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Tourism, Development and Growth: International Evidence and Lessons for Cyprus†

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Abstract

We empirically investigate the relationship between tourism specialization, development and economic growth. Descriptive cross-country comparisons indicate a link between tourism specialization and level of development. Econometric analysis shows that tourism specialization is associated with higher rates of economic growth at relatively low levels of specialization but eventually diminishing returns set in and tourism's contribution becomes minimal. Cyprus was one of the success stories of international tourism in the 1980s and 1990s but has since struggled to position itself in the international tourism landscape. Its example illustrates well both the promise and the limitations of tourism-driven economic growth.

Keywords: tourism, tourism specialization, economic growth

JEL: F43, O57

1. Introduction

Tourism and travel is a large and growing sector of the global economy. As world income grows, more individuals can afford the relative luxury of leisure travel. Demand for tourism services is expected to keep growing as more countries reach the stage of development where consumption of leisure services becomes affordable. Many countries have benefited from rising demand by developing vibrant hospitality sectors that generate much-needed foreign currency for the local economy. For many small countries, tourism is the single most important sector of the economy. This has a potential downside, as tourism demand is highly volatile and countries that become dependent on it are susceptible to negative shocks

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that can have a severe impact on the entire economy. The current downturn in the global economy illustrates well the perils of over-dependence on tourism.

In some sense, tourism is to services what clothing is to manufacturing. It requires relatively low levels of technology and basic labour skills. Countries at an early stage of development with suitable natural resource endowments can easily develop successful tourism sectors. The capital investment required is relatively small and unsophisticated. Tourists demand four main types of goods and services: accommodation, food, transportation and entertainment. These services are mostly labour intensive and tourism leads to the creation of many jobs that are primarily low-skilled. The development of a tourism sector can lead to an increase in production, income and employment and foster overall economic growth. Many developing countries have been able to rapidly ascend global income rankings by successfully exploiting their natural resources in this way.

A question that arises is whether there are limits to the extent that tourism can carry an entire economy forward. It seems reasonable to expect that diminishing returns will eventually set in, putting a limit to the extent that the tourism sector can contribute to the enhancement of national well-being. Consider, for example, the impact of labour cost. As a tourism destination develops, wages rise. This will lead to an increase in the price of tourism services, as they are mostly labour intensive. At the same time, other countries might be beginning to develop their own tourism sectors, starting from a lower point of development and offering a similar product at a lower price. Thus a country specializing in tourism will become less competitive as it becomes richer. This theoretical mechanism seems to be consistent with casual empirical observation. For example, traditional Mediterranean destinations such as Spain, Greece, and Cyprus now face tough competition from relative newcomers such as Croatia, Turkey, and Egypt.

The objective of this paper is to present the latest findings of the economic literature investigating the link between tourism specialization and economic growth and to discuss their implications for Cyprus and its tourism sector. Special attention will be given to the hypothesis that tourism specialization can foster economic growth in early stages of development but that tourism's contribution to growth exhibits diminishing returns, possibly becoming negligible beyond some level of specialization. The literature review and econometric analysis will draw heavily on recent work described in more detail in Adamou and Clerides (2010). In relating the findings of the economic literature to Cyprus we will present and discuss evidence on the experiences of other countries that are

in a similar position in Cyprus in terms of natural resource endowments and path of economic development.

The main finding emerging from the econometric analysis is that tourism specialization is associated with a higher growth rate but the relationship is nonlinear. Once a threshold level of specialization is exceeded, tourism no longer contributes to economic growth, even though it can still continue to grow as a sector. This threshold level is estimated to be reached when tourism receipts reach a level of about 20% of GDP. The experience of Cyprus seems consistent with this estimate, as its receipts have hovered around the 20% level for most of the 1990s before starting to decline with the turn of the century. Cyprus is now faced with an urgent need to upgrade its tourism infrastructure in order to remain competitive in the international marketplace.

It should be noted that the development of a large tourism sector has some well-known negative aspects. In addition to the demand volatility mentioned above, tourism development imparts negative externalities on the environment and more generally on local residents' quality of life. Tourists consume a lot of water and energy at prices that often do not reflect the true cost of provision. As tourist destinations become increasingly popular the effects of pollution and congestion begin to compromise the quality of life of local residents and the sustainability of natural ecosystems. The quality of the tourist product itself also begins to suffer as a result. The external effects of tourism are obviously important and we will touch briefly on them in our discussion but they are not the focus of this paper.

The paper is organized as follows. Section 2 provides some historical background and reviews existing empirical literature. Section 3 presents descriptive evidence on the size of the tourism sector in different countries and its relationship with country size and the level of economic development. Section 4 examines the relationship between tourism specialization and growth using both descriptive and econometric analysis. Section 5 relates the findings to the case of Cyprus and discusses their implications for future policy.

