q1-2000 to Q4-2010. Data are obtained from a variety of sources such as: Quarterly reports from IT and telecommunication providers (IBM, Atos, Capgemini, BT, Orange, Telefónica, T-Systems, AT&T and Verizon); consultancies (Data Monitor, Forrester Research, Gartner, IDATE, Ovum, Markess International, IDC, and Jupiter Research)—release of detailed databases on many ICT services.

Most sources report annual data. This modeling is based on quarterly data, thus the statistical approach is based on the Chow and Lin (1971) procedure for quarterly interpolation of annual data. Pavía Miralles et al. (2003) is used to approximate quarterly data from annual data.

Economic data are from European Union Office of Statistics (Eurostat) and the National Statistical Office (INSEE, France). Both of these sources provide monthly, quarterly, and annual data by industry and other segments. While information on the economics and demographics is abundant, regulatory data is problematic. There is a lack of information concerning regulatory variables such as market openness, local loop competition, and interconnection.[5] Dummy variables are used to represent the qualitative effects of market openness and the IP transformation of SMEs and LEs. For example, the market openness variable is a categorical values variable with the discrete values 1 (closed market) through 5 (fully open market). The limited length of the data series for new products such as 3G+, ADSL+, VoIP, iPBX, and security is also an issue. This paucity of data is a limitation when the impact of new offers and services is integrated into the core business models.

8.5.1 Model Specification

When forecasting BCS demand and supply, in which convergent telecommunications and IT markets are experiencing significant innovation, the cross-elastic impacts must be considered. Single-equation estimations are unable to include interaction among sub-markets that are characterized by new technology and services for which there is a lack of historical data (e.g., iPBX, mobile data applications, ultra-high broadband and VoIP) (Rao and Angelov 2005). An alternative approach is to apply a multi-equation framework to the market (Loomis

[5] In part, because some of this information is confidential.

and Swann 2004). For this system, single equation ordinary least squares (OLS) estimations are biased when arguments are endogenous (Fisher 1966; Fernández 1981; Brown 1983; Amemiya 1986). Moreover, OLS parameter estimates in a structural simultaneous equation system are biased and inconsistent because of nonzero correlations among the random error term and right-hand side endogenous variables (Gorobets 2005). Consistent parameter estimates are obtainable from indirect least squares, instrumental variables, two-stage least squares (2SLS), or three-stage least squares (3SLS) routines. 3SLS, which is a combination of 2SLS and seemingly unrelated regression, is employed for this estimation (Alvarez and Glasgow 1999). However, both 2SLS and 3SLS models are estimated for the purpose of comparison. The "threesls" routine from Zelig package is used to obtain parameter estimates (Alimadhi et al. 2007). This approach also allows integration of a multi-output and multi-input industry framework. Alternative model specifications considered for estimation are models which includes publicly listed revenues to determine ARPU and price per staff member arguments. Model 2 contains negotiated prices (which are lower than the listed prices).

Many model specifications integrating several combinations of variables are run. The two most accurate models are presented. Both models were estimated by 3SLS on quarterly data from Q1-2000 to Q4-2010.

8.5.2 Model 1

8.5.2.1 Supply Equation

BCS product j supply function is specified as a log–log function of the form:

$$\begin{aligned} \ln y_{jt}^{s} &= a_s + \beta_s \ln INV_{t-1} + \sum_j \gamma_{sj} \ln P_{jt} + \sum_j \delta_{sj} \ln y_{jt}^{d} \\ &\quad + \varepsilon_s \ln NA_t + \xi_s \ln NC_{t-1} + u_t, \end{aligned} \tag{8.1}$$

where: y_{jt}^{s} is product j supply, INV_{t-1} is ICT and technology investment (lagged), P_{jt} is product j price, y_{jt}^{d} is product j demand, NA_t is network accesses, NC_{t-1} is network capacity (lagged) and u_t is a random error term. γ_{sj} is the own-price elasticity of supply, δ_{sj} is the demand price elasticity of supply; ε_s is the network access elasticity of supply and ξ_s is the network capacity elasticity of supply.

