Tourism Economics, 2015, 21 (1), 159–182 doi: 10.5367/te.2014.0442

Tourism and poverty reduction: an economic sector analysis for Costa Rica and Nicaragua

Manuel Vanegas Sr, William Gartner and Benjamin Senauer

Department of Applied Economics, University of Minnesota, St Paul, MN 55108, USA.
E-mail: vaneg001@umn.edu; wcg@umn.edu; bsenauer@umn.edu.
(Corresponding author: William Gartner.)

This study examines the existence of a long-run relationship between indigence or extreme poverty reduction and agricultural, manufacturing and tourism development in Costa Rica and Nicaragua. An econometric methodology consisting of an autoregressive distributed lag bounds testing approach to co-integration is used. For Costa Rica, agricultural and manufacturing (not statistically significant) and tourism development are negatively related to indigence poverty with estimated elasticity values of –0.50 for agriculture, –0.17 for manufacturing and –0.58 for tourism. For Nicaragua, the estimated elasticity values are –0.40 for agriculture, –0.13 for manufacturing (not statistically significant) and –0.64 for tourism. Tourism's rate of poverty reduction was statistically significantly greater than that of agriculture for both countries. The main contribution of this paper lies in the understanding of sector contributions to alleviating poverty. The methods utilized can be undertaken by most countries in the world, thereby providing insights into developing targeted investment policies and strategies to achieve higher rates of poverty reduction.

Keywords: poverty; tourism and development; agriculture; Nicaragua; Costa Rica

A goal of central importance to the United Nations' Millennium agenda was to cut in half the proportion of people living below the extreme poverty line of US$1 a day from around 30% of the developing world's population in 1990 to 15% by 2015. The latest estimates of the United Nations Conference on

We thank the Center for Food and International Agriculture Policy (CIFAP), University of Minnesota for providing partial financial funding in support of implementing this study. We are grateful for valuable updated information provided by Ms Jackeline Zamora-Bolaños, Central Bank of Costa Rica; Ms Pilar Ramos-Vargas and Mr Eddy Madrigal-Méndez, *Instituto Nacional de Estadisticas y Censos* (INEC), Costa Rica; the staff of the *Instituto Costarricense de Turismo* (ICT); Mr Mario Salinas, President *Instituto Nicaragüense de Turismo* (INTUR) and the staff of the *Departamento de Estudios Económicos, Banco Central de Nicaragua*. We also thank Mrs Olga L. Vanegas, and Mr Sebastian Monroy for their valuable research assistance and the two reviewers for their helpful comments.

Table 1. Evolution of indigence poverty headcount ratio,[a] and annual average growth of per capita income and indigence poverty.[b]

Country	1980–1990	1990–2000	2000–2010	2011	2012
Average indigence poverty headcount ratio (%)					
Costa Rica[c]	10.06	7.27	4.92	6.31	6.19
Nicaragua	24.14	23.40	17.10	14.86	14.34
Growth rates of real GDP					
Costa Rica[c]	3.09	5.14	4.81	4.19	4.77
Nicaragua	–1.97	4.51	3.08	4.66	2.66
Growth rates of per capita income					
Costa Rica[c]	1.36	2.57	3.32	3.02	3.59
Nicaragua	–3.80	2.45	1.77	3.35	1.24
Growth rates of indigence poverty					
Costa Rica	–4.75	–5.58	–5.51	68.15[d]	–1.90[d]
[c]Nicaragua	4.35	–3.82	–3.05	–3.38	3.50

Notes: [a]The growth rate is calculated using the following exponential equation: $Y = \alpha\varepsilon\exp^{\beta TIME}$ where β multiplied by 100 provides the growth rate value. [b]As defined by the country's specific national indigence poverty line: the share of the country's population whose income or consumption is below the poverty line, that is, the percentage of population that cannot afford to buy a defined basic basket of goods. [c]For 1970–1980 the average population living below the national indigence poverty line was 16.30%, the annual growth rate of real GDP was 5.63%, the annual average growth rate of per capita income was 1.67%, and the average growth rate for indigence poverty was –3.51%. [d]Unadjusted values as reported by INEC Costa Rica. It has been explained to the authors' of this study that the relatively significant increase was due in part to methodological changes in the surveys and the strong social safety net that had been put into place by the government being eroded due to increased financial constraints on government expenditures. When the methodological changes are considered, the estimated adjusted values are 4.96% for 2011, and 2.93% for 2012.
Source: Authors' calculations.

Trade and Development (UNCTAD, 2008, 2010), and the World Bank (2012), suggest that nearly 1.42 billion people (nearly 20.3%) are below the US$1-a-day poverty line. The number of poor people has increased in India, South Asia and Sub-Saharan Africa. There was virtually no significant change in the number of poor people in Latin America and the Caribbean. Although the percentage of people in poverty is falling worldwide, absolute numbers in poverty have shown little change.

In this context, the nexus between economic growth and poverty has been a subject of considerable scrutiny over the past three decades. The literature, which we briefly review below, provides different answers to the question of which sectors work best to reduce poverty and to a lesser extent the causality between sector growth and poverty reduction.

Costa Rica's impressive reduction in poverty during the last three decades is well documented. The fast pace of poverty reduction between the mid-1970s and the late-2000s reflects both relatively higher economic growth and a relatively higher economic growth elasticity of poverty reduction. Costa Rica's relatively rapid economic growth in the last three decades has been mainly driven by the tourism sector, high technology manufacturing development and agricultural growth. The impact of the housing collapse in the USA and the global crisis of the late 2000s led to a sharp jump in indigence or extreme

poverty and the headcount index of indigence poverty estimated at 3.94% in 2010 jumped to nearly 6.31% in 2011 (Table 1). In 2012, it declined to 6.19% (INEC, 2008, 2009, 2012).

Nicaragua's slow pace of poverty reduction between the early 1980s and the late 2000s reflects both low growth and a low economic growth elasticity of poverty reduction. Although there has also been a reduction in indigence or extreme poverty in Nicaragua, progress has been much slower than in Costa Rica. Progress in indigence poverty reduction, however, has been more rapid since 2005. According to the latest estimates as shown in Table 1, 38.39% of the Nicaraguan population fell into the category of indigence or extreme poverty in 1985, but by 2012 only 14.34% were below the indigence poverty line (Central Bank of Nicaragua, 2011). The indigence poor population remains highly vulnerable to risks posed by lack of employment opportunities, low levels of schooling or skills, and unexpected events.

Nicaragua's rapid decline in poverty in recent years has been mainly driven by high agricultural export prices, tourism development, and expanded and better targeted social spending programmes (Central Bank of Nicaragua, 2011). Development in Nicaragua's tourism sector benefits the poor directly, because employment in tourism is rapidly generated and requires relatively lower qualifications for some job categories.

The objective of this study, at a disaggregated level, is to examine the existence of a long-run relationship among indigence or extreme poverty and agriculture, manufacturing and tourism development in Costa Rica and Nicaragua through the following related hypotheses: (a) If, in the long-run, sector composition development has promoted poverty reduction, to what extent has poverty reduction in Costa Rica and Nicaragua responded to changes in sector development? (b) If a long-run relationship exists, is there causality between sector development and poverty reduction? This study uses an econometric methodology consisting of an autoregressive distributed lag bounds testing approach to co-integration (ARDL) developed by Pesaran *et al* (2001), vector error correction modeling (ECM), and Granger causality testing (Granger, 1988).

The United Nations Conference on Trade and Development, the World Tourism and Travel Council and the United Nations World Tourism Organization strongly support a change in prevailing economic development strategies arguing that tourism development can play a significant role in poverty reduction and in economic growth for the developing world (Croes and Vanegas, 2006, 2008; Cortés-Jiménez *et al*, 2009; Croes, 2012; Vanegas, 2012a). The World Bank, however, has focused on agricultural development and underestimated the opportunity to promote tourism development (Hawkins and Mann, 2007). These opposing views provide another reason to establish whether agriculture, manufacturing or tourism development is more important for leading poverty reduction efforts.

Costa Rica and Nicaragua are of special interest for this enquiry given the diversity found both in their policy environments and in initial conditions. Comparable indigence poverty data exist for Costa Rica and Nicaragua since the 1970s and 1980s on an annual basis, respectively. Macroeconomic data, disaggregated by sector are available for Costa Rica since 1951 (Central Bank of Costa Rica, 2012) and for Nicaragua since 1960 (Central Bank of Nicaragua,

2001, 2009, 2011). Combining these various sources of data, we model poverty dynamics in Costa Rica and Nicaragua disaggregated by sector for a 43-year period for Costa Rica (1970–2012) and a 33-year period for Nicaragua (1980–2012). The poverty rates utilized in our analysis are the percentage of the population below each country's specific indigence poverty line. These poverty levels are determined by the cost of acquiring a basic food basket in the country. The World Bank poverty data are only available every several years, whereas the domestic poverty estimates are annual. The United Nations Statistical Division suggests that national poverty data should be used when available.

