Construction Economics

A new approach

Third Edition

Danny Myers

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Construction Economics

Construction Economics provides students with the principles and concepts underlying the relationship between economic theory and the construction industry. The *new approach* adopts an argument that economics is central to government initiatives concerning sustainable construction.

This edition has been revised to explain the effects of the current economic crisis on the construction industry. In addition, sections relating to less developed countries, the economics of sustainable development and theories relating to a firm's bid strategy have all been rewritten. With new data, examples, initiatives, readings, glossary items and references, the third edition of this established core text builds on the strengths of the previous edition:

- a clear and user-friendly style
- use of a second colour to highlight important definitions and formulae
- regular summaries of key points
- a glossary of key terms
- extensive use of tables and figures
- extracts from the academic journal *Construction Management and Economics* to consolidate and prompt discussion
- reviews of useful websites.

This invaluable textbook is essential reading across a wide range of disciplines from construction management and civil engineering to architecture, property and surveying.

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ACKNOWLEDGEMENTS

Although the book cover implies this is all my own work, it was not achieved alone. The staff and students that I have worked with have subtly, and not so subtly, made their mark. In particular, research undertaken with Kevin Burnside, a supportive colleague over a number of years, has helped to improve the clarity of the process of bidding for work in a construction industry dragged down by financial crisis and subsequent recession. The fruits of our discussion should be evident in Chapters 7 and 8.

Next, to bring life to a manuscript is no easy task and this would have been impossible without the graphic design skills, and patience, of Chris Wade, who has added some new artwork to this edition.

A major concern from the outset was to create a text that was easy to read and use. This is some challenge in the subject area, and again it has been a pleasure to be supported by the editing skills of Paul Stirner. His perceptive, informed and detailed line of enquiry has added greater clarity and rigour to the text, making the completed manuscript as accessible as possible.

Finally I should acknowledge the support of the publishers, in particular Brian Guerin who co-ordinates the team involved in commissioning a new edition and taking it through to publication, and you would be surprised at the number of departments that involves.

I hope you find the finished product interesting and relatively easy to use. If any errors or omissions remain, I apologise for these in advance, and would be grateful for correspondence bringing them to my attention. Enjoy the book!

Danny Myers
September, 2012

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1 An Introduction to the Basic Concepts

This book is written for students from many backgrounds: architecture, surveying, civil engineering, mechanical engineering, structural engineering; construction, project or estate management, property development, conservation and, even, economics. Economics students may find it possible to skip over some of the standard analysis, but should be forewarned that in many ways construction is quite distinct from other sectors of the economy. An important aim of this text is to draw out these distinctions and clarify the unique nature of the industry. In this first chapter we begin to outline the main characteristics of firms involved in construction markets, introducing the complexity of the construction process and diversity of activities. As the chapter develops you will sense that there are a number of possible ways to describe the construction industry. Table 1.1 identifies a range of activities that can be included in a broad definition of the industry. By contrast, Table 1.2 (see page 11) divides the construction process into a number of professional stages and Table 1.3 (see page 19) outlines a simple classification system that narrowly defines the industry as firms that just construct and maintain buildings and infrastructure.

Table 1.1 The construction industry – broadly defined

	The key actors include:
✓	Suppliers of basic materials, e.g. cement and bricks
✓	Machinery manufacturers who provide equipment used on site, such as cranes and bulldozers
✓	Manufacturers of building components, e.g. windows and doors
✓	Site operatives who bring together components and materials
✓	Project managers and surveyors who co-ordinate the overall assembly
✓	Developers and architects who initiate and design new projects
✓	Facility managers who manage and maintain property
✓	Providers of complementary goods and services such as transportation, distribution, demolition, disposal and clean-up

Source: Adapted from Manseau and Seaden (2001: 3–4)

The aim of the text is to demonstrate that underlying the construction process, from conception to demolition, is a lot of useful economics. As a discipline, economics should not be regarded as solely related to the appraisal of costs. The subject matter is far broader, and this text introduces a number of branches of economic theory. These have been selected to provide fresh insights into the

performance of construction firms and a greater understanding of the need for a more holistic approach if the industry is to contribute to an efficient and sustainable economy in the future. These economic ideas should inform the work of all professionals concerned with the construction and maintenance of buildings and infrastructure – and, in particular, the way that they think.

