THE CONSTRUCTION SECTOR IN BARBADOS: THE MEASUREMENT OF ITS' CONTRIBUTION TO THE GROSS DOMESTIC PRODUCT OF BARBADOS

by

Denny Lewis
Senior Economist
Research Department
Central Bank of Barbados
P.O. Box 1016
Bridgetown
Barbados

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Introduction

The construction industry contributes to the development of the economy as a productive activity creating value added and employment and as a catalyst for continued growth of other sectors in the economy. Construction investment depends on demand for the construction product, generated by an economic upturn or expected economic upturn. The growth in the sector overtime therefore reflects the economic health of the country and the future growth potential as given by the stock of physical infrastructures, which serves as a catalyst for the growth of the other sectors. Ascertaining the current contribution of the construction industry and its future prospects is therefore important.

Presently, the methodology employed in the estimation of the real value added of the construction sector has a number of seemingly unavoidable drawbacks, in the face of current data constraints. A better understanding of the magnitude of the methodological problem requires a closer examination of current practices in the estimation of real GDP. This paper reviews these practices and examines some alternatives that are more accessible given available data. This analysis follows a brief review of developments in the sector over the last twenty years.

Methodologies

The estimation of the real value added(GDP) by any sector has traditionally been undertaken using the double deflation method. The value added of any industry/sector is the value of goods and services produced by that industry less the value of the input used by this industry in the

production of goods and services[1]. In real terms, this method provides an estimate of the quantity of goods and services produced as the value (in dollar terms) of goods and services produced by the sector deflated using an index of output prices, less the value of inputs deflated using an index of input prices. This can be expressed as follows:

$RVA = (O/P_o)-(I/P_I)$.....equation (1)

where: RVA = Real Value Added, O = Output, P_o = Index of output prices, I = Inputs, and P_I = Index of input prices.

It is the equivalent to taking a weighted average of the input and output volume indices. Traditionally, an input-output table is constructed for each year that automatically provides estimates of the real output by the sector. The calculation of an input-output table however requires substantial time and information, but it is preferred, as it provides more accurate and reliable results. Unfortunately, the data requirements make it difficult to utilise in the Barbadian context.

An alternative and less demanding approach involves constructing an input-output table for a base year and extrapolating for subsequent years using particular volume indices. This technique is more accessible because it only requires the construction of an input-output table in the base year. Single indicators based on outputs, are used to extrapolate for subsequent years the movement in the value added with respect to the base year. This is the methodology currently employed in the estimation of the construction sector's real value added in Barbados.

Construction sector output indicators are cement consumption, quarrying and the real imports of construction materials. The change in value added by the construction sector is calculated as the change in the weighted average of cement consumption (weight=0.25), quarrying(weight=0.50), and real imports of construction materials (weight=0.25). Quarrying production is used as a proxy for quarrying consumption in the absence of consumption data. Quarrying output is broken out of the mining and quarrying index using a 54.7% weight for quarrying and 45.3% for mining. An estimate of real imports of construction is obtained by taking retained imports of construction material (a current value measure) and deflating it with the relevant price index from the retail price index(RPI).

The choice of quarrying production as a proxy for quarrying consumption is based on the assumption that the movements in these two variables mirror each other. Unfortunately, there are times when the output does not mirror consumption[2], due to stockpiling by quarries and this is reflected in the conflicting movements of quarrying production to the other indicators of construction activity. This creates a problem with the use of the methodology. It is not however a methodological problem but a data problem. An additional difficulty relates to the weighting system. It is assumed that the chosen weights reflect the factor intensities of construction

[1]In this way only the value added to the production of a good by a given sector is considered not the contribution of other sectors captured as inputs in the sector's production process.

[2]Quarrying sales data collected but not a statistically consistent basis unlike the production data.

activities and value added. The weights are arbitrarily chosen and in the absences of data we can only make assumptions regarding the relative composition of the construction process, that is, the percentage of cement and imported construction material used. The weighting issue is a very important one given the impact that different weights can have on our results. To illustrate, consider a situation in which a greater weight is assigned to imports of construction material. This is an intuitively appealing assumption from the point of view of the apparent importance of fixtures, fittings and other finishes to the construction process. This system of weights is labelled scenario (A) and the results are presented in table (1). A second possibility of equal weights is also considered called scenario (B)(see table (2)). Results differ as reflected in the growth rates. This shows clearly that the weighting process cannot be arbitrary if accuracy is important. Though the issue of choice of weights is difficult to resolve, it is evident from the above that a more scientific approach is needed(possible a survey of construction practices).