The contribution of this study to the literature is fourfold. First, we add to the existing evidence by studying the relationships of poverty dynamics in Costa Rica and Nicaragua. We focus on an analytical model that investigates the role played by the pattern of growth of their sector composition in determining the pace of poverty reduction and how this has changed over time. Second, we use country specific evidence with the advantages and disadvantages associated with increasing the underlying variation of the data. Third, we address the fundamental causal relationship among the four variables of the study: poverty reduction, agricultural, manufacturing and tourism development. Fourth, considering the benefits of each sector's development, it can be argued that if one of them has the potential to become a strategic engine of long-run poverty reduction and economic growth, more resources should be allocated to that sector. From a policy perspective, therefore, it is important for the governments of Costa Rica and Nicaragua to know and understand the relationship between poverty reduction and sector development in their economies.

Literature review

The literature on the relationship between poverty reduction and aggregate economic growth is extensive (Dollar and Kraay, 2002; Bourguignon, 2003, 2004; UNU-WIDER, 2008). Research focused on disaggregated sector analysis, however, is limited in quantity and quality in terms of empirical methods, data periods, constructed and applied variables, data frequency and dynamic features of the relationships. There is a dearth of literature concerning the integrated relationship between sector composition development of output (agriculture, manufacturing and services/tourism) and poverty reduction. Poverty studies, in general, have been addressed from the overall perspective of economic growth and inequality on poverty reduction and in particular the impact of agricultural development.

Poverty reduction and agriculture

Agricultural growth has long been recognized as an important instrument for poverty reduction. Yet measurements of this relationship are still scarce and not always reliable. The role of agriculture in poverty reduction is supposedly due to the fact that: (a) the rural poor typically rely on agriculture for food and income either as peasant farmers or agricultural labourers; (b) the incidence of both absolute and extreme poverty are disproportionately high in the rural developing world, which still relies on agriculture as the primary sector for

employment and income generation; (c) the rural poor have lower levels of skills to sell and face many obstacles in connecting with manufacturing, tourism, construction, and other services for jobs; and (d) agricultural development can provide them jobs where they live.

That growth in the agricultural sector is important for poverty reduction is supported by the studies of Topalova (2008), Virmani (2007) and Warr (2006). They show that the differences in the rates of farm output growth mattered most for the poor and non-farm growth was less effective in reducing poverty. In contrast, Habito (2009) and Suryahadi *et al* (2009, 2012) found that in the South East Asian region growth in manufacturing and urban services has played a more significant role, respectively. De Janvry and Sadoulet (2010) found agriculture productivity had a much larger positive effect than other sectors on poverty reduction in both Sub-Saharan Africa and South Asia, but not so in Latin America and the Caribbean. They reported poverty elasticity values of –1.2 for China and India and only –0.3 for Brazil. In other words, in Latin America and the Caribbean, agricultural growth did not translate into substantially lower poverty rates.

Using poverty at US$2.00 and US$1.00 per day for the period 1980–2005, Cervantes-Godoy and Dewbre (2010) disaggregated overall income sources into agricultural gross domestic product per worker, non-agricultural gross domestic product per worker and per capita remittances. The authors find that in comparison with the rest of the economy, agriculture appears especially powerful in lifting the extreme poor out of poverty, though its comparative edge declines substantially when it comes closer to the US$2 per day poverty line. Non-agricultural led growth is more powerful in reducing the US$2 per day poverty headcount ratio. The dominance of agriculture in reducing extreme poverty declines as countries become richer and as income inequality increases. From this study it is important to note, however, that non-agricultural development made the largest contribution to poverty reduction in China and Vietnam, whereas agricultural development made the largest contribution in Indonesia.

The finding by Cervantes-Godoy and Dewbre (2010) about China is in contrast to the results obtained by Ravallion and Chen (2007). Similarly, their results also contradict the finding by Habito (2009) and Suryahadi *et al* (2009, 2012) that manufacturing development and urban services were the most important factors in poverty reduction particularly in recent years. Hasan and Quibria (2004) caution against what they call misplaced 'agricultural fundamentalism', or the argument that agricultural growth always leads to more rapid poverty reduction, because they also find that while agriculture was relatively the most effective sector in poverty reduction in South Asia and Sub-Saharan Africa, poverty reduction in East Asia resulted more from the industrial sector and in Latin America from the services sector.

Poverty reduction and tourism

Developing countries worldwide have managed to increase their participation in the global economy through development of international tourism. Tourism development is increasingly viewed as an important tool in promoting economic growth, alleviating poverty and advancing food security. In this context, the idea of using tourism development to reduce poverty has been embraced by

governments, by the United Nations World Tourism Organization, by the United Nations Conference on Trade and Development and by some members of the donor community (Ashley and Mitchell, 2005; Vanegas and Croes, 2007a; Croes, 2011; Vanegas, 2012b). The majority of studies in developing countries around the world, using different empirical methods and datasets, have found positive and significant relationships between tourism and economic growth (Vanegas and Croes, 2007b; Croes and Vanegas, 2008; Sequeira and Nuñes, 2008; Belloumi, 2010; Lean and Tang, 2010; Du and Ng, 2011; Kreishan, 2011; Tang, 2011; Vanegas, 2012b).

Relatively few studies, however, have examined an empirical link between tourism and poverty reduction. Among those few studies, one that has informed about this causality is that conducted by Croes and Vanegas (2008). Their study begins from an income poverty paradigm perspective and assessed empirically the relationship between poverty reduction and tourism development in the case of Nicaragua. They found a one-way causal relation between tourism development and economic expansion, and between tourism and poverty reduction. These authors characterized the relationship among tourism, economic growth and poverty reduction as related to the 'democratization of the dollar' by highlighting the employment, income and participation opportunities that are derived from a transfer of wealth and income from residents of wealthier countries to developing countries (Vanegas and Croes, 2003, 2007b).

Blake *et al* (2008) used a computable general equilibrium model to assess the contribution of tourism to poverty reduction in Brazil. They found that tourism benefits the lowest income households, albeit to a lesser extent than higher income groups. Mbaiwa (2005) found that while tourism development increased in the Okavango region in Botswana, poverty also increased, thereby concluding that tourism is not sustainable in reducing poverty. However the overriding concentration of multi-national safari operators in Botswana, compared to local operators, may have influenced their results.

Poverty reduction and the pattern of sector composition

Several scholars using different methodological procedures have considered the impact of sector composition development on the poor. Cross-country evidence suggests that rates of poverty reduction depend on the sector composition of economic growth and that there is a systematic pattern to this variation. Sectors that are more labour intensive, in relation to their size, tend to have stronger effects on poverty alleviation (Christiaensen and Demery, 2007; Loayza and Raddatz, 2010).

Focusing on the structure of output growth, Loayza and Raddatz (2010) took a different, albeit complementary, perspective on the sources of heterogeneity in the poverty-growth relationship. They concluded that 'the lack of individual significance of sector growth rates and the inability to separate their effects indicates that the three major sectors are highly linked in their relationship with poverty reduction' (Loayza and Raddatz, 2010, p 141). In the context of India, Ravallion and Datt (1996, 2002) found that the sector and geographic composition of growth mattered to aggregate (absolute) poverty reduction. Growth in agriculture (the primary sector) was, on average, more effective at reducing poverty relative to secondary (manufacturing) and tertiary (services)

sectors. For China, Ravallion and Chen (2007) found that agricultural growth had a far higher absolute poverty-reducing impact than did growth in either the manufacturing or services sectors.

Moreover, the study on China by Montalvo and Ravallion (2010) also rejects the null hypothesis that the composition of growth does not matter and the elasticity of poverty with respect to gross domestic product per capita in the primary and secondary sectors is significantly different from zero. In marked contrast to Ravallion and Datt's (1996, 2002) findings for India, the elasticity value of poverty with respect to the output per capita in the services sector is not significantly different from zero. They cannot rule out, however, the possibility that secondary or tertiary sector growth are having an indirect effect via primary-sector growth.

The experience in East Asian countries (the original Asian Tigers) is in contrast with the experience of India and China. During the period from the 1960s to the 1990s, when the East Asian countries achieved their success in economic growth and poverty reduction, the process was essentially propelled by a rapid increase in the production and export of manufactured products (Asian Development Bank, 1997). Similarly, the finding by Habito (2009) and Suryahadi *et al* (2009, 2012) showed that manufacturing development and urban services were the most important factors in poverty reduction in Indonesia. Using state-level data over time for India, Ravallion and Datt (2002) found that the elasticity of poverty to non-agricultural growth varied significantly across states, and was greater in states with higher initial literacy and farm productivity rates, with lower landlessness and infant mortality rates.

In summary, the contrasting or contradicting findings noted above underscore the fact that the results of empirical studies can vary between countries and regions and depend crucially on the methodologies used. This suggests that possibly the aggregation of a large number of very different countries, into a single group, may provide misleading information about the key drivers of poverty reduction. It is also possible that since the different studies cover different periods, temporal influences had an effect. In addition, analysing the effect of a sector in isolation, instead of simultaneously with other sectors, may not be able to explain the full effect of forward and backward linkages among sectors, therefore generating contradicting or misleading results. In this context, the paper by Habito (2009) gives us a good example. When using pair-wise correlations, he found no significant contribution of agriculture or industry or services to poverty reduction. However, this result changed when the sectors were analysed by simultaneous regression equations.