2. Background

The mechanics of economic development and the achievement of economic growth lie at the heart of economics. In a classic contribution, Rostow (1959) described how an economy might progress through different stages of development. He argued that economic modernization occurs in five basic stages of varying length - traditional society, preconditions for take-

off, take-off, drive to maturity, and high mass consumption. Each stage is characterized by distinct patterns of investment, consumption and social trends. The process by which societies move through the various stages of development continues to be a subject of debate to this day, as witnessed by the endogenous growth literature that has blossomed since the 1980s. This literature has focused on the determinants of long-run economic growth and has highlighted the important role of human capital, technological progress and institutions in that process. Hundreds of studies have empirically investigated the impact of different factors on economic growth.

Empirical studies seeking to identify the impact of tourism specialization on growth can be classified as either case studies or cross-country comparisons using panel data. The case study approach was dominant for many years because cross-country data were hard to obtain. Some recent examples of studies exploring the link between tourism and growth in particular countries include Balaguer and Cantavella-Jorda (2002) for Spain, Dritsakis (2004) for Greece, Durbarry (2004) for Mauritius and Katircioglu (2009) for Cyprus. These studies rely on econometric techniques such as cointegration and error correction models and typically obtain evidence of a strong relationship between economic growth and tourism receipts.

Lanza and Pigliaru (2000) were first to investigate theoretically the link between tourism specialization and economic growth. They observed that countries with relatively large tourism sectors have two distinguishing characteristics: they exhibit higher than average rates of growth; and they are small. The authors developed a Lucas-type two-sector model with production in one of the sectors (which we shall call tourism) depending on endowments of a natural resource. They show that the country with a relative abundance of the natural resource will specialize in tourism and enter the faster growth path. If small countries are more likely to be relatively resource-rich, as seems likely, then it follows that small countries will specialize in tourism and achieve higher growth rates, as the data seem to suggest.

In one of the first large-scale cross-sectional studies, Brau, Lanza, and Pigliaru (2007) set out to empirically investigate the observations made by Lanza and Pigliaru (2000). They employ a panel dataset of 143 countries, 14 of which are classified as "small tourism countries" (17 countries are classified as "tourism countries"; 14 of them are also classified as small). They try to evaluate the relative growth performance of these 14 countries by regressing economic growth on a set of dummy variables identifying groups of countries (OECD, Oil producers, LDCs, Small) and different control variables. The results indicate that tourism countries grow

significantly faster than all the other sub-groups considered in their analysis. Almost half of the 29 countries classified as "microstates" are heavily dependent on tourism. The authors conclude that small tourism countries perform much better other small countries. In their findings, smallness per se can be bad for growth, while the opposite is true when smallness goes together with a specialization in tourism. These findings are useful but they cannot be considered definitive as the models do not include controls for factors that are considered important in the endogenous growth literature, such as investment and human capital (though they do include controls for some other factors, such as openness to trade and initial income levels).

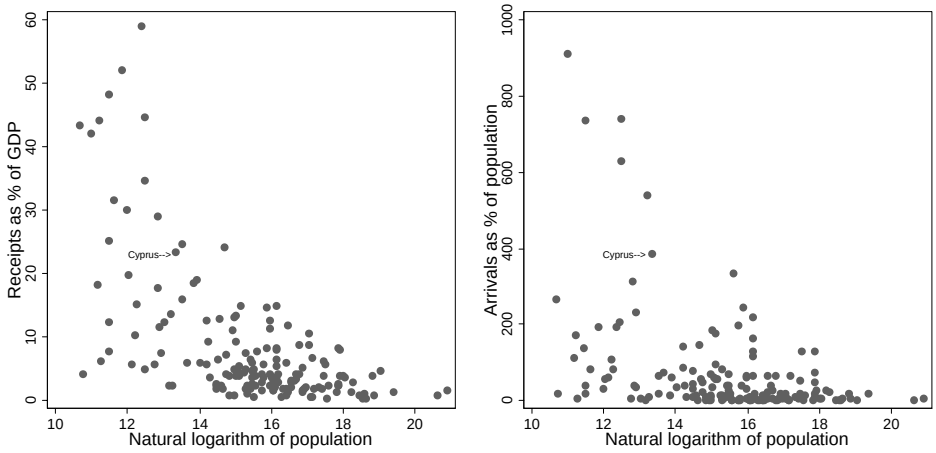
Several recent studies have tried to follow the endogenous growth literature more closely. Eugenio-Martin, Morales, and Scarpa (2004) focus on Latin American countries and employ a dynamic model of economic growth, where they include the growth of the tourism sector as an explanatory variable. They find that tourism growth is associated with higher economic growth in low and medium income countries, but not in high income countries. Sequeira and Campos (2007) also use an endogenous growth approach but do not find evidence linking tourism specialization with higher growth rates. A closely related paper involving one of the previous two authors (Sequeira and Nunes, 2008) uses different control variables and a dynamic panel framework, this time reaching the conclusion that tourism specialization does contribute to economic growth, both in a broad sample of countries and in a sample of poor countries. Cortes Jimenez (2008) focuses on Spain and Italy and studies tourism expansion at both the regional and international level. Domestic tourism is found to be a relevant factor for Spanish growth, whereas international tourism seems to be more important for Italian economic growth. Figini and Vici (2010) try to explain growth in the longer run by looking at the entire 1980-2005 period and also the 1980-1990 and 1991-2005 sub-periods. They find some evidence for a link between tourism specialization and growth only in 1980-1990 but they point out that the data for that this period are not reliable and therefore conclude that there is no robust evidence linking tourism specialization and growth. Adamou and Clerides (2010) take a slightly different approach by allowing for the relationship between tourism and economic growth to take a nonlinear form. They find evidence of a concave relationship, meaning that tourism can contribute to faster growth at relatively low levels of specialization but the impact diminishes as a country becomes increasingly specialized.

