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The construction sector and economic development: the 'Bon curve'

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The complexities of the relationship between a country's level of construction activity and its stage of economic development are considerable. Studies over the last three decades, based on macroeconomic analysis, have attempted to model the relationship but have usually been hampered by problems of data quality and availability. Nevertheless, paradigms have emerged (usually based on Keynesian philosophy), which are concerned with the dynamics of construction activity as an agent in the promotion of economic growth in economies at different stages of development. One such is the 'Bon curve'. An examination of the data issues of attempting to assess the validity of the proposition is made and then the role of the construction sector in highly developed economies is considered.

Keywords: 'Bon curve', construction activity, economic development

Introduction

The relationship between a country's state of development and the level of activity in the construction sector is one, which has been the subject of study at the macroeconomic level for a number of years (Turin, 1973; World Bank, 1984; Wells, 1987; Bon, 1990). A major obstacle to such studies has been the lack of appropriate information on the sector, particularly in developing countries. Existing paradigms on the structural change in the construction industry, as a national economy develops over time, tend to be based on cross-sectional data across countries rather than longitudinal studies based on one country's time-series statistics. However, longitudinal studies pertaining to developing countries of Africa have been developed in Lopes and Ruddock (1997) and Lopes *et al.* (2002).

Bon (1992) analysed the changing role of the construction sector at various stages of economic development and presented a development pattern for the industry based on the stage of development of a country's economy. This notion is well-explained in basic terms by Tan (2002): 'In low income countries, construction output is low. As industrialization proceeds, factories, offices, infrastructure and houses are required, and construction as a percentage of gross domestic product reaches a peak in middle income countries. It then tapers off as the infrastructure becomes more developed and housing shortages are less severe or are eliminated'. An important aspect of the proposition was that, in the early stages of development, the share of construction increases but ultimately declines, in relative terms, in industrially advanced countries - and even at some stage, the decline is not only relative but also in absolute terms i.e. 'volume follows share' (2002, p. 593).

This argument about construction's share runs counter to the argument first advanced by Turin (1973). In Bon's 1992 paper, the link between economic development and construction is discussed and Bon points out the problem with Turin's analysis, which is largely focused on developing countries. As the share of construction in total output first goes up and then comes down with economic development, this is called the inverted U-shaped relationship, following Maddison, who, in his studies of economic development, tracked several key advanced industrial advanced countries (AICs). Bon's 1992 argument concerns the

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entire path from LDC (least developed countries) to NIC (newly industrialized countries) to AIC status. It is worth noting, as Bon (1992) put it, that: *This proposition deals with long-term, secular development patterns, rather than short to medium-term associations*.

Definitions of developed and developing countries

The classification of countries according to their development status does not have a definitive basis. There is no established convention for the designation of 'developed' and 'developing' countries in the United Nations system. In common practice, Japan in Asia, Canada and the United States in northern America, and Australia and New Zealand in Oceania are considered 'developed' regions or areas. In international trade statistics, the Southern African Customs Union is also treated as a developed region and Israel as a developed country. The states emerged from the former Yugoslavia are treated as developing countries and the countries of eastern Europe and the former USSR countries in Europe are not included under either developed or developing regions (United Nations, 2004a).

As far as LDCs are concerned, as agreed by the United Nations Economic and Social Council, the General Assembly, on the recommendation of the Committee for Development Policy, decides on the countries included in the list of the least developed countries (United Nations, 2004b).

Data

The indicator of construction industry activity used for this analysis is gross value added (GVA) in construction. GVA in construction is calculated the same way as in any other sector, but includes only the activities of the construction activity proper. For example, it excludes the building materials industry which is accounted in the manufacturing sector. The main indicator of general economic activity used in this study is GDP per capita. It adjusts the growth in the economy with the growth in population. It is a better indicator of a country's welfare particularly in developing nations, where the growth rate of population has been since the Second World War roughly twice as high as in developed economies.

Using data adapted from the *UN Statistical Yearbook 47th Issue* (United Nations, 2003), Table 1 provides data on Gross Domestic Product (GDP) and on Gross Value-Added by the construction industry in current prices. Cross-matching sources, data is available for 75 countries and these countries can be split into four categories according to the level of GDP per capita in 2000. Figures 1a to 1d illustrate the four categories.

The delineated categories are used as a proxy for the level of economic development for these countries. This categorization is not an attempt to apply labels of least-developed through to most developed to the four groups but represents an arbitrary proxy for a simple classification into four groups based simply on GDP per capita. The categorization is as follows:

- Category 1: GDP per capita (US$) <1000;
- Category 2: >1000 but <2500;
- Category 3: $>2\,500$ but $<10\,000$;
- Category 4: $>10\,000$ (Note: GDP per capita is based on Purchasing Power Parity).

