Explorations in Economic History 46 (2009) 418–435

Contents lists available at ScienceDirect

Explorations in Economic History

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

Engels' pause: Technical change, capital accumulation, and inequality in the british industrial revolution

Robert C. Allen

Nuffield College, New Road, Oxford OX1 1NF, UK
Department of Economics, Oxford University, Manor Road, Oxford OX1 3UQ, UK

ARTICLE INFO

Article history:
Received 8 February 2008
Available online 3 May 2009

Keywords:
British industrial revolution
Kuznets curve
Inequality
Savings
Investment

ABSTRACT

The paper reviews the macroeconomic data describing the British economy from 1760 to 1913 and shows that it passed through a two stage evolution of inequality. In the first half of the 19th century, the real wage stagnated while output per worker expanded. The profit rate doubled and the share of profits in national income expanded at the expense of labour and land. After the middle of the 19th century, real wages began to grow in line with productivity, and the profit rate and factor shares stabilized. An integrated model of growth and distribution is developed to explain these trends. The model includes an aggregate production function that explains the distribution of income, while a savings function in which savings depended on property income governs accumulation. Simulations with the model show that technical progress was the prime mover behind the industrial revolution. Capital accumulation was a necessary complement. The surge in inequality was intrinsic to the growth process: technical change increased the demand for capital and raised the profit rate and capital's share. The rise in profits, in turn, sustained the industrial revolution by financing the necessary capital accumulation. After the middle of the 19th century, accumulation had caught up with the requirements of technology and wages rose in line with productivity.

> "Since the Reform Act of 1832 the most important social issue in England has been the condition of the working classes, who form the vast majority of the English people... What is to become of these propertyless millions who own nothing and consume today what they earned yesterday?... The English middle classes prefer to ignore the distress of the workers and this is particularly true of the industrialists, who grow rich on the misery of the mass of wage earners."
> –Friedrich Engels, *The Condition of the Working Class in England in 1844*, pp. 25–26.

Engels' *Condition of the Working Class in England in 1844* (1845) was an early and famous account of unequal development. He describes how the industrial revolution led to massive urbanisation and great increases in output. While per capita income was rising, real wages remained constant, however, so the gains from economic development accrued overwhelmingly to capitalists. The period of constant wages in the midst of rising output per worker was 'Engel's pause'. The pause had a progressive side, however, for the bourgeoisie saved from its growing income, and the ensuing investment drove the economy forward. In this paper, I argue that Engel's description of the industrial revolution was, in many respects, an insightful one.

Engels was not alone in his view of British industrialization. Among economists, Ricardo, Malthus, and Marx all believed that real wages would remain constant during capitalist development. They differed, however, in their explanations: Ricardo and Malthus believed that population growth would accelerate in response to any rise in income and ultimately force wages back to subsistence; Marx, on the other hand, believed that technological progress had a labour saving bias that would

E-mail address: bob.allen@nuffield.oxford.ac.uk

0014-4983/$ - see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.eeh.2009.04.004

eliminate any upward demand pressure on wages even as output per worker surged. In this paper, I offer a model that explains why Engel's pause happened and why it eventually gave way to a more equitable process of growth in which workers gained as well as capitalists. The model allows us to assess the importance of the demographic and technological factors emphasized by the classical economists in their analyses of industrialization.

The empirical point of departure is the comparison between the growth of output per worker and the real wage shown by the most widely used measures of these variables (Fig. 1). According to the Crafts-Harley estimates of British GDP, output per worker rose by 46% between 1780 and 1840. Over the same period, Feinstein's real wage index rose by only 12%. It was only a slight exaggeration to say that the average real wage was constant, and it certainly rose much less than output per worker. This was the period, and the circumstances, described by Engel's in *The Condition of the Working Class*. In the next 60 years, however, the situation changed. Between 1840 and 1900, output per worker increased by 90% and the real wage by 123%. This was the 'modern' pattern in which labour productivity and wages advance at roughly the same rate, and it emerged in Britain around the time Engel's wrote his famous book.

The key question is: why did the British economy go through this two phase trajectory of development? Table 1 provides some basic macro data in a growth accounting framework that help specify the question. Between 1760 and 1800, the real wage grew slowly (0.39% per annum) but so did output per worker (0.26%), capital per worker, and total factor productivity (0.19%). Between 1800 and 1830, the famous inventions of the industrial revolution came on stream and raised aggregate TFP growth to 0.69% per year. This technology shock pushed up growth in output per worker to 0.63% pa but had little impact on capital accumulation or the real wage, which remained constant. This was the heart of Engel's Pause, and the relationship between technology, capital accumulation, and wages is the problematic of this paper. In the next 30 years 1830–1860, TFP growth increased to almost one percent per annum, capital per worker began to grow, and the growth in output per worker rose to 1.12% pa. The real wage finally began to grow (0.86% pa) but still lagged behind output per worker with most of the shortfall in the beginning of the period. From 1860 to 1900, productivity, capital per worker, and output per worker continued to grow as they had in 1830–1860. In this period, the real wage grew slightly faster than output per worker (1.61% pa versus 1.03%). The 'modern' pattern was established.

Before explaining why the productivity shock of the industrial revolution was accompanied by a lag in real wage growth, we must acknowledge that not everyone shares this characterization of the industrial revolution. There is a long standing, 'optimistic' tradition that maintains that workers did better than Engels and the classical economists thought. The most recent proponent of this view is Clark (2001, 2005, 2007a,b), who believes that the average real wage grew faster than Feinstein contended and who also thinks that GDP grew less rapidly than Crafts and Harley calculated. Putting faster wage growth together with slower output growth implies that 'manual worker's real incomes in the industrial revolution period rose much more than did real output per capita' (Clark, 2001, p. 6). Workers, rather than capitalists, were the winners in the industrial revolution, according to Clark. This is exciting revisionism, but neither Clark's real wage series nor his GDP series are convincing improvements on the existing literature (See Appendix B for more discussion). Consequently, this paper is based largely on the estimates of Feinstein, Crafts, and Harley.

1. The functional distribution of income

A complete description of the functional distribution of income in the industrial revolution requires the histories of the prices of labour, land, and capital as well as the shares of national income accruing to each. Figs. 1–3 graph most of these. All

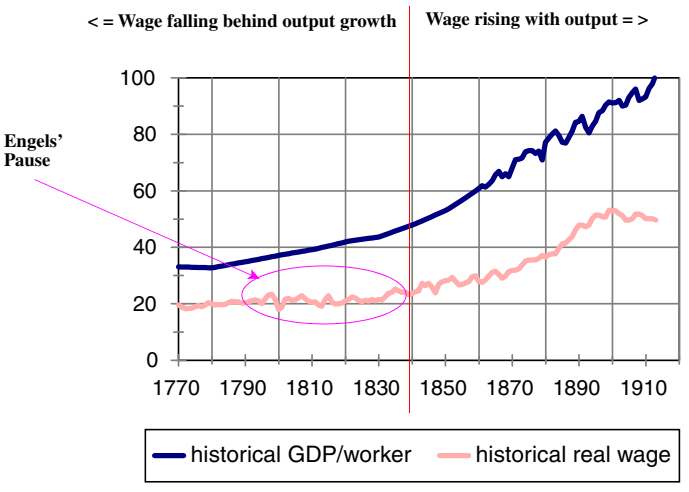

Fig. 1. The two phases of the British industrial revolution.