International Journal of Industrial Organization 31 (2013) 462–476

Contents lists available at ScienceDirect

International Journal of Industrial Organization

journal homepage: www.elsevier.com/locate/ijio

Regulatory bias in the price structure of local telephone service ☆

Carlos Pérez Montes *

Financial Stability Department, Banco de España, Calle Alcalá 48, 28014 Madrid, Spain

ARTICLE INFO

Article history:
Received 22 December 2011
Received in revised form 8 March 2013
Accepted 12 August 2013
Available online 23 August 2013

JEL classification:
L51
L96
D61

Keywords:
Ramsey prices
Regulatory bias
Welfare analysis
Telecommunications
GMM

ABSTRACT

This article combines a discrete choice model of demand for residential local telephone access and an optimal price regulation model to estimate the welfare weights that state regulators implicitly place on consumers with different incomes and locations. I find no evidence of a bias towards rural consumers on average, but the relative weight on low income consumers in a geographic area can vary as a function of the proportions of rural and poor population and the political characteristics of the regulator. I also measure the welfare consequences of deviating from total consumer surplus maximization and disconnecting prices from costs.

1. Introduction

Residential access to the telephone network is a local service for which demand and cost conditions differ across the geography and social groups of the United States. Optimal prices, which maximize total welfare given the constraints on the regulator, would vary as a function of these different market conditions, but the bias of regulators in favor of particular consumer groups can introduce additional price dispersion. This article estimates the welfare weights that state regulators implicitly place on the surplus of consumers with different incomes and geographic locations and obtains a measure of the welfare effects of bias towards different consumer groups.

A state telephone regulator in the United States has jurisdiction over multiple local markets and, in principle, it could set a different price for each local market and consumer group. In practice, the pricing policies of state regulators are homogenous across large areas of their jurisdictions. In addition, non-geographic price discrimination is limited to discounted prices for low income consumers. I use an optimal regulation model to rationalize these observed pricing decisions and allow for a regulator's objective function that is a weighted sum of the profits of the firm and consumer surplus. This formal model can accommodate both the cases of a welfare maximizing regulator that acts in the public interest, and a regulator guided by private interest that places different weights across members of its jurisdiction.

Cross subsidies across telecommunications consumers (business to residential, urban to rural, high-income to low-income) have concerned both academics and practitioners.[1] This concern originates from the potential of cross subsidies to decrease social welfare by disconnecting prices and costs. A particular form of cross subsidy that lacks rigorous analysis is the possible transfer between urban and rural customers, as pointed out in Riordan (2002). Riordan (2002) or Rosston and Wimmer (2005) reveal that telephone rates for rural areas are on average below average cost and lower than in corresponding urban areas. This observation alone is not enough to conclude that there is a different weight on urban and rural consumers. The optimal prices in a rural area with high costs might not be greater than the prices in a low cost urban area if the demand for local telephone in this rural area is weaker. Additionally, the federal government pays a fraction of the price subsidies to low income customers and high cost areas. State regulators

☆ This article is a revised version of the second chapter of my dissertation. I am grateful to Michael Riordan, Katherine Ho, Bernard Salanie and Catherine Thomas for their invaluable advice and support. I also thank Patrick Bolton, Robert Atkinson, Bradley Wimmer, Gregory Rosston, Raicho Bojilov, the editor and two anonymous referees for their helpful contributions. This work is my sole responsibility and, in particular, it does not necessarily reflect the views of the Bank of Spain or the Eurosystem.

* Tel.: +34 91 338 8780.
E-mail address: carlos.perezmontes@bde.es.

[1] The term cross subsidy generally refers to price distortions originated by allowing losses for a subset of services *A* sustained by positive profits in subset *B*. Faulhaber (1975) provides a formal definition characterizing a price structure as subsidy-free if revenues do not exceed stand-alone costs for any subset of services. Palmer (1992) finds positive evidence of a subsidy from business to residential telephone users.

0167-7187/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.ijindorg.2013.08.002

might not internalize federal subsidy costs and reduce prices for these consumer groups even though they do not receive a higher weight.

The formal regulation model and GMM estimation allow me to separate demand and cost factors from regulatory bias. Relative welfare weights on consumers are recovered from the optimal regulation model evaluated with discrete choice demand estimates, data on regulated prices and engineering cost data from the Federal Communications Commission (FCC).

I estimate the demand for telephone access with a discrete choice model applied to a broad cross section of local market data in the US. I combine simulation techniques and the empirical income distribution in the Census of the United States to control for household heterogeneity in income and participation in welfare programs. Income affects the price sensitivity of a household, and also the actual price schedule of the household through the presence of low income subsidies. The estimated average price elasticity is low with a value of −0.018, although low income households, who are potential marginal adopters, exhibit significantly higher elasticities.

The optimal regulation model implies low relative weights on low income consumers when the regulator's objective function excludes the cost of federal subsidies, including only state components of profit and surplus. Given that federal programs reduce the cost for the states of price subsidies, the low estimated weights on low income consumers rationalize that observed subsidies are not higher. From an economic perspective, it is however more relevant to gage whether the overall effect of federal and state regulation implies a distortion on total welfare. To address this question, I add federal subsidy costs to state surplus and profit elements in the regulator's objective, recovering significantly higher implied weights on low income consumers. This result provides some evidence that the combined action of state and federal regulations produces price subsidies consistent with some overweighting of the welfare of low income users above demand and cost fundamentals. Additionally, I find that a higher percentage of rural population in an area generally increases the weight in favor of the low income consumers in that area, but not the weight on other consumers.

