Medical Tourism and Economic Development

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Abstract: This paper considers welfare and wage inequality effects of developing medical tourism on the host country. Due to the competition between public healthcare provision and medical tourism, the development of medical tourism might widen wage inequality via the increased wage rates of healthcare workers and decreased wage rates of production workers. In addition, the expansion of medical tourism can lower social welfare of the host country through a decline in workers’ productivity caused by reduced public healthcare provision. This paper empirically investigates the economic influence of medical tourism by considering this crowding-out effect. The results confirm the positive impact of medical tourism on the host economy’s output growth. Nonetheless, the output contribution of medical tourism could be overestimated by 29.6 percent if the unfavorable indirect productivity effect is not taken into account. This paper proposes a tax-subsidy scheme to mitigate the unfavorable productivity effect of medical tourism on the host economy.

JEL classifications: F10, O15
Keywords: Medical tourism, labor productivity, economic development

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1. Introduction

Medical tourism refers to the phenomenon in which people travel abroad to access medical treatment. Recently, many countries have employed medical tourism as development and trade strategies to stimulate the economy, particularly after the global financial crisis in 2008. In addition, since the 1997 Asian financial crisis, many countries in Asia have sought to promote medical tourism to bring in foreign exchange. Governments in Southeast Asia, like Malaysia, Singapore, and Thailand, have implemented various policies and programs to attract foreign patients and establish a name for themselves as world-class medical hubs. The initiatives taken to promote this industry have been successful, and medical tourism exports in Asian countries have subsequently grown at double-digit rates in recent years. For example, the medical tourism industry in Thailand has become the largest in the world, generating revenue of US$3.2 billion in 2011 and between US$4.0 billion to US$4.7 billion in 2012—representing a growth rate of at least 25% (Thailand Board of Investment, 2014). Medical tourism revenue accounted for as much as 0.93% and 1.09% of Thailand’s gross domestic product (GDP) in 2011 and 2012, respectively. Likewise, Singapore’s medical tourism revenue in 2011 was worth approximately S$980 million, representing 0.28% of Singapore’s 2011 GDP (Medical Tourism Association, n.a.).

Apart from countries in Asia, a strong interest in promoting the medical tourism sector can be seen in other parts of the world. Countries in Latin America, such as Mexico, Brazil, and Colombia, have invested heavily in their healthcare infrastructure to attract patients from North America. Some Eastern European countries, like Hungary, the Czech Republic, and Poland, have also established themselves as regional medical destinations, targeting patients from Western Europe. The surge of medical tourists in Europe prompted the adoption of the “Directive 2011/24/EU on patients’ rights in cross-border healthcare” in March 2011, which solidified the rights of the citizens in the European Union to look for medical treatment in the member states. In the Middle East, Israel, Turkey, and the United Arab Emirates have also actively invested to develop their healthcare system to attract foreign patients from neighboring countries and Europe.
For example, Dubai revealed a master plan in 2014 to build 22 hospital facilities in order to boost its economy by up to Dh2.6 billion by 2020 (Kannan, 2014).

In the literature, this worldwide interest in promoting medical tourism can be attributed to three main factors. First, medical tourism revenue is recognized as an alternative form of exports that can generate foreign exchange revenue to improve a country’s balance of payments. Second, medical tourism helps improve the access to and quality of domestic healthcare (Helble, 2011). This is because in order to appeal to foreign patients, private healthcare providers in host countries have made significant investments to upgrade their healthcare facilities and train highly skilled healthcare workers. In addition, foreign direct investments in healthcare facilities in host countries, encouraged through various tax incentives, provide additional resources for investments, which can result in technology and knowledge transfer (Hanefeld & Smith, 2015; Pocock & Phua, 2011). Moreover, to signal the quality of healthcare facilities, many private healthcare providers establish linkages with reputed United States healthcare providers, such as Harvard Medicine, the John Hopkins Hospital, and the Memorial Sloan-Kettering Cancer Center (Bookman & Bookman, 2007), and acquire accreditation from Joint Commission International, which is an international scheme providing accreditation to healthcare organizations (Herrick, 2007). These initiatives not only raise the country’s profile in medical tourism, but also benefit the local population by enabling access to contemporary, high-quality healthcare facilities. Third, the expansion of medical tourism increases employment opportunities in the healthcare sector. The presence of high-quality healthcare facilities not only stems the outward migration of highly skilled healthcare personnel to other countries (‘external brain drain’), but also encourages those living abroad to return home (Hanefeld & Smith, 2015; Helble, 2011; Pocock & Phua, 2011).