3. Tourism specialization, income and size

In this section we present descriptive evidence on the relationship between tourism specialization, level of development and natural resource endowments. We collected annual data on tourism receipts, tourist arrivals and other relevant information for 162 countries during the period 1980-2005 (see Adamou and Clerides (2010) for details on data sources). As is common in the literature, we measure tourism specialization as tourism receipts as a percentage of GDP or as tourist arrivals as a percentage of population.

FIGURE 1

Scatter plot of tourism specialization versus country size



Source: World Development Indicators.

The literature has noted that tourism specialist countries tend to be small. Figure 1 demonstrates that relationship by means of two scatter plots of tourism specialization against country size, measured as the natural logarithm of population. Because we are interested in investigating the possible limits of the tourism sector we use the *maximum* level of specialization achieved during the sample period for each country (for population we use the average over the period). In each plot one can visually trace a downward sloping envelope that could be interpreted as a "possibility frontier" representing the maximum possible specialization for a given level of country size. We hasten to add that there are no theoretical reasons why such a frontier would exist or where it should lie; this is simply what we observe in the data. We have marked Cyprus on the two

plots. It is situated near this frontier in both cases but especially in terms of tourism receipts.

In Table 1 we present some additional information on countries with large tourism sectors in either relative or in absolute terms. The first group of countries include all those with tourism receipts averaging at least 15% of their GDP during the 2001-2005 period. Every one of the 12 countries meeting this criterion is either an island or a group of islands. Most of them are small, the largest one (Fiji) being about twice the size of Cyprus but with roughly the same population. Half of them are quite well off, with a GDP per capital above $15,000, while the rest are poor but perhaps not devastatingly so. By comparison, the six countries with the large tourism sectors in absolute terms are among the richest countries in the world. These countries attract millions of visitors every year and generate substantial income from them, but they cannot be said to be dependent on tourism.

TABLE 1

Countries with tourism receipts greater than 15% of GDP in period 2001-2005

Country	% of GDP	Size(km^2)	Population ('000)	GDP($)/ population	Geographic Location
Aruba	43.5	193	994	21,567	Caribbean
Seychelles	36.3	450	83	16,982	Indian Ocean
Bahamas	32.5	13,880	314	25,036	Caribbean
Barbados	28.2	430	268	22,378	Caribbean
Vanuatu	25.3	12,190	203	4,989	South Pacific
Fiji	23.1	18,270	833	5,924	South Pacific
Samoa	19.6	2,840	182	5,299	South Pacific
Cyprus	19.5	9,250	726	21,844	Mediterranean
Jamaica	18.6	10,990	2,630	8,015	Caribbean
Mauritius	18.5	2,040	1,222	17,013	Indian Ocean
Malta	17.8	320	399	18,811	Mediterranean
Cape Verde	16.6	4,030	484	6,466	Atlantic Ocean
Spain	5.0	505,990	42,026	27,380	Europe
Italy	2.3	301,340	57,705	27,689	Europe
France	2.3[1]	551,500	60,068	28,070	Europe
United Kingdom	1.8	242,910	59,689	28,963	Europe
Germany	1.3	357,030	82,474	29,235	Europe
United States	1.0	9,629,090	290,913	40,095	N. America

