1 Introduction

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1.1 Overview

Currency values, prices, consumption and incomes are intimately linked and are at the heart of the economic performance of all countries. For example, a fundamental issue in geopolitics is the size of the Chinese economy and how fast it is growing: Is it really now larger than that of Japan? Is it likely to grow to become bigger than the US economy within the planning horizon?[1] Are the Chinese official statistics credible? If China is doing so well, why does the average Chinese consume so little, and why does there appear to be so much poverty? What is the appropriate exchange rate to use to convert RMB into dollars? If the RMB is undervalued, as claimed by the US administration, using the current rate would skew the result towards a larger gap between the two economies. These and related questions are at the forefront of contemporary discussions around the world that involve basic concepts of economics and measurement. As the issues are controversial, complex and far from settled, their understanding requires a serious research effort. This book takes a fresh approach to the area using a mixture of international macroeconomics, microeconomic theory and econometrics.

To make them comparable across countries, gross national product (GNP) and income data obviously need to be expressed in a common unit. In view of the notorious volatility of market exchange rates and their pronounced cyclical swings, these rates are particularly unsuitable for such comparisons. A popular approach is to use the purchasing power parity (PPP) exchange rates published by the International

[1] *The Economist* magazine has an interactive web page devoted to the relative size of the Chinese economy. At default growth rates, China is estimated to overtake the United States in 2019. See www.economist.com/blogs/dailychart/2010/12/save_date.

Comparison Program (ICP) of the World Bank; these are rates that equalise the cost of market baskets across countries. Although PPP rates are fast dominating this area, they are not without problems, including the vast resources needed to collect the underlying detailed information on prices and the long publication delays (of the order of five years). This book contains an in-depth investigation of two alternative approaches. The first is the Big Mac Index (BMI), popularised by *The Economist* magazine, which uses hamburger prices as the standard of measurement. At first glance, the hamburger standard might seem too narrow and an unpromising basis for serious income comparisons. However, this book establishes that the BMI contains substantial information regarding economic fundamentals, making it a viable alternative for cross-country income comparisons. In addition, as this index is shown to possess substantial predictive power, it can also be used to gauge the likely future course of currency values, a feature of considerable value to financial markets. And, of course, while not all McDonald's outlets are open for business 24/7, Big Mac prices are readily available on a high-frequency basis.

A second approach to the measurement of incomes internationally is a revealed-preference one. According to Engel's law, the proportion of consumption devoted to food (the food share) declines with income. Much research has established the validity of this law, and there is now a deep understanding of the nature of the dependence of the food share on income. Food shares of a reasonable quality are published regularly by most countries (even the poorest), and as these are pure numbers that are independent of currency values and price levels, they are readily comparable across countries. Accordingly, after adjusting for price differences, these shares can be combined with the income sensitivity of consumption to infer incomes across countries, an approach that can be described as reverse engineering of Engel's law. This book demonstrates that this is a viable approach for making reliable international income comparisons.

Commodity exporting countries, such as Australia, Canada, South Africa, Norway, New Zealand, and a number of developing economies, represent an important group for which world markets for commodities – minerals, energy and agricultural products – play a significant role in determining economic conditions. Here commodity markets can be responsible for prosperity, slumps and, always, volatility. The wide swings experienced by these countries can provide laboratory evidence for the rest of the world on the behaviour of economies under extreme conditions. This book analyses the two-way links between commodity prices and currency values in the form of the theory of so-called commodity currencies and currency commodities. Also included is an analysis of the determinants and patterns of certain specific commodity prices over time, countries and markets.

In many countries, consumption accounts for approximately three-quarters of GDP. An understanding of consumption patterns is of fundamental importance to appreciating the nature of the economy and the underlying affluence of consumers. In comparing consumption across countries, a major issue is the comparison of like with like. In what sense can consumers in, say, New York be compared in a meaningful way with those in New Delhi? Certainly, incomes and the prices in these cities differ, but allowances can be made for these observable differences. Do systematic differences remain after controlling for these factors? In other words, are tastes different in different countries? A related topic is the international variability of the quality of goods consumed. This book addresses these issues and provides measures of dispersion of prices, incomes and quality internationally.

In summary, this book covers considerable but interrelated territory in providing insights into the measurement and understanding of currency values, prices, consumption and incomes across countries. The book has three parts, and in what follows, each is briefly described.