Analysis

Table 1 presents GDP per capita in 2000 for the 75 countries grouped according to their stages of economic development, and GVA in the construction industry for the same year. It is shown that the share of GVA in construction varies widely across the countries. Looking at countries grouped according to their economic development status, that variation is less pronounced in Category 4 but still noticeable in Categories 2 and 3, and particularly in Category 1. In the former (allowing for the special case of Puerto Rico), the share of construction in GDP varies from 4.8% in Israel to 7.9% in Portugal; in Category 3, from 3.9% in Costa Rica and Malaysia to an impressive 10.5% in Trinidad and Tobago. In Category 2, the percentage of construction in GDP varies from 3.6% in Bulgaria to 10.4% in Surinam, and for Category 1, GVA in construction varies from 2.4% in Myanmar to 10.1% in Azerbaijan.

Taking into account temporal fluctuations, this behaviour both at groups and world levels tends to corroborate the observations made by Turin (1973), that the share of construction value added is generally between 3% and 8% of GDP, an important pattern of the construction industry activity that has remained from the 1960s onwards.

The mean values for the percentage of GDP in construction for each category are shown in Table 2. When these mean figures are depicted graphically, the pattern (see Figure 2) is one, which reflects the results of earlier calculations based on 1994 data (see Ruddock, 2000). The level of construction activity increases as the level of GDP rises but then falls for the final category, consisting mainly of industrially developed countries.

Table 1 Percentage of gross value added in construction in countries categorized by GDP per capita

Category 1 Countries with GDP per capita ($US) <1000	GDP per capita ($US) (2000)	GVA in construction
Tajikistan	143	3.4
Kyrgystan	265	4.4
Republic of Moldova	299	3.4
Bangladesh	362	7.7
Vietnam	401	5.5
Pakistan	458	3.1
Nicaragua	478	6.2
Uzbekistan	543	7
Georgia	573	4.2
Ukraine	639	4.2
Azerbaijan	655	10.1
Indonesia	723	5.6
Myanmar	726	2.4
Sri Lanka	854	6.9
Honduras	919	5.7
Philippines	988	5
Bolivia	995	2.8
Category 2 Countries with GDP per capita ($US) >1000 but <2500	**GDP per capita ($US) (2000)**	**% GVA in construction**
Belarus	1 022	6
Ecuador	1 088	3.6
Morocco	1 101	5.1
Bulgaria	1 508	3.6
Surinam	1 584	10.1
Romania	1 635	5.3
Algeria	1 663	7.5
Russian Federation	1 726	8.3
Colombia	1 930	3.8
Thailand	1 945	3.5
Peru	2 085	6
El Salvador	2 103	4.5

This represents only a snapshot view across countries but this cross-sectional study, now that it has been replicated, albeit over a six-year period, can also provide some interesting data permitting consideration of the longitudinal picture.

Change over time

If those countries, which showed growth in GDP per capita over the period 1994 to 2000, are considered using United Nations data (United Nations, 1997, 2003), there are 39 countries for which data is available on both GVA in construction and GDP per capita. This list of countries is shown in Table 3.

Table 1 (cont'd)

Category 3 Countries with GDP per capita ($US) >2500 but <10 000	GDP per capita ($US) (2000)	% GVA in construction
Jamaica	2 801	10.4
Latvia	2 952	6.2
Lithuania	3 039	6.3
Belize	3 345	7.1
Brazil	3 484	8.8
Panama	3 508	4.8
Estonia	3 569	5.8
Slovakia	3 570	5.8
Mauritius	3 886	5.4
Costa Rica	3 964	3.9
Malaysia	4 035	3.9
Poland	4 082	8.3
Croatia	4 089	5.6
Hungary	4 649	4.6
Chile	4 669	8.5
Czech Republic	4 942	7.1
Venezuela	5 017	4.8
Mexico	5 805	4.9
Uruguay	6 009	5.6
Trinidad and Tobago	6 239	10.5
Argentina	7 678	5
Slovenia	9 118	5.8
Barbados	9 721	5.8
Korea, Republic of	9 782	8.2
Category 4 Countries with GDP per capita ($US) >10 000	**GDP per capita ($US) (2000)**	**% GVA in construction**
Portugal	10 603	7.9
Greece	10 680	6.9
Cyprus	11 231	7.7
Spain	14 054	7.4
Puerto Rico	17 069	2.9
Italy	18 653	4.9
Israel	19 521	4.8
Australia	20 298	5.5
Belgium	22 323	5
Germany	22 753	5.1
Canada	22 778	5.3
Singapore	22 959	5.8
Netherlands	23 294	5.7
Austria	23 357	7.8
Finland	23 377	5.7
China, Hong Kong SAR	23 709	4.9
United Kingdom	24 058	5
Ireland	25 066	6
Denmark	30 141	4.9
United States	34 637	4.8
Japan	37 494	7
Luxembourg	43 372	6.3