Despite the favorable effects of medical tourism, a number of researchers have raised serious questions regarding the potential adverse impacts of the development and promotion of the medical tourism industry to the host economy, since it may cause the diversion of healthcare services catering to foreign patients, such as cosmetic surgery, cardiology, and ophthalmology.
The diversion of domestic healthcare facilities to meet foreign patients’ needs generates a shortage of already-insufficient health professionals in primary and preventive healthcare areas that are relied on by the local population (Cattaneo, 2009; Helble, 2011; Chen & Flood, 2013). As a result, the healthcare system suffers without additional resources, thereby contributing to the emergence or strengthening of the two-tier (public and private) health system commonly found in developing countries, such as Thailand and Malaysia (Bookman & Bookman, 2007; Pocock & Phua, 2011, Reisman, 2015).

In addition, to attract foreign patients, private healthcare providers in the host country tend to invest enormous amounts in high-technology medical equipment and to offer personalized nursing care and quick access to specialists, radiology, and so forth (Whittaker, 2015). For example, private hospitals in Bangkok have a higher concentration of the latest cutting edge medical equipment, such as computed tomography scanners, Gamma Knife machines and mammography equipment, than do all health facilities in England (Arellano, 2007). Thus, increases in foreign demand for healthcare services via medical tourism can drive up the prices of local healthcare services (NaRanong & NaRanong, 2011), thereby making healthcare less affordable for local residents.

Further, although medical tourism can help prevent external brain drain, it can exacerbate internal brain drain because health workers—especially highly skilled and experienced health professionals—in the public healthcare sector of the host country are attracted to work in the private sector due to its more appealing remuneration packages (Chen & Flood, 2013). Outflow of health workers reduces the already-insufficient medical resources serving the majority of the local population in the public-provided healthcare sector. This may lead to endangering the existence of the public healthcare system.

Although many developing countries have favored the development of medical tourism on economic grounds, the issue of whether or not medical tourism genuinely benefits the local population of the host country remains open for debate. Despite the importance of this issue, it
remains under-explored because of the lack of reliable and quality data associated with medical tourism. Unlike general tourism data from countries around the world, which are being gathered by the United Nations World Tourism Organization (UNWTO) into a vast database, medical tourism data by country are scarce, scattered, and not yet collected in a systematic manner because this industry is still considered in its early stage. This paucity of medical tourism data makes empirical investigation challenging. Using data provided by Thailand’s Ministry of Commerce, NaRanong and NaRanong (2011) estimated the total revenue and value added from medical tourism in Thailand from 2006 to 2012. However, they did not single out the economic cost of medical tourism. Recently, Beladi et al. (2015) investigated the product-variety-induced effects of medical tourism for the host country. They showed that an increase in medical tourism helps retain skilled healthcare workers in the host country due to an increase in wage rates in the medical tourism industry; however, it creates internal brain drain and raises the prices of public healthcare services, which results in reduced local residents’ access to healthcare services. However, the study did not provide empirical evidence to support the theoretical findings. Nonetheless, the authors highlighted the need to consider the trade-off between the benefits from tourism exports and migration retention, and the economic cost of medical tourism when devising strategies to promote varieties of medical tourism.