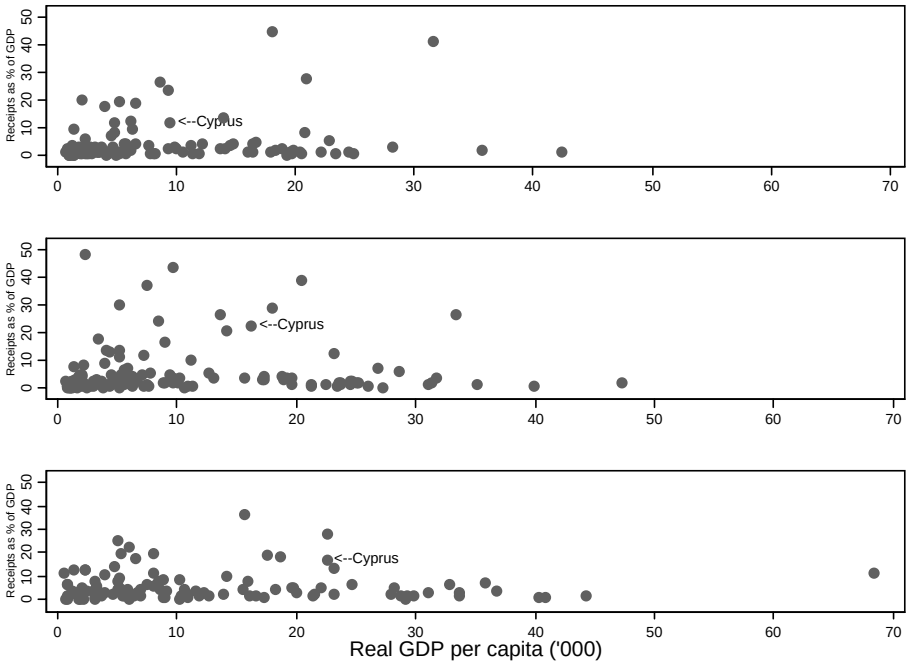
Sources: World Development Indicators, Penn World Tables.

Note: [1] Ratio is for year 2000 due to the lack of data for 2001-2005.

The relationship between tourism specialization and level of development is further explored in Figure 2 by means of scatter plots for the years 1981, 1992, and 2004. Large tourism specialization is typically limited to countries at relatively low income levels, the exceptions being countries like Hong Kong and Luxembourg. Relative to the other two years we observe large dispersion in the data in 1992, reflecting the fact that the 1990s in general were boon years for international tourism. Even as early as 1981, Cyprus was close to the frontier of the income-tourism specialization relationship. In 2004, only country with at least the same income level as Cyprus had more receipts from tourism. We note that looking at similar scatter plots using arrivals instead of receipts does not produce any discernible patterns.

FIGURE 2

Tourism specialization and income, 1981, 1992, 2004



Source: World Development Indicators.

4. Tourism specialization and growth

This section focuses on the link between tourism specialization and economic growth. The relationship is first examined by graphical means,

followed by econometric analysis in the context of an empirical growth framework.

