chemicals in western europe 1850-1914

RAND McNALLY

CHEMICALS IN WESTERN EUROPE:
1850–1914

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An economic study of technical change

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For my Mother and to the
Memory of my Father

Preface

My interest in the growth of chemical production in Europe dates back to a seminar at the Fletcher School, Tufts University. It grew, there and at the Massachusetts Institute of Technology, under the guidance and encouragement of Charles P. Kindleberger.

Many others, on both sides of the ocean and on both coasts of the American continent, have also given of their help and encouragement and, not least, of their critical thought. A very partial list of those who helped me gather information in Europe includes Messrs. C. Morazé, R. Robin, J. Bouvier, M. Lagache, T. Markovitch, E. Sohmen, C. Menzi, and A. Bürgin. I am also indebted to the management of the following companies for access to material in their possession: Geigy, Sandoz, Höchst, the BASF, St. Gobain, and the Union des Industries Chimiques in Paris.

It is impossible to mention all the teachers and colleagues, at MIT and Stanford, whose patient but critical questions forced me to think the argument through a number of times. I think particularly of David Landes, Moses Abramovitz, and the other members of the Berkeley–Stanford colloquium in economic history. I hasten to add that the people and institutions mentioned here bear no responsibility for errors, either of omission or commission.

I am happy to acknowledge the help of several institutional sponsors, who turn out on inspection to have a common origin in support provided by the Ford Foundation. My research was helped by a grant from MIT's Department of Economics, and I wrote the study while the holder of a Ford Dissertation Fellowship. Finally, I thank the Research Center in Economic Growth at Stanford for providing the financial help and institutional support which enabled me to revise the manuscript.

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Palo Alto, September 1966 Paul M. Hohenberg

Contents

Preface 7
Contents 9
Introduction 13

Part I. Growth and technical progress in the chemical industry

Chapter 1. Sources of information and a survey of technical developments to 1914 21
1. Summary of the technical history 23
1.1. Soda and related heavy chemicals 23
1.2. Coal-tar and organic chemicals 26
1.3. Chemical fertilizers 28
1.4. Electricity and chemical processes 30
Notes 32

Chapter 2. The chemical industry in three European countries: comparative performance and the role of market factors . 35
1. The industry in France, Germany, and Switzerland, 1850–1914 35
1.1. France. 35
1.2. Germany 38
1.3. Switzerland 40
2. The role of factor supply and product demand 42
2.1. Resources. 42
2.2. Labor 44
2.3. Capital 45
2.4. Demand 47
2.5. Transport. 50
3. Conclusion. 52
Notes 53

Chapter 3. Growth through technical effort and technical progress . 57

1. A theoretical framework 57
   1.1. The role and costs of technical effort in the firm . . . 57
   1.2. The extent of technical effort in the firm 61
2. The determinants of technical effort in the chemical industry . 67
   2.1. Education 67
   2.2. Government 71
   2.3. Entrepreneurship 75
3. Conclusion 83
Notes 84

Chapter 4. Knowledge-centered firms in the chemical industry . . 89

1. Types of chemical firms 89
   1.1. Heavy inorganics or 'Soda' producers 89
   1.2. Specialties or 'Lyon' firms 90
   1.3. Organic chemicals or 'Dyes' firms 90
   1.4. Scientific specialties or 'Basle' firms 91
2. Economic behavior of chemical firms 91
3. The knowledge-centered industry 95
Notes 97

Part II. The chemical industry and economic growth

Chapter 5. The role of the chemical industry: search for an approach 101

1. Introduction 101
2. The importance of chemical production in static terms . . . 103
3. Chemicals and derived demand 105
4. The chemical industry and economic efficiency 109
Notes 113

Chapter 6. The chemical industry and transmitted technical progress 117

1. New chemical materials 118
2. Chemicals and the diffusion of techniques 120
3. The external effects of technical effort 122
4. The chemical industry and transmitted knowledge 125
5. The institutional aspects of transmitting technical progress . . 132
Notes 136

Chapter 7. Conclusion 139

1. Observations on French economic growth 142
2. A summary of the economic argument 143
3. The implications of the argument for purposive economic development 145

Notes 149

Bibliography 151

Index 161

Introduction

The Great War of 1914–1918 showed the world that a new generation of industries had come of age, supplementing older established sectors they were soon in part to displace. To be sure, textiles, coal mining, iron and steel manufacture and transformation, and food processing still occupied most of the labor force in large-scale industry. However, many of the bottlenecks of wartime production involved light metals and alloys, new types of vehicles, equipment and instruments, and a wide variety of chemically processed materials such as liquid fuels, explosives, drugs, and synthetic materials. Of the industries pushed into the foreground of attention, none had more numerous and varied connections with the productive process than the manufacture of industrial chemicals. The chemical industry was not new in western Europe, but it took the war to bring out that here were more than a few ill-smelling factories producing mysterious and noxious witches' brews. Not only were the industry's products greatly needed, but it seemed to have a remarkable capacity to expand its range of activity to meet new needs and shortages.

This book is an economic study of the European chemical industry from about 1850 to the outbreak of World War I. It focuses on France, Germany, and Switzerland, casting only sidelong glances at Great Britain and Belgium, the other countries in which the industry enjoyed any considerable development. For the purposes of this study, the chemical industry is defined rather narrowly; I am excluding, for example, the production of rubber, petroleum products, soap, and explosives. Definitional problems of this type should prove minor in relation to the central concern of the book, which is to characterize and explain economic performance rather than to measure it. They do, however, make it difficult to use such limited quantitative data as are available regarding the size and rate of growth of the industry.