The purpose of the current paper is to fill this research lacuna. The contributions of this study to the emerging medical tourism literature are as follows. First, it investigates the effects of developing medical tourism on the host country by considering whether or not the development of the medical tourism sector may yield a crowd-out effect by reducing the public healthcare provision to production workers in the host economy. In particular, using a general-equilibrium model, this study addresses the internal reallocation of medical workers and its associated crowding-out effect on labor productivity. This study indicates that, due to the competition between public healthcare provision and medical tourism, development of the medical tourism sector can worsen wage inequality via the increased wage rate of healthcare workers and decreased wage rate of production
workers. In addition, this study demonstrates that the expansion of medical tourism can lower social welfare of the host economy through a decline in workers’ productivity caused by reduced public health provision. Second, using a set of multiple-country medical tourism revenue data, manually extracted from health and wellness tourism reports from Euromonitor International, this study empirically supports the theoretical predictions and implications derived in the model about the positive direct revenue and negative indirect productivity effects of medical tourism on the economy. The empirical findings also indicate that the economic contribution of medical tourism would be substantially overestimated by 29.6 percent if the unfavorable indirect productivity effect is not taken into account. The findings also show that the overestimation becomes larger in non-OECD countries. Third, this study proposes that the unfavorable effects of medical tourism on the host economy can be mitigated or reversed if a production subsidy—financed by the revenue from a tax on medical tourism—is provided to the domestic healthcare sector. Under this compensation scheme, the development of medical tourism could benefit the host country by increasing the wages of production workers and improving the welfare of the country.

This study is related to three strands of literature. First, this paper adds to the growing literature on the socioeconomic implications of medical tourism. Previous studies have mainly addressed on a descriptive analysis of the favorable and unfavorable effects of the development and promotion of the medical tourism industry on the host country, especially on the host country’s healthcare system (Barros, 2015; Cattaneo, 2009; Chanda, 2002; Chen & Flood, 2013; Helble, 2011; Pocock & Phua, 2011; Whittaker, 2015). Using existing descriptive evidence, Chen and Flood (2013) examined the influence of medical tourism on the accessibility and equity of healthcare in low- and middle-income countries. They concluded that an increase in medical tourism in those countries is likely to reduce healthcare services available to the local population. They also stated that the current realization of the potential benefits from developing the medical tourism industry does not appear to outweigh its unfavorable effects on equitable healthcare access. Echoing the recommendations of other researchers on the need to create a proper global governance system to
regulate medical tourism, Chen and Flood (2013) stressed the importance of ensuring international collaboration between sending and host countries to ensure the net positive effects of medical tourism on host countries. In line with other studies (Blouin, 2010), the authors also suggested that host countries implement policies that use part of profits from medical tourism to cross-subsidize the public healthcare sector.

In regard to empirical studies, Pachanee and Wibulpolprasert (2006) analyzed the foreign patients’ demand for physicians, and concluded that medical tourism does not constitute a major factor to the existence of the internal brain drain in Thailand. However, NaRanong and NaRanong’s (2011) estimation suggested that patients’ demand for physicians by foreigners in Thailand may be three times higher than the estimation by Pachanee and Wibulpolprasert (2006), thus indirectly lending support to the hypothesis that foreign patients compete with local residents for healthcare resources. The current study also relates to Beladi et al. (2015), as already discussed. However, the current study differs from the existing literature because it develops a theoretical model to investigate the economic implications of medical tourism on the host country by emphasizing the crowding-out effect of medical tourism disadvantaging local residents. Further, this paper provides a comprehensive study to probe the empirical relationships between medical tourism and output growth, and quantify the crowding-out effects of developing the medical tourism industry on the public healthcare system of the host country.

Second, since medical tourism is a special niche of tourism, this study also fits into the vast body of tourism literature examining the costs and benefits of tourism on the economy. Previous empirical studies examining the tourism–growth nexus were single-country studies (Balaguer & Cantavella-Jorda, 2002; Dritsakis, 2004; Oh, 2005) and multiple-country studies (Brau et al., 2007; Chou, 2013; Holzner, 2011; Lee & Chang, 2008). In general, most studies found that tourism and economic growth are positively related (Balaguer & Cantavella-Jorda, 2002; Chou, 2013; Dritsakis, 2004; Lee & Chang, 2008). However, using the data of South Korea, Oh (2005) could not conclude the long-term tourism-led growth hypothesis. The current study departs from the literature by
focusing on the productivity channel of medical tourism on output growth, instead of the general tourism–growth relationship.

