Wage bargaining, productivity growth and long-run industry structure ☆

Helmut Bester [a], Chrysovalantou Milliou [b], Emmanuel Petrakis [c,*]

[a] *Free University Berlin, Department of Economics, Boltzmannstr. 20, D-14195 Berlin, Germany*
[b] *Athens University of Economics and Business, Department of International and European Economic Studies, Athens, Greece*
[c] *University of Crete, Department of Economics, Rethymnon, Greece*

HIGHLIGHTS

► Firms invest in labor productivity before competing in a free entry oligopoly.
► The industry's static and steady state equilibria are characterized and compared.
► Rent sharing may generate productivity dependent differentials.
► Productivity growth is driven by wage growth at the steady state.
► Hold-up is absent in the long-run.

ARTICLE INFO

ABSTRACT

This paper studies the innovation dynamics of an oligopolistic industry. The firms compete not only in the output market but also by engaging in productivity enhancing innovations to reduce labor costs. Rent sharing may generate productivity dependent wage differentials. Productivity growth creates intertemporal spillover effects, which affect the incentives for innovation at subsequent dates. Over time the industry equilibrium approaches a steady state. The paper characterizes the evolution of the industry's innovation behavior and its market structure on the adjustment path.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

The relationship between wages and productivity growth has attracted a lot of attention in economic theory. According to the traditional view in growth theory, the causality runs from productivity growth to wage growth, with higher productivity leading to higher wages. This relation is based on the argument that "the marginal productivity equation determines the time path of the real wage" (Solow 1956, p. 68).

A number of empirical studies, though, indicate that labor market conditions affect productivity growth and thus, they point out to a reverse causality. In a recent paper, Dew-Becker and Gordon (2008) have demonstrated that changes in labor market policies, and thus, in the labor market conditions can explain the behavior of the EU's productivity growth after 1995, as well as the differences in the productivity growth's trends in the EU and the US. Moreover, Gordon (1987, 2000) has found that the behavior of the ratio of wages to labor productivity plays a crucial role in explaining the trends of macroeconomic productivity growth in the US, Japan and Europe. Similar findings at the industry level are presented in Flaig and Stadler (1994), Doms et al. (1997), and Chennells and Van Reenen (1997).

Taking the above into account, in this paper, we reverse the causality between wages and productivity growth and examine the impact of wages on firms' productivity enhancing innovation investments in an

oligopolistic industry. In particular, this paper studies the short- and the long-run evolution of productivity growth in an oligopolistic industry in which firms produce a homogeneous good, entry and exit are free and the time horizon is infinite. In each period, firms enter the market, they invest in capacity and in labor productivity enhancing innovation, and they compete in quantities in the following period. The competitive wage in the economy is exogenous. Yet, each firm's specific wage is determined through bargaining with its employees. This allows us to investigate the effect of unionization on the industry's equilibrium path. Firms have free access to the last period's best production technology and their current innovation investments affect their labor cost at the subsequent date, and thus, the future innovation incentives. This process generates the industry's dynamics.

We demonstrate that in the short-run, the higher is the industry's competitive wage (i.e., the wage per efficiency unit of labor in the industry), and thus, the higher is the labor cost, the higher are firms' investments in labor productivity enhancing innovation. Intuitively, when labor is costly, firms have stronger incentives to substitute against it, i.e., to use less labor by increasing the productivity of labor. In the long-run, there is a unique steady state. In the steady state, firm's unit labor costs are constant over time and firm's investments in productivity enhancing innovation are equal to the growth rate of the industry's competitive wage. In the steady state also, the number of firms that enter in the market in each period, the output and the unit labor cost of each active firm depend only on the growth rate of the industry's competitive wage and not on the level of the competitive wage. But the level of wages is important for the industry's adjustment path towards the steady state. On this path, the number and size of firms and their innovation activities depend on the level of their labor cost. An increase in the employees' bargaining power reduces the innovation rate, and thus, slows down the speed of adjustment towards the steady state. In contrast, the impact of unionization on the number and size of firms is ambiguous outside the steady state.

Examining the interaction between unionization and firms' innovation activities, we find that wage bargaining reduces firms' short-run incentives to invest in productivity enhancing innovation. Intuitively, rent sharing between the employees and the firms leads to the standard hold up problem in labor markets. This observation is in line with the findings of Baldwin (1983), Grout (1984) and van der Ploeg (1987) who demonstrate that due to the hold up problem, firms' investments decrease with the employees' bargaining power.[1] Interestingly, things change in the long-run. In particular, wage bargaining does not affect the growth rate of the industry's competitive wage. Given that in the long-run firms' investments are equal to the latter, it follows that unionization does not influence firms' long-run innovation incentives and productivity growth.[2] Nevertheless, higher union bargaining power means fewer firms and higher output per firm in the steady state, i.e. a more concentrated market with less efficient firms.