1.2 Exchange rates and prices

There is an almost insatiable appetite for research to enhance understanding of exchanges rates, their links to economic fundamentals, their impact on competitiveness, their substantial volatility and how business and government can best manage foreign exchange risk. Part I contains two chapters. The first (Chapter 2) contains a comprehensive account of the theory of PPP, the formal link between currency values and prices, and how it can be applied to the BMI, which is published annually by *The Economist* magazine. The index has now been in existence for almost a quarter of a century, and *The Economist* describes it as the most popular single item in the whole magazine. This chapter contains a unified account of PPP theory, introduces a new generalisation of the theory that is dubbed 'stochastic PPP' and then uses the BMI in extensive empirical testing of the theory.

This chapter demonstrates the considerable information on the likely future course of currency values contained in the BMI. In particular, it is established that once the BMI is modified appropriately, those currencies identified as being undervalued subsequently appreciate, and vice versa, a finding of significant value to importers, exporters and investors. The BMI thus reflects economic fundamentals and can be used as a reliable conversion factor in cross-country comparisons of incomes, earnings, prices and so on. In short, while not perfect, at a cost of less than $ 10 per year, the BMI seems to provide good value for money. This chapter also contains in one place all available historical values of the BMI and its components (i.e., exchange rates and prices), which will be valuable to researchers.

The second chapter in Part I (Chapter 3) addresses the interactions between commodity prices and currency values. This is particularly relevant for commodity exporting countries, for which world commodity prices are an important driving force for exchange rates and the overall state of the economy. For these countries, commodity prices lead to an important modification to PPP theory. An additional factor that needs to be accounted for is the fact that because some of these countries are such substantial producers, they possess pricing power in world markets.

This chapter starts with the well-known theory of commodity currencies, according to which the value of the currency of a commodity exporting country moves in sympathy with world commodity prices. Thus a commodity boom appreciates the currency, which squeezes the country's noncommodity exporters and firms in the import competing sector. The appreciation also lowers the prices of imports at home, which enhances the real income of consumers and is an indirect way of distributing the benefits of the boom. The flip side of the theory of commodity currencies is called 'currency commodities' and refers to commodities whose world prices are substantially affected by variations in currency values. This involves the controversial case in which some commodity exporting countries possess hidden market power so that they are to some degree price-makers in commodity markets. This pricing power means that producers can pass on to customers cost increases or what amounts to the same thing, lost revenue due to an appreciating currency. This is a departure from the usual 'small country' assumption, whereby world prices are taken as given. The simultaneous existence of commodity currencies and currency commodities can account for at least part of the turbulence in commodity markets that seems to go hand in hand with volatility in the foreign exchange market. The theory of currency commodities and how they interact with commodity currencies is new and rich and offers considerable insight into the workings of the markets for foreign exchange and commodities. These matters are discussed at length in this chapter, which also contains an empirical application of the theory.

1.3 Commodity prices

Part II of this book deals with the pricing of commodities. It starts with the controversial case of marijuana (Chapter 4). The Australian Crime Commission made available unique information on marijuana prices, obtained from undercover drug busts. These prices have declined substantially, a decline that is much greater than that for most agricultural products. Why has this occurred, and what are the implications? One possible reason is that productivity in this industry has surged because of the hydroponic revolution, whereby the majority of Australian marijuana is now grown indoors under ideal conditions. Hydroponic growing techniques have enhanced productivity and reduced costs, with some of the benefits passed on to consumers in the form of lower prices. Another possible reason for the price decline is that laws have become softer and penalties have been reduced. In this chapter, marijuana prices are systematically compared with other commodity prices to emphasise just how rapidly they have fallen. This chapter also shows that patterns in prices can be used to divide Australia into three broad regions: (1) Sydney, where prices are highest; (2) Melbourne and Canberra, which have somewhat lower prices; and (3) everywhere else, where marijuana is cheapest. An exploratory analysis indicates the extent to which the price decreases have stimulated marijuana consumption and reduced growth in the consumption of a substitute product, alcohol.

Next, in Chapter 5, world prices for and quantities of major metals over the last half-century are analysed. These are summarised in the form of index numbers of changes in prices and quantities, their volatility and their covariation. This chapter also uses matrix comparisons as a way to conveniently compare the price of each metal with all others. In addition, some new results on the sensitivity of metal prices to changes in supply are presented.

1.4 International patterns for incomes, prices and consumption

Measurement of the comparative affluence of countries – and understanding the reasons lying behind the differences – is one of the most basic issues in economics. Part III of this book is devoted to analytic explorations of differences in incomes, prices and consumption across countries, with an emphasis on measurement.