Anyone familiar with the literature of industrial history will no doubt grant the need for making what should be an obvious point: economic studies of an industry gain from being cast in the form of answers to one or more questions, preferably specific and explicit ones. As the book will show, even this necessary step does not ensure full and definite answers, but it brings out, at least, the degree of success achieved in coming to grips with the problem posed. There is, to be sure, room for answering the open-ended question 'what happened?', especially when new or unfamiliar material is presented, and it is hoped that the book makes some modest contributions in this direction. The main emphasis, however, will be on two questions:

1. What factors account for the relative performance of the industry in the three countries?
2. What impact did the industry have on the process of economic growth in the three countries?

These are rather straightforward questions. They may be rephrased even more simply, perhaps, to read:

1. Why did the industry grow more rapidly here than there?
2. What difference did it make to the economies?

Putting the questions in this form may give a clue to the fact that the answers are likely to be less easy than the questions. Scientific method is justly wary of questions containing too much 'why?', although the social scientist, and the economic historian in particular, seeks explanations of what has happened to compensate for his inability to recreate phenomena in the laboratory or to accumulate truly comparable observations outside it.

Specifically, the questions imply a theory of the growth of firms and industries on the one hand, and on the other a theoretical model of the interaction between sectors of the economy in the process of economic growth. While there is no shortage of work on either score, contact with an actual historical situation has convinced me that it falls short of providing an operational framework. The study therefore incorporates attempts to add to the corpus of theoretical work some reflections on growth and on the process of technical change.

In addition to specifying the scope of the study, it may be well to set out certain general views about the process of growth that underlie what follows. The reader may find some of them obvious and others highly

doubtful. They are not original and do not add up to anything like a consistent theory. But they are implicit throughout the book and hardly spelled out or argued again.

I believe that the process of economic growth is associated much more closely with more productive use of economic resources than with their accumulation. Thus, of the three ways in which growth may occur, one should stress reallocation of resources and improved productivity of given combinations of resources over increases in their amount. It should be noted that reallocation and changes in efficiency are not nearly so separable as production theory often suggests. Perhaps the sharp distinction between movements along a curve (here the isoquant) and shifts of the curve has been taken over too literally from the theory of demand. In both cases the distinction is valid only where information is full and free, but relaxing this assumption has more tangible implications in the case of production. The matter is taken up again in more detail in Chapter 3. For the present, it is enough to note that a growing economy is characterized by relatively frequent and sizeable change. At the microeconomic level, this suggests that an important condition for firms in such an economy is the ability to deal efficiently with change, and, if possible, to initiate it of themselves. Perhaps this type of dynamic efficiency is more important than minimization of costs under static technical and market conditions. At the aggregate level, growth depends on the elasticity with which resources can be reallocated between economic units and on the rate at which economically useful knowledge is produced and then effectively incorporated in the economic process.

Looking now at the process of economic growth over time, I think it is most fruitful to see the development of an economy as a cumulative but not irreversible process. Growth is indeed a powerful force promoting further growth, and it is useful to think of a progressive economy, i.e., one in which the process and expectation of growth are built into the behavior of economic units. But I reject the model of a one-time shift from stagnation to progressiveness implied by the notion of a take-off. Such a position is virtually inescapable for the student of France in the 19th century, since he is faced with a clearly intermediate case, one in which steady growth was combined with persistent resistance to rapid modernization. Furthermore, I am concerned with economies already engaged in the process of industrialization and with the role of a partic-

ular industry in accelerating or retarding it. For the problem to be non-trivial, I must assume that there are obstacles to growth, or at least postulate the need for continued autonomous stimuli to further progress. What I seek is not *the* key to growth, *the* sector or impulse necessary and sufficient for a progressive economy. The task is a more modest one. It is that of identifying, documenting, and evaluating mechanisms by which firms and industries grow, and by which they in turn provide a stimulus for further growth to other parts of the economy. In this connection, an industry may be called 'leading' if its own growth is *relatively* autonomous, i.e., independent of particularly favorable environmental conditions, and if, in addition, it provides *relatively* strong stimuli to the rest of the economy.

The major theoretical hypothesis on which the book is based should be stated at the outset, with the hope that the reader will reserve judgment and let the study argue for the author that the following propositions are neither wrong nor trivial.

> Technical progress is in substantial part the fruit of resources devoted to the production of knowledge. The extent of such *technical effort* (as this activity is called hereafter) varies widely among firms and industries. Relatively great technical effort is conducive to rapid growth for the firm or industry in which the activity takes place. It also gives rise to technical progress which is implemented elsewhere in the economy. In this way even a small sector may have substantial growth-promoting effects.

Since the above hypothesis grew out of studying the chemical industry in 19th-century western Europe, it is not surprising that the evidence appears to fit it rather well. The purpose of the book is, however, to break out of the closed loop formed by one case and one hypothesis, and to argue for the need to treat technical change as endogenous, given its central role in the process of economic growth.

I have tried to make this an exercise in interpretive economic history as well as a case study for certain observations about growth in industrializing countries. As economic history it may seem insufficiently quantitative to many readers. The reason is not that I eschew the use of numerical data, but that I have wanted to go further than the sparse and often inappropriate quantitative record would permit. In the last analysis, the extent to which one uses data which are available as proxies for variables one cannot measure must remain partly a matter of taste. I can only say