The main lesson learned appears to be in support of a poverty study that is able to examine the incidence of poverty and sector contributions at a disaggregated level. Moreover, the literature on the effect of sector composition of growth on poverty reduction suggests that while the composition of growth matters, different sectors seem to have played significant roles, in poverty reduction, in different countries and at different periods. It is also clear that aggregation of very different countries and regions into larger sample groups might reduce the value of a study, especially if the focus of the study is on poverty reduction, as poverty happens to be excessively concentrated in specific developing areas, worldwide.

Trends in economic growth and poverty

Costa Rica

Costa Rica's economy did not stagnate during the Latin America debt crisis of the 1980s. As shown in Table 1, prior to the global economic crisis, it enjoyed stable economic performance growing, on average, at an annual rate of nearly 4.35% (2.42% on a per capita basis). The economy, however, contracted nearly 1.02% (–2.29% per capita) in 2009 but resumed growth at nearly 4.48% (3.31% per capita) per year in 2011–2012.

Indigence or extreme poverty in Costa Rica has decreased consistently since the 1970s from a high of 10.6% in the 1980–1990 period to a low of 4.92% in the 2000–2010 period. However, the percentage of those in extreme poverty has trended upward in the last few years reaching 6.31% and 6.19% in 2011 and 2012, respectively (Table 1). The indigence poverty level (based on the cost of a defined basket of basic foods) in Costa Rica in 2012 for rural areas was equivalent to nearly US$2.39 per person per day at the market foreign currency exchange rate and US$3.42 using the purchasing power parity (PPP) exchange rate determined by the World Bank (2013). For urban areas the dollar equivalent levels were US$2.86 at market rates and US$4.08 at PPP. The strong social safety net that had been put into place by the government, however, has eroded due to increased financial constraints on government expenditures. Immigration from Nicaragua has increasingly become a concern for the government. The estimated 300,000 to 500,000 Nicaraguans in Costa Rica legally and illegally are an important source of mostly unskilled labour, but also place heavy demands on the social welfare system.

Costa Rica is the country that captures the largest amount of tourists in Central America, nearly 25% of the total. Promoting itself as a destination with *No Artificial Ingredients*, ecotourism has flourished in the rain forest and nature lodges of Costa Rica, which provides holidays rich in natural wonders and adventure. The economic and social benefits have been significant and since the beginning of the 1990s tourism has been the primary source of foreign exchange revenue. The 2 million plus tourists that entered the country in 2012, generated foreign exchange earnings of nearly US$2.3 billion, equivalent to nearly 24.3% of total exports (CT, 2012). It is also important to consider that there are other activities that depend upon tourism for development, such as agriculture, transportation, construction and commercial activities. Moreover, according to the Comisión Económica para Latino América y el Caribe (2007), the poverty incidence among all employees in Costa Rica is 7.1%. It is only 3.6% for the tourism sector.

While the traditional agricultural exports of bananas, coffee and pineapples are still a big part of its commodity trade, a variety of industrial and specialized agricultural products have broadened export trade in recent years. High value-added goods and services, including microchips, have further bolstered exports (Sauma, 2001; Sauma and Sánchez, 2003; Bashir *et al*, 2012). Costa Rica is the only country in Central America where high-technology manufacturing makes up a significant proportion of exports. The United States–Central American–Dominican Republic Free Trade Agreement, which entered into force in January 2009, has increased foreign direct investment in key sectors of the economy,

including the insurance and telecommunications sectors recently opened to private investors. Foreign direct investors remain attracted by the country's political stability and relatively high education levels, as well as the incentives offered in the free-trade zones.

In this context, Costa Rica has attracted one of the highest levels of foreign direct investment per capita in Latin America. Today, it is one of the largest exporters of microchips in the world, and the fourth largest exporter of medical devices (Bashir, *et al*, 2012; Gindling and Trejos, 2013). Unlike the rest of Central America, Costa Rica is not highly dependent on remittances as they only represented 1.64% of GDP in 2012.

Nicaragua

Nicaragua's economy, in contrast, stagnated during the Latin America debt crisis of the 1980s. Coupled with internal turmoil, the economy, on a per capita basis, contracted by 3.8% and indigence poverty, on average, increased at nearly 4.35% per year during the period 1980–1990 (Table 1). Nicaragua is categorized as a low income country by the World Bank and is much poorer than Costa Rica. Not surprisingly, therefore, its indigence poverty standard (also based on the cost of a basket of food basics) is much lower. The indigence poverty level in 2012 was equivalent to US$0.76 per capita per day at the market currency exchange rate and US$1.91 at a PPP rate. The country was not growing at the rate required to alleviate poverty. This was due to Nicaragua's vulnerability to external changes and its inability to compete in the global market. Nicaragua suffered from severe structural problems; it had a very poorly diversified industrial structure, and its trading performance was correspondingly weak, relying on basic agricultural commodities. Nicaragua was a clear example of a country that was struggling to maintain sustainable economic development while trying to achieve poverty reduction.

Since the mid-1990s, the country has witnessed extraordinary economic, social and political changes. Monetary and fiscal policies were implemented in order to promote economic growth. Opening domestic markets to foreign trade and investment were also important measures that allowed the Nicaraguan economy to participate in the global market. As a result, the economy resumed growth and has enjoyed stable economic performance, growing, on average, at an annual rate of nearly 2.45% and 1.77% on a per capita basis, for the periods of 1990–2000 and 2000–2010, respectively. Indigence poverty rates have fallen.

Tourism in Nicaragua is a relatively recent phenomenon and with the expansion of its airport and its new promotional campaign there have been significant investments in airlift infrastructure and facilities to house and cater to visitors. In 2002, the government of Nicaragua announced a policy to propel tourism development as a tool to combat poverty. As such, the importance of tourism is increasing in real terms. Vanegas (2002) in his study found that of the three sectors (agriculture, manufacturing and tourism), tourism offered the largest power to generate foreign exchange earnings, generated the largest increases in job creation, stimulated the largest increases in economic expansion, and had the largest positive impact on income distribution.

Descriptive statistics for indigence poverty for each country during the study period are presented in Table 2. These include mean, median, maximum,

Table 2. Descriptive statistics of indigence poverty.

Statistics	Costa Rica	Nicaragua
Mean	13.05%	20.70%
Median	9.14	19.72
Maximum	23.46	44.56
Minimum	3.28[a]	14.34[b]
Standard deviation	8.91	4.00
Coefficient of variation	68.30	19.32
Skewness	0.67	0.89
Kurtosis	–1.13	–1.62
Correlation		
POV*Ag	–0.43	–0.39
POV*Ma	–0.53	–0.47
POV*Tou	–0.68	–0.52
MaAg*	0.62	0.60
Ag*Tou	0.71	0.53
Ma*Tou	0.77	0.58

Note: [a]Reached in 2007; [b]reached in 2012.
Source: Authors' own calculations.

minimum and standard deviation; the coefficient of variation, skewness and kurtosis of the national indigence poverty lines for Costa Rica and Nicaragua; and the correlation indicators among the four variables considered in this study, over the periods 1970–2012 for Costa Rica and 1980–2012 for Nicaragua. Unsurprisingly, Costa Rica's indigence or extreme poverty was, on average, nearly 37% lower than in Nicaragua and the gap between the minimum values was even greater at nearly 77%. The negative correlation values between indigence poverty and the agricultural sector were the lowest in absolute value in both countries for any sector: –0.43 in Costa Rica and –0.39 in Nicaragua. Manufacturing was –0.53 in Costa Rica and –0.47 in Nicaragua, and tourism –0.68 and –0.52.

Data and methodology

Our analysis uses annual data from both household surveys and the national accounts in each country. The data sets contain four variables: the indigence or extreme poverty headcount indexes (as a percentage of the populations) from household surveys are the dependent variables and the explanatory variables are international tourism receipts and agricultural and manufacturing exports from the national accounts. Tourism receipts produce inflows of money for a country similar to those from agricultural and manufacturing exports.

Each sector has a domestic component which we did not consider. One reason is that data are not available for domestic tourism. It is recognized that, especially for agriculture, domestic production might be substantially higher than export-led production. However, growth and corresponding poverty reduction is primarily tied to the flow of money from outside. International tourists, who travel to any country, consume agricultural products during their visit.

This amounts to export-led growth in agriculture, assuming the agricultural goods served to tourists are domestically produced, but in the national balance sheets this export-led growth would show up as domestic production as the agricultural goods are sold within the country of production. The purpose of focusing on only exports, apart from data availability considerations, is to show clearly how exports in different sectors are affecting overall poverty reductions.

The dataset we used was improved in various respects. After discarded observations due to calibration and comparability issues, the study ended up with 43 observations for Costa Rica over the period 1970–2012 (ICT, 1975, 2012; INEC, 2008, 2009, 2012), and 33 observations for Nicaragua over the period 1980–2012 (Central Bank of Nicaragua, 2001, 2009, 2011). The availability of a much richer data set makes it possible to use a better methodological framework to estimate national poverty measures for both countries. In addition, the present analysis is based on a much larger data set than earlier ones, as a result of more household surveys being made available.