The most recently published ICP data for more than one-hundred countries are used to investigate the dispersion of incomes, prices and consumption. There are substantial differences across countries in these data. For example, in the richest countries, on average, food accounts for less than 5 per cent of consumers' budgets, whereas this rises to more than 50 per cent for the poorest; and per capita incomes in the richest countries are of the order of 200 times larger than those in the poorest. While such large differences can be useful in identifying empirical regularities that otherwise would be hidden, coming to grips with diversity of this magnitude is itself a challenge requiring special approaches.

Chapter 6 shows that the dispersion of the distribution of prices in poor countries is substantially higher than that in rich countries and that the relative price of food has a systematic tendency to decline as countries become richer. As relative prices are closely related to incomes, a model is developed that shows that the price of luxuries increases with income growth, and vice versa for necessities. This model provides a link between price dispersion and incomes that leads to several interesting concepts, including minimum variance income and dispersion-equivalent income, the income needed to compensate for higher dispersion. This chapter also contains an analysis of the welfare cost of higher dispersion in poorer countries.

Chapter 7 proposes an alternative measure of incomes across countries, the inverse of the food budget share (the proportion of total consumption devoted to food). Using this share for cross-country comparisons has several attractions. As mentioned previously, the food share is a pure number that is independent of currency units, which makes it readily comparable across time and countries. In addition, fairly reliable information on the food share is available in most countries within a reasonable time frame. By contrast, there tends to be long delays in the publication of the ICP data. Finally, the relation between this share and income is one of the most studied in economics and is enshrined in Engel's law (the food share falls as income rises or, equivalently, the income elasticity of food is less than unity). In this chapter, it is established that after making a simple adjustment for price differences, the food share can be used to compare incomes across widely different countries. All that is required in addition to the food share and prices is numerical values for two parameters: the food income elasticity and the income elasticity of the marginal utility of income. This new approach permits the economic performance of countries to be monitored in a more timely manner than was previously possible. However, this approach to income measurement, like all others, is necessarily imperfect. As a partial way to recognise this, the uncertainty of the results is highlighted by presenting the probability distribution of the income of one country relative to another.

1.5 Notes on the literature

There is no single source that deals with the broad sweep of topics included in this book, which is not surprising given the tendency to compartmentalise and specialise in economics and finance. However, previous research has dealt separately with parts of the subject matter of this book, and important prior work is mentioned below.

Exchange rates and prices

There is a large body of literature on this topic that ranges from the most abstract academic level to material for practitioners. A selection of well-regarded scholarly books on exchange rate economics includes those by De Grauwe (2005), Dornbusch (1991), Isard (1995), MacDonald (2007), Manzur (2008), Ong (2003) and Sarno and Taylor (2002). Another related book is by Prasada Rao (2009), which mostly deals with the PPPs produced by the ICP. The book assesses the methodologies used, usually on the basis of index number theory, suggests alternative approaches and analyses estimates from the IPC and elsewhere.

Commodity prices

The pricing of commodities is a rapidly changing area of research with contributions from financial institutions, governments and international agencies concerned with economic development and academics.

A selection of reasonably recent books at the academic end of the spectrum includes those by Grynberg and Newton (2007), Manzur (2003), Sarris and Hallam (2006), Tyers and Anderson (1992) and Winters and Sapsford (1990). There is a tendency for these works to give more weight to agricultural prices instead of metals. Older books by Malenbaum (1978) and Tilton (1990) deal with world metal markets but focus mostly on quantities rather than prices. Tcha (2003) addresses the gold market. Greenaway and Morgan (1999) provide a collection of important articles on commodity prices and related areas.

International patterns for prices, consumption and incomes

This is an emerging area, and interest in the topic now seems to be accelerating with the publication of the latest instalment of data on 146 countries by the ICP (2008). Books dealing with cross-country consumption economics are those by Chen (1999), Lluch et al. (1977), Selvanathan (1993), Selvanathan and Selvanathan (2003), Theil (1996), Theil et al. (1989), Theil and Clements (1987) and Theil and Suhm (1981). Additional influential articles on this topic include those by Cranfield et al. (2002), Goldberger and Gamalestos (1970), Houthakker (1957), Lluch and Powell (1975), Neary (2004), Pollak and Wales (1987), Rimmer and Powell (1996) and Seale and Regmi (2006).

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