A priori, the sign of the own-price coefficient is negative, whereas the cross-price coefficients are expected to be positive. A lag supply response to ICT and technology investment is also considered.

8.5.2.2 Demand Equation

Similarly, the demand equation for product j is a log–log function of the form:

$$\ln y_t^d = a_d + \beta_d COMPNRS_t + \sum_j \gamma_{dj} \ln P_{jt} + \sum_j \delta_{dj} \ln y_{jt}^s + \varepsilon_d \ln EMP_t + \xi_d \ln SPEN_{t-1} + \upsilon_t \tag{8.2}$$

where y_t^d is product j demand, $COMPRNS_t$ is competition in network-related service markets, P_{jt} is product j price, y_{jt}^s is the supply of product j, EMP_t is SoHo, SME, and LE employment, $SPEN_{t-1}$ is SoHo, SME, and LE expenditure on ICT products and v_t is a random error term. β_d is the Network Related Services competition elasticity of demand, γ_{dj} is the own-price elasticity of demand, δ_{dj} is the supply price elasticity of demand, ε_d is the SoHo, SME, and LE employment elasticity of demand; and ξ_d ICT expenditure elasticity of supply. *A priori*, the own-price coefficients are assumed negative, while the cross-product price parameters are assumed positive.

8.5.3 Model 2

8.5.3.1 Supply Equation

In Model 2 BCS product j supply and demand functions are similar to Model 1. The major difference consists in the bundled price as an explanatory variable. Model 2 is specified as a log–log function of the form:

$$\ln y_t^s = a_s + \beta_s \ln INV_{t-1} + \sum_j \gamma_{sj} \ln BUNCAT_{jt} + \sum_j \delta_{sj} \ln y_{jt}^d + \varepsilon_s \ln NC_{t-1} + u_t \tag{8.3}$$

where y_t^s is product supply, INV_{t-1} is ICT and technology investment, $BUNCAT_{jt}$ is the bundled (and catalogued) product price, y_{jt}^d is product j demand, NC_{t-1} is network capacity and u_t is a random error term. β_s is the ICT and technology investment supply elasticity, γ_{sj} is the own price supply elasticity, δ_{sj} is the own product demand supply elasticity and ε_s is the network access supply elasticity. *A priori* bundle (and catalogued) products price is assumed negative. All remaining price parameter values are assumed positive. The lagged demand response to ICT investment and technology and network capacity change represents the ability to supply broadband.

8.5.3.2 Demand Equation

Finally, the demand for the product is:

$$\ln y_t^d = a_d + \beta_d COMPNRS_t + \sum_j \gamma_{dj} \ln BUNCAT_{jt} + \sum_j \delta_{dj} \ln y_{jt}^s + \varepsilon_d \ln EMP_t + \zeta_d \ln y_{t-1}^d + \upsilon_t \quad (8.4)$$

where the terms are defined as above, in Eq. (8.2).

A priori bundled (and catalogued), the product price parameter is assumed negative. All the cross-product price parameters are assumed positive. Also specified is a lag demand response.

8.5.4 Estimation Results

8.5.4.1 Supply Equation in Model 1

As shown in Table 8.4, the estimated INV parameter is inelastic, except for "Mobile Data" services. While investments in technology commonly impacts on supply and demand, the low elasticity only reflects the immediate effect, that is, there may be a more complex temporal pattern ignored by this specification. The estimated product price parameters are signed correctly, except for "Communication Services." "Data," "IT Infrastructure," and "Desktop Management" services are relatively elastic in supply. The estimated network capacity parameter is inelastic for all products, and the result from the specified lag structure. The estimated demand parameters exceed unity for "Data," "Mobile Data" and "IT Infrastructure" services, which means the demand impact on supply is important. However, a longer lag might provide a more elastic estimate.

