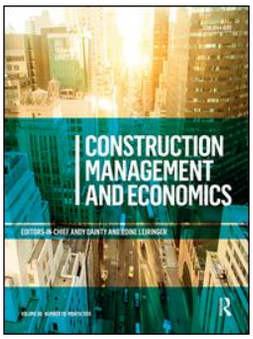

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The global construction market: a cross-sectional analysis

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Construction is a major industry throughout the world accounting for a sizeable proportion of most countries gross domestic product (GDP). According to a recent survey, total world construction spending in 1998 was over $3 trillion. Furthermore the importance of the construction sector is related not only to its size but also to its role in economic development. This paper examines the extent of international construction activity, and is based on a cross-sectional analysis of published data pertaining to global construction spending. The principal findings suggest that the role of construction changes as economic development proceeds. It was found that the share of construction spending in GDP first grows during less developed country (LDC) status, peaks during newly industrializing country (NIC) status and then declines as countries move from NIC to advanced industrialized country (AIC) status. The research identifies the importance of construction within NICs. The regions of Asia and Latin America and the countries of China, Mexico, Argentina and Egypt are considered noteworthy in regard to various indicators concerned with construction and economic activity. However, the conclusion is that as economic development proceeds from NIC to AIC status construction fails to maintain its share of GDP and therefore declines in importance.

Keywords: global construction activity, cross-sectional analysis, economic development, regional markets, national markets.

Introduction

Construction is a major industry throughout the world accounting for a sizeable proportion of most countries gross domestic product (GDP). According to a recent survey in *Engineering News Record* (ENR, 1998) total world construction spending in 1998 was over $3 trillion. Despite the size of the world construction market there has been only a limited number of studies concerned with world markets in construction, perhaps the best known of these are the works of Bon (1990) and Low (1991a, b). Furthermore the importance of the construction sector is related not only to its size but also to its role in economic development. It produces the facilities that house a wide variety of human activities, as well as the infrastructure that connects these facilities into an increasingly complex network. Most importantly, the construction sector produces all the facilities needed for the production of goods and services, starting from those needed by other producers and ending with those needed by the ultimate consumers.

Both Bon (1990) and Low (1991a, b) attempted to estimate the value and share of global construction output. Their primary data source was the UN's *National Account Statistics Yearbook* (which ceased publication in 1988/89), which provided data on the sectoral share of GDP for approximately 150 countries. From this source the value-added by construction was calculated. This was the best data set available in terms of coverage and accuracy on construction activity worldwide. However, several problems existed

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with the UN data: for instance there were problems with coverage, several countries were missing and often the data were not complete for all years. More recently a new data set has become available and it is now possible to examine and analyse international construction activity through a survey provided by *ENR* (1998), which attempts to examine the size and growth of the world market in construction. The survey provides data on estimated construction spending for 150 countries during 1996–1998; additionally the survey estimates total construction spending as a proportion of each country's GDP. *ENR* sourced the construction data from the UN, IMF, OECD, national statistical agencies, central banks and industry associations. The GDP figures were taken from the OECD and the IMF.

Methodology

The aim of this study is to investigate the extent of international construction activity. The research provides a cross-sectional analysis of the international construction market using the *ENR* data set concerned with international construction activity. Analysis is performed on the data to establish any relationships that may exist. Additionally, values for construction's share and growth are calculated to observe the role of the construction sector in various regional and national economies.

The *ENR* survey

The *ENR* (1998) survey differs from the earlier works by Bon (1990), Low (1991a, b), and others, which were concerned with construction value-added (net construction output) and focuses on total construction spending. The definition of construction activity in most national income accounts is expressed as the value added by construction and generally includes only labour costs, and overheads and profit. This definition is rather narrow, as others have pointed out (Drewer, 1980; Wells, 1985), and value-added by construction is only a small part of the total construction process; a large percentage of total construction output consists of intermediate inputs from other sectors of the economy, mainly the building materials and service industries.

Wells (1985) remarked that, in spite of the fact that construction appears twice in the national accounts of most countries, nowhere in the national accounts of any country is there a comprehensive picture of the total output of construction. The *ENR* (1998) data set provides us with our first look at total construction spending worldwide. However, there are certain limitations with the *ENR* survey: it is limited to 150 countries; the definition of construction activity is construction spending rather than value-added, and therefore is not typical of national account conventions; some countries are omitted due to the non-availability of data; current prices are used; and spending is measured in US dollars. Despite these limitations, the *ENR* data set is useful for cross-sectional analysis and relative distributions among countries and regions, both objectives of this research. In short it is the best estimate of world wide construction activity currently available.