Third, the model developed in this study is related to the tourism literature that considers the Dutch Disease effect. Corden and Neary (1982) were the first to examine the Dutch Disease effect in a small, open economy. Copeland (1991) investigated the Dutch Disease effect in the context of tourism in a static general-equilibrium setup and showed that an increase in tourism activities can enhance welfare of the host country through an improvement in the so-called tourism terms of trade. He further showed that, if capital is internationally mobile, the expansion of the tourism sector could contract the manufacturing industry of the economy and hence reduce the gains from an increase in tourism. Chao et al. (2006) obtained similar results in regard to the Dutch Disease phenomenon in tourism by extending the model to a dynamic-specific factor setting. Based on Copeland’s (1991) static model and Chao et al.’s (2006) dynamic model, Holzner (2011) empirically investigated the Dutch Disease effect using a set of more than 130 tourism-dependent countries for a period of almost four decades. However, Holzner’s (2011) findings did not find the crowding-out effect that an increase in tourism causes a contraction of the manufacturing sector. The current study differ from their work by addressing the detrimental crowding out effect induced by the expansion of medical tourism on the economy through a reduction in labor productivity. This echoes the serious concerns about the adverse effects of medical tourism, frequently been raised by researchers on medical tourism.

The organization of this paper is as follows. Utilizing a general-equilibrium framework, in section 2 this study probes the welfare and income distribution effects of a rise in medical tourism activities on the host country without any compensation scheme. Section 3 proposes a complementary policy to mitigate the unfavorable effect caused by medical tourism activities on the host country. Section 4 provides empirical support for the theoretical findings on the output effect of medical tourism to the economy. Finally, Section 5 presents this study’s concluding remarks.
2. The model

This study considers an open economy that comprises three sectors: the goods sector, \( X \); public healthcare sector, \( Y \); and medical tourism sector, \( Z \). The goods \( X \) are traded internationally, while public healthcare services and medical tourism goods are initially non-tradable. By selecting goods \( X \) as the numeraire, the domestic prices of the public healthcare services, \( Y \), and medical tourism goods, \( Z \), are presented respectively by \( p \) and \( q \), which are determined in the host country.

The host country receives foreign tourists for medical tourism, while domestic consumers demand traded goods, \( D_X \); healthcare services, \( D_Y \); and medical tourism, \( D_Z \). Following Brander and Spencer (1985), for analytical tractability, we adopt a quasi-linear utility function, \( U(D_X, D_Y, D_Z) = D_X + u(D_Y) + v(D_Z) \) with \( u'( \cdot ) > 0 \) and \( v'( \cdot ) > 0 \), in modelling the demand behavior of domestic consumers. Under quasi-linear preference, the focus of the analysis is on the price effect, rather than the income effect, as noted in Singh and Vives (1984).\(^1\) This is not a stringent assumption to model medical tourism since it is a price-elastic good. For example, attractive prices make Thailand a medical tourism hub in Asia. Welfare maximization hence yields the first-order conditions for healthcare services and medical tourism by domestic consumers as \( u'(D_Y) = p \) and \( v'(D_Z) = q \), and the corresponding demand functions are given by: \( D_Y = D_Y(p) \) and \( D_Z = D_Z(q) \). The (inverse) demand function for public healthcare services, \( Y \), can therefore be expressed by: \( p = p(D_Y) \), with \( p' = u''(D_Y) < 0 \). Because public healthcare is non-traded service, domestic demand, \( D_Y \), equals the supply, \( Y \), provided in the host economy. This gives: \( D_Y = Y \) and hence \( p = p(Y) \).