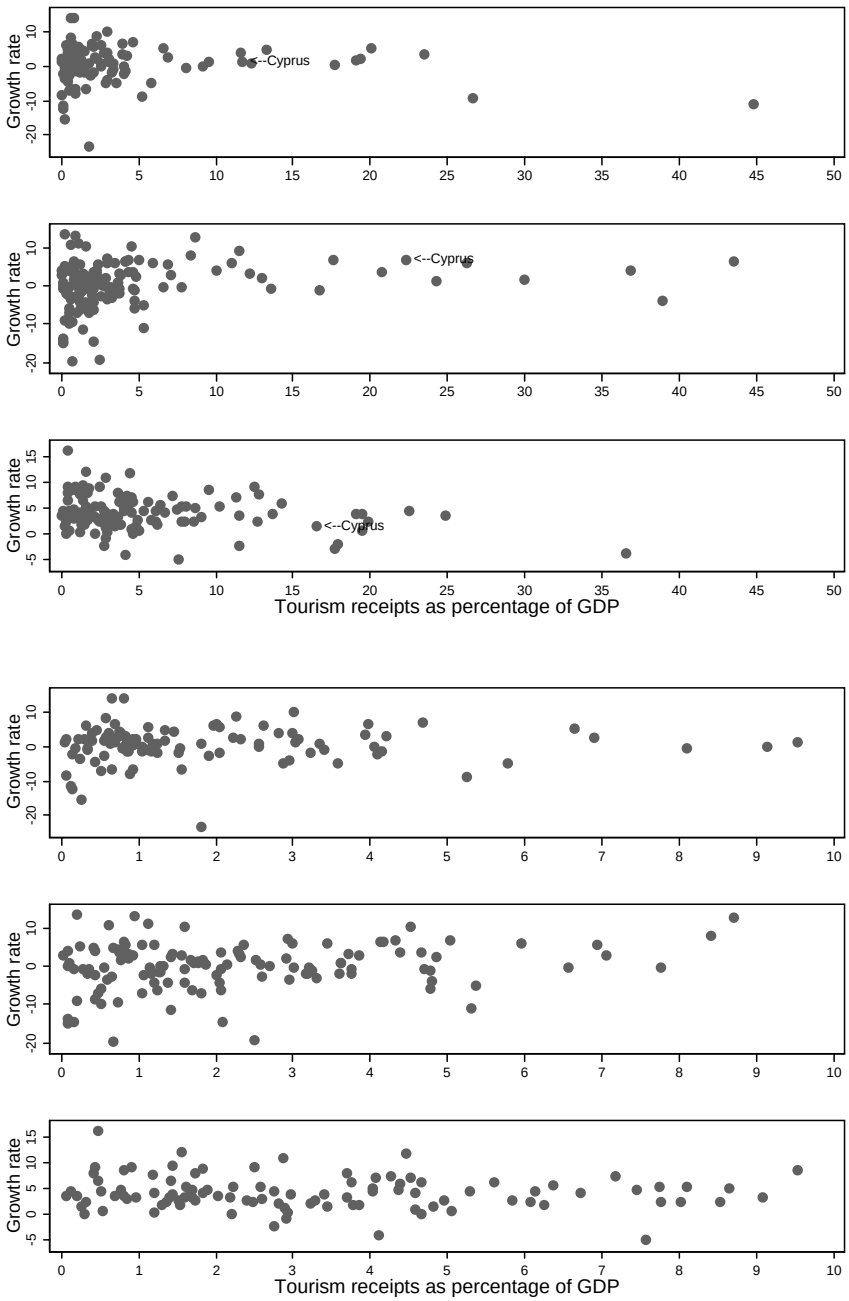
4.1 Graphical analysis

Figure 3 provides scatter plots of the degree of tourism specialization (measured as tourism receipts as a percentage of GDP) and economic growth in three specific years, corresponding to the beginning, mid-point and end of our sample period. Focusing on countries with tourism specialization above 10%, there appears to be a slight negative relationship in years 1981 and 2004 but a positive relationship in 1992. Countries with relatively low specialization are clustered closely together, making it hard to discern any patterns. For this reason in the bottom figure we plotted only observations with tourism specialization below 10%. There is a hint of a positive relationship in 1981 and 1992, while the data for 2004 are quite dispersed. Overall, no clear patterns emerge from looking at the cross-sectional variation presented in these scatter plots.

Figure 4 explores the temporal dimension of the data. We selected the 21 countries that had the highest mean level of tourism specialization during our sample period and plotted the evolution of specialization for these countries over time. Several of them maintained high levels of specialization throughout the sample period. For example, Aruba, Barbados, and the Bahamas maintain receipts above 25% of GDP. A number of countries that started at relatively low levels of specialization increased their dependence on tourism substantially (Samoa, Mauritius, Croatia, Dominica), while several countries that were highly specialized in the 1980s and early 1990s are now exhibiting a downward trend (Bermuda, Bahamas, St Kitts and Nevis, and to a lesser degree Malta, Cyprus, Grenada, Singapore). The fact that so many countries are currently on a downward trend in terms of tourism specialization seems consistent with the hypothesis that there are diminishing returns in that activity. This possibility is investigated more rigorously in the remainder of this section.

FIGURE 3

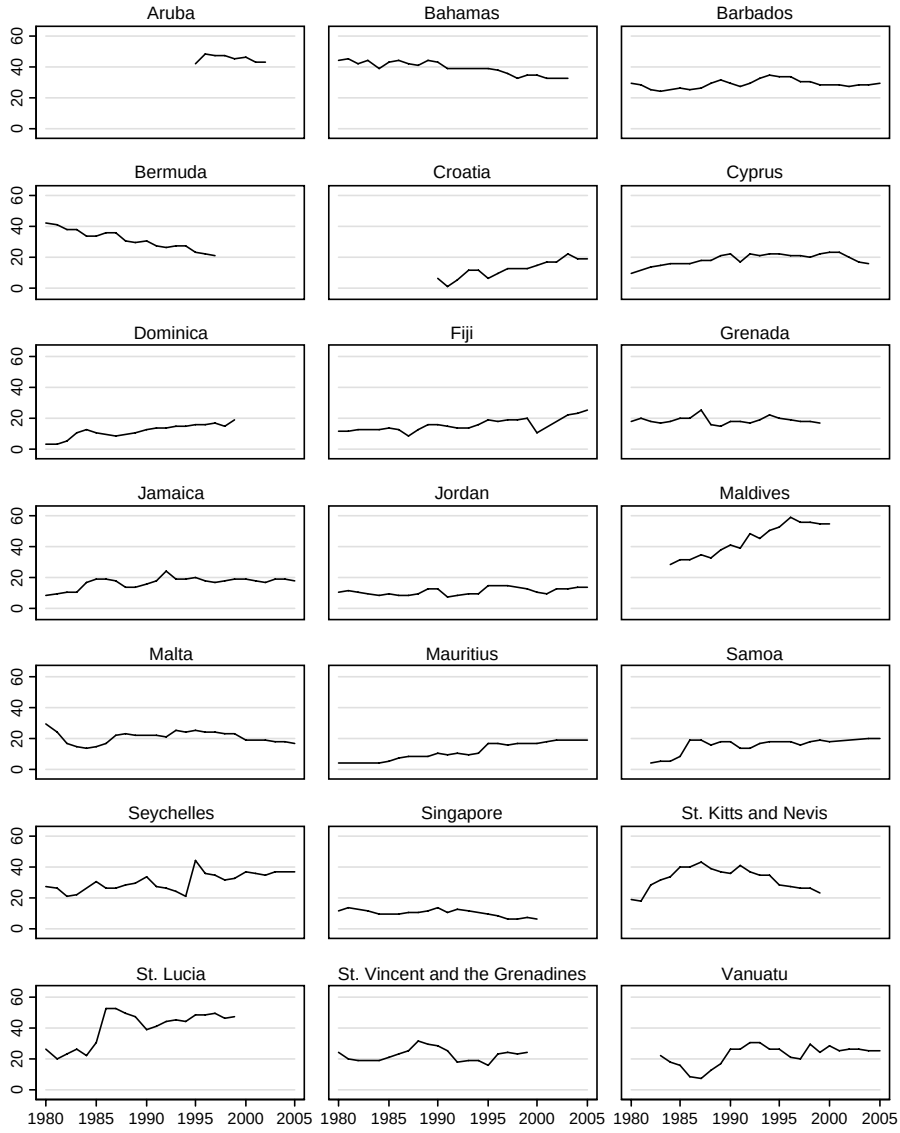
Economic growth and tourism specialization