Construction, economic growth and economic development

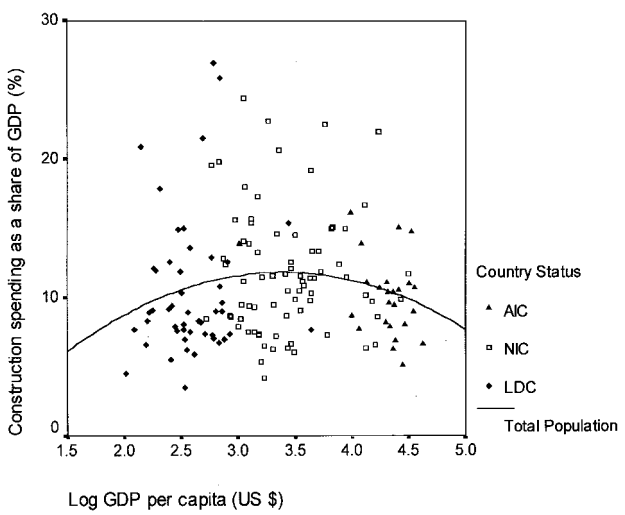
Turin (1969), Strassmann (1970), Drewer (1980), Edmonds and Miles (1984) and Wells (1985) have established the relationship between construction activity and economic development. Most previous studies found a positive correlation between GDP per capita and various measures of construction output, and indeed many studies found a linear relationship existed between construction as a share of GDP (measured as value added in construction) and GDP per capita. This analysis, while concerned with construction spending as a share of GDP rather than value added by the construction sector, exhibits no such linear relationship between construction spending as a share of GDP and GDP per capita. However, there appears to be a reasonably strong nonlinear relationship between these two variables.

Figure 1 shows the relationship between average construction spending as a share of GDP and GDP per capita. The *ENR* data set provides construction spending data for 150 countries, and in addition these countries have been categorized by their income to arrive at their development status: less developed country (LDC), newly industrializing country (NIC) or advanced industrialized country (AIC). Using a method for classifying economies similar to that employed by The World Bank (1999a), LDCs are categorized as low-income economies with per capita GDP of $785 or less. NICs are categorized as middle-income economies with per capita GDP of between $786 and $9655. AICs are categorized as high-income economies with per capita GDP of $9656 or more. Generally LDCs and NICs are classified as developing countries while AICs are regarded as developed countries. Thus the total sample was broken down into 48 LDCs, 77 NICs and 25 AICs. The contribution to GDP of total construction spending for these 150 countries has been averaged over the three-year period 1996–1998, in an attempt to reduce the effect

of annual variations. This variable was then plotted against GDP per capita 1997 (figures derived from The World Bank, 1999b), the mid-period, following a similar analysis by Turin (1978) and Wells (1985). The results of the analysis can be seen in Figure 1. There is no evidence of a linear relationship between the two variables, with the correlation coefficient close to zero. Indeed the coefficient of determination (R^2) is extremely low, suggesting that the linear assumption of the R^2 is inappropriate. However, following quadratic regression a least-squares regression curve was fitted to the data which exhibits an inverted U-shaped relationship or parabola.

The analysis indicates that construction's share of GDP is at its greatest during the NIC stage of economic development, rather than construction's share of GDP first growing at an increasing rate and then at a decreasing rate with the level of economic development (see Turin, 1978; Wells, 1985). This analysis suggests that the share of construction in GDP first grows during LDC status, peaks during NIC status and then declines as countries move from NIC to AIC status. According to this analysis average construction spending as a share of GDP is at its highest at approximately the $3000 GDP per capita level.

This analysis suggests that construction spending is in a range 4–58% of these countries' GDP. Table 1 displays construction spending as a share of GDP for countries at differing levels of income. It can be seen that NICs display consistent growth over the period and have the highest share of GDP devoted to construction spending, closely followed by LDCs. AICs have the lowest share of GDP devoted to construction spending.