During the last two decades, considerable attention has been paid to testing for the existence of short and long-run relationships between economic variables based on the use of different co-integration techniques (Engle and Granger, 1987; Johansen, 1988; and Johansen and Juselius, 1992). All of these methods can only be applied when the variables are integrated of the same order. This technical requirement implies a severe limitation on the use of traditional co-integration techniques. In order to overcome this restriction, Pesaran *et al* (2001) proposed the autoregressive distributed lag (ARDL) bounds testing approach to co-integration for testing for the existence of a long-run relationship between variables, which is applicable regardless of whether the underlying variables are stationary I(0) or non-stationary I(1), or a mixture of both. The test statistics underlying the econometric procedure are the *F*-statistic or Wald test in a generalized Dickey–Fuller type regression. The *F*-statistic is used to test the significance of lagged levels of the study's variables in a conditional unrestricted equilibrium correction model (Pesaran *et al*, 2001).

The growth model that has been adopted in this study is based on the principles of some earlier studies, among others, Croes and Vanegas, 2008 (for Nicaragua); Ferreira *et al*, 2010 (for Brazil); Hasan and Quibria, 2004 (for four developing regions); Loayza and Raddatz, 2010 (for a cross-section of developing countries); and Montalvo and Ravallion, 2010 (for China). Thus, we include the sector sources of growth namely agriculture, manufacturing and tourism. The ARDL model approach to co-integration implies estimating the following unrestricted error correction model (ECM):

$$\Delta \ln POV_t = \beta_0 + \Sigma\beta_1 \Delta \ln Ag_{t-m} + \Sigma\beta_2 \Delta \ln Ma_{t-m} + \Sigma\beta_3 \Delta \ln Tou_{t-m} + \Sigma\beta_4 \Delta \ln POV_{t-m} + \beta_5 \ln Ag_{t-1} + \beta_6 \ln Ma_{t-1} + \beta_7 \ln TouURe_{t-1} + \beta_8 \ln POV_{t-1} + \beta_9 D1 + \beta_{10} D2 + \beta_{11} D3 + \beta_{12} D4 + \mu_{jt,} \quad (1)$$

where Δ represents the first-difference operator, POV denotes a measure of the indigence poverty headcount ratio in Costa Rica and Nicaragua in year t, Ag denotes a measure of the agricultural exports in year t, Ma denotes a measure of the manufacturing exports in year t, and Tou denotes a measure of the

tourism receipts in year t. The parameters β_5, β_6, β_7 and β_8 are the long-run coefficients, β_1, β_2, β_3, and β_4 the short run coefficients, and μ represent the residuals. The dummy variables are specified to capture: (D1) for the impact caused by the overthrown of the Somoza regime in Nicaragua and its aftermath in 1979–1980, (D2), for the Sandinistas-Contras civil turmoil in Nicaragua in 1982–1989, which affected the Central American region, (D3) for the economic global crisis in 2008–2010, and D4 for the effect of survey methodology changes in Costa Rica (2011–2012). The dummy variables take the value of 1 for the year of the occurrence of the special event and the value of 0 for all other years. The optimal number of lags of the unrestricted ECM is determined using a specific criterion of selection (for example, the Akaike Information Criterion). Separate equations are estimated for Costa Rica and Nicaragua.

This approach has certain advantages over the common practice of univariate (Engle and Granger, 1987) and multivariate (Johansen, 1988; Johansen and Juselius, 1992) co-integration analysis. First, the methodology is relieved of the burden of establishing the order of integration among the variables and of pre-testing for unit roots. Second, it allows testing for the existence of relationships between variables in level, regardless of whether the underlying regressors are I(0), I(1), or mutually co-integrated. Third, it provides robust results in small sample sizes, such as the sample size for each country in this study. Fourth, it distinguishes dependent and independent explanatory variables, which means that the endogeneity problems and inability to test hypothesis on the estimated coefficients in the long-run are avoided. Fifth, the long-run and short-run parameters of the tourism demand model are estimated simultaneously.

Following Pesaran *et al* (2001), our testing procedure of a long-run relationship between POV, Ag, Ma and Tou is based on two alternative statistics. The first one is the null hypothesis of no long-run relationship or no co-integration (H0: $\beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$), which is tested against the alternative hypothesis of the existence of a long-run relationship or co-integration (Ha: $\beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq \beta_9 \neq 0$) via a partial *F*-test. The second statistic is an individual *t*-test on the lagged dependent variable ($\beta_8 = 0$).

As discussed by Pesaran *et al* (2001), the asymptotic distribution of the *F*-statistics is non-standard, regardless of whether the variables are I(0) or I(1). This procedure provides lower and upper bound critical values, where the lower bound critical values assume that all variables are I(0), while the upper bound critical values assume that all variables are I(1). If the calculated F-statistic is above the upper critical value, the null hypothesis of no co-integration can be rejected notwithstanding the orders of integration of the respective variables. If the calculated F-statistic is below the lower critical value, the null hypothesis of no co-integration cannot be rejected. If the calculated *F*-statistic falls between the lower and upper critical values, the result is inconclusive.

Unit roots

In the first step of the analysis, we need to be sure that variables are not of a higher order than I(1). For this reason, it is necessary to analyse the order of integration using a combination of the augmented Dickey and Fuller (1981) (ADF) and Phillips and Perron (1988) (PP) statistical tests. The ADF and PP tests, presented in Table 3, reveal that for Costa Rica and Nicaragua POV and

Table 3. Unit roots.

ADF and PP procedures	Log Ag	Log Ma	Log Tou	LogPOV
Costa Rica				
Tests in levels				
ADF (it)	–3.9322 (0)	–1.5681 (2)	–2.6181 (0)	–1.6935 (2)
ADF (i)	–4.0679 (0)	–2.8611 (2)	–3.0947 (0)	–3.1538 (2)
ADF (wit)	–3.7833 (0)	–1.9728 (2)	–2.9118 (0)	–2.0450 (2)
PP (it)	–6.0429 (0)	–2.7387 (1)	–5.8467 (1)	–3.0400 (2)
PP (i)	–7.6904 (2)	–2.8819 (1)	–6.3132 (1)	–3.2277 (2)
PP (wit)	–3.3671 (1)	–1.7643 (1)	–3.1678 (1)	–1.8304 (2)
Tests in first differences				
ADF (it)	–7.8678 (1)	–6.3928 (1)	–6.8759 (1)	–6.2649 (0)
ADF (i)	–8.1858 (1)	–7.0716 (1)	–5.7341 (1)	–7.3707 (0)
ADF (wit)	–9.8753 (1)	–8.1827 (1)	–8.4464 (1)	–8.9155 (0)
PP (it)	–10.1542 (2)	–4.7372 (1)	–7.8791 (2)	–5.8461 (0)
PP (i)	–13.9928 (2)	–8.6416 (1)	–11.7883 (2)	–9.5323 (0)
PP (wit)	–11.7114 (2)	–5.2166 (2)	–13.1127 (2)	–6.0043 (0)
Nicaragua				
Tests in levels				
ADF (it)	–0.4889 (1)	–0.8118 (2)	–3.8161 (2)	–0.9456 (1)
ADF (i)	–1.3778 (1)	–0.9249 (2)	–2.9516 (2)	–1.0673 (1)
ADF (wit)	–1.2862 (1)	–0.9867 (2)	–3.7418 (2)	–1.2486 (1)
PP (it)	–4.6364 (2)	–2.9061 (1)	–4.9304 (1)	–3.5454 (1)
PP (i)	–4.2318 (2)	–2.5878 (1)	–2.8463 (1)	–2.9501 (1)
PP (wit)	–4.5101 (1)	–1.3736 (1)	–4.7419 (1)	–5.0264 (1)
Tests in first differences				
ADF (it)	–6.2664 (1)	–2.5026 (0)	–7.0480 (0)	–2.6590
ADF (i)	–3.1996 (1)	–3.0618 (0)	–7.4967 (0)	–3.4382
ADF (wit)	–7.7153 (1)	–3.4984 (0)	–5.7616 (0)	–4.1182
PP (it)	–4.5796 (2)	–4.5084 (2)	–13.7475 (1)	–5.3038
PP (i)	–4.7284 (2)	–8.1122 (2)	–8.7362 (1)	–8.8942
PP (wit)	–4.9527 (2)	–5.7946 (1)	–11.8811 (2)	–6.2327

Notes: 'it' = intercept and trend; 'i' = intercept but no trend; 'wit' = without intercept and without trend and is the most restrictive model. The numbers in brackets are lag lengths used to remove serial correlation. The corresponding critical values used for the statistics with 43 and 33 observations for Costa Rica and Nicaragua, respectively, are from Dickey and Fuller (1981). The rejection of the null hypothesis is based on MacKinnon (2010) critical values. Estimates obtained from STATA version 10.

Tou are stationary I(0), and Ag and Ma are both non-stationary time series at their levels, but stationary at first differences; so they are integrated of order one I(1). Once the order of integration is known not to be greater than one, the next step is to apply the bounds testing approach to co-integration proposed by Pesaran *et al* (2001). The Akaike's (1974) information criterion (AIC) was used in selecting the optimum lag length (p) in Equation (1).

Testing co-integration

In the second step the ARDL approach involves examining the existence of a long-run relationship among all variables in Equation (1). The test-statistics

Table 4. Results of the bounds co-integration tests.

Country	Model with unrestricted intercept and no trend	Model with unrestricted intercept and restricted trend	Upper and lower critical values
Costa Rica			
F-statistics	6.137[a]	–	4.57–5.90
F-statistics	–	5.942[b]	3.74–5.06
Nicaragua			
F-statistics	–	–	4.52–5.90
F-statistics	6.418[a]	5.713[b]	3.74–5.06

Note: Upper and lower critical values are from Pesaran *et al* (2001), [a]Table C1, iii: Case III, and [b]Table CI, iv: Case IV.