Source: Adamou and Clerides (2010).
Note: Each figure displays the relationship in three different years: 1981, 1992 and 2004. The top figure uses all data while the bottom figure displays only observations with less than 10% tourism specialization.

FIGURE 4

Degree of tourism specialization over time for "tourism specialist" countries



Source: Adamou and Clerides (2010).

4.2 Econometric analysis

The relationship between tourism specialization and economic growth is the focus of our econometric analysis. We utilize the economic growth regression framework proposed by Barro (1991) and Barro and Sala-i-

Martin (2003). The framework relates the real per capita growth of GDP to two kinds of variables: state variables, which describe the initial state of the economy, and control or environmental variables, which are determined either by government or by the actions of private agents. The key state variables are the stock of physical capital and the stock of human capital. There are many possible choices of control variables, such as investment, the size of government, openness to international trade, and the quality of institutions.

As a pre-cursor to the main results, we first estimated a simple regression of the rate of growth of tourism receipts on just two variables, the degree of specialization (tourism receipts as a percentage of GDP) and its square. The purpose of this regression is to obtain a simple estimate of how the growth rate of receipts varies with specialization. Results obtained using fixed effect estimation are presented in Table 2. When specialization is the included in the regression on its own (without its square) it is positive and statistically significant, indicating a positive correlation between specialization and growth in tourism receipts. When the squared term is included it is estimated with a negative sign, indicating that the relationship is in fact concave. This provides some suggestive evidence that allowing for nonlinearity is important. The estimates imply that the growth rate of receipts is maximized when specialization reaches 36.9%. Receipts continue to grow as specialization increases beyond that point, but at a diminishing rate. Note, however, that this is the point that maximizes tourism growth, not economic growth. As a country can divert resources from tourism to another activity, we expect that the contribution of tourism to economic growth will reach its maximum point at a lower level of tourism specialization.

TABLE 2

Estimates of tourism growth equation

Dependent variable: growth rate of tourism receipts		
Receipts/GDP	0.018**	0.042**
Receipts/GDP squared		-0.00057**

Notes: ** denotes significance at the 1% level. N=3,350.

We now move to the main object of interest, the growth equation. The key results are reported in Table 3 and were obtained using fixed effect estimation on three-year intervals and instrumenting for lagged GDP (full results are provided in the appendix). The estimates are very much in line with the literature. Initial GDP has the expected negative coefficient; it is higher than what Barro and Sala-i-Martin (2003) find but the time period is different. Life expectancy, investment, and openness have a positive impact on long-run growth while government size, inflation and fertility rate have a negative impact (which is not, however, statistically significant). Tourism specialization is statistically significant regardless of whether it is included linearly or quadratically. The quadratic coefficients imply that the growth rate is maximized at a specialization level of 20.8%. This is what we take away as our best estimate of the turnaround point for tourism's contribution to economic growth. The estimate seems consistent with the descriptive evidence presented earlier, where we had observed the tourism sectors of several countries going on a relative decline after peaking at above 20% of GDP.

TABLE 3

Estimates of the economic growth equation

Variables	Estimates	
Lag of GDP (LGDP)	-0.104521**	-0.101713**
Lag of life expectancy	0.000810†	0.000843†
Investment	0.002124**	0.002104**
Government consumption	-0.000529	-0.000625
Openness	0.000291**	0.000269**
Fertility rate	-0.024860	-0.023209
Inflation rate	-0.000398	-0.000427
Receipts/GDP	0.001089	0.003912**
Receipts/GDP squared		-0.000094**

Notes: Significance levels: † : 10%, * : 5%, ** : 1%. N=620.