The choice of fixed weights in an environment of continued changing composition of construction activity poses another problem. The fixed weight assumption is based on the premise that all construction activities provide the same level of value added. This is obviously not so, for example, road construction uses more quarrying materials than building construction, but provides lower value added. On the other hand, building construction a higher value added activity uses more cement and imported materials and less quarrying products compared with road construction. Given these relationships then in a given period of significant road construction and a commensurate increase in quarrying production, the existing weighting system overestimates the overall value added of the sector. Conversely, in a period of significant building activity compared with road construction the value added would be underestimated using this weighting scheme. This suggests the need for a flexible weighting system.

These difficulties to the utilisation of this technique prompted the examination of a number of less demanding possibilities. One such possibility is the deflation of the current construction value added(dollar terms) provided by the BSS, using construction import prices as a proxy of the input and output price movements of the sector. This is similar to the double deflation methodology previously outlined except that in the absences of both an input and output price indices for the sector. In reality, these two sets of quantities are inherently different. It seems implausible however to assume that the average price change of one quantity(output) can realistically apply to that of another(inputs) that import prices can serve as a price index for total building activity. Despite this, most countries measure output by deflated values using a price index based on inputs, and import prices have proven to be a relatively stable proxy.

In the Barbadian context, a modification of this technique is used in the forecasting of the construction sector value added. In the absence of construction import prices data, the unit value index of import prices of developing countries is used. Current value added is forecasted as a ratio to forecasting total value building activity and then deflated. Total building activity is forecasted and a historical established five year moving average ratio of current construction to total building activity is applied to the forecasted total building activity to give a forecasted value added figure for construction. It is evident that the reliability of the method hinges on the accuracy of the forecast of total building activity.

This technique has not proven highly effective as a forecasting tool. Table (3) gives the associated margins of errors. According to table (3) this technique consistently over estimates construction GDP, based on production indicators, in many cases by as much as 50%, with a low of 43%.

As an estimator the technique would involve taking estimates of current construction provided by the BSS and deflating them. The problem with this approach is however one of timeliness. At present the Barbados Statistical Service estimates GDP(BSS) only annually and with a considerable lag. Policy makers do however require GDP information on a more timely basis, namely a quarterly basis. This is likely to be problematic for the BSS[3] because of its limited resources and its broad mandate regarding the provision of a wide range of other statistical data and its limited resources. This technique as evident in table (4) gives a higher value added than that involving the weighted production indicators. In addition, table (5) also reveals an interesting finding regarding methodology currently utilised. The calculation of the implicit deflators reveals significant changes in this variable overtime. The movements in the deflator are much greater and in some cases of contrary direction to import price movements. Given the large import content of construction activity it is surprising to see these significant differences over time between the implicit deflators and import prices. If we accept import prices as an adequate proxy then it would suggest that there is need for some adjustment of current or real GDP. Given the acknowledged difficulties with estimating the construction sector value added in real terms, it is likely that the real construction GDP needs adjusting.

[3]The Central Bank of Barbados has neither the resources or the mandate to conduct the comprehensive work required for estimating current GDP on a quarterly basis.

These difficulties are not however insurmountable. The problem of timeliness can be addressed in the following way. One could attempt to estimate directly, using available data on indicators of current construction, a quarterly current value construction sector GDP. This can be done using regression analysis. Simply, estimate an output function in current value terms by quantifying the influence of various current value indicators on construction activity. In this regard one may need to desegregate construction into its various types such as:

- Private sector housing
- Commercial building
- Infrastructural development

This would most likely provide a more accurate result to an aggregate approach because of the heterogenous nature of construction activity and therefore of its influences. For example, private housing and commercial building are likely to be more heavily dependent on income and prices than government infrastructural construction. In effect, therefore, an output function can be derived for each of these types of construction activities. Unfortunately, however enough data is not available on the different components to make this a useful exercise.

Another possibility for the estimation of current construction, is to broke down construction activity into private and public construction and specified an output function for both. This can be done by applying the ratio of public to private building activity to current construction. This ratio shows the proportion of private building investment/activity relative to public investment/building activity and should therefore serve as a good proxy of the ratio of private construction activity to public construction activity. Given quarterly current value construction

GDP, an estimate of real GDP for the sector can be obtained by deflated the current values using the import price index as a proxy.