In contrast, foreign tourists visit the host country by demanding medical tourism goods, \( D_Z(q, T) \), where \( T \) denotes a shift variable to capture their medical tourism activities, such as the number of foreign tourists seeking medical treatment, with \( \partial D_Z / \partial q < 0 \) and \( \partial D_Z / \partial T > 0 \).\(^2\) Since medical tourism goods are non-traded, the equilibrium condition requires its total demand equal the domestic supply in the host economy:

\[
D_Z(q) + D_Z(q, T) = Z, \tag{1}
\]
where domestic supply of medical tourism, \( Z \), will be determined later. Thus, the domestic price, \( q \), of medical tourism is endogenously determined. This suggests that formally non-tradable goods can become tradable via medical tourism.

In the production side of the host economy, the traded good sector produces good \( X \) by employing production workers, \( L_X \), and domestic capital, \( K_X \), under a constant returns-to-scale technology: \( X = X(aL_X, K_X) \), where \( a \) expresses the health status of production workers and is positively associated with the healthcare services received—that is, \( a = a(Y) \) with \( a'(Y) > 0 \). This productivity-externality effect is the unique feature for modelling medical tourism in a general equilibrium setup since it can crowd out healthcare services to production workers, as shown below.\(^3\) Therefore, \( aL_X \) measures the effective labor input in the production of good \( X \), and the corresponding effective wage rate is \( w_L/a \), where \( w_L \) denotes the wage rate of production workers—that is, \( \partial X/\partial L_X = w_L \). By considering the assumptions that the market of the good \( X \) is perfectly competitive and internationally traded. By setting its price to unity, the condition of zero profit must be satisfied:

\[
c^X(w_L/a, r) = 1, \tag{2}
\]

where \( c^X(\cdot) \) expresses the unit cost function of producing good \( X \), and \( r \) stands for the rate of returns on domestic capital.

Consider the public healthcare sector, \( Y \), in the host economy. Producing healthcare services requires variable healthcare workers, along with fixed equipment or capital input. Hence, the total cost for the production of public healthcare services, \( Y \), is: \( C^Y(w_S, r, Y) = F(r) + m(w_S)Y \), where \( w_S \) denotes the wage of healthcare professionals. The host government provides public healthcare services for welfare consideration. The associated welfare, \( W \), can be captured by consumer surplus, \( CS \), and profit, \( \pi_Y \), where \( CS = u(D_Y) - p_DY \) and \( \pi_Y = p(Y)Y - C^Y(w_S, r, Y) \).\(^4\) Hence, this leads to: \( W = u(D_Y) - C^Y(w_S, r, Y) \). Maximizing welfare \( W \) yields:

\[
p(Y) = m(w_S). \tag{3}
\]
Equation (3) gives the marginal cost pricing for the public healthcare services. That is, the provision of public healthcare services, $Y$, depending entirely on the cost of healthcare workers, involves a loss of fixed capital cost.

The market of the medical tourism sector in the host economy is considered perfectly competitive. In many countries, medical tourism has been rapidly developed in the last decade. Due to keen competition, advanced foreign medical equipment and treatment are often employed to attract customers. In equilibrium, the unit cost from hiring domestic healthcare workers and using foreign medical equipment and treatment is equal to its domestic price:

$$c^Z(w_S, r^*) = q, \quad (4)$$

where $r^*$ denotes the user cost of foreign medical equipment and treatment.

For the general-equilibrium framework, it is necessary to consider the factor markets of the host economy. There are $L$ production workers employed in the traded good sector, $X$, while its effective labor supply is $aL$, adjusted by the health condition of workers by noting $a = a(Y)$ with $a' > 0$. In equilibrium, this leads to:

$$c^X(w_L/a, r)X = aL. \quad (5)$$

Note that $c^X = \partial cX/\partial(w/a)$, being the effective labor demand for producing one unit of goods $X$.