Summary of the quadratic regression of construction spending as a share of GDP (Y) and GDP per capita (X):

$$Y = 10.9 \log X - 1.6 \log X^2 - 6.6$$

t-ratios (1.99) (-2.00) (-0.73)
R square = 0.027
N = 149
SEE = 4.48

Figure 1 Relationship between construction spending as a share of GDP and GDP per capita

Table 1 Construction spending as a share of GDP, by country status 1996–1998[a]

Country status	1996 (%)	1997 (%)	1998 (%)	1996–1998 (%)
LDC	11.7	12	11.9	11.9
NIC	13.2	13.4	13.7	13.4
AIC	10.8	10.1	10.5	10.5

[a] Source: adapted from *ENR* (1998).

Figure 2 shows the relationship between construction spending growth and GDP growth. Construction spending growth and GDP growth rates were calculated from *ENR* (1998) data and averaged over the three year period to arrive at the average annual growth rate for each variable. The average annual rate of construction spending growth was then plotted against the average annual rate of GDP growth. As can be seen the relationship is linear, and the correlation between construction spending growth and GDP growth is positive. Linear regression analysis indicates that GDP growth explains 43% of the variation in construction spending growth. The analysis indicates that generally both LDCs and NICs exhibit the highest rates of both GDP growth and construction spending growth.

Table 2 shows average annual construction spending growth at differing levels of income. It can be seen that LDCs exhibit the fastest growth in construction spending, closely followed by NICs. AICs display negative annual rates of construction spending growth. Table 2, in addition, shows average annual GDP growth. Again LDCs exhibit the fastest growth in GDP, closely followed by NICs. AICs display negative annual rates of GDP growth. What is interesting about Table 2 is that at LDC and NIC status construction spending grows faster than the economy as a whole. However, as economic growth slows from LDC to AIC status so does construction spending growth. Indeed by AIC status construction spending exhibits relative decline.

A further relationship exists and can be seen in Figure 3, which displays the relationship between construction spending per capita and GDP per capita. Construction spending per capita was calculated from construction spending data (*ENR*, 1998) and 1997 population figures derived from The World Bank (1999b). Construction spending per capita was then plotted against GDP per capita. As can be seen the relationship is linear, the correlation between construction

Table 2 Average annual construction spending and GDP growth, by country status 1996–1998[a]

Country status	Cons. growth (%)	GDP growth (%)
LDC	6.2	5.2
NIC	5.8	3.8
AIC	–2.1	–0.4

[a] Source: adapted from *ENR* (1998).

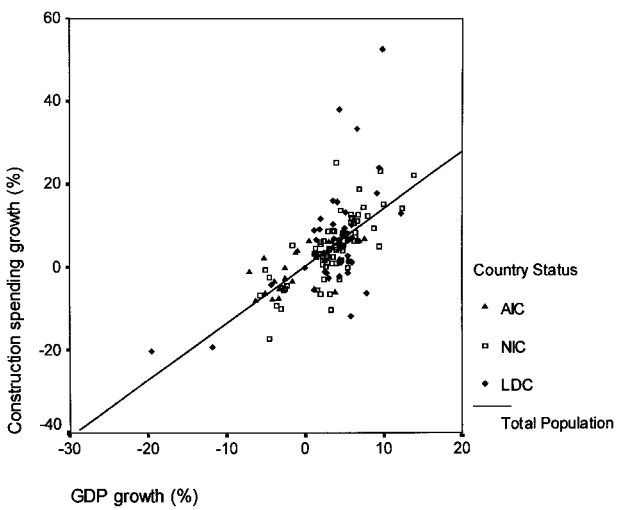
spending per capita and GDP per capita is positive, and the correlation coefficient is close to one. Clearly there is a very strong association between GDP per capita and construction spending per capita. Linear regression analysis indicates that GDP per capita explains 91% of the variation in construction spending per capita. The steep incline of the regression line in Figure 3 indicates that a small change in GDP per capita results in a large change in construction spending per capita. In other words construction spending per capita grows more rapidly than GDP per capita.

According to this analysis construction spending as a share of GDP peaks during NIC status, in addition LDCs were found to exhibit the fastest rates of construction spending growth. Despite construction spending per capita increasing as economic development proceeds, the analysis suggests that as countries pass from NIC to AIC status construction spending fails to maintain its share of GDP, and therefore declines in importance. This suggests that beyond a certain stage of development the construction sector does not keep pace with GDP growth, and therefore makes a smaller contribution to economic growth.

It appears from this analysis that the role of construction changes as economic development proceeds from LDC to AIC status. It is potentially interesting to see how the identified relationships apply to both regional and national construction markets.