The next section explains some of the key concepts used by economists. Further clarification is provided in the glossary at the back of the book, where all the economic terms highlighted in the text and other concepts and ideas relevant to construction economics are defined.

INTRODUCING CONSTRUCTION ECONOMICS

Construction economics – like pure economics, its mainstream equivalent – is concerned with the allocation of scarce resources. This is far more complex than it at first appears. Many of the world's resources (factors of production such as land, labour, capital and enterprise) are finite, yet people have infinite wants. We are, therefore, faced with a two-pronged problem: at any point in time there is a fixed stock of resources, set against many wants. This problem is formally referred to as **scarcity**. In an attempt to reconcile this problem, economists argue that people must make careful choices – choices about what is made, how it is made and for whom it is made; or in terms of construction, choices about what investments are made, how these are constructed and on whose behalf. Indeed, at its very simplest level, **economics** is 'the science of choice'.

When a choice is made, therefore, some other thing that is also desired has to be forgone. In other words, in a world of scarcity, for every want that is satisfied, some other want, or wants, remain unsatisfied. Choosing one thing inevitably requires giving up something else. An opportunity has been missed or forgone. To highlight this dilemma, economists refer to the concept of **opportunity cost**. One definition of opportunity cost is:

> the value of the alternative forgone by choosing a particular activity.

Once you have grasped this basic economic concept, you will begin to understand how economists think – how they think about children allocating their time between different games; governments determining what their budgets will be spent on; and construction firms deciding which projects to proceed with. In short, opportunity costs enable relative values to be placed on all employed resources.

This way of thinking emphasises that whenever an economic decision is made there is a **trade-off** between the use of one resource for one or more alternative uses. From an economic viewpoint the value of a trade-off is the 'real cost' – or opportunity cost – of the decision. This can be demonstrated by examining the opportunity cost of reading this book. Let us assume that you have a maximum of four hours each week to spend studying just two topics – construction economics and construction technology. The more you study construction economics, the higher will be your expected grade; the more you study construction technology, the higher will be your expected grade in that subject. There is a trade-off, between spending one more hour reading this book and spending that hour studying

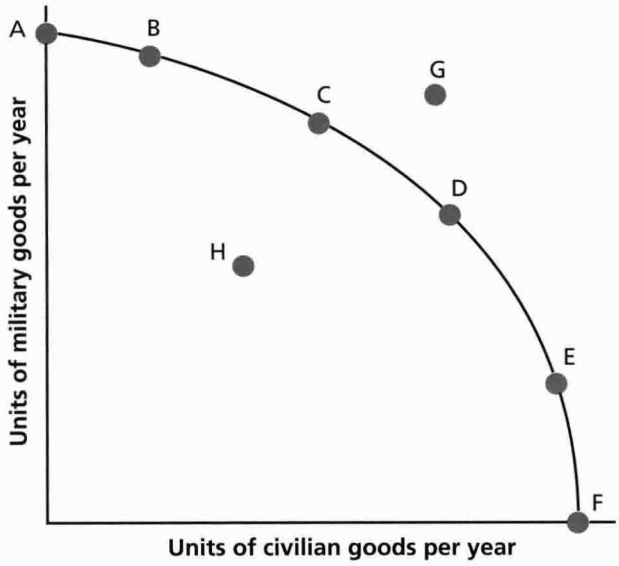
technology. In this example there is a fixed trade-off ratio. In practice, however, some people are better suited to some subjects than others and the same thing can be applied to resources. As a general rule, therefore, resources are rarely equally adaptable to alternative projects.