Actual residential telephone prices are generally below average line costs, and the residential deficit is covered by other telecommunication profits and regulatory subsidies, leading to a transfer from firms to residential users. Counterfactual experiments examine the realignment of prices with costs. The counterfactual change from actual prices to average cost pricing transfers approximately $8.6 bn annually from consumers to firms, with a much more limited adjustment of $90 m in total welfare. Unless indirect efficiency gains are sizeable, the reduction in consumer surplus from the price shift to average costs well exceeds the increase in welfare. I also compute the Ramsey prices that maximize welfare given a zero deficit requirement, which provide results close to average cost pricing rule, but with a higher efficiency gain of $153 m. Finally, I calculate the prices that maximize total unweighted consumer surplus given a constant deficit. These counterfactual prices imply an annual welfare transfer with respect to actual prices of $150 m from the low income to the general population.

The demand for telephone access across the United States has been studied with aggregate data in a number of works including Taylor and Kreidel (1990), Taylor (1994), Hausman et al. (1993), Crandall and Waverman (2000), Ross et al. (1998), Garbacz and Thompson (2002) and Ackerberg et al. (2008). An important motivation of these studies is measuring the elasticity of demand for local telephone access to prices in order to evaluate the effect of federal and state subsidies. Hausman et al. (1993) use FCC data on penetration aggregated over multiple local markets and conclude that there is a low elasticity of access to price. Ross et al. (1998) and Garbacz and Thompson (2002) find similar results with the use of state-wide data. The use of aggregated data masks variation in demand conditions across local markets and demographic groups. Ackerberg et al. (2008) address these shortcomings with a sample at the local market level focused on poor households, who are more likely to have a homogenous price elasticity. Ackerberg et al. (2008) also control for the endogeneity of prices and subsidies and find higher price elasticities than previous work.

The current article contributes to this literature with an explicit optimal regulation model for the endogenous choice of prices and with simulation methods to control for income heterogeneity with data aggregated at the local market level. The use of discrete choice models with simulation to study markets for differentiated goods and heterogeneous consumers has become popular in the empirical IO literature following the work of Berry et al. (1995), BLP henceforth. Applications are numerous, e. g., Nevo (2000, 2001) and Ho (2006).

A related strand of the literature studies demand for telephone services with micro data in articles such as Perl (1984), Train et al. (1987), Miravete (2002), Wolak (1996), and Economides et al. (2008). These micro data allow one to control directly for the effect of individual income and demographic characteristics. Additionally, the observation of individual usage and choices over price menus allows the estimation of not only the demand for access but also for the number of calls, duration and service plans. These articles find a low average elasticity of local usage to the price per call and that households make a stable number of local calls per month. These findings provide some justification for the use of the minimum cost of a fixed number of monthly calls as a proxy for the cost of local telephone service in the studies with aggregate data.

The study of telecommunications regulation includes examples such as Ai and Sappington (2002), Ai et al. (2004), Donald and Sappington (1995), Greenstein et al. (1995), Rosston and Wimmer (2005) and Rosston et al. (2008). These empirical studies estimate the effect of different economic and political characteristics of the state on the choices of regulators (price and quality levels, incentive plans, etc.) and the firm (investment, etc.). This literature connects with the early work of Joskow (1972, 1973) that studies the interaction between regulatory process and policy for regulated utilities. The present work is closest to Rosston et al. (2008) as that article studies the effect of private interest groups on the structure of telephone prices (retail, business and wholesale) by estimating a system of price equations that controls for demand, cost and political factors. The current article is focused on residential prices and it uses a structural approach that recovers information on the objective function of the regulator and welfare variations.

Related structural studies of regulation include Wolak (1994), Gagnepain and Ivaldi (2002) and Timmins (2002). Wolak (1994) and Gagnepain and Ivaldi (2002) focus on the estimation of the production function of regulated utilities and test for the presence of private information on costs. Wolak (1994) uses a formal optimal regulation model to estimate the production function, whereas Gagnepain and Ivaldi (2002) only consider welfare optimizing regulators to calculate counterfactual welfare levels of alternative regulation regimes. Timmins (2002) recovers the forward-looking costs of water supply in California and he uses a regulator's welfare function with weight differences between consumers and the firm. The use of an optimal regulation model to separate welfare weights can be traced back to Ross (1984). This article spanned a series of empirical applications such as Morrison (1987), Kim (1995) and Knittel (2003). I contribute to this literature with the joint GMM estimation of the demand and the structural regulation models.

The rest of the article is organized as follows. Section 2 describes the industry background and data set. Section 3 presents the demand and regulation models. Section 4 builds the estimation method. Sections 5 and 6 present results and policy experiments. Section 7 concludes.

2. Data set and industry background

2.1. The local telephone network in the US

A local telephone network combines a wire center (switching office) and connection facilities (lines), which are operated by a local carrier