The global construction market

Examination of Table 3 shows that total world construction spending was $3.24 trillion in 1996, $3.01 trillion in 1997 and $3.22 trillion in 1998. Furthermore, total worldwide spending on construction accounts for approximately 11% of world GDP according to *ENR* data. The table shows that most regions display a growth trend; however, there was a decline in construction spending in both the Asian and European regions during 1996–1998, although it should be noted that by 1998 there were signs of recovery in both markets. Figure 4 shows construction spending by regional grouping and highlights the decline in Asia and Europe, while other regions (namely Africa, Latin America, North America and the Middle East) can be seen to have increased their construction spending during the survey period. Table 4 indicates that the

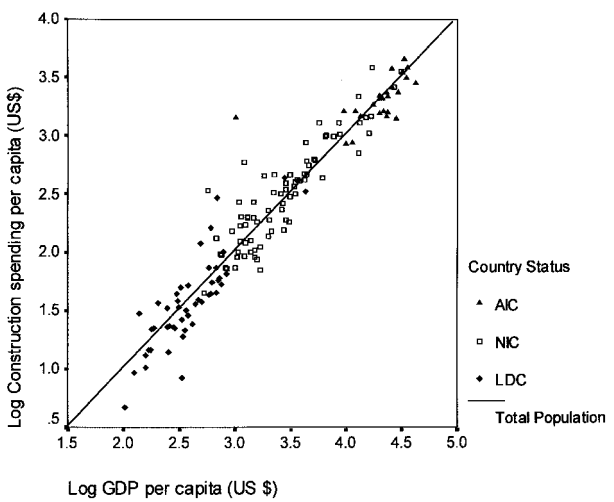


Summary of the linear regression of construction spending growth (Y) and GDP growth (X):

$$Y = 1.38X + 0.36$$

t-ratios (10.40) (0.50)
R square = 0.43
N = 146
SEE = 7.24

Figure 2 Relationship between construction spending growth and GDP growth



Summary of the linear regression of construction spending per capita (Y) and GDP per capita (X):

$$\log Y = 1.0 \log X - 0.98$$

t-ratios (38.68) (-11.24)
R square = 0.91
N = 150
SEE = 0.216

Figure 3 Relationship between construction spending per capita and GDP per capita

regions with declining construction spending are also the regions with declining GDP over the study period.

Additionally, Figure 5 shows the share of total construction spending per region. The importance of the Asian, European and North American regions is visible. Asia is the largest market and accounted for 35% of total world construction spending in 1998 according to *ENR* data, followed by Europe, which accounted for 31%, and North America, which accounted for a further 22%. The Middle Eastern, Latin American and African markets are significantly smaller in comparison.

Table 5 ranks the top twenty countries in relation to construction spending in 1998. The top of the table is dominated by developed countries, with the exception of China and Brazil. The United States tops the table, closely followed by Japan. Table 6 ranks the top twenty countries in relation to construction spending per capita and, as one would expect following the earlier analysis (Figure 3), the table is dominated by developed countries. Japan is the first-ranked country; however, the positions of the United Arab Emirates, Singapore and Hong Kong are noteworthy. Nevertheless, as already discussed, the limitations of the *ENR* survey make this sort of comparison spurious, it is perhaps more meaningful to compare construction spending growth and the importance as a share that construction spending occupies for various countries and regions economies.

Table 3 Construction spending by region 1996–1998 (US$ million)[a]

Region	1996	1997	1998
Asia	1 173 242	1 062 779	1 125 942
Africa	51 116	55 992	59 433
Europe	1 080 235	962 190	994 324
Latin America	200 357	228 022	244 440
North America	663 243	693 339	723 570
Middle East	69 328	74 760	76 775
Total	3 237 521	3 077 082	3 224 484

[a] Source: *ENR* (1998).

Table 4 GDP by region 1996–1998 (US$ million)[a]

Region	1996	1997	1998
Asia	7 945 437	7 656 874	7 635 164
Africa	459 733	477 601	499 439
Europe	9 884 503	9 335 106	9 537 091
Latin America	1 744 662	1 886 654	1 947 746
North America	7 978 720	8 427 277	8 642 793
Middle East	626 868	655 115	673 432
Total	28 639 923	28 438 627	28 935 665

[a] Source: *ENR* (1998).