Moreover, the market equilibrium condition for healthcare workers requires its demand equal its supply:

$$m_w(w_S)Y + c^Z(w_S, r^*)Z = S. \quad (6)$$

The left-hand side of Equation (6) expresses total demands of healthcare workers by the sectors of healthcare provision and medical tourism, while the supply of healthcare professionals in the host economy is given by $S$.

Finally, the equilibrium conditions of domestic capital and foreign medical equipment or technology are respectively given by:

$$c^X_r(w_L/a, r)X + F_r(r) = K, \quad (7)$$
\[ c_r^Z(w_S, r^*)Z = K^*, \quad (8) \]

where \( K \) expresses domestic capital in the host country and \( K^* \) is the demand for foreign medical equipment or technology.

This specifies the model of the host economy with the existence of a medical tourism sector, \( Z \). This model has eight endogenous variables \( (q, w_L, w_S, r, X, Y, Z, K^*) \), along with an exogenous variable for foreign medical tourism activities, \( T \), as stated in Equation (1). The system is stepwise recursive: Equation (1) determines the domestic medical tourism price, \( q \), while the remaining seven equations describe the supply-side variables that are functions of the medical tourism price, \( q \).

2.1 Price effect of medical tourism

Figure 1 depicts the effects of changes in the medical tourism price, \( q \), on the supply-side variables of the economy. Note that schedules \( YY \) and \( ZZ \) in the northeast quadrant express, respectively, the goods market equilibrium conditions of healthcare services and medical tourism, as stated in Equations (3) and (4). Initially, the equilibrium is at point \( a \). From Equation (4), a rise in the price, \( q \), of medical tourism (by shifting schedule \( ZZ \) to \( ZZ' \) and consequently moving the equilibrium point from point \( a \) to \( b \)) increases the demand for healthcare workers; hence, their wage rate rises:

\[ \frac{\partial w_S}{\partial q} = 1/\varepsilon^Z_{ws} > 0. \quad (9) \]

However, a higher cost of healthcare workers lowers the provision of public healthcare services in sector \( Y \) according to Equation (3):

\[ \frac{\partial Y}{\partial q} = (m_u/p')(\varepsilon w_S/\partial q) < 0. \quad (10) \]

The fall in output, \( Y \), of the public healthcare service sector lowers the demand for domestic capital expressed by Equation (7), thereby lowering the capital rental rate as:

\[ \hat{r} = g \lambda KX \theta_X/X > 0, \quad (11) \]
where \( \hat{Y} = dY/Y \) and \( A > 0 \). It is noted that \( \lambda_{ij} \) and \( \theta_{ij} \) in Equation (11) denote, respectively, the employment and cost shares of factor \( i \) in sector \( j \) (c.f., Jones, 1965), while \( g = (da/a)/(dY/Y) \) expresses the percentage change of the effective measure of labor demand in sector \( X \). This relationship is depicted in schedule \( KK \) in the southeast quadrant of Figure 1.

Moreover, from Equation (5), the reduced health service, \( Y \), lowers labor productivity in sector \( X \) and hence reduces the output of good \( X \) by:

\[
\hat{X}/\hat{Y} = g(s_{KX} + \theta_{KX}s_{KY})/A > 0,  \tag{12}
\]

where \( s_{KX} = \sigma_X \lambda_{KX} \theta_{LX} \) and so forth, and \( \sigma_X \) signifies the factor substitution of labor and capital in sector \( X \). This leads to reductions in the demand for production labor and domestic capital in sector \( X \). Further, the lowered rate of domestic capital returns, expressed in the southeast quadrant of Figure 1, results in a factor substitution effect by using more capital for labor. This places a pressure on the wage rate of production workers. From Equation (2), the market equilibrium condition of good \( X \), the overall change in the wage rate and then the rental rate can be solved as:

\[
\theta_{LX} \hat{w}_L + \theta_{KX} \hat{r} = g \theta_{LX} \hat{Y}.  \tag{13}
\]