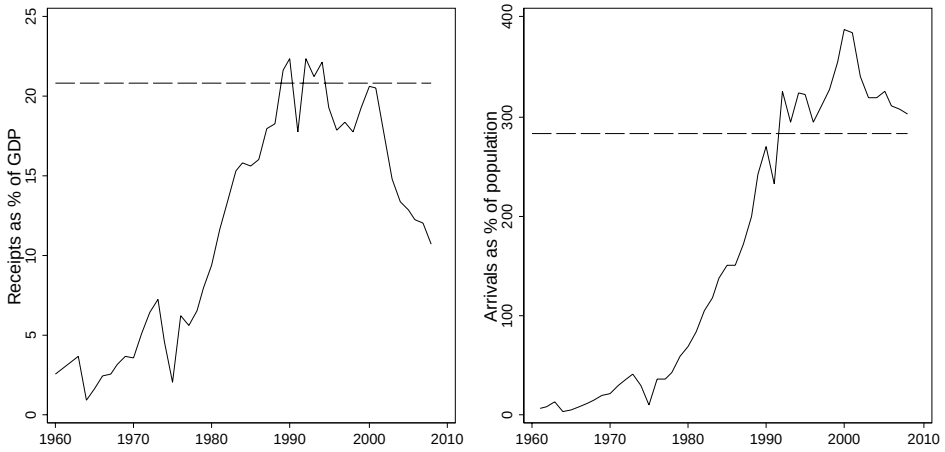
These results are obtained from a panel analysis and are therefore average effects over a large number of countries with diverse circumstances. Clearly each country should decide the extent of its tourism specialization based on its particular characteristics, such as its natural resource

endowment, human capital, and technological level. The general message that comes out of the analysis is that specialization in tourism can yield large dividends to countries at relatively early stages of development, but at the same time these countries should have an eye toward developing new areas of economic activity that will carry their economy further once the potential benefits of tourism are exhausted.

5. The case of Cyprus

Cyprus makes for an illustrative case study of the potential but also the limits of tourism-driven economic growth. Figure 5 displays the evolution of our two indices of tourism specialization (receipts as a percentage of GDP and arrivals as a percentage of population) for Cyprus during the period 1960-2007. Tourism started growing in the mid-1960s but took a big hit from the Turkish invasion of 1974 and the subsequent occupation. The war did not just temporarily disrupt the flow of tourists. More importantly, it led to the loss of much of the tourist infrastructure that had been developed in Famagusta and Kyrenia. In the aftermath of the war policymakers encouraged investment in tourism infrastructure as a way to put the Cyprus economy on a growth path once again. This was successful and led to a quick rebound of the tourism sector in the late 1970s and a phenomenal boom in the 1980s. By the end of that decade receipts from tourism had exceeded 20% of GDP and arrivals had reached 2.5 times the population. The sector stabilized in the 1990s, with the exception of a temporary disruption caused by the 1991 Gulf War. It began showing some signs of decline in the later part of the decade but rebounded around 2000. This proved to be a brief reprieve, however, as the sector exhibited a sharp decline in both receipts and arrivals in the last several years. Receipts in 2007 were 12.1% of GDP while arrivals have hovered around 2.4 million visitors, down from a peak of 2.7 million in 2001. The onset of the global economic crisis in 2008 essentially dashed any hopes of recovery for the sector and has prompted much debate about its future.

FIGURE 5
Trends in tourism receipts and arrivals in Cyprus, 1960-2008



Source: Cyprus Statistical Service.

Perhaps the most troubling trend is that between 2002 and 2008 receipts have declined substantially even though arrivals have held relatively steady. This suggests that spending per visitor has declined. Indeed, Clerides and Pashourtidou (2007) show that receipts per arrival have followed a downward trend in real terms after 2001. The Cyprus Tourism Organization's Strategic Plan for Tourism Development envisioned 3.5 million tourists and receipts in excess of €3 billion for 2010 (Cyprus Tourism Organization 2003). These targets were clearly wide off the mark. In 2008 there were 2.4 million arrivals and receipts were €1.8 billion; both will be even lower in 2009. In real terms, receipts are currently at roughly the same level as they were in the late 1990s.

Recent trends in Cyprus tourism may be disappointing to those involved with the sector but they are consistent with the international evidence presented in the previous two sections. Cyprus has been pushing the limits of its capacity to sustain mass-market tourism for several years now. The sector has essentially remained stagnant in absolute terms during the last decade. It seems likely that the relative magnitude of the tourism sector will continue to decline as the economy diversifies towards financial and legal services that have higher value-added. The tourist sector is longer attractive to Cypriot workers as higher wages and better work conditions can be found elsewhere. Successive governments have permitted the employment of migrant workers to fill the gap. This has provided some temporary relief but at the same time it has created concerns about

diminished quality of service and the disappearance of local character in hospitality services.

Most policymakers and industry actors agree that Cyprus needs to move away from the traditional sun-and-sea model of tourism towards a higher quality, higher value-added product. One of the biggest challenges that must be addressed in order to successfully make that transition is the deteriorating state of the tourist infrastructure. Many of the hotels were built in the 1980s and early 1990s and are by now in need of major renovation. Resort areas were developed hastily without a proper blueprint and are lacking basic amenities such as public transportation, facilities for pedestrians and bicyclists, parks and other public areas. In customer satisfaction surveys, visitors consistently express dissatisfaction with the state of the infrastructure and the natural environment (Clerides, Filippou, Pashardes and Pashourtidou 2009). Private investment in the sector has been channelled into new structures but not on upgrading existing ones. As result, productivity in the sector has been stagnant (Mamuneas and Pashardes 2003).