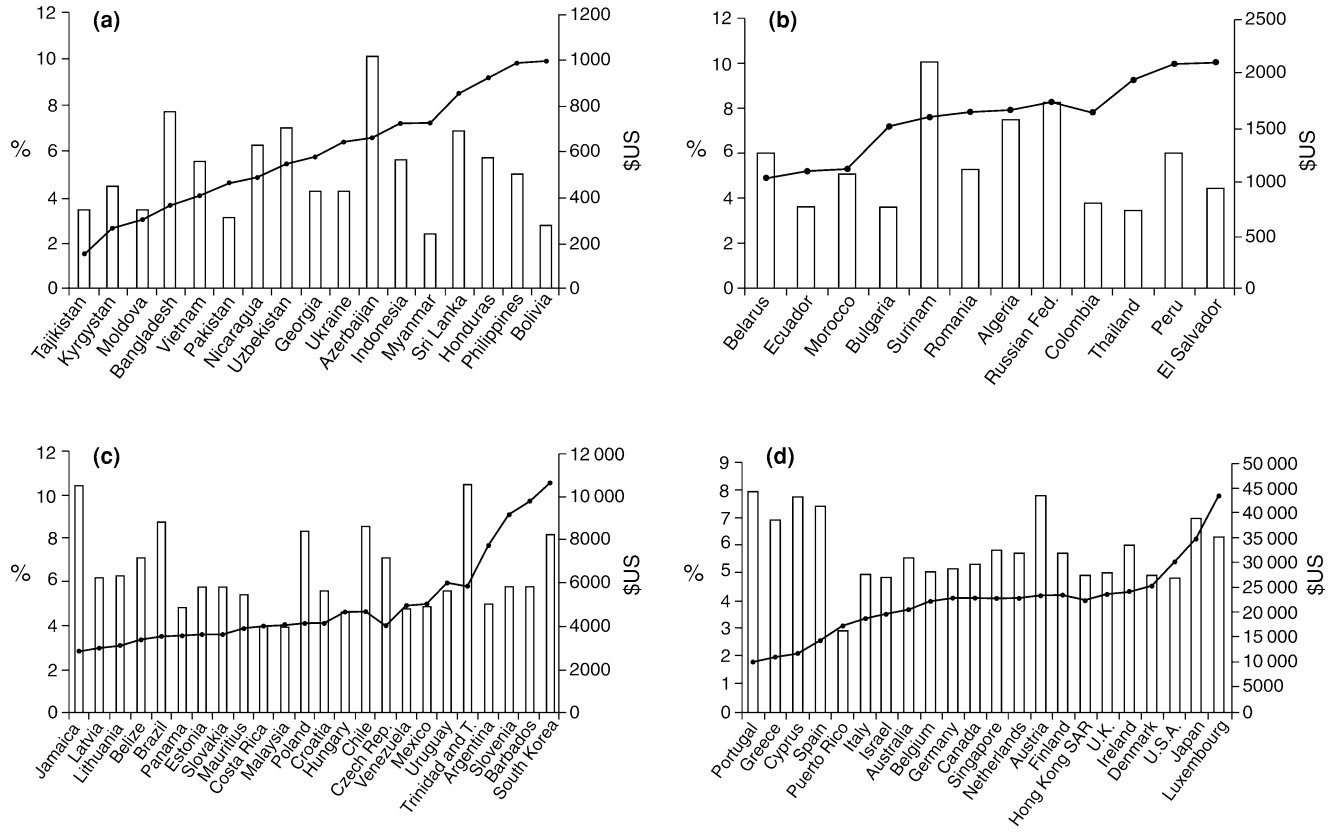

Figure 1 **(a)** Category 1 countries: GDP per capita and GVA in construction (2000) **(b)** Category 2 countries: GDP per capita and GVA in construction (2000). **(c)** Category 3 countries: GDP per capita and GVA in construction (2000). **(d)** Category 4 countries: GDP per capita and GVA in construction (2000)