In construction, or any other economic sector, it is rare to experience a constant opportunity-cost ratio, in which each unit of production can be directly adapted to an alternative use. It is far more usual in business trade-off decisions to see each additional unit of production cost more in forgone alternatives than the previously produced unit. This rule is formally referred to as the **law of increasing opportunity costs**. This can be illustrated with the 'guns or butter' argument – this states that, at any point in time, a nation can have either more military goods (guns) or civilian goods (butter) – but not in equal proportions. For example, consider the hypothetical position in which all resources in the first instance are devoted to making civilian goods, and the production of military goods is zero. If we begin production of military goods, at first production will increase relatively quickly, as we might find some engineers who could easily produce military goods and their productivity might be roughly the same in either sector. Eventually, however, as we run out of talent, it may become necessary to transfer manual agricultural labour used to harvesting potatoes to produce military goods – and their talents will be relatively ill-suited to these new tasks. We may find it necessary to use fifty manual labourers to obtain the same increment in military goods output that we achieved when we hired one sophisticated engineer for the first units of military goods. Thus the opportunity cost of an additional unit of military goods will be higher when we use resources that are inappropriate to the task. By using poorly suited resources, the cost increases as we attempt to produce more and more military goods and fewer and fewer civilian goods.

The law of increasing opportunity costs is easier to explain using a **production possibility curve**. Using these curves, it is possible to show the maximum amount of output that can be produced from a fixed amount of resources. In Figure 1.1 (see page 4) we show a hypothetical trade-off between units of military goods and civilian goods produced per year. If no civilian goods are produced, all resources would be used in the production of military goods and, at the other extreme, if no military goods are produced, all resources would be used to produce civilian goods. Points A and F in Figure 1.1 represent these two extreme positions. Points B, C, D and E represent various other combinations that are possible. If these points are connected with a smooth curve, society's production possibilities curve is obtained, and it demonstrates the trade-off between the production of military and civilian goods. These trade-offs occur on the production possibility curve. The curve is bowed outwards to reflect the law of increasing opportunity cost. If the trade-off is equal, unit for unit, the curve would not bow out, it would simply be a straight line. Other interesting observations arising from the production possibility curve are shown by points G and H. Point G lies outside the production possibility curve and is unattainable at the present point in time, but it does represent a target for the future. Point H, on the other hand, lies inside the production possibility curve and is, therefore, achievable, but it represents an inefficient use of available resources.

Figure 1.1 The trade-off between military goods and civilian goods

Points A to F represent the various combinations of military and civilian goods that can be achieved. Connecting the points with a smooth line creates the production possibility curve. Point G lies outside the production possibility curve and is unattainable at the present time; point H represents an inefficient use of resources at the present time.



There are a number of assumptions underlying the production possibility curve. The first relates to the fact that we are referring to the output possible on a yearly basis. In other words, we have specified a time period during which production takes place. Second, we are assuming that resources are fixed throughout this time period. To understand fully what is meant by a fixed amount of resources, consider the two lists that follow, showing (a) factors that influence labour hours available for work and (b) factors that influence productivity, or the output per unit of input.

FACTORS INFLUENCING LABOUR HOURS AVAILABLE FOR WORK

The number of labour hours available for work depends on the nature of human resources in society. This is determined by three factors:

- the number of economically active people that make up the labour force – this depends on the size of the population and its age structure, as children and retired persons will be economically inactive
- the percentage of the labour force who then choose to work
- prevailing customs and traditions (such as typical length of the working week, number of bank holidays, etc.).

FACTORS INFLUENCING PRODUCTIVITY

There are a number of factors influencing the productivity of an economy or sector of the economy:

- the quantity and quality of natural and man-made resources
- the quality and extent of the education and training of the labour force
- the levels of expectation, motivation and wellbeing
- the commitment to research and development.

The third and final assumption that is made when we draw the production possibility curve is that efficient use is being made of all available resources. In other words, society cannot for the moment be more productive with the present quantity and quality of its resources. (The concept of efficiency is examined more closely in Chapters 2, 5, 6, 7 and 8.)