8.5.4.2 Supply Equation in Model 2

Also shown in Table 8.4 are the supply estimates of Model 2. All estimated INV parameters are inelastic. ICT investment substantially impacts on supply. Again, the results suggest that investigation of a more complex geometric lag structure may prove useful. In this model, negotiated price (BUNCAT) replaces ARPU. All price parameter estimates have their expected signs, with most products more supply-elastic than in the Model 1 specification.

8.5.4.3 Demand Equation in Model 1

The demand estimates are shown in Table 8.5. The Network Related Services (NRS) competition parameters are less than unity. This positive impact suggests that competitive forces stimulate demand. However, as the products are standardized they are distinguished only by delivery, price and ability to manage

Table 8.4 Estimated Supply parameters (Q1-2000 to Q4-2010)

Estimated **Supply** parameters	Parameters printed in bold are significant at the 5% level								
Variable		Data	Voice	Mobile	Data	Mobile Voice			
Communication	Applicative Solutions				Desktop				
Management	IT Intrastructure								
Model 1	Constant	**16.02**	**9.23**	7.05	**0.77**	4.66	**11.52**	0.99	11.32
	Investments in BCS (t-1)	**0.82**	0.76	**1.36**	0.57	**0.66**	**1.06**	0.95	**1.35**
	Product Price	**-1.44**	**-1.59**	**-1.09**	**-0.76**	-0.62	**-0.84**	**-1.22**	-0.71
	Demand	**1.55**	**0.53**	**1.64**	**0.66**	**0.59**	**1.06**	0.22	**1.36**
	Network Access	**0.76**	**0.74**	0.62	0.38	0.55	0.76	**0.93**	**1.05**
	Network Capacity (t-1)	**0.76**	0.52	**0.77**	**0.96**	0.21	**0.62**	0.08	**0.94**
	Adjusted R_2	0.66	0.87	0.82	0.33	0.92	**0.95**	0.87	0.77
	Durbin-Watson	1.63	2.033	1.86	1.68	1.33	1.84	1.39	1.74
Model 2	Constant	**24.71**	**8.73**	**12.86**	7.89	**8.39**	**1.88**	**6.33**	**12.2**
	Investments in BCS (t-1)	0.77	**1.23**	**0.87**	**0.54**	**1.03**	0.55	**0.92**	0.36
	Bundle Price	**-0.92**	-1.12	**-0.72**	**-1.03**	**-0.44**	**-1.16**	**-1.09**	**-1.55**
	Demand	**0.77**	0.93	**0.55**	**0.32**	**0.89**	1.12	0.77	0.25
	Network Capacity (t-1)	**0.54**	0.37	**0.85**	**0.44**	**0.7**	0.94	-0.12	0.77
	Adjusted R_2	0.87	0.66	0.82	0.75	0.61	0.84	0.81	0.77
	Durbin-Watson	1.84	1.33	1.09	1.65	0.94	1.66	1.95	1.44

Table 8.5 Estimated Demand parameters (Q1-2000 to Q4-2010)