These alternatives though attractive are not possible given available data. Available data permits one to utilise a more direct but aggregate approach to the measurement of real construction GDP, such as the one utilised in a study by Lewis(1997) in a paper entitled the "A quarterly GDP series for Barbados, 1974-1995: A sectoral approach." In this study sectoral employment was used as an indicator of quarterly sectoral output. Quarterly construction GDP(Q^c) was regressed on quarterly employment. Given:

Q^c = f(employment in the construction sector).....equation (2)

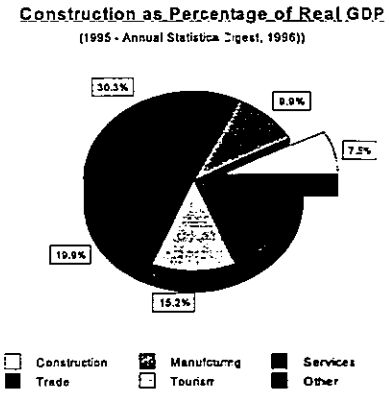
This equation was estimated over the period covering 1st quarter 1987 to 4th quarter 1995 and yielded the following results:

Q^c = 8.9006 + 0.640*(employment in the construction sector).....equation (3)

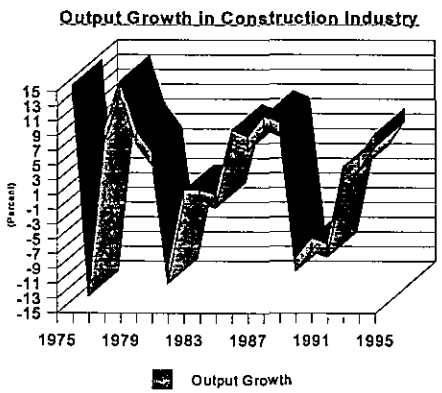
The results of this study provided strong support for the employment variable as a proxy for construction output changes. The results of this technique are shown in the table (6) and as evident the resulting deflator movements are more consistent with the import price movements.

Historical Developments in the Construction Sector

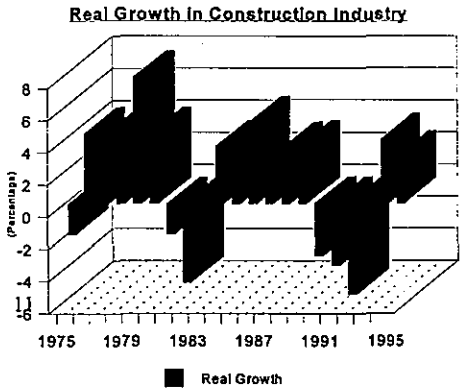
Over the last twenty years Barbados has experienced significant real economic growth(on average....). The construction sector has however maintained a relatively stable contribution to GDP of a modest 7%(see chart 1), ranging from as high as 7.6% to a low of 6.3%. The construction sector's performance may be positively correlated to the performance of the overall economy. Over the period studied, 1975-1995, there were two periods of expansion and two periods of recession, mirroring international developments. In times of prosperity more construction activity was undertaken and vice versa. In this way international developments have affected construction activity. This is reflected in the fluctuation of the real growth rate of the sector as seen in Chart (2). The period from 1975-1980 was one of little real growth averaging 4.0%. This is in comparison to the 1960's when construction activity grew by more than 10% due to significant increases in demand for hotel accommodations and other large commercial facilities. This slowed expansion was due to external demand conditions of Barbados' major trading, especially in tourism. In 1979, however, the construction industry recovered, recording nominal output growth of 13.8% and a real growth rate of 7.9%. There was significant spending by the government through a wide capital work's program during the previous years. The high level of government expenditure did however create bottle necks within the industry as it resulted in a shortage in both skilled and unskilled labour. In



subsequent years an international recession further exacerbated the problems of the industry. For the four years following 1979 construction activity declined, as the international recession adversely affected on the domestic economy and the demand for construction services.



The sector would again recover in 1986, led by the government's public roads program. This expansion was also attributed to the declining cost of construction and increased access to credit facilitating private construction activity. The combination of these factors allowed the industry a small recovery from the previous five-year recession. This recovery was however short-lived as in 1990 as a domestic recession spurred by an imbalance in the fiscal and monetary systems, and an international recession reduced demand for construction activity. During this period, 1991-1993, construction activity dropped significantly, as the country undertook a programme of structural adjustment during which there was a complete halt of government construction programmes. The contractionary monetary policy adopted by the government at the time resulted in a significant reduction in private sector activity.