Table 5 Estimated co-integration regressions for Costa Rica (1970–2012) and Nicaragua (1980–2012): dependent variable, Log POV.

Variable	Costa Rica	*t*-statistics	Nicaragua	*t*-statistics
	Coefficient		Coefficient	
Constant				
Log Ag_{t-1}	-0.1934^{***}	–5.1852	-0.1378^{**}	–2.3882
Log Ma_{t-1}	-0.0644^{NS}	–1.2891	-0.0456^{NS}	–1.7406
Log Tou_{t-1}	-0.2232^{***}	–5.7988	-0.2194^{***}	–3.9819
Log POV_{t-1}	-0.3841^{***}	–4.2489	-0.3418^{***}	–2.8962
ΔLog Ag_{t-1}	-0.0803^{**}	–4.3335	-0.1636^{*}	–1.7733
ΔLog Ma_{t-1}	–0.0224	–1.1538	-0.0742^{*}	–1.7139
ΔLog $TouU_{t-1}$	-0.2117^{***}	–4.004	-0.2143^{**}	–2.4761
ΔLog POV_{t-1}	-0.7435^{***}	–4.1178	-0.6189^{**}	–2.5347
Θ_{t-1}	-0.3871^{***}	–3.3508	-0.2146^{***}	–3.1622
D1	–	–	-0.1622^{*}	–1.6937
D2	0.1432^{*}	1.6943	0.5327^{***}	4.4638
D3	0.2641^{**}	2.3864	0.1131^{NS}	1.1543
D4	0.1744^{*}	1.6608	—	
Adjusted R^2	0.7982		0.7738	
DW	1.6124		1.3963	
F-statistic	6.8103		5.8871	
Co-integration tests				
ADF	-4.2211^{**}		-4.9032^{***}	
PP	-4.1426^{**}		-4.9921^{***}	
Diagnostic test				
RESET (specification test)	2.8839		2.1738	
JBNO (normality test)	2.6009		4.9883	
BGSC serial correlation test	2.8809		0.1369	
WHITE (heteroscedasticity)	7.4151		8.9562	
ARCH (LM test statistic)	1.3626		1.2992	

Notes: ***1%, **5% and *10% significance levels, respectively. DW = Durbin–Watson statistic. The optimal lag lengths are based on the minimum of the Akaike information criterion (AIC), and the Schwartz (1978) information criterion (SIC).

underlying the econometric procedure is the Wald *F*-statistic in a generalized Dickey–Fuller type regression. The Wald *F*-statistic is used to test the significance of lagged levels of the study's variables in a conditional unrestricted equilibrium correction model (Pesaran *et al*, 2001). To capture the pattern of growth as comprehensibly as possible, Equation (1) was initially estimated in its most flexible form using real export values (2005 = 100) for each sector. In a separate specification, not reported here, we also estimated Equation (1) using each sectors' proportion of gross domestic product. The results do not differ. Moreover, we also used sector exports per capita in an alternate specification and again the results were similar.

In Table 4, the results of the bounds co-integration test demonstrate that the null hypothesis of no co-integration (H0: $\beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$) is rejected at the 1% significance level. The computed Wald *F*-statistic of 6.137 and 5.942 for Costa Rica and 6.418 and 5.713 for Nicaragua are greater than the upper bounds of 5.06 and 5.90, thus indicating the existence of a steady state long-run relationship among poverty, agriculture, manufacturing and tourism. Using the results of Table 5, the long-run elasticity values are the coefficients of the explanatory variables lagged one period divided by the coefficient of the dependent variable lagged one period, multiplied by a negative sign (Bardsen, 1989). For example, the long-run effect of LogAg in Equation (2) is derived by dividing the absolute value of the coefficient for LogAg_{t-1} by the coefficient for LogPOV_{t-1}, which gives a long-run elasticity value equal to –0.5035.

The estimated coefficients of the long-run relationship for Costa Rica and Nicaragua are represented below by Equations (2) and (3), respectively:

$$\text{Log POV} = -0.5035\text{LogAg} - 0.1681\text{LogMa} - 0.5811\text{LogTou} + 0.393, \quad (2)$$

$$\text{Log POV} = -0.4031\text{LogAg} - 0.1331\text{LogMa} - 0.6421\text{LogTou} + 0.526. \quad (3)$$

For Costa Rica, Equation (2) indicates that agriculture, manufacturing and tourism are negatively related to indigence poverty with estimated elasticity values of –0.50 for agriculture, –0.17 for manufacturing and –0.58 for tourism. The coefficient estimated for manufacturing is not statistically significant, so it will be treated as having no effect on poverty. In other words, a 1% increase in agricultural exports and tourism receipts would bring nearly a 0.50% and 0.58% decrease in the indigence poverty headcount ratio, respectively, *ceteris paribus*. For Nicaragua, Equation (3) indicates that agriculture and manufacturing exports and tourism receipts are negatively related to indigence poverty with elasticity values of –0.40 for agriculture, –0.13 for manufacturing (but again not statistically significant) and -0.64 for tourism. In other words, a 1% increase in agricultural exports and tourism receipts would produce nearly a 0.40% and 0.64% decrease in the indigence poverty headcount ratio, respectively, *ceteris paribus*.

It is noteworthy that the contributions of agriculture and manufacturing to indigence poverty reduction in Costa Rica and Nicaragua are relatively lower as compared to tourism development. Using the statistics in Table 5, a *t*-test was conducted on the difference between agriculture elasticity values and tourism elasticity values for both countries. In each case tourism was statistically greater, at the 0.01 significance level, at reducing poverty than agriculture.

On this issue, Hasan and Quibria (2004) found that the sector growth having the highest impact on poverty reduction is country specific.

With agricultural exports of US$673 million in 2012 and international tourism receipts of US$421 million in Nicaragua, a 1% increase in the former would amount to US$6.73 million versus only US$4.21 for the latter. Agricultural exports would have to grow by 59.8% more in value for a 1% change, and yet would still reduce poverty by less than a similar 1% growth in tourism. The necessary government policies and investments, and their cost, to expand agricultural exports and tourism receipts are beyond this analysis. However, assuming investments similar to those of past years, it would take a much smaller investment in tourism to achieve a substantially higher rate of poverty reduction, than for agriculture, in Nicaragua.

As expected *a priori*, political instability in Nicaragua caused by the overthrow of the Somoza regime (D1) affected only Nicaragua, and was statistically significant at the 1% level. The civil turmoil of the 1980s (D2) had bigger and significant repercussions on increasing poverty in Nicaragua. In Costa Rica, its impact was not significant. The financial and global economic crisis (D3) significantly affected Costa Rica and to a lesser extent Nicaragua. As expected the change in survey methodology (D4) in Costa Rica had a positive effect, and was statistically significant at the 1% level.

We find for Costa Rica and Nicaragua that an increased tourism sector had the greatest impact on reducing indigence poverty, with coefficients greater than for an increased agricultural export sector of nearly 15% and 59% for Costa Rica and Nicaragua, respectively. Our results are relatively consistent with the findings of Croes and Vanegas (2008) for Nicaragua, Ferreira *et al* (2010) for Brazil, Hasan and Quibria (2004) for Latin America, Ravallion and Daat (2002) for India, Suryahadi *et al* (2009, 2012) for Asia, Vanegas (2012b) for El Salvador, and Warr (2006) for Thailand, Indonesia, Malaysia and the Philippines. It is important to note that most of these studies used services, not tourism, as representative of the tertiary sector.

Error correction estimates

In the third step conditional upon establishing co-integration, the long-run coefficients and the short-run coefficients are estimated using the associated ARDL and ECMs. After finding the long-run relationship we then estimated an error correction model which shows the speed of adjustment back to long-run equilibrium after a short-run disturbance. In other words, in the presence of co-integration, the short-run elasticity values can also be derived by building an error correction model.

The error correction model's specification causes the long-run behaviour of the endogenous variables to converge to their co-integrating relationships, while accommodating short-run dynamics. In the short-run, the main conclusions to be drawn from the error correction model, in terms of economic interpretation of the elasticity values, are in many cases similar to the ones obtained with the long-run equations. A 1% growth in agriculture, manufacturing and tourism would lead to a short-run poverty reduction of –0.08%, –0.02% (but not statistically significant) and –0.21% for Costa Rica, and –0.16%, –0.07% and –0.21% for Nicaragua, respectively, *ceteris paribus*. For example, the short-run

elasticity for agricultural exports in Nicaragua is equal to the coefficient in Table 5 for "Log $Ag_{t-1,}$ –0.0803.

As shown in Table 5, the coefficient of the lagged residual in the error correction model shows the speed of adjustment towards the equilibrium following a shock to the system. The coefficients of the error correction terms, –0.3871 for Costa Rica and –0.2146 for Nicaragua, are significant and indicate that about 39% and 22% of the deviation of poverty from its long-run level is adjusted for in one year, respectively. It suggests that indigence poverty in Nicaragua has both a fairly modest speed of recovery toward its equilibrium state and a more unstable behaviour as compared to Costa Rica.