Estimated **Demand** parameters	Parameters printed in bold are significant at the 5% level								
Variable		Data	Voice	Mobile	Data	Mobile Voice			
Communication	Applicative Solutions				Desktop				
Management	IT Intrastructure								
Model 1	Constant	**1.33**	**-**			**23.71**	**-9.59**	0.43	-0.77
	-11.94	-		0.03	-0.33				
	Investments in BCS	**0.88**	**0.77**	0.69	**1.06**	0.21	**1.17**	0.05	0.52
	Product Price	**-**		**1.66**	**-0.99**	**-1.77**	**-1.17**	-0.87	-0.67
	-1.71	**-**		**1.34**					
	Supply	**1.19**	**0.98**	**0.84**	**1.12**	**1.09**	**0.87**	**0.98**	**1.04**
	Enterprise Employment	**0.96**	**1.12**	1.02	**1.55**	0.77	0.22	0.69	**1.09**
	Spending in BCS	**1.25**	1.09	**1.13**	**0.87**	0.92	**0.88**	**0.55**	0.46
Adjusted R_2	0.77	0.85	0.78	0.81	0.66	**0.56**	0.83	0.88	
Durbin-Watson	1.33	2.05	1.76	0.98	1.38	1.78	1.06	1.99	
Model 2	Constant	**-**		**7.53**	**-9.26**	0.88	-4.29	**-1.66**	**-9.54**
	-6.1	-		0.77					
	Investments in BCS	**0.94**	0.44	**0.72**	**1.23**	**0.57**	**0.66**	-0.26	0.33
	Bundle Price	**-**		**1.13**	**-1.37**	**-1.4**	**-2.12**	**-1.04**	**-1.56**
	-0.88	**-**		**1.32**					
	Supply	**0.96**	**0.77**	**0.52**	**0.75**	0.33	0.45	0.02	0.53
	Enterprise Employment	**0.87**	**0.63**	**1.1**	**1.24**	**0.92**	**0.52**	**0.61**	**0.94**
	Demand	**1.33**	**1.06**	**1.59**	1.3	1.95	**2.04**	**1.36**	**0.94**
Adjusted R2	0.88	0.63	0.85	0.91	0.7	0.66	0.91	0.9	
Durbin-Watson	1.63	2.05	1.56	1.23	1.87	1.66	1.95	2.27	

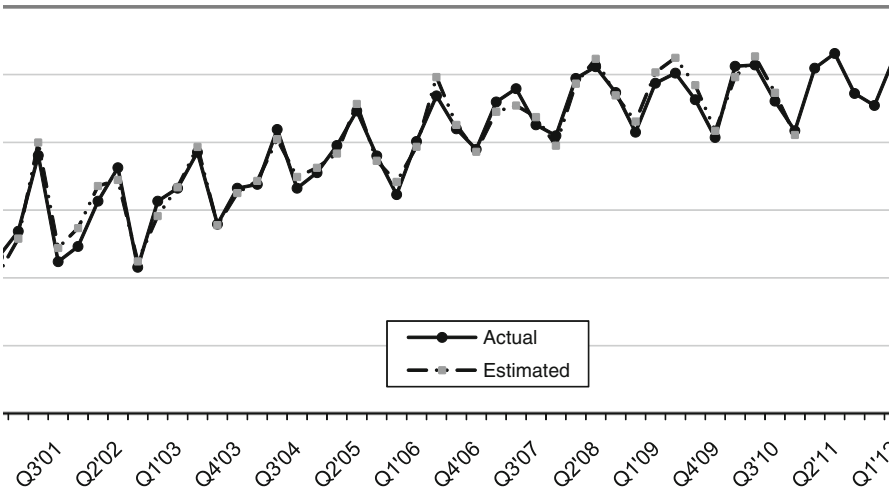

Fig. 8.2 Forecast business communication services in France 2011–2013 (€ million) based on model 1

complex IT and telecommunications projects. Accordingly, the number of suppliers appears less important than anticipated. The reported price parameters are correctly signed, however, demand is elastic. The estimated supply parameter value is less than unity for all products, except for "Voice," "Mobile Data," and "Communications" services, for which the estimated expenditure is elastic. This suggests the integration of delayed supply in the demand equation.

8.5.4.4 Demand Equation in Model 2

Also shown in Table 8.5 are the demand estimates of Model 2. As with Model 1, the NRS competition parameters are less than unity and follow the conclusions above. The estimated parameters for negotiated prices are appropriately signed. *Via* comparison with Model 1, demand is uniformly more price elastic (with most reported prices elastic). Further, the enterprise (SoHo, SME and LE) employment parameter is positive and inelastic. This result accords with the interpretation that an increase in employment more than matches growth in customer need.

8.5.5 Illustrative Forecasts

Figure 8.2 shows forecast for BCS of the French market over the 2011–2013 period based on model 1 which is the most optimistic. The average growth rate per year over the period (+2.9 %) is lower than over the 2005–2010 period (4.4 %).