Construction GDP

(BDS $Million)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
In 1974 Prices	44.1	49.9	43.1	46.3	52.7	56.4	58.7	51.7	51.2	50.7	49.9
Total GDP	628.0	655.4	679.3	712.4	768.7	802.3	786.8	748.0	751.8	778.5	786.9
Real Growth	-1.9	4.4	3.6	4.9	7.9	4.4	-1.9	-4.9	0.1	3.6	1.1
Construction as % GDP	7.0%	7.6%	6.3%	6.5%	6.9%	7.0%	7.5%	6.9%	6.8%	6.5%	6.3%
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	
In 1974 Prices	53.5	56.8	61.9	66.9	60.1	55.6	51.0	52.1	53.9	57.5	
Total GDP	827.0	848.1	877.5	908.8	879.1	844.6	796.1	802.7	834.6	858.7	
Real Growth	5.1	2.6	3.5	3.6	-3.3	-3.9	-5.7	0.8	4.0	2.9	
Construction as % GDP	6.5%	6.7%	7.1%	7.4%	6.8%	6.6%	6.4%	6.5%	6.5%	6.7%	

Source: Annual Statistical Digest, 1996

In subsequent years the sector recovered with real sectoral growth averaging 5%, led by large public and private initiatives. The large influx of tourists has allowed many hotels to refurbish their property and new roads and public buildings to be constructed. The growth in construction has also led to a boost in the cement consumption of more than 10% in the last year alone.

Construction's Effect on Employment

Employment in the construction sector has been relatively stable over the last twenty years, like construction GDP. The average employment has been at 7.7% of the total workforce, with little fluctuation, ranging from a low of 6.3% in 1981, to a high of 9.1% in 1986. This stability can possibly be attributed to two factors. First, one would expect that there would be a constant need for construction even in an economic downturn. The second possible factor is the changing structure of the industry toward more small scale operations. The industry is presently characterised by the prevalence of small establishments. From 1970 to 1995, the number of construction establishments increased from 32 to 143.

Classification by Size of Establishment	Size according to number of employees	1970	1995
	Under 10	n/a	87
Source:	10 - 19	5	22
Barbados	20 - 49	8	7
Statistical	50 - 99	7	7
Service	100 and Over	12	8
	Unknown	0	12
	Total	32	143

In the industry approximately 61% of the construction establishments currently operate with under 10 employees. This is in comparison with a 1970 figure of businesses operated with under 20 employees. It is likely that these many small, household businesses contribute to the stability of the industry by opening and closing as the economic climate changes. The small scale of operation and therefore overhead would undoubtedly allow for the flexibility to stay profitable during good times, while shutting down and cutting losses during bad. Improve technology and increased mechanisation might have contributed to the prevalence of small operators by allowing them to employ minimal labor to compete in the market. Ascertaining which of these factors are more important is difficult.

Construction Employment

(Thousands)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Construction			5.7	8.0	8.1	6.3	7.4	7.8	6.9	7.0
Total Employment			89.6	95.4	100.3	100.2	96.6	95.7	93.1	92.0
Construction as % of Total			6.4%	8.4%	8.1%	6.3%	7.7%	8.2%	7.4%	7.6%
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Construction	8.8	7.7	n/a	n/a	n/a	9.3	7.6	7.3	8.0	8.8
Total Employment	96.2	98.0	n/a	n/a	n/a	107.1	101.7	100.5	105.5	109.9
Construction as % of Total	9.1%	7.9%	n/a	n/a	n/a	8.7%	7.5%	7.3%	7.6%	8.0%

Source: Annual Statistical Digest, 1996

Table 1

Scenario (A): Weighted Average of Cement Consumption(weight=0.25), Quarrying production(weight=0.25) and Real Imports of Construction Materials(weight=0.50)			
Period	Published Real construction GDP	Scenario (A) real construction GDP	Differences
1992	51	54.7	-7.25%
1993	52.1	63	-20.92%
1994	53.9	70	-29.87%
1995	57.5	80.6	-40.17%
1996	59.05	79.8	-35.14%

Table 2

Scenario (B): Weighted Average of Cement Consumption(weight=0.333), Quarrying production(weight=0.333) and Real Imports of Construction Materials(weight=0.333)			
Period	Published Real construction GDP	Scenario (B) real construction GDP	Differences
1992	51	53.4	-4.71%
1993	52.1	56.6	-8.64%
1994	53.9	64.7	-20.04%
1995	57.5	72.2	-25.57%
1996	59	72.9	-23.56%

Table 3

A comparison of the results of the forecasting technique for construction sector value added with actual published construction data.

