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Was technological change in the early Industrial Revolution Schumpeterian? Evidence of cotton textile profitability

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ABSTRACT

Price and profit data between the 1770s and the 1820s from accounting records of three Lancashire cotton firms help to illumine the nature of the economic processes at work in early industrialization. Many historians have seen the Industrial Revolution as a Schumpeterian process in which discontinuous technological change led by the mechanized factories of the cotton industry created large profits for innovators that persisted in succeeding decades while technology slowly diffused. In this view imperfect capital markets limited the use of the new technology, keeping profits high. Reinvestment of these profits gradually financed expansion of innovating firms. The new technology dominated only after a long diffusion process. The evidence here, however, supports a more equilibrium view in which the industry expanded rapidly and prices fell in response to technological change. Expansion of the industry led to dramatic declines in the prices of cotton goods as early as the 1780s. There is no evidence of super-normal profits thereafter. Prices continued to fall and output expand thereafter as cost-reducing technological change continued.

1 . Introduction

The British Industrial Revolution in the last quarter of the eighteenth century was a key event in the emergence of modern economic growth. Years ago, Eric Hobsbawm noted (1968, 34) "Whoever says Industrial Revolution says cotton." Technological and organizational changes in the cotton industry have been widely studied in attempts to understand the nature of economic change. This extensive literature notwithstanding, questions remain unanswered. In particular, it is of interest to know the way in which the fruits of technological advance were shared between rising profits, rising wages and falling prices. Although the existing literature frequently makes assumptions on this issue, there is little evidence based firmly on primary sources. This paper attempts to fill this gap by examining cotton textile prices, costs, profits and capital mobilization between the 1760s to the early nineteenth century using surviving account books, although, unfortunately, of a very limited number of firms.

Most of the new data have been compiled from the accounts of three cotton textile firms that are preserved in archives in Greater Manchester. One was a weaving firm, Richard Cardwell and Richard Birley and partners, that put yarn (and initially unspun cotton) out to domestically-based handloom weavers. The other two were spinners who were early adopters of the new mechanized spinning techniques: Samuel Greg and partners, and William Grey and partners. This is, of course, a very much narrower coverage of the industry than one would hope for and general conclusions cannot be definitively drawn. The data do, nonetheless, add important detail to what we know about cotton textiles in the Industrial Revolution.

The data presented here are, of course, useful in their own right. Additionally, they can help us to understand the process of economic change in the leading industry in late eighteenth and early nineteenth century Britain, and by extension, about the Industrial Revolution generally. The question of how great a role the mechanical inventions and the associated development of the factory system in British cotton textiles at the end of the eighteenth century played in the emergence of modern economic growth and

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the subsequent 'great divergence' remains a persistent debate in economic history. From the late nineteenth century onwards most economic histories have taken a Schumpeterian view that emphasized that innovations in economic organization, social relationships and technology in the cotton factories in the late seventeenth century were the key transformation. Some dissenters, most notable Sir John Clapham (1926), pointed out despite its growth cotton constituted a small part of the economy and emphasized continuity. Nonetheless, the view of a decisive change — the Industrial Revolution — dominates. The pioneering quantitative estimate of British economic growth by Hoffmann (1955) and Deane and Cole (1962) showed accelerating growth during the Industrial Revolution and reinforced the view of the decisiveness of the cotton innovations. The revisions of national income estimates in the 1980s (Crafts, 1985; Harley, 1999; Crafts and Harley, 1992) showed little, if any, acceleration of aggregate growth between 1760 and 1830, suggesting a more gradualist view in which changes in the cotton industry were less central to the emergence of modern economic growth.

A perception of slower aggregate change, however, does not necessarily contradict a central position for the cotton innovations. Joel Mokyr, one of the leading scholars of the Industrial Revolution, has argued for what he calls a 'growing-up model' (Mokyr, 1976, 1999, 82–89; 98–103). This is a Schumpeterian view in which technology created profit opportunities but innovation only slowly diffused throughout the economy. The essence of the model can be seen in the following quotation (Mokyr, 1999, 83):

> The growing-up model…is a disequilibrium model. Its dynamics depend on the coexistence and interaction of the "old" and "new" technologies…. The traditional sector, which produces the same good (or a close substitute) as the factories, can continue its existence for a long time after the process has started, because the modern sector is still too small to supplant it altogether. As long as the two sectors coexist, the modern sector earns a "quasi-rent," a disequilibrium payment that will eventually disappear when the manual industries have disappeared. Through continual reinvestment, this rent in its turn provides the fuel for further growth of the modern sector.