This is essentially due to (a) the continuing decrease in voice and data spending (−8 to −10 %), (b) the uncertainty about the spending of some new solutions (UC&Cs, Cloud computing) over 2011–2013 period, and (c) the low macroeconomic perspectives in France (GDP: +1.2 % per year) and in the Euroland.[6] However, it seems that the growth of GDP and spending in ICT recorded in 2012 and early 2013 in France is in fact lower than that retained in this model.

The forecast based on model 1 shows 5.3 % variation with commercially available projection of French BCS demand. The estimated annual demand based on our model will reach 41.6 € million in 2013 versus 39.5 € million from commercial sources. Naturally, individual product forecast comparisons record greater discrepancy, with margins of 3–18 %.

8.6 Concluding Remarks

This study estimates the interaction of the ICT and IT sectors—the expansion of IT and telecommunications services into each other's territory. It notes the important role of innovation in terms of devices, processes, and applications. Obviously, analyzing and forecasting the demand of BCS is key for IT and telecoms providers. In aggressive, competitive markets it is critical to understand the key drivers of the demand and their evolution.

Correct analysis and forecasting of the demand will enable IT and telecoms providers to reduce the financial risks and optimize their investments in resources (networks, new products, human resources, skills, customer experience …). They also will be able to anticipate and meet the market demand, customers' expectations and determine the service level to be provided to their clients.

Although recent technology waves shape the BCS markets thus enabling enterprise IP transformations resulting in price competition (especially negotiated prices), innovation and investment in technology remain important variables in explaining market growth. The modeling addressed the deployment of new technology (4G+, iPBX) for which observations are available. The estimation suggests that model specifications are robust and valid using the simultaneous equation modeling approach. Future refinements are being considered. In particular, data are being gathered on variables related to new BCS—especially security, hosting, and professional services. Further, the analysis intends to focus on other new services such as UCCs and cloud computing. For instance (intuitively), investment in technology and innovation and prices should impact on demand for more than a quarter.

Acknowledgments We would like to warmly thank Professor James Alleman for reviewing the manuscript and for his helpful comments and suggestions. We also are grateful to Professor Robert Fildes for his comments and remarks.

[6] Forecast based on model 1.

References

Alimadhi F, Lu Y, Villalon E (2007) Seemingly unrelated regression. In: Imai K, King G, Lau O Zelig: Everyone's statistical software. Available at: gking.harvard.edu/zelig

Alvarez R, Glasgow G (1999) Two-stage estimation of non-recursive choice models. Political Analyses 8:147–165

Amemiya T (1986) Advanced econometrics. TJ Press Ltd, Oxford

Brown B (1983) The identification problem in systems nonlinear in the variables. Econometrica 51:175–196

Chow G, Lin A (1971) Best linear unbiased distribution and extrapolation of economic time series by related series. Rev Econ Stat 53:372–375

Fernández R (1981) Methodological note on the estimation of time series. Rev Econ Stat 63:471–478

Fisher F (1966) The identification problem in econometrics. McGraw-Hill, New York

Gorobets A (2005) The error of prediction for a simultaneous equation model. Econ Bull 17:1–7

Hamoudia M, Scaglione M (2007) An econometric model for forecasting the ICT business market using the simultaneous multi-equation modeling. Presented at the international telecommunications society Africa-Asia-Australasia regional conference, Perth, Australia

Loomis D, Swann C (2004) Telecommunications demand forecasting with intermodal competition: a multi-equation modeling approach. Telektronikk 100:180–184

Pavía Miralles J, Vila Lladoas L, Escuder Vallés R (2003) On the performance of the Chow-Lin procedure for quarterly interpolation of annual data: some monte-carlo analyses. Span Econ Rev 5:291–305

Rao B, Angelov B (2005) Bandwidth intensive applications: demand trends, usage forecasts, and comparative costs. In: NSF-ITR technical report on fast file transfers across optical circuit-switched networks, Grant No. ANI-0