Over the last few decades, the theoretical literature on industry dynamics has expanded sharply. A strand of this literature has focused on informational learning as the driving force for the industry dynamics (e.g. Jovanovic, 1982; Hopenhayn, 1992a, 1992b, 1993; Horvath et al., 2001; Asplund and Nocke, 2007; Hanazono and Yang, 2009; Tong, 2009). Another strand of the literature has, instead, offered an explanation for industry dynamics based on

incoming technological advances and firms' technological innovation activities in perfectly or imperfectly competitive industries. Representative papers include Jovanovic and Lach (1989), Klepper and Graddy (1990), Jovanovic and MacDonald (1994), Ericson and Pakes (1995), Klepper (1996), Pakes and Ericson (1998), Petrakis and Roy (1999), Klepper and Simons (2000), Götz (2002), Melitz (2003), Klette and Kortum (2004), Laincz (2005), Luttmer (2007) and Ederington and McCalman (2009).[3,4] None of these papers, however, considers the impact of labor market features on industry dynamics, a task that we undertake in this paper.[5] In particular, we analyze the evolution of an imperfectly competitive industry with free entry and exit where unionized firms are exposed to an exogenous growth of the competitive wage and are able to enhance their labor productivity by investing in deterministic innovation. We show that different competitive wage growth rates and bargaining power distributions between firms and their employees may lead to quite different evolution paths and steady states for the industry. We thus contribute to the industry dynamics literature by characterizing the firms' labor productivity enhancing innovation, and entry and exit decisions, as well as the structure of the industry over time, under alternative labor market features (such as unionization rates and cost-push factors).

By incorporating a rich model of industry dynamics in an imperfectly competitive sector with free entry and exit, this paper complements Bester and Petrakis (2003, 2004) who have examined the relation between wages and productivity growth in a perfectly competitive and a monopolistic industry, respectively. Our paper thus allows for the analysis of firms' strategic interactions in their entry, capacity and innovation decisions over time, as well as for the analysis of the role of the market structure. In contrast to the case of perfect competition, in this paper each firm's wage rate is not necessarily identical to the competitive economy-wide wage. Instead, it depends on how unionization and wage bargaining affect the sharing of surplus between the firm and its employees. As a result, unionization can have a significant impact on the endogenous variables of the industry both on the adjustment path and in the steady state. In contrast to the monopoly case, the number of active firms is endogenous in this paper, because there is free entry and exit. This also implies that the rate of innovation and the competitiveness of the industry are simultaneously determined on the equilibrium path. Indeed, our theoretical results indicate that free entry and exit play a significant role for the firms' innovation decisions: Whereas in Bester and Petrakis (2004) the monopolist has the highest innovation incentive for some intermediate range of unit labor cost, the present model, in line with Bester and Petrakis (2003), leads to a monotone relation between these variables.

The remainder of the paper is organized as follows. Section 2 describes our model. In Section 3, we derive the equilibrium for a given state of the environment. The firms' innovation decisions change the state of the environment over time. The steady state of this process is studied in Section 4. In Section 5, we show that the industry monotonically approaches the steady state and describe the industry's dynamics on its adjustment path. We conclude in Section 6. The proofs of all formal results are relegated in the Appendix A section.

---

[1] See Malcomson (1997) for an overview. Tauman and Weiss (1987) and Ulph and Ulph (1994, 1998, 2001) consider different environments, with asymmetric firms and a patent race respectively; they find that unionization can lead to overinvestment in innovation.

[2] Note that the empirical evidence on the relation between unionization and innovation is mixed (see e.g., Hirsch and Link, 1984; Connolly et al., 1986; Acs and Audretsch, 1987a, 1987b; Machin and Wadhwani, 1991; Menezes-Filho et al., 1998). For a review of the empirical literature see Flanagan (1999).

[3] Most of this literature considers a stochastic technological environment where firms are typically ex-ante heterogeneous. Exceptions are Petrakis and Roy (1999), Götz (2002), and Ederington and McCalman (2009) in which ex-ante homogenous firms operate in a deterministic environment.

[4] For a review of this literature see Malerba (2007).

[5] To best of our knowledge, Hopenhayn and Rogerson (1993) and Thompson and Pintea (2008) are the only papers that consider the role of labor market frictions on industry dynamics, but they focus on completely different aspects of the labor market than ours. Hopenhayn and Rogerson analyze the impact of changes in firing costs, while Thompson and Pintea consider a slow process of reallocation across firms of workers with heterogenous skills.