The robustness of the model has been established by several diagnostic tests; the Ramsey (1969) test (RESET) for model misspecification; the Jarque–Bera (1980) (JB) normality test for normal distribution of the errors in the regression models; the Breusch–Godfrey (BG) test for residual serial correlation (Breusch, 1978; Godfrey, 1978); and the White (1980) heteroscedasticity test for the detection of non-constant variance in the errors. The Engle (1982) autoregressive-conditional heteroscedasticity test (ARCH) was used to test for the problem of heteroscedasticity under serially correlated errors. All the diagnostic tests reported that the model has the expected econometric properties: correct functional form, the errors are not serially correlated, normally distributed, and there is no presence of heteroscedasticity. The cumulative residuals (CUSUM) and cumulative square of recursive residuals (CUSUMSQ) tests, as proposed by Brown *et al* (1975), indicate model stability.

Granger causality

The fourth step explores the direction of predictive causality between poverty, agriculture, manufacturing and tourism for the series of paired variables by using the Granger (1988) causality test. Engle and Granger (1987) and Granger (1988) noted that if two time series variables are co-integrated, then there must be Granger causality in at least one direction. The existence of a stable long-run relationship between poverty and the other variables means that any pair of variables is Granger causally related at least in one direction. For example, is agricultural growth influencing poverty reduction, or is poverty reduction influencing agricultural growth? Meanwhile the null hypothesis can be tested by using the *F*-test. If significant, the null hypothesis of the *F*-statistic is rejected, which implies that the first series (for example, Ag) Granger influences the second series (for example, poverty) and vice versa.

The use of Granger causality is controversial. Is it really predictive causality that is being modelled or simply a statistical relationship? Without entering into the debate, we use Granger causality measures in this paper not to determine cause and effect but rather to investigate the relationships between sectors. In other words if Granger causality is shown to be significant between two sectors, the direction of 'causality' has more to do with the ability to forecast the effects of growth in one sector from growth in another sector. This is not a 'true' causal relationship, but rather a method for statistical forecasting.

The Granger-causality results for Costa Rica and Nicaragua are reported in Table 6. For Costa Rica, the results indicate that there is two-way or bi-directional Granger-causality between agricultural development and poverty

Table 6. Granger-causality results for Costa Rica, 1970–2012 and Nicaragua, 1980–2012.

Null hypothesis	Wald test	Probability values	Decision on hypothesis
Costa Rica			
Ag does not Granger-cause POV	2.4355	0.0021	Weak Ag → POV
POV does not Granger-cause Ag	6.6221	0.0516	Rejected
Ma does not Granger-cause POV	3.4432	0.0361	Rejected
POV does not Granger-cause Ma	4.1233	0.0156	Rejected
Tou does not Granger-cause POV	9.8714	0.0973	Rejected
POV does not Granger-cause Tou	1.7744	0.0381	Rejected
Ag does not Granger-cause Ma	4.7691	0.0322	Rejected
Ma does not Granger-cause Ag	6.5482	0.0922	Rejected
Ag does not Granger-cause Tou	0.8963	0.2218	Accepted
Tou does not Granger-cause Ag	7.1327	0.6114	Rejected
Ma does not Granger-cause Tou	4.3876	0.1126	Rejected
Tou does not Granger-cause Ma	5.3771	0.0398	Rejected
Nicaragua			
Ag does not Granger-cause POV	2.1686	0.0002	Accepted
POV does not Granger-cause Ag	1.3719	0.0175	Accepted
Ma does not Granger-cause POV	2.4093	0.0063	Weak Ma → POV
POV does not Granger-cause Ma	4.5547	0.0081	Rejected
Tou does not Granger-cause POV	6.2598	0.0043	Rejected
POV does not Granger-cause Tou	0.6845	0.0036	Accepted
Ag does not Granger-cause Ma	4.3708	0.0088	Rejected
Ma does not Granger-cause Ag	6.4823	0.0613	Rejected
Ag does not Granger-cause Tou	1.0643	0.1074	Accepted
Tou does not Granger-cause Ag	3.6193	0.0823	Rejected
Ma does not Granger-cause Tou	3.2367	0.1001	Rejected
TOU does not Granger-cause IND	4.7331	0.0008	Rejected

reduction (Ag ↔ POV). Interestingly, the Granger causality running from agriculture to poverty is relatively weak in the case of Costa Rica. A bi-directional Granger-causality effect exists running between poverty and manufacturing development (POV ↔ Ma). Moreover, a uni-directional Granger-causality effect exists running from tourism development to poverty reduction (Tou → POV). The Granger-causality test also shows a two-way or bi-directional Granger causality between agriculture and manufacturing (Ag ↔ Ma) and between manufacturing and tourism development (Ma ↔ Tou), which is an indication that tourism development is associated with increased physical capital investment, most likely in tourism infrastructure, agriculture and industry. It also shows that these linkages matter and it is increasing tourism capacity.

From Costa Rica's longer-term perspective, the most fundamental and obvious contribution of tourism development has been to stimulate investment, structural changes and generate productive employment and therefore higher living standards. The connectivity of tourism and poverty reduction (direct, indirect and induced impacts) on the growth of other sectors in terms of increased demand as tourism grew and living standards improved has also been important.

For Nicaragua the results for agriculture and indigence poverty do not show

Granger causality, which is an indication that there is relative independence between agricultural exports and poverty reduction. A bi-directional Granger-causality effect exists running between manufacturing development and poverty (POV ↔ Ma), and a uni-directional Granger-causality effect exists both running from tourism development to indigence poverty reduction (Tou → POV), and running from tourism development to agriculture (Tou → Ag).

In the case of Nicaragua, similar to what happened in Costa Rica, tourism development has triggered increased agriculture production to provide a relatively large proportion of the increased food demand generated from increased arrivals and tourism spending. This affect would not show up in our analysis as we only considered export-led growth. Domestic agricultural production increases would be the result of this linkage. Although not modelled in this study, it makes intuitive sense that agriculture benefits more from international tourism than tourism benefits from agricultural export growth. The Granger-causality test for agricultural and manufacturing exports also shows relative independence between agriculture and industry. It means perhaps that both sectors have developed in response to other factors, such as subsidies, investment laws, and other macroeconomic policies.

Policy implications

For Costa Rica and Nicaragua, the findings support the proposition that tourism, as a source of economic growth and poverty reduction, offers a convincing case for the use of policy instruments, such as targeted investment initiatives, marketing and promotion, and the support of tourism organizations focused to drive a tourism-based economy and/or tourism programs and projects.

Disaggregating exports into various sectors, we find evidence that the tourism sector has had a major impact on the economies of Costa Rica and Nicaragua during the past three decades, although the agricultural sector has also contributed significantly to indigence poverty reduction. For Costa Rica and Nicaragua and perhaps for other developing countries, this knowledge could play an important role in determining the appropriate development strategy to realize more benefits from tourism expansion and development management. Furthermore, it suggests that if Costa Rica continues on this path and Nicaragua follows the path of tourism expansion, it should result in significant reductions in indigence poverty.

The findings, presented in this paper are in line with the results obtained by Archer (1984, 1995), Croes and Vanegas (2006, 2008), Dritsakis (2004), Durbarry (2004), Dwyer et al (2003), Ferreira *et al* (2010), Figini and Vici (2010), Ghali (1976), Habito (2009), Khan *et al* (1990), Khan *et al* (1995), Kim *et al* (2006), Montalvo and Ravallion (2010), Ravallion and Datt (2002), Rodriguez (2005), Suryahadi *et al* (2009, 2012), and Vanegas and Croes (2003, 2007a).

Even though this study has demonstrated that poverty can be effectively reduced through tourism development, there is much more to understanding the process of how this works than is, or can be, reported in this paper. For example, we have only examined sector exports and international tourism receipts, and not domestic consumption. Unfortunately, as mentioned earlier,

no reliable data could be obtained for domestic tourism. Those records are not kept in either country.

Also the type of development should be examined in detail. Earlier it was mentioned that Mbaiwa (2005) found no reduction in poverty from tourism development in Botswana. Tourism in Botswana is relatively minor in importance compared to diamond mining. It is also dominated by multi-national safari companies, especially in the Okavango region. Thus it is possible that countries that rely on multi-national companies to lead tourism development efforts may not see the same poverty reducing forces as countries that rely on domestic tourism investment. The use of foreign direct investment as a variable should be integrated into future works of this type.

The case of Botswana, as well as some of the other countries studied, indicates that other sectors may be more significant at reducing poverty levels than tourism. This is to be expected as some countries have a comparative advantage with low wages and possibly lax regulations to entice manufacturing enterprises to operate within their borders (for example, China, Bangladesh). Other countries may have little to offer in the way of organized tourism attractions, but be ideal for agriculture (such as Uruguay) or minerals (such as Angola).

There is also the issue of the informal economy. Tourism is ideal for operators within the informal economy ranging from unlicensed taxi drivers to tour guides. Estimates of how the informal economy contributes to tourism development and local earnings are difficult to come by for any sector and are not dealt with in this paper. However, that does not mean to imply that it should be ignored in more detailed studies of tourism's effect on reducing poverty. The use of export values for the sectors examined in this study is, at the present time, the only way to pursue an analysis of the nature presented in this paper. Export values are more easily estimated than domestic production, especially in economies where the informal sector is substantial, which would include most of the developing nations in the world.

