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The structure of the labor market, telecommuting, and optimal peak period congestion tolls: A numerical optimization model☆

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ABSTRACT

This paper extends a standard model of welfare optimal peak-period congestion tolls to take into account two characteristics of typical European labor markets, viz. wage bargaining and the increasing potential of telecommuting as an alternative to working on-the-job. Specifically, we consider the government's problem of determining optimal labor and peak-period transport taxes under two different labor market structures, viz., a competitive labor market and a wage bargaining setting. The models include commuting and non-commuting transports, and they allow for telecommuting. We implement the models numerically using Belgian data. Results include the following. First, if union preferences reflect the transport concerns of their members, we find that optimal congestion taxes under competitive labor market conditions exceed those under bargaining by 10–17%. Second, the combination of substantially higher transport taxes and lower labor taxes compared to the reference situation jointly implies that the optimal tax structure strongly stimulates telecommuting for both labor market structures considered. Third, it is found that improving the efficiency of telecommuting results in a considerable reduction of optimal congestion tolls.

1. Introduction

The economic and social consequences of congestion have been widely recognized by economists, and an abundant literature on policies to alleviate congestion has been developed. As many of these policies advocate the introduction of some form of congestion tax, a large number of studies has analyzed first-best and second-best optimal congestion pricing (see, among many others, Keeler and Small, 1977, Kraus, 1989, Arnott et al., 1993, and Verhoef et al., 1995). Moreover, as the technology required to implement congestion pricing is now available, a number of cities have actually introduced at least some form of congestion charge (Singapore, Trondheim, Stockholm, and London), and many others are seriously considering or preparing its introduction.

Of course, a large fraction of rush hour traffic consists of commuting trips, and policy-makers have expressed some concern about the potential negative employment effects of introducing congestion charges. For many workers, congestion charges raise the cost of commuting to work and hence reduce the net benefits of employment, so that a reduction in labor supply is to be expected. Not surprisingly, a number of recent studies have focused on the close relation between commuting, congestion and the labor market. In a seminal paper, Parry and Bento (2001) assumed competitive labor markets and perfect complementarity between commuting and labor supply. They studied revenue-neutral increases in congestion taxes, whereby the transport tax revenues are recycled through a reduction in the labor tax. They showed that the feedback effects of congestion improve the employment implications of such a transport tax reform, because the reduction in congestion raises the net return to working, making working more attractive relative to leisure. At low levels of the congestion tax, the employment effect of a revenue neutral congestion tax is in fact positive, rather than negative.

Several studies extended the initial approach of Parry and Bento (2001). For example, Van Dender (2003) introduced different trip purposes into the model (commuting and non-commuting) and studied optimal taxes on labor and transport markets, allowing for tax differentiation between commuting trips and other trips. His numerical results show that the labor supply implications of congestion taxes on commuters provide an argument in favor of lower taxes on commuting than on other trip purposes.[1] More recently, Guttiérez-i-Puigarnau and van Ommeren (2010) distinguish two margins of adjustment in the overall labor supply decisions of individuals, viz. the number of days

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[1] Such commuting 'subsidies' were also defended on political economy grounds by, among others, Borck and Wrede (2005).

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people work per month and the number of hours they work per day. Their empirical results suggest that individuals' choices of how many days to work per month (and hence commuting demand) and how many hours to work per day respond quite differently to transport and labor tax changes. A transport tax increase may not so much reduce overall labor supply, but rather lead to working more hours per day and fewer days per month.

The models referred to above provided important insights into the relation between the transport and labor markets; however, they largely ignored several common features of European labor markets. First, in many countries, the labor market is highly unionized, and wages and employment are the result of negotiations between employer organizations and labor unions. If unions care about the workers they represent and if these workers suffer from congestion or face congestion tolls on their journey-to-work, one expects these issues to come up at the negotiation table, where wage adjustments are discussed with employers.[2] In a recent theoretical paper, De Borger (2009) reconsiders the problem of peak period congestion taxes in a model that captures the main ingredients of such a wage bargaining setting.[3] He shows that optimal congestion taxes strongly depend on the union's preferences towards transport issues. If the union fiercely negotiates for higher wages in response to an increased congestion toll, it is optimal for the government not to set the congestion toll too high, to limit adverse employment effects. However, if the union does not translate congestion tolls into higher wage demands at the negotiation table, a much higher toll is optimal, because in that case the employment effects of the congestion toll are more limited. Finally, the paper suggests that different assumptions on the working of the labor market may well have important implications for optimal labor and peak period congestion taxes.