Period	Published Real construction GDP	Forecasted values for construction GDP	Differences
1993	52.1	55.8	-7.10%
1994	53.9	57.9	-7.42%
1995	57.5	63.7	-10.78%
1996	59	71.1	-20.51%

Table 4

A comparison of the results of deflating current construction value added estimates to obtain an estimate of real construction value added with actual published construction data.

Period	Current construction GDP	Deflator: Import Prices %	Real construction GDP	Published Real values for construction GDP	Errors: (percentages)
1980	104.5	18.2	56.4	56.4	0.00%
1981	138.3	1.01	73.9	58.7	-25.89%
1982	122.1	-3.6	67.68	51.7	-30.91%
1983	132.5	-4.2	76.66	51.2	-49.73%
1984	130	-1.5	7.36	50.7	85.48%
1985	117.9	-3.4	71.69	49.9	-43.67%
1986	131.4	4.2	76.68	53.5	-43.33%
1987	144.3	7.1	78.62	56.8	-38.42%
1988	170.3	6.4	87.21	61.9	-40.89%
1989	196.7	3.1	97.7	66.9	-46.04%
1990	193.9	4.5	92.16	60.1	-53.34%
1991	161.9	1	76.19	55.6	-37.03%
1992	112.6	-0.4	53.2	51	-4.31%
1993	120.9	-0.9	57.64	52.1	-10.63%
1994	133.8	1.9	62.6	53.9	-16.14%
1995	150.5	2.7	68.57	57.5	-19.25%

Table 5

A comparison of the implicit deflators and import prices movements			
Period	Deflator: Import Prices %	Implict deflators%	Differences
1980	18.2	10.95	7.25
1981	1.01	27.16	-26.15
1982	-3.6	0.24	-3.84
1983	-4.2	9.58	-13.78
1984	-1.5	-0.92	-0.58
1985	-3.4	-7.85	4.45
1986	4.2	3.95	0.25
1987	7.1	3.44	3.66
1988	6.4	8.29	-1.89
1989	3.1	6.87	-3.77
1990	4.5	9.73	-5.23
1991	1	-9.75	10.75
1992	-0.4	-24.1	23.7
1993	-0.9	5.1	-6
1994	1.9	6.97	-5.07
1995	2.7	5.42	-2.72

Table 6

A comparison of the results of the employment methodology with actual published construction data, including the implicit deflator movements with import price movements.								
Period	Real construction GDP published data	Real construction GDP using the employment method	Current construction GDP	Differences	Implicit Deflators of published data	Implicit Deflators of employment methodology	Deflator: Import Prices %	
1980	56.4	54.7	104.5	3.01%	10.95		18.2	
1981	58.7	50.2	138.3	14.48%	27.16	44.21	1.01	
1982	51.7	53.4	122.1	-3.29%	0.24	17	-3.6	
1983	51.2	53.7	132.5	-4.88%	9.58	7.91	-4.2	
1984	50.7	51.6	130	-1.78%	-0.92	2.11	-1.5	
1985	49.9	52.3	117.9	-4.81%	-7.85	-10.52	-3.4	
1986	53.5	56.3	131.4	-5.23%	3.95	3.53	4.2	
1987	56.8	53.8	144.3	5.28%	3.44	14.92	7.1	
1988	61.9	57.5	170.3	7.11%	8.29	10.42	6.4	
1989	66.9	60.1	196.7	10.16%	6.87	10.51	3.1	
1990	60.1	58.4	193.9	2.83%	9.73	1.45	4.5	
1991	55.6	57	161.9	-2.52%	-9.75	-14.45	1	
1992	51	53.2	112.6	-4.31%	-24.1	-25.48	-0.4	
1993	52.1	52.2	120.9	-0.19%	5.1	9.43	-0.9	
1994	53.9	55.3	133.8	-2.60%	6.97	4.47	1.9	
1995	57.5	57.7	150.5	-0.35%	5.42	7.8	2.7	