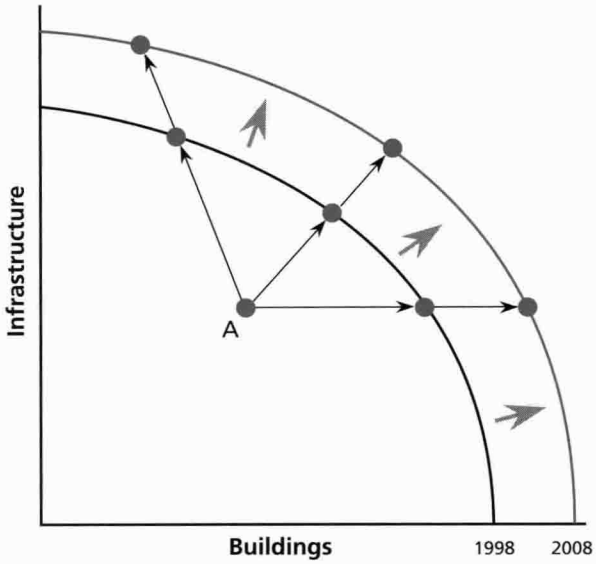
According to several government reports (Egan 1998; NAO 2001, 2005 and 2007; Cabinet Office 2011), given the existing level of resources in construction it should be possible to increase productivity by at least 10 per cent. In other words, a production possibility curve representing all construction activities could be pushed out to the right, as shown in Figure 1.2 (see page 6). Several common sets of problem are identified as the root cause of this inefficiency. First, the industry demonstrates a poor safety record and an inability to recruit good staff. Second, there appears to be no real culture of learning from previous projects, and no organised career structure to develop supervisory and management grades. Third, concern is expressed about the poor level of investment into research and development that restricts the industry's ability to innovate and learn from best practice. The fourth, and possibly most worrying, problem is the fact that technology (in the sense of IT, innovation, prefabrication and off-site assembly) is not used widely enough across the construction sector.

Another plausible scenario suggested by the production possibility curve approach is that the construction industry may at present be working within the boundary of its production curve (say, point A in Figure 1.2). In which case, an increase in output could be simply achieved by greater efficiency. Supply constraints need to be reduced, the problems identified by the government reports resolved, and the factors generally acknowledged to increase productivity (listed above) must be addressed to achieve the full potential of the industry. Both these scenarios are shown in Figure 1.2 and they support the idea that the level of productivity in the construction industry needs to improve.

In very general terms, therefore, the study of economics (and construction economics) is concerned with making efficient use of limited resources to maximise output and satisfy the greatest possible number of wants. In short, the basis of the subject rotates around the concepts of choice, scarcity and opportunity cost.

Figure 1.2 Increasing output and the production possibility curve

In this diagram we show two scenarios: (a) improved productivity shifts the entire production possibility curve outwards over time; (b) output can be achieved more efficiently by moving to a position of full potential on the actual production possibility curve.



In modern society, economics is involved in all activities leading to the production of goods and services. Consequently a range of specialisms have evolved out of mainstream economics, such as transport economics, health economics, business economics, financial economics, agricultural economics, labour economics, international economics and, even, ecological economics. Hence it is not particularly surprising that many students in the twenty-first century are expected to read something called construction economics as part of their degree course. What is surprising, however, is that other vocationally oriented degrees do not have a similarly developed economics specialism. For example, students reading for degrees in catering, sports and leisure, publishing, retailing or computing do not benefit from a range of specialised literature in economics.

The reasons usually stated for construction warranting its own specialised economics is accounted for by the sheer size of the industry, its profound contribution to a nation's standard of living and its products' unique characteristics. Put very simply, the industry has five distinct qualities.

- The physical nature of the product is large, heavy and expensive.
- The construction industry is dominated by a large number of relatively small firms, spread over a vast geographical area.
- Demand for activity within the industry is directly determined by the general state of the economy as a whole.

- The method of price determination is unusually complex due to the tendering process used at various stages.
- Most projects can be considered as a 'one-off', as there is usually some defining quality that makes them in some ways unique.

