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Resistance to technology adoption: The rise and decline of guilds ☆

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ABSTRACT

This paper analyzes the decision of a group of specialized workers to form a guild and block the adoption of a new technology that does not require their specialized input. The theory predicts an inverted-U relation between guilds and market size: for small markets, firm profits are insufficient to cover the fixed cost of adopting the new technology, and hence, specialized workers have no reason to form guilds; for intermediate sized markets, firm profits are large enough to cover the higher fixed costs, but not large enough to defeat workers' resistance, and so workers form guilds and block adoption; and for large markets, these profits are sufficiently large to overcome worker resistance and so guilds disband and the more productive technology diffuses throughout the economy. We show that this inverted-U relation between guilds and market size predicted by our theory exists in a dataset of Italian guilds from the 14th to the 19th century.

1. Introduction

According to Joel Mokyr (1990), the factor that most clearly demarcates the Malthusian era of stagnant living standards from the modern growth era is not the technological creativity of humanity, but rather the intensity of resistance to the introduction of new technologies by guilds and trade associations. Starting in the Middle Ages, these groups successfully blocked the adoption of countless cost-saving production techniques through both legal and illegal means. However, in the 18th century, their effectiveness began to wane, at least in Europe where the political establishment stopped supporting their causes, and by the middle of the 19th century, these groups had all but disappeared, thereby eliminating a main impediment to economic growth in Britain and the Continent.

Why did the successful resistance to the diffusion of new technologies by guilds and other trade associations start to end sometime in the 18th century and not earlier? A general consensus that has emerged, particularly among economic historians, is that guilds and other rent-seeking institutions in Europe declined once society realized that the application of

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new ideas to the production of goods and services had a positive effect on humanity, and was thus not a zero-sum game. This shift in societal attitude, led by a handful of enlightened thinkers of the day, such as Francis Bacon, Robert Boyle, Adam Smith and David Hume, is what Mokyr (2005) labels the *Great Enlightenment*, Jacob (1981) the *Radical Enlightenment*, McCloskey (2010) the *Bourgeois Revaluation*, and Goldstone (2002) the *Engineering Culture*. Once these enlightened individuals educated society and shifted public policy on this matter, the deathlike grip guilds had held on technology adoption for the previous five centuries ended, and sustained economic growth followed.

In this paper, we offer a different story for the demise of the guilds. Successful resistance by the guilds, in our theory, ended not because a small number of enlightened individuals educated society about the net positive welfare gains associated with technological change. Instead, it ended naturally as markets in Europe expanded over time. When markets were small and competition was weak, as in the Middle Ages, guilds and other factor suppliers to the existing production processes had the ability to block the introduction of new production techniques, since profits of would-be-adopters were insufficient either to garner enough political influence to assist them in overcoming guild resistance or to defeat this resistance themselves. With the expansion of markets, these profits became sufficiently large so that would-be-adopters had enough economic power and political influence to break guild resistance. With one of their main raisons d'être gone, guilds had little choice but to disband.

Why would market size and the intensity of competition affect the ability of guilds to resist the introduction of cost-saving production processes? In our theory, market size and the intensity of competition, which go hand in hand, determine the number of goods that an economy can sustain. In a larger market, with a greater number of goods, competition toughens, the price elasticity of demand increases, and mark-ups fall. This means firms become larger, since each firm must sell more output to cover any fixed operating cost. Larger firm size is the key to ending guild resistance. As a would-be-adopter can spread any fixed adoption costs over a larger quantity of output, profits to adoption are greater. This means more resources available to an adopting firm for the purpose of overcoming the resistance of guilds to the new technologies. In this way, expanding markets make it more difficult for workers to block the adoption of new technology.

Would-be-adopters may overcome resistance via political and judicial channels, as their newfound economic power translates into political influence. There are several well documented cases where resistance ended only after government troops were sent in. For example, both the Lancashire Riots of 1779 and the Luddite uprisings of 1811–1813 were put down by the British army (Mokyr, 1990). More often, guild resistance ended following a ruling on a petition by worker groups on the legality of introducing new production processes. For example, in the cotton and woolen textile industries in England, Parliament separately ruled against spinners, combers, and shearers in their legal challenges to halt the adoption of cotton-spinning machinery, wool combing machines, and gig mills. Alternatively, would-be-adopters can overcome resistance through their own means by buying off some of the workers, in the form of wage concessions and severance payments. Another possibility is for would-be-adopters to move production operations to regions outside guild control. In the words of Mokyr (1990), "industry discovered the countryside", which was free from the tight rules imposed by guilds in cities. This has been cited as an important reason for why England's Industrial Revolution preceded the Continent's.

Our theory provides an explanation not only for the decline of guilds, but also for their rise. In our framework, specialized workers only form a guild when two conditions hold: adopting a new technology is profitable for the firm, but the profits are not enough to cover the cost of overcoming workers' resistance. This implies an inverted-U relation between guilds and market size. For small markets where competition is weak, firms have no desire to change their production process as profits from technology adoption are negative. Hence workers have no incentive to organize into guilds. For intermediate sized markets with modest competition, technology adoption is profitable in the sense of covering any fixed cost, but not sufficiently so to be able to break the resistance of guilds. Hence, guilds appear and block the introduction of cost-saving technologies in their industries. For large markets with intense competition, profits from technology adoption are sufficiently large to give firms enough firepower to either defeat guilds on their own or influence government policy in their favor. Consequently, guilds disband and more productive technology diffuses throughout the economy.

In addition to the vast literature on guilds, some of which we review in the next section, our paper relates to two other distinct literatures. First, it relates to the growing theoretical literature that examines the role of market size and competition for technological innovation. Relevant papers in this literature include Peretto (1998), Aghion et al. (2005), Vives (2008), and Desmet and Parente (2010). Second, it relates to the small but growing literature that formally models the formation and/or break-up of growth-inhibiting special interest groups. Important papers in this literature include Dowrick and Spencer (1994), Krusell and Rios-Rull (1996), Parente and Prescott (1999), Acemoglu et al. (2001), Lommerud et al. (2006), Parente and Zhao (2006), Dinopoulos and Syropoulos (2007), and Bridgman (2011). These papers emphasize different mechanisms. For instance, in Krusell and Rios-Rull (1996) and Dinopoulos and Syropoulos (2007) the distribution of skills across agents is important to the formation and break-up of these groups, whereas in Parente and Zhao (2006) the cost of introducing new goods is emphasized. Although they note the importance of the price elasticity of demand for resistance, neither Dowrick and Spencer (1994) nor Parente and Prescott (1999) nor Bridgman (2011) provide a mechanism whereby market size or any other factor affects the price elasticity of demand.

The rest of the paper is organized as follows. Section 2 serves to motivate our market size based theory of guilds and resistance by reviewing the relevant literature on the historical role of guilds and their demise. Sections 3 and 4 put forth a model to illustrate our mechanism and show how guild formation and technology adoption are affected by market size. Specifically, Section 3 describes the basic structure of the model without technology adoption or guild formation in order to illustrate the link between market size and firm size, whereas Section 4 introduces technology adoption and a game between