The results presented in this paper do not automatically imply that tourism development is the fastest way to reduce poverty in developing countries possessing tourism attractions. Tourism is a fragile sector, often influenced by endogenous and exogenous shocks. The almost complete elimination of international tourists visiting China after the 1989 Tiananmen Square conflict serve to remind development experts how one significant incident can reduce the tourism sector to a fraction of its former self. Similar effects were felt in the USA after the 2001 terrorist attacks and the Bali bombings, directed against international tourists, in 2005. Significant drops in international tourists were evident from the SARS (severe acute respiratory syndrome) in Toronto, Canada and Hong Kong in 2003. However, tourism did rebound in each of the destinations affected after normalcy returned with the absence of any further terrorist attacks or health issues. The time it took for each destination to return to normal inbound tourist levels varied but today each of the destinations is recording higher levels of international tourists than before the disruptions.

A much bigger issue is that of destination image. The Somoza regime's demise at the hand of the Sandinistas's led Nicaragua from one of the America's wealthiest countries to its current state of second poorest. While one can debate the merits of the Sandinista revolt the effects, from a tourism perspective, were to put Nicaragua into the category of countries with a negative image for

international tourists. Negative images, brought on by long term issues (like a civil war) have a tendency to linger much longer than negative images resulting from a onetime event (a health scare, for example).

The other sectors analysed in this paper are not free from shocks that might affect their exports. Nicaragua and Costa Rica are both exporters of beef products. An outbreak of hoof and mouth disease or brain wasting disease would have disastrous effects on their agricultural exports. However these shocks may also be temporary once corrective measures to deal with the problem are initiated.

It is up to a country's government agencies to determine both the external and internal threats to its various economic sectors and act accordingly. However what this paper shows is that given the present state of affairs, based on a long time-series trend, international tourism is the sector with the most promise for reducing indigenous poverty in both countries, compared to agricultural and manufacturing exports.

Conclusion

The main contribution of this paper lies not in the specific results presented, but in the understanding of sector contributions to alleviating poverty. Although differences in countries prevent sweeping generalizations about which sector is best to invest in if the goal is to reduce poverty, the analysis in this study can be replicated in almost every country in the world. By doing so, the international agencies that are focused on reducing poverty, as well as NGOs and government institutions, can effectively target development efforts to achieve the highest rates of poverty reduction possible. Of course, much more has to be learned about the 'right' form of development to be pursued, but at the very least sectors contributing the most to poverty reduction will have been identified.

References

Akaike, H. (1974), 'A new look at the statistical model identification, IEEE', *Transactions on Automatic Control*, Vol 19, pp 716–723.

Archer, B. (1995), 'Importance of tourism for the economy of Bermuda', *Annals of Tourism Research*, Vol 22, No 4, pp 918–930.

Archer, E. (1984), 'Estimating the relationship between tourism and economic growth in Barbados', *Journal of Travel Research*, Spring, pp 8–12.

Ashley, C., and Mitchell, J. (2005), *Can Tourism Accelerate Pro-Poor Growth in Africa?*, Overseas Development Institute Opinions, ODI, UK.

Asian Development Bank (1997), *Emerging Asia*, Oxford University Press, Oxford.

Bardsen, G. (1989), 'Estimation of long-run coefficients in error correction models', *Oxford Bulletin of Economic and Statistics*, Vol 54, pp 345–350.

Bashir, S., Gindling, T.H., and Oviedo, A.M. (2012), *Better Jobs in Central America: The Role of Human Capital*, Central America Policy Note, The World Bank, Washington, DC.

Belloumi, M. (2010), 'The relationship between tourism receipts, real effective exchange and economic growth in Tunisia', *International Journal of Tourism Research*, Vol 12, No 5, pp 550–560.

Blake, A., Arbache, J., Sinclair, M., and Teles, V. (2008), 'Tourism and poverty relief', *Annals of Tourism Research*, Vol 35, No 1, pp 106–127.

Bourguignon, F. (2003), 'The growth elasticity of poverty reduction: explaining heterogeneity across countries and time periods', in Eicher, T.S., and Turnovsky, S.J., eds, *Inequality and Growth: Theory and Policy Implications*, MIT Press, Cambridge, MA, pp 3–26.

Bourguignon, F. (2004), 'The poverty-growth-inequality triangle', Working Papers No 125, Indian Council for Research on International Economic Relations, New Delhi, India.
Breusch, T. (1978), 'Testing for autocorrelation in dynamic linear models', *Journal of Australia Economic Papers*, Vol. 17, pp 334–355.
Brown, R.J., Durbin, J., and Evans, J. (1975), 'Techniques for testing the constancy of regression relationships over time', *Journal of Royal Statistics Society*, Vol B37, pp 149–163.
Central Bank of Costa Rica (2012), *Costa Rica: Economic Indicators, 1951-2010*, Economic Studies, Central Bank of Costa Rica, San Jose, Costa Rica.
Central Bank of Nicaragua (2001), *Nicaragua: Economic Indicators, 1960–1999*, Economic Studies, Central Bank of Nicaragua, Managua, Nicaragua.
Central Bank of Nicaragua (2009), *Nicaragua: Economic Indicators, 2001–2009*, Economic Studies, Central Bank of Nicaragua, Managua, Nicaragua.
Central Bank of Nicaragua (2011), *Annual Report of the Central Bank, 2011*, Central Bank of Nicaragua, Managua, Nicaragua.
Cervantes-Godoy, D., and Dewbre, J. (2010), *Economic Importance of Agriculture for Poverty Reduction*, OECD Food, Agriculture and Fisheries Working Papers, No 23, OECD, Paris.
Christiaensen, L., and Demery, L. (2007), *Down to Earth: Agriculture and Poverty Reduction in Africa*, World Bank, Washington, DC.
Comisión Económica para Latino América y el Caribe (2007), *Tourism and Social Conditions in Central America: Experiencas in Costa Rica and Nicaragua*, Comisión Económica para Latino América y el Caribe, Mexico.
Cortés-Jiménez, I., Pulina, M., Riera i Prunera, C., and Artis, M. (2009), *Tourism and Exports as a Means of Growth*, Working Papers 2009/2010, Research Institute of Applied Economics.
Croes, R. (2011), *The Small Island Paradox, Tourism Specialization as a Potential Solution*, Lambert Academic, Saarbrüken,.
Croes, R. (2012), 'Tourism, poverty relief, and the quality-of-life in developing countries', in Uysal, M., Perdue, R., and Sirghy, M.J., eds, *Handbook of Tourism and Quality-of-Life Research: Enhancing the Lives of Tourists and Residents of Host Communities*, Springer, Dordrecht, pp 85–104.
Croes, R., and Vanegas, M. (2006), 'Tourism and poverty alleviation: real promise or false premise?', paper presented at the Second International Conference on Tourism Economics, Department of Applied Economics, University of the Balearic Islands, Palma de Mallorca, Spain, 18–20 May.
Croes, R., and Vanegas, M. (2008), 'Tourism and poverty alleviation: a cointegration analysis', *Journal of Travel Research*, Vol 47, pp 94–103.
De Janvry, A., and Sadoulet, E. (2010), 'Agricultural growth and poverty reduction: additional evidence', *World Bank Research Observer*, Vol 25, No 1, pp 1–20.
Dickey, D.A., and Fuller, W.A. (1981), 'Likelihood ratio statistics for autoregressive time series with a unit root', *Econometrica*, Vol 49, No 4, pp 1057–1071.
Dollar, D., and Kraay, A. (2002), 'Growth is good for the poor', *Journal of Economic Growth*, Vol 7, No 3, pp. 195–225.
Dritsakis, N. (2004), 'Tourism as a long-run economic growth factor: an empirical investigation for Greece using causality analysis', *Tourism Economics*, Vol 10, No 3, pp 305–316.
Du, D., and Ng, P. (2011), 'Is tourism a long-run economic growth factor', Working Paper Series Northern Arisona University, 12–02.
Durbarry, R. (2004), 'Tourism and economic growth: the case of Mauritius', *Tourism Economics*, Vol 10, No 4, pp 389–401.
Dwyer, L., Forsyth, P., and Spurr, R. (2003), 'Inter-industry effects of tourism growth: implications for destination managers', *Tourism Economics*, Vol 9, No 2, pp 117–132.
Engle, R.F. (1982), 'Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation', *Econometrica*, Vol 50, pp 987–1007.
Engle, R.F., and Granger, C.W.J. (1987), 'Co-integration and error correction: representation, estimation, and testing', *Econometrica*, Vol 55, pp 251–276.
Ferreira, H.G., Leite, P., and Ravallion, M. (2010), 'Poverty reduction without economic growth? Explaining Brazil's poverty dynamics, 1985–2004', *Journal of Development Economics*, Vol 93, pp 20–36.
Figini, P., and Vici, L. (2010), 'Tourism and growth in a cross section of countries', *Tourism Economics*, Vol 16, No 4, pp 789–805.
Ghali, M. (1976), 'Tourism and economic growth: an empirical study', *Economic Development and Cultural Change*, Vol 24, No 3, pp 527–538.