The CTO's 2003 Strategic Plan recognized this problem and highlighted the importance of upgrading the quality of the Cypriot tourist product. But although the maximization of tourism revenue was stated as the over-arching goal, most of the more specific numerical targets (increase in arrivals, longer stays, increase in winter tourism, etc.) focused on quantity rather than quality. Successive Cypriot governments have been painfully slow in implementing much-needed infrastructure projects such as marinas and golf courses. In this uncertain environment, the private sector has been reluctant to proceed with large-scale investments of its own.

A successful transition away from mass tourism and toward a more diversified and higher quality product will benefit the Cypriot economy in a number of ways. Tourists impose several negative externalities such as congestion and use of scarce resources that are not usually priced in the competitive marketplace. Focusing on attracting high-quality tourism and maximizing income per visitor rather than number of arrivals or overnight stays will reduce the environmental burden of tourism. Moreover, the provision of high value-added services will create high quality jobs. For example, the development of an infrastructure to attract visitors interested in Cyprus' cultural heritage will generate a need for historians and other professionals for work in museums and historical sites. Countries like France and Italy are good examples of how that can be accomplished. They demonstrate that a high level of development is not incompatible with the existence of a vibrant tourism sector.

Appendix

Econometric Estimates

Estimation of this economic growth equation presented in section 4 requires making several decisions with regard to modelling, specification and choice of estimation method. One issue concerns the length of the time interval that is to be considered as a single observation. Growth models are designed to measure the impact of different factors on long-run growth. Established practice is to arrange the variables in five- or even ten-year intervals, rather than use annual data, in order to focus on the long-run effects and to minimize the impact of measurement errors and of cycles in variables. Because our sample is short, we use three-year intervals. We use the ratio of receipts to GDP as our primary index of tourism specialization. The model was estimated using both fixed and random effects but the random effects estimator was rejected on the basis of the Hausman test.

Results from fixed effect estimation using three-year intervals are reported in Table 4. In addition to the variables listed, our models include time effects (dummy variables for each time period), which we do not report in the interest of brevity. The first two columns present results without instrumenting for potentially endogenous variables while in the last two columns lagged GDP is instrumented for. The difference between the first and second column (and between the third and the fourth) is the inclusion of the squared specialization term in the second (and fourth) column. The quadratic coefficients imply that the growth rate is maximized at a specialization level of 36.4%.

Several of the right-hand side variables are likely to be endogenous and the literature typically proceeds by instrumenting those variables using their lagged values as instruments. In the last two columns we present results obtained when lagged GDP is instrumented using first and second lags as instruments. Standard tests perform well. The null hypothesis of under-identification is rejected while the Sargan test of over-identifying restrictions does not reject the null hypothesis that the instruments are valid.

Further details and estimates from alternative specifications can be found in Adamou and Clerides (2010).

TABLE 4

Fixed effect estimates of economic growth equation

Variables	No instruments		LGDP instrumented	
Lag of GDP (LGDP)	-0.1005** (0.0077)	-0.1011** (0.0076)	-0.1045** (0.0182)	-0.1017** (0.0180)
Lag of life expectancy	0.0011** (0.00041)	0.0011** (0.00035)	0.00081† (0.00047)	0.00084† (0.00046)
Investment	0.0013** (0.00035)	0.0013** (0.00035)	0.0021** (0.00043)	0.0021** (0.00042)
Government consumption	-0.00076† (0.00041)	-0.00077† (0.00041)	-0.00053 (0.00053)	-0.00062 (0.00053)
Openness	0.00028** (0.000081)	0.00026** (0.000081)	0.00029** (0.000097)	0.00027** (0.000096)
Fertility rate	-0.025* (0.012)	-0.024* (0.012)	-0.025 (0.015)	-0.023 (0.015)
Inflation rate	-0.00092** (0.00026)	-0.00093** (0.00026)	-0.00040 (0.00028)	-0.00043 (0.00028)
Receipts/GDP	0.0020** (0.00056)	0.0041** (0.00096)	0.0011 (0.0007)	0.0039** (0.0012)
Receipts/GDP squared		-0.000057** (0.000021)		-0.000094** (0.000030)
Constant	0.84** (0.069)	0.84** (0.068)		
Wald test	21.90**	21.16**	12.20**	11.99**
Observations	876	876	620	620
Under-identification test			0.000	0.000
Sargan test			0.337	0.384

Notes: Significance levels: † : 10%, * : 5%, ** : 1%. Standard errors are reported in parentheses. Time fixed effects were also included but are not reported for brevity.

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