Table 2 Mean percentage of GDP in construction (2000)

Category	1	2	3	4
Percentage of GDP	5.15	5.68	6.38	5.79

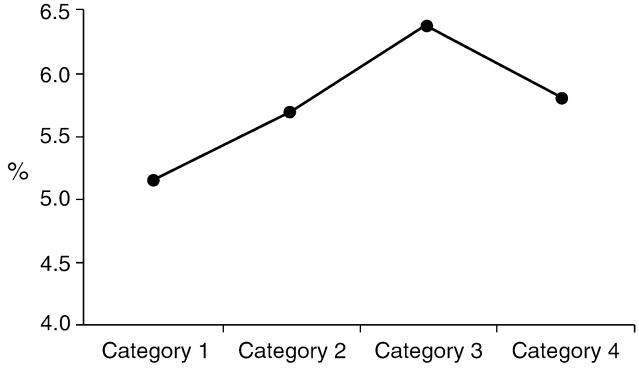

Figure 2 Percentage of GDP in construction

In order to compare the changing situation of these countries since 1994, the relative change in GVA in construction can be measured and for these calculations, the countries can be categorized according to their level of GDP per capita in 1994. Table 4 shows that the middle categories of countries undertook the greatest relative growth in construction activity (i.e. percentage relative increase in GVA in construction) over the period. The limited amount of data and the aggregation of the countries mean that there are only limited conclusions to be drawn from the analysis. Nevertheless, the pattern (see Figure 3) is one of higher relative increases in construction activity, for countries in the mid-range of GDP per capita.

According to a recent study undertaken by a CIB (International Council for Research and Innovation in Building and Construction) project group, after allowing for cyclical fluctuations, the general trend in construction activity in very developed countries is for construction activity to be in a *relative* decline (Carassus, 2004). This longitudinal study of nine

Table 3 GDP per capita and GVA in construction for countries showing growth in GDP per capita (1994–2000)

	GDP per capita ($US) (1994)	% GVA in construction (1994)	GDP per capita ($US) (2000)	% GVA in construction (2000)
Bangladesh	250	5.9	362	7.7
Indonesia	909	6.9	723	5.6
Sri Lanka	660	7	854	6.9
Honduras	622	5	919	5.7
Philippines	965	5.8	988	5
Bolivia	841	4.7	995	2.8
Bulgaria	1136	5.1	1508	3.6
Surinam	924	3.3	1584	10.1
Romania	1317	6.1	1635	5.3
El Salvador	1463	4.7	2103	4.5
Jamaica	1583	12.9	2801	10.4
Latvia	1140	7.9	2952	6.2
Lithuania	1970	8.8	3039	6.3
Belize	2459	7.2	3345	7.1
Panama	2870	4.4	3508	4.8
Estonia	1538	5.7	3569	5.8
Mauritius	3134	6.6	3886	5.4
Costa Rica	2485	2.3	3964	3.9
Czech Rep.	3507	6.8	4942	7.1
Venezuela	2719	4	5017	4.8
Mexico	4145	5.4	5805	4.9
Trinidad and T.	3791	9.2	6239	10.5
Barbados	6643	3.6	9721	5.8
Korea, Rep. of	8858	13.7	9782	8.2
Greece	7467	5.3	10680	6.9
Cyprus	9924	9	11231	7.7
Spain	12188	8	14054	7.4
Puerto Rico	11559	2.2	17069	2.9
Italy	17800	5.2	18653	4.9
Israel	14629	4.6	19521	4.8
Australia	18847	6.3	20298	5.5
Singapore	21681	7.4	22959	5.8
Netherlands	21896	5.2	23294	5.7
Finland	19201	4.7	22377	5.7
Hong Kong SAR	21642	4.9	23709	4.9
UK	17510	4.8	24058	5
Ireland	14694	4.6	25066	6
Denmark	28038	4.7	30141	4.9
USA	25127	3.8	34637	4.8

countries over an 11-year period concluded that 'at the beginning of the twenty-first century, the construction industry share is around 4 to 5 % of GDP' (2004, p. 194). The study also reveals that a noticeable feature of the activity of the industry in these countries has been the change in the *new build: repair and maintenance* mix over the last few decades. Repair and maintenance now accounts for almost a half of the industry's activity, as stock management has become a relatively much more important aspect, particularly in post-industrial economies.

Does the volume follow the share?