Gindling, T.H., and Trejos, J.D. (2013), 'The distribution of income in Central America', IZA Discussion Paper No 7236, Bonn, Germany.
Godfrey, L.G. (1978), 'Testing for higher order serial correlation in regression equations when the regressors contain lagged dependent variables', *Econometrica*, Vol 46, pp 1303–1310.
Granger, C.W.J. (1988), 'Some recent development in a concept of causality', *Journal of Econometrics*, Vol 39, pp 424–438.
Habito, C. (2009), 'Patterns of inclusive growth in developing Asia: insights from an empirical growth-poverty elasticity analysis', ADBI Working Paper No 145, Asian Development Bank Institute, Tokyo.
Hasan, R., and Quibria, M.G. (2004), 'Industry matters for poverty: a critique of agricultural Fundamentalism', *KYKLOS*, Vol 57, pp 253–264.
Hawkins, D., and Mann, S. (2007), 'The World Bank's role in tourism development', *Annals of Tourism Research*, Vol 34, No 2, pp 348–363.
INEC (2008), 'Encuesta Nacional de Hogares: resultados generales', Instituto Nacional de Estadísticas y Censos, Julio, San José, Costa Rica.
INEC (2009), 'Encuesta Nacional de Hogares: resultados generales', Instituto Nacional de Estadísticas y Censos, Julio, San José, Costa Rica.
INEC (2012), 'Encuesta Nacional de Hogares: resultados generales', Instituto Nacional de Estadísticas y Censos, Vol 1, Año 3, Julio, San José, Costa Rica.
Instituto Costarricense de Turismo (ICT) (1975), Base de datos del Departamento de Estadisticas, (1951–1975), San José, Costa Rica.
Instituto Costarricense de Turismo (ICT) (2012), Anuario Estadístico (base de datos, 1980–2012), San José, Costa Rica.
Jarque, C.M., and Bera, A.K. (1980), 'Efficient tests for normality, homoscedasticity and serial independence of regression residuals', *Economic Letters*, Vol 6, pp 255–259.
Johansen, S. (1988), 'Statistical analysis of co-integration vectors', *Journal of Economic Dynamics and Control*, Vol 12, pp 231–254.
Johansen, S., and Juselius, K. (1992), 'Testing structural hypothesis in a multivariate co integration analysis at the purchasing power parity and the uncovered interest parity for the UK', *Journal of Econometrics*, Vol 53, pp 211–244.
Khan, H., Seng, C.F., and Cheong, W.K. (1990), 'Tourism multiplier effects on Singapore', *Annals of Tourism Research*, Vol 17, No 3, pp 408–418.
Khan, H., Phang, S., and Toh, R. (1995), 'The multiplier effect: Singapore's hospitality industry', *Cornell Hotel and Restaurant Administration Quarterly*, Vol 36, pp 64–69.
Kim, H.J., Chen, M-H., and Jang, S.C. (2006), 'Tourism expansion and economic development: the case of Taiwan', *Tourism Management*, Vol 27, pp 925–933.
Kreishan, F. (2011), 'Time-series evidence for tourism-led growth hypothesis: a case study of Jordan', *International Management Review*, Vol 7, No 11, pp 89–93.
Lean, H., and Tang, C. (2010), 'Is the tourism-led growth hypothesis stable for Malaysia? A note', *International Journal of Tourism Research*, Vol 12, No 4, pp 375–378.
Loayza, N., and Raddatz, C. (2010), 'The composition of growth matters for poverty alleviation', *Journal of Development Economics*, Vol 93, pp 137–151.
Mbaiwa, J. (2005), 'The problems and prospects of sustainable tourism development in the Okavango Delta, Botswana', *Journal of Sustainable Tourism*, Vol 13, No 3, pp 203–227.
MacKinnon, J.G. (2010), 'Critical values for integration tests,' Economics Working Paper No 1227, Queen's University, Kingston, Canada.
Montalvo, J.G., and Ravallion, M. (2010), 'The pattern of growth and poverty reduction in China', *Journal of Comparative Economics*, Vol 38, pp 2–16.
Pesaran, M.H., Shin, T., and Smith, R.J. (2001), 'Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics*, Vol 16, pp 289–326.
Phillips, P.C.B., and Perron, P. (1988), 'Testing for a unit root in time series regression', *Biometrica*, Vol 75, pp 335–346.
Ramsey, J.B. (1969), 'Test for specification errors in classical linear test squares regression analysis', *Journal of the Royal Statistical Society*, Series B, Vol 31, pp 350–371.
Ravallion, M., and Chen, S. (2007), 'China's (uneven) progress against poverty', *Journal of Development Economics*, Vol 82, No 1, pp 1–42.
Ravallion, M., and Datt, G. (1996), 'How important to India's poor is the sectoral composition of economic growth?', *World Bank Economic Review*, Vol 10, pp 1–26.
Ravallion, M., and Datt, G. (2002), 'Why has economic growth been more pro-poor in some states

of India than others?', *Journal of Development Economics*, Vol 68, No 2, pp 381–400.
Rodriguez, W. (2005), *Tourism Reality in Costa Rica*, Digital Parliamentary Review, August, San José, Costa Rica.
Sauma, P., and Sánchez, M.V. (2003), *Exportaciones, crecimiento económico, desigualdad y pobreza: el caso de Costa Rica*, Editorial Isis, San José, Costa Rica.
Sauma, P. (2001), *Pobreza, distribución del ingreso e inversión social*, Informe de consultoría realizada para el Proyecto Estado de la Nación, insumo para el VII Informe sobre el Estado de la Nación en Desarrollo Humano Sostenible, San José, Costa Rica.
Schwartz, G. (1978), 'Estimating the dimension of a model', *Annals of Statistics*, Vol 6, pp 461–464.
Sequeira, T., and Nuñes, P. (2008), 'Does tourism influence economic growth? A dynamic panel data approach', *Applied Economics*, Vol 40, No 18, pp 2431–2441.
Suryahadi, A., Suryadarma, D., and Sumarto, S. (2009), 'The effects of location and sectoral components of economic growth on poverty: evidence from Indonesia', *Journal of Development Economics*, Vol 89, No 1, pp 109–117.
Suryahadi, A., Hadiwidjaja, G., and Sumarto, S. (2012), *Economic Growth and Poverty Reduction in Indonesia Before and After the Asian Financial Crisis*, The Smeru Research Institute, Jakarta, Indonesia.
Tang, C. (2011), 'Is the tourism-led growth hypothesis valid for Malaysia? A view from disaggregated tourism markets', *International Journal of Tourism Research*, Vol 13, pp 97–101.
Topalova, P.B. (2008), 'India: is the rising tide lifting all boats?', IMF Working Paper No 08/54, International Monetary Fund, Washington, D.C.
UNCTAD (2008), *The Least Developed Countries Report 2008: Growth, Poverty and the Terms of Development Partnership*, United Nations Conference on Trade and Development, New York.
UNCTAD (2010), *The Least Developed Countries Report 2010: Towards a New International Development Architecture for LDC.s*, UNCTAD, New York.
UNU-WIDER (2008), *The Poverty-Growth-Inequality Triangle in China*, World Institute for Development Economics Research of the United Nations University, United Nations, New York.
Vanegas, M. (2002), *Turismo Creando Riqueza y Actuando Contra la Pobreza en Nicaragua*, paper presented at CANATUR (*Camara Nacional de Turismo*), Second International Congress: Tourism Image and Promotion, Hotel Crown Plaza, Managua, Nicaragua, October.
Vanegas, M. (2012a), 'Poverty elimination through tourism dynamics', in Uysal, M., Perdue, R., and Sirgy, J., eds, *Handbook of Tourism and Quality of Life Research: Enhancing the Lives of Tourists and Residents of Host Communities*, Springer, Dordrecht, London/New York, pp 65–83.
Vanegas, M. (2012b), 'Tourism in El Salvador: co-integration and causality analysis', *Tourism Analysis*, Vol 17, pp 311–323.
Vanegas, M., and Croes, R. (2003), 'Growth, development and tourism in a small economy: evidence from Aruba', *International Journal of Tourism Research*, Vol 5, pp 315–330.
Vanegas, M., and Croes, R. (2007a), 'Tourism, economic expansion and poverty in Nicaragua: investigating co-integration and causal relations', Department of Applied Economics, Staff Paper Series # P07–10, University of Minnesota, Saint Paul.
Vanegas, M., and Croes, R. (2007b), 'Building an econometric nexus between tourism development and poverty in Nicaragua', paper presented at the International Conference on Tourism and Poverty, Managua, Nicaragua, September.
Virmani, A. (2007), 'The sudoku of growth, poverty and malnutrition: policy implications for lagging states', Planning Commission Working Paper No 2/2007-PC.
Warr, P. (2006), 'Poverty and sectoral growth in South Asia', *Asean Economic Bulletin*, Vol 28, No 3, pp 279–302.
White, H. (1980), 'A heteroscedasticity-consistent covariance matrix estimator and a direct test of heteroscedasticity', *Econometrica*, Vol 48, pp 817–838.
World Bank (2012), *World Development Indicators*, World Bank, Washington, DC.
World Bank (2013), 'Data: PPP conversion factor (GDP) to market exchange rate ratio' (data.worldbank.org/.indicator/PA.NUS.PPPC.RF, accessed 1 June 2013).