Second, recently telecommunication developments have increased the potential for telework and telecommuting as alternatives to working on the job. In fact, a moderately large literature studies the potential role of telework and telecommuting opportunities as a way to break down the direct link between labor supply and commuting.[4] The potential for telework and telecommuting to reduce peak-period travel demand and congestion has been suggested several decades ago (see, e.g., Nilles, 1988; and Lund and Mokhtarian, 1994). Interestingly, at the aggregate level, the empirical evidence on the relation between telecommuting and telework on the one hand and commuting transport and total transport demand on the other hand remained, for a variety of reasons, inconclusive (see, e.g., Mokhtarian, 1991; Salomon, 1998; Golob and Regan, 2001; and Salomon and Mokhtarian, 2008). The reduction in commuting may be counteracted by more non-work related traffic by either the same individual or other household members, longer commuting trips may result if telecommuters move further from their workplace, etc. However, the majority of recent empirical studies (see, e.g., Choo et al., 2005 and the survey by Andreev et al., 2010) do suggest that stimulating telecommuting may be a promising avenue to reduce commuting travel and hence peak-period congestion.[5]

The described literature has suggested the relevance of the labor market setting one assumes, and it has pointed out the potential relevance of telecommuting. However, the implications for optimal congestion taxes have not been studied in detail. This is the purpose of this paper. Specifically, using simple but highly transparent models, we compare optimal labor taxes and congestion tolls derived under competitive labor market conditions and under wage bargaining. The various models include different trip purposes (commuting and non-commuting), and they allow for telecommuting by assuming exogenous productivity differences between working time on the job and work done at home. The models are calibrated and implemented using Belgian data for the year 2000.

The results of this paper can be summarized as follows. First, wage bargaining models may imply higher or lower congestion tolls on peak-period car traffic as compared to competitive labor markets, depending on the response of negotiated wages and employment to changes in transport taxes and congestion. Second, numerical implementation of the models, assuming that union preferences reflect the concerns of their members (in a way made precise below), we find optimal congestion taxes that are 10–17% lower under wage bargaining than under competitive labor market conditions. Third, the combination of substantially higher transport taxes and lower labor taxes compared to the reference situation jointly implies that the optimal tax structure strongly stimulates telecommuting for both labor market structures considered. Fourth, enhancing the efficiency of telecommuting (in the sense of reducing the productivity difference between working at home and on the job) is found to imply a considerable reduction in optimal congestion tolls under all labor market structures. Finally, optimal congestion tolls under wage bargaining are highly sensitive to the specification of union preferences.

This paper has some obvious limitations. First, we use highly stylized models. However, the main purpose of the paper is to suggest that the way we model the wage formation process may have important implications for the level and structure of optimal congestion tolls. Second, telecommuting is introduced in a very simple way, and we do not incorporate potential agglomeration economies (see, e.g., Arnott, 2007; Safirova, 2002; Venables, 2007). Third, the model deals with the peak period only and assumes that all transport takes place on a single link, used by both commuting and non-commuting transport. Fourth, there is neither freight nor public transport. Although incorporating these types of travel would substantially enhance the realism of the models, they are not essential for making the points this paper is interested in, viz. the impact of the structure of the labor market for congestion tolls.

The structure of this paper is as follows. In Section 2, we briefly discuss optimal taxation under competitive conditions and wage bargaining on the labor market, respectively. A numerical illustration is implemented and discussed in Section 3, focusing on different labor market assumptions and the role of increasing the efficiency of telecommuting, in the sense of reducing the productivity difference between working on the job and working at home, is explored. Finally, conclusions are summarized in Section 4.

[2] There is not yet, to the best of our knowledge, empirical evidence available that documents the effect of congestion and congestion taxes on wage negotiation outcomes on the labor market. De Borger (2009) does report some anecdotal evidence that suggests unions indeed care about the commuting costs of their members.

[3] Analyzing the effects of optimal taxation and tax reform within the framework of wage bargaining models has a long tradition in the literature on environmental taxation (see, among many others, Schneider, 1997; Strand, 1999; Bayindir-Upmann and Raith, 2003 and Schöb, 2005). Unlike congestion, however, environmental externalities do not generate feedback effects on demand, so that the externality itself does not affect negotiated wages and employment. In a recent paper, Van Ommeren and Rietveld (2005) studied commuting in a search model of the labor market where wages are determined through wage bargaining. The model implies that commuting time and commuting costs both affect equilibrium wages, and it explains the 'commuting time paradox'—i.e., the stability of average commuting times over extended periods of time. It does not include congestion, however, and the paper is not concerned with taxation.

[4] Telework means that the worker partly works at home or at some place other than the workplace, using information and communication technology for that purpose. Telecommuting implies the actual substitution of the commuting trip. Although in many cases the implications for the demand for transport will be the same, this obviously need not be the case. See, for example, De Graaff and Rietveld (2007) and Salomon and Mokhtarian (2008).

[5] It should be noted that, in a more general framework, telecommuting may have some unexpected side effects. For example, Safirova (2002) studied the potential role of telecommuting in reducing commuting and peak-period congestion in a general equilibrium framework, allowing for agglomeration effects. She finds that the presence of telecommuting may well imply that taxing congestion at marginal external cost reduces, rather than raises, welfare. The intuition is that congestion tolls increase telecommuting demand, which reduces the agglomeration potential of the economy.