These qualities alone have justified a number of dedicated academic publications. In 1974 the first edition of Patricia Hillebrandt's *Economic Theory and the Construction Industry* was published. Subsequently several other titles have appeared – for details see the reference section at the back of this book – in particular the two-part text co-authored by Ive and Gruneberg (2000) and the edited volume by Gerard de Valence (2011). In 1982, *Construction Management and Economics* a specialist refereed journal began to report on research contributing to the new subject specialism. This journal is published monthly and more than 1800 papers have appeared; several of them are drawn upon to support this text. Some extracts have been selected from these papers as case study readings to consolidate the three sections of this textbook. Another relevant academic journal is *Building Research and Information*. This has an interdisciplinary focus, with linkages made between the built, natural, social and economic environments. Consequently many of the papers in this journal contribute to our understanding of how buildings and infrastructure impact on ecology, resources, climate change and sustainable development; appropriately several examples are cited as references.

Alongside these academic developments, there has also been a succession of government reports investigating the problems of the construction industry (for example, see Latham 1994; Egan 1998; National Audit Office 2001; Fairclough 2002; HM Government 2008; IGT 2010; Cabinet Office 2011). These reports have highlighted the inefficiency caused by the sheer scale and complexity of the construction industry. A recurring recommendation is the need for the construction process to be viewed in a holistic way by a multidisciplinary team. This reflects the fact that construction draws knowledge from many areas, and an important but undervalued area is economics. Indeed, it is commonly observed that far too many projects run over budget and are delivered late, with a general disrespect for the client. Clearly it should not be acceptable for construction projects to fail cost-wise, time-wise or client-wise. An authoritative study by Professor Flyvbjerg (2003: 16–26) of 258 major public transport infrastructure projects constructed across Europe, USA, Japan and developing countries between 1927 and 1998 suggests that on average costs overrun by approximately 30 per cent, deadlines are missed by as much as ten years and the expected level of demand fails to meet targets by around 40 per cent. Worryingly the cost, time and quality dimensions continue to be problematic right up to the current day.

Each of the construction economics texts that have been published to date conveys a slightly different emphasis. For example, Hillebrandt (1974, 2000) defines construction economics as the application of economics to the study of the construction firm, the construction process and the construction industry. Whereas the preference of Ive and Gruneberg (2000: xxiii) is for a slightly less orthodox approach, adapting traditional economic models to capture local circumstances

even if that means losing the ability to generalise about the economy at large. As a result, there is no coherent conceptual consensus about what constitutes the precise nature of construction economics. As George Ofori (1994: 304) bluntly concluded in his seminal review of the subject: 'Construction economics cannot be regarded as a bona-fide academic discipline. It lacks a clear indication of its main concerns and content.' A situation that de Valence (2011: 1) suggests still exists today.

The purpose of this text is to address this lack of consensus and make the case for a coherent economic vocabulary. The crux of the argument for this new approach is the increasing importance of strategies aimed at achieving **sustainable construction**. In other words, there is an increasing recognition that the industry makes an important contribution to a country's economic, social and environmental wellbeing.

INTRODUCING SUSTAINABLE CONSTRUCTION

The UK government published its first strategy for sustainable construction, *Building a Better Quality of Life*, in April 2000. This document aimed to provide a catalyst for change in the approach to construction processes. Subsequently it has been revised and extended, and the *Strategy for Sustainable Construction* published in June 2008 states the current UK position. Similar agendas have emerged in Europe, North America and some developing countries (see Chapter 15 for further discussion). Sustainable construction can be described in simple terms as comprising:

- efficient use of resources
- effective protection of the environment
- economic growth
- social progress that meets the needs of everyone.

Each of these strands is underpinned by economic concepts, which provide the rationale for this book.

Part A Effective use of resources

This deals with microeconomics, and outlines the various ways of efficiently allocating resources between competing ends. In this section the prime focus is concerned with the determinants of demand and supply for infrastructure, housing, industrial buildings, commercial property, and repair and maintenance.

Part B Protection and enhancement of the environment

This section considers failures of the market system, drawing upon various environmental economic concepts and tools to encourage future members of the construction industry to evaluate projects by more than just financial criteria.

Part C Economic growth that meets the needs of everyone

This section incorporates coverage of the broader macroeconomic scene. It outlines the various government objectives that need to be achieved alongside sustainable construction. It highlights the difficulty of managing an economy and the need for professionals working in the construction industry to acquire an economic vocabulary.