Regional construction markets

Construction spending as a share of GDP for various regions throughout the world is shown in Table 7. As previously mentioned, total world construction

Table 5 Top 20 countries ranked by construction spending 1998 (US$ million)[a]

Rank	Country	1998
1	United States	651 607
2	Japan	626 525
3	Germany	314 992
4	China	185 912
5	United Kingdom	104 880
6	Brazil	102 095
7	France	97 979
8	Italy	95 271
9	Korea, Republic of	73 631
10	Canada	71 963
11	Russian Federation	65 193
12	Spain	59 417
13	India	52 729
14	Mexico	51 300
15	Argentina	41 645
16	Netherlands	40 348
17	Australia	39 133
18	Taiwan	29 884
19	Switzerland	26 833
20	Sweden	24 091

[a] Source: *ENR* (1998).

Table 6 Top 20 countries ranked by construction spending per capita 1998 (US $)[a]

Rank	Country	1998
1	Japan	4975
2	United Arab Emirates	4340
3	Germany	3838
4	Switzerland	3696
5	Denmark	3618
6	Singapore	3209
7	Norway	3079
8	Sweden	2711
9	Hong Kong	2600
10	Netherlands	2565
11	United States	2411
12	Ireland	2357
13	Canada	2346
14	Belgium	2337
15	Australia	2103
16	New Zealand	2014
17	United Kingdom	1779
18	Italy	1678
19	France	1666
20	Korea, Republic of	1586

[a] Source: *ENR* (1998).

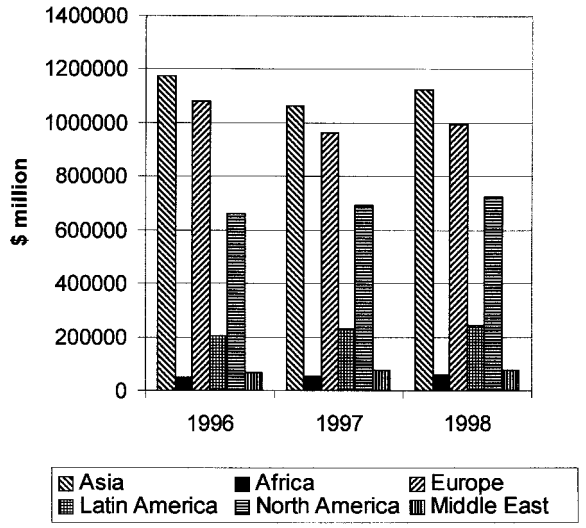


Figure 4 Construction spending (US$ million) per region 1996–1998 (source: *ENR* 1998)

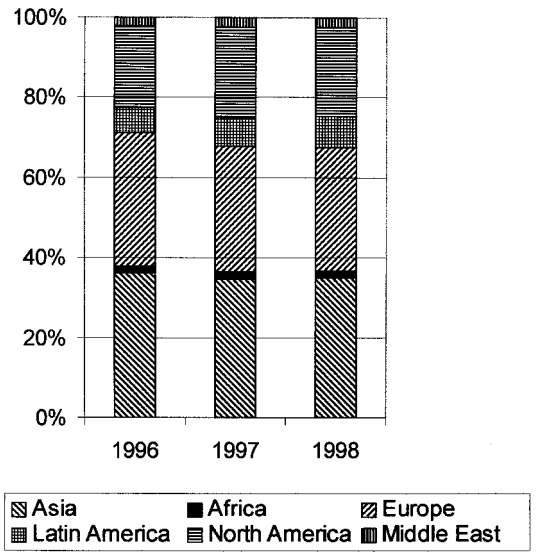


Figure 5 Regional share (%) of global construction spending 1996–1998 (source: *ENR* 1998)

spending accounted for approximately 11% of world GDP in 1998. Table 7 provides details of the importance of construction spending to various regions economies. Asian construction spending averaged 14.5% of the regions GDP during 1996–1998. This was the largest regional share, followed by Latin America, Africa, the Middle East, Europe and finally North America. This indicates the importance of construction spending to developing regions economies.

During the study period only Latin America and Africa display consistent growth in construction spending as a share of GDP. Asian construction spending as a share of the regions GDP fell quite dramatically in

Table 7 Regional construction spending as a share of GDP 1996–1998[a]

Region	1996 (%)	1997 (%)	1998 (%)	1996–1998 (%)
Asia	14.8	13.9	14.8	14.5
Africa	11.1	11.7	11.9	11.6
Europe	10.9	10.3	10.4	10.5
Latin America	11.5	12.1	12.6	12.1
North America	8.3	8.2	8.4	8.3
Middle East	11.1	11.4	11.4	11.3
Total	11.3	10.8	11.2	11.1

[a] Source: adapted from *ENR* (1998).