The analysis depicted above clearly demonstrates that the inverse 'U'-shaped pattern holds for the share of construction in the national economy. That is the share of construction in total output first goes up and then comes down with economic development. Compared to Bon's grouping of countries, according to their status of development, Categories 1 and 2 taken together represent the LDCs, Category 3 the NICs and Category 4 represents the AICs.

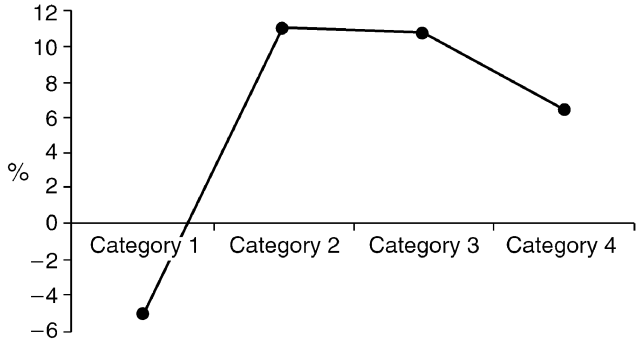

Figure 3 Relative change in GVA in construction

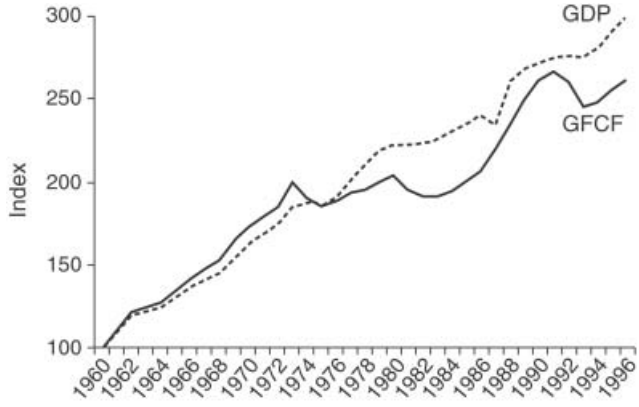

Figure 4 Volume indices of gross domestic product and gross fixed capital formation in the European Union 15 (1960=100) (Source: OECD, 1988)

What about Bon's proposition that at some stage the decline of the construction industry activity switches from relative to absolute decline, i.e. 'volume follows share'? Looking at Table 4, it can be seen that the share of GVA in construction in the advanced industrial countries increased by 6.5% in the period 1994–2000, which suggests that construction volume did not decrease in these countries over the period. Again, the aggregation of data and the fact that the relative weight of each country was not taken into consideration mean that limited conclusions can be drawn, but the pattern is still revealing when looking at the individual behaviour of each country in Table 3. This is consistent with Carassus' (2004) findings that the construction volume, measured in constant prices, in seven out of eight advanced industrial countries did not decline in the period 1990–2001. OECD (1998) sheds new light on the argument. Figure 4 depicts data on gross fixed capital formation (GFCF) and GDP for the long period 1960–1996 for the European Union 15 in 1990 constant prices. It can be seen that both GDP and GFCF increased in the period 1960–1996, though remained generally stagnant in the period 1974–1982. Figure 4 also shows that the growth in GDP is higher than that of GFCF, thus the relative decline in capital formation is also evident for the entire period.

As gross fixed capital formation in construction is roughly half of GFCF, it can reasonably be assumed that the absolute decline is not a definitive pattern of the construction industry in the industrially advanced countries, of course allowing for cross-sectional and temporal variations. We do believe that Bon's (1990) analysis – which concerned the period 1970–1985 – was certainly influenced by the recessive period 1973–1982, which was characterized by two oil shocks, and that followed the period 1960–1973 – the 'golden age' of the world economy.

Conclusion

A prerequisite to making valid international comparisons of national construction sectors must always be the availability of valid, reliable and transparent data. Recent discourses on the quality of available data have indicated the limitations of existing data sources (Ofori, 2000; Ruddock, 2002). The utilization of a standard definition of construction activity (based on United Nations (1998) recommendations and the International Standard of Industrial Classification) by national statistical bodies is progressing but the inadequacy of data from many developing countries is still an issue.

At the other end of the development spectrum, a new role for the construction sector in post-industrial economies has certainly emerged. Being a dynamic process, modelling of the construction sector and economic development relationship has to deal with such changes. What is true, though, is that the 'Bon curve' still provides a paradigm from which the new models can be developed.

Table 4 Relative growth rate in GVA in Construction (1994 to 2000): Mean value for all the countries in each category

GDP per capita in 1994 ($US)	<1000	1000 to 2499	2500 to 9999	10 000 or over
Relative change in GVA in construction (%)	−5.0	11.1	10.7	6.5

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