Mokyr envisages a long disequilibrium phase; his discussion of wage trends (Mokyr, 1991, 190) suggests that he feels it persisted until 1840 or 1850. Imperfect capital markets underlie the long disequilibrium. New firms are unable to enter the industry in response to high profits and expansion of innovating firms depends on retained earnings and so the growth of firms with the new technology is limited (Mokyr, 1999, 99).

In contrast to Mokyr's perception of a long disequilibrium diffusion of new Industrial Revolution technology, Crafts and Harley have attempted to analyze the Industrial Revolution using comparative static general equilibrium analysis (Harley and Crafts, 2000; Crafts and Harley, 2004). This analysis rests on assumptions of product and factor markets finding equilibrium fairly rapidly. Profit opportunities created by technological change provided incentives that induced output growth and falling prices.

Mokyr's perspective owes much to Schumpeter's insights on the central role of entrepreneurship and industrial finance in economic development and also draws on Arthur Lewis's (1954) model of development with unlimited labor. This view sees the Industrial Revolution as a discontinuous technological change affecting the whole economy. Cotton technology and factory organization acted, in Harberger's (1998) term, like a "yeast", leavening the economic process generally, but involving protracted diffusion. The leavening process of shift to modern conditions was constrained by limited enterprise, secrecy in technological knowledge and pre-industrial constrains on the mobilization of capital to new profitable industries. The Schumpeterian view characterizes the textile (and steam power) innovations in mechanical production and factory organization as introducing a major discrete general-purpose technology in the late 1760s. Innovators experienced a significant fall in costs but initially their output was small relative to the economy so product prices did not fall. Instead innovators reaped large returns on their investments. In this view, the following several decades were characterized by profits for innovators, reinvestment of these profits and slow diffusion of the superior technology.

In contrast, an alternative, more neo-classical, view, recognizes the important initial technological breakthrough, but sees them more like mushrooms popping up here and there in specific technologies in specific industries. The effects of the breakthrough, although initially creating profits to some innovators, principally resulted in lower prices of the products of particular industries in which technology improved. In this view the decades after 1790 when cotton textile prices continued to fall and output continued to expand arose from refinements of technology, introduced more or less continuously into textile production for a half a century or more after Arkwright and Crompton's conceptual breakthroughs, rather than by a diffusion process. The technology was specific to textile production; not a general-purpose technology applicable to the manufacturing generally but mushroom-like appearing here and there apparently at random. Historians of particular regions or industries tend toward the "mushroom" view and stress diversity among regions and industries in the late eighteenth and early nineteenth century (e.g. Clapham, 1926; Berg and Hudson, 1992). The histories of the cotton industry (Fitton and Wadsworth, 1958; Fitton, 1989; Chapman, 1967, 1972; Wadsworth and Mann, 1931; Edwards, 1967), implicitly at least, take the "mushroom" view and stress cotton industry specific changes.

The competing views have contrasting predictions about the movement of observable economic variables. Prices movements are the most easily observable implication. A Schumpeterian view, such as Mokyr's Lewis-type model, predicts and, in fact depends on, a delay in the fall of the price of goods after the technological breakthrough and a protracted period of exceptionally high profits for the innovating firms. The gradualists, or neo-classicists, emphasize the diversity of manufactured products, the product-specific nature of technological change, and the rapid exploitation of technological change. In this view the prices of cotton textiles — the specific goods in which technological breakthroughs occurred — fall rapidly relative to the prices of other goods, both manufactured and agricultural, as cotton output expands.

The relationship between technologically advanced industries and the capital market provides another contrast. Capital market failure is central to delayed diffusion of technology in Schumpeterian diffusion models. New firms were unable to challenge