Table 8 Average annual construction spending and GDP growth, by region 1996–1998[a]

Region	Cons. growth (%)	GDP growth (%)
Asia	–2	–2
Africa	8.2	4.3
Europe	–4	–1.8
Latin America	11	5.8
North America	4.6	4.2
Middle East	5.4	3.7

[a] Source: adapted from *ENR* (1998).

1997, this was quite probably a result of the Asian financial crisis in 1997. However, by 1998 Asian construction spending had returned to the 1996 level of 14.8% of the regions GDP. Similarly, European construction spending as a share of the regions GDP fell in 1997; however, only a slight recovery was evident in this region in 1998. Construction spending as a share of GDP in North America and the Middle East displays relative stability over the survey period. It is worth noting that North America has the lowest share of GDP devoted to construction spending, indicating the relatively low level of importance construction spending occupies within the economies of the North American region as a whole.

Table 8 shows average construction spending growth per region during 1996–1998. Latin America is the region with the fastest growth in construction spending, followed by Africa. Other regions with positive average annual rates of growth include the Middle East and North America. It is worth noting that Europe and Asia both display negative average annual rates of construction spending growth during 1996–1998. In addition, Table 8 shows the average annual GDP growth. Latin America is the region with the fastest growing GDP followed by Africa. In fact Latin America and Africa have construction spending growth significantly higher than their economic growth as a whole. Other regions with positive GDP growth include North America and the Middle East. It is worth noting that

Asia and Europe both display negative average annual rates of GDP growth during 1996–1998. However, it is undoubtedly the case that Asian GDP growth and Asian construction spending growth have been adversely affected by the recent financial crisis in the region.

The regions with the fastest average annual rates of GDP growth are also the regions with the fastest average annual rates of construction spending growth. Conversely, the regions with negative average annual rates of GDP growth are also the regions with negative average annual rates of construction spending growth. Latin America is the region worthy of note: it combines the fastest construction spending growth and the fastest GDP growth with a reasonably large construction market by volume and share of GDP. Latin America is a developing region, made up of predominately NICs, investing heavily in constructed facilities. Furthermore the importance of construction spending within the Asian region is clear. Asia is the largest construction market by volume, and in addition Asia has the highest share of GDP devoted to construction spending, indicating the relative importance of construction spending to Asian economies as a whole.

National construction markets

Table 5 showed countries ranked according to their construction spending; however, the limitations of this sort of comparison have already been discussed. A caveat is in order here: the Gambia has been omitted from this analysis due to perceived inaccuracies in the data. Table 9 ranks the top twenty countries with the highest share of GDP devoted to construction spending during the period 1996–1998, and is concerned with average annual construction spending as a share of GDP. Equatorial Guinea is the first ranked country and outstrips other countries by a wide margin. As one would expect, Table 9 is dominated by developing countries, indicating the importance of construction spending to developing countries economies. However, the position of the Republic of Korea is interesting, being a developed country that devotes a relatively large share of GDP to construction spending. Similarly, mention should be made of Germany and Japan: although not apparent in the table, construction spending annually averaged 15.1% of German GDP and 14.8% of Japanese GDP, during the survey period, indicating the importance of construction spending to the German and Japanese economies.

Table 10 ranks the top twenty countries with the fastest average annual rates of construction spending growth during the period 1996–1998. Again the data are dominated by developing countries. Costa Rica tops the table, closely followed by Nicaragua and Chad. What is perhaps most interesting is the combination of construction spending growth and market size. The country that stands out is China. Although ranked fifteenth with regards to construction spending

Table 9 Top 20 countries ranked by average annual construction spending as a share of GDP 1996–1998[a]

Rank	Country	1996–1998 (%)
1	Equatorial Guinea	57.6
2	Lesotho	27
3	Turkmenistan	25.9
4	Cape Verde	24.4
5	Dominican Republic	22.8
6	Oman	22.5
7	United Arab Emirates	22
8	Azerbaijan	21.5
9	Eritrea	20.9
10	Russian Federation	20.7
11	China	19.8
12	Jamaica	19.6
13	Trinidad and Tobago	19.2
14	Suriname	18
15	Nepal	17.9
16	Algeria	17.3
17	Qatar	16.7
18	Korea, Republic of	16.2
19	Morocco	15.9
20	Yugoslavia	15.7

[a] Source: adapted from *ENR* (1998).

Table 10 Top 20 countries ranked by average annual construction spending growth 1996–1998[a]

Rank	Country	1996–1998 (%)
1	Costa Rica	61.9
2	Nicaragua	56.7
3	Chad	52.5
4	Angola	37.9
5	Azerbaijan	33.5
6	Namibia	25.2
7	Mozambique	23.9
8	Egypt	23.2
9	Mexico	22.1
10	Argentina	18.8
11	Tanzania	17.7
12	Tajikistan	16.1
13	Nigeria	15.7
14	Georgia	15.2
15	China	14.4
16	Qatar	14.3
17	Bolivia	13.8
18	Uganda	13.1
19	Rwanda	13
20	Latvia	12.8

[a] Source: adapted from *ENR* (1998).

Table 11 Top 20 countries ranked by average annual GDP growth 1996–1998[a]

Rank	Country	1996–1998 (%)
1	Nicaragua	42.4
2	Mexico	13.8
3	Qatar	12.4
4	Rwanda	12.2
5	Georgia	10
6	Chad	9.8
7	Egypt	9.6
8	Dominican Republic	9.5
9	Mozambique	9.4
10	Tanzania	9.2
11	Estonia	8.8
12	Guatemala	8
13	Lesotho	7.9
14	Ireland	7.6
15	China	7.5
16	Argentina	6.9
16	United Kingdom	6.9
17	Latvia	6.7
18	Lithuania	6.6
18	Slovak Republic	6.6
18	Azerbaijan	6.6
19	Croatia	6.4
20	Chile	6.3

[a] Source: adapted from *ENR* (1998).

growth, when this is combined with China's position as the fourth largest construction market by volume the importance of the construction sector in China is clear. Other countries that include relatively fast construction spending growth and relatively high construction volume include Mexico, Argentina and Egypt. Frequently this combination of large market size and fast market growth is cited as a primary motivator for transnational companies locating in foreign markets. It is not unreasonable to suggest that the NICs of China, Mexico, Argentina, and Egypt could be some of the most attractive markets for construction companies wishing to operate overseas.

Next, country comparisons are made between construction spending growth and GDP growth. Table 11 ranks the top twenty countries with the fastest average annual rate of GDP growth during the period 1996–1998. Again the data are dominated by developing countries. Nicaragua is the first ranked country and outstrips other countries by a wide margin. China, Mexico, Argentina and Egypt are again well positioned. Further analysis indicates that many of the countries in Table 10, concerned with the fastest average annual rates of construction spending growth, are also in Table 11 concerned with the fastest average annual rates of GDP growth. Many of the countries listed have construction spending growth higher than their economic growth. On the whole the countries with the fastest average annual rates of GDP growth are also the countries with the fastest average annual rates of construction spending growth.

Conclusion

Clearly there is a relationship between construction activity, economic growth and economic development. In summary, this analysis suggests that the role of construction changes as economic development proceeds from LDC to AIC status. It was found that the share of construction spending in GDP first grows during LDC status, peaks during NIC status and then declines as countries move from NIC to AIC status. In addition it was found that LDCs experience the fastest growth in construction spending. From the evidence presented in this paper it may be concluded that as economic development proceeds from NIC to AIC status construction fails to maintain its share of GDP, and therefore declines in importance.

The research identified the importance of construction within NICs at both the regional and national level. Asia was identified as being the largest regional construction market in the world and, in addition, the Asian region has the largest share of GDP devoted to construction spending. Furthermore the Latin American region was identified as exhibiting relatively fast economic and construction spending growth combined with a reasonably large construction market by volume and share of GDP. Similarly at the national level China, Mexico, Argentina and Egypt were identified as countries noteworthy in regard to various indicators concerned with construction and economic activity.

It is reasonable to assume that the cross-sectional relationships identified here, between countries at different income levels at a fixed point in time, are valid also within any one country over a period of time, assuming that each country goes through the three stages of economic development. However, it should be remembered that any of the suggestions made here are at best estimates of the relationship between construction activity, economic growth and economic development, due to the lack of directly comparable data on global construction activity over time. Once the *ENR* survey has been running for a number of years future research can focus on time-series analysis to test further the relationships identified here.

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