Solving Equations (11) and (13) leads to:

\[
\hat{w}_L/\hat{Y} = g[\lambda_{KX}(\sigma_X - \theta_{KX}) + \lambda_{LX} \theta_{LX} s_{KY}]/A,  \tag{14}
\]

Therefore, this leads to: \( \hat{w}_L/\hat{Y} > 0 \) if \( \sigma_X > \theta_{KX} \). Thus, the wage of production workers can be lower \((d\hat{w}_L/dq < 0)\) when the factor substitution effect between domestic capital and production workers in sector \( X \) is sufficiently large. This result is illustrated in Figure 1. As expressed in the southwest quadrant of Figure 1, the decrease in domestic healthcare services, \( Y \), causes the iso-unit cost curve to shift inwards from \( c^X \) to \( c^Y \), yielding a lower wage rate for production workers in sector \( X \) (that is, \( d\hat{w}_L/dq < 0 \)).

Note that a rise in \( q \) lowers the production of good \( Y \) by Equation (10). This causes a movement of healthcare workers away from the healthcare sector, \( Y \), into the medical tourism sector, \( Z \). From Equation (6), the output of medical tourism rises by:
\[
\dot{Z}/\dot{q} = \left(\frac{s_{SY} + s_{SZ}}{\lambda_{SZ}}(\dot{W}_{S}/\dot{q}) - \left(\frac{\lambda_{SY}}{\lambda_{SZ}}\right)(\dot{V}/\dot{q})\right) > 0.
\] (15)

This gives the supply function of the domestic medical tourism goods as \( Z = Z(q) \), with \( \partial Z/\partial q > 0 \).

From Equation (1), it is possible to solve the effect of an expansion of the medical tourism sector from more foreign tourists on the domestic price of medical tourism, as follows:

\[
\frac{dq}{dT} = \frac{(\partial DZ^*/\partial T)}{B} > 0,
\] (16)

where \( B = \partial Z/\partial q - \partial DZ/\partial q - \partial DZ^*/\partial q > 0 \).

2.2 Welfare effect of medical tourism

This subsection considers the effect of developing the medical tourism industry on domestic welfare, where domestic consumers’ preference is: \( U = D_X + u(D_Y) + v(D_Z) \), with \( D_Y = D_Y(p) \), \( D_Z = D_Z(q) \) and \( D_X = I - pD_Y - qD_Z \). National income, \( I \), consists of GDP net of the payment to foreign capital: \( I = X + pY + qZ - r^*K^* \). The indirect utility function is thus given by: \( V = V(p, q, I) \), where \( V_p = -D_Y \), \( V_q = -D_Z \) and \( V_I = 1 \). Therefore, the welfare effect of a change in medical tourism by foreign tourists can be obtained as follows:

\[
\frac{dV}{dT} = D_Z^*(dq/dT) + \left(\frac{w_L}{a}\right)a' L \frac{dY}{dT},
\] (17)

The development of the medical tourism sector from more foreign tourists benefits the host economy via an improvement in the terms of trade by the exports of medical tourism. Nonetheless, this gain could be mitigated or outweighed by the decline in labor productivity in sector \( X \), caused by less provision of public healthcare services. This crowding-out effect on public healthcare services caused by the development of medical tourism can reduce the welfare (or real output) of the host economy. If this unfavorable productivity effect is not considered, the output contribution of medical tourism to the host country could be overestimated.

2.3 General results
In summary, this study generated the following proposition regarding income distribution and welfare related to medical tourism:

**Proposition 1:** Considering the competition between public healthcare services and medical tourism, development of the medical tourism sector can worsen wage inequality by increasing the wage rate of healthcare workers, while lowering the wage rate of production workers. In addition, the expansion of medical tourism can lower social welfare via a fall in workers’ productivity caused by reduced public healthcare provision.

3. **Complementary policy: Subsidy to healthcare provision**

The previous section indicates that the development of medical tourism may crowd out the provision of public healthcare services to production workers in the host country. This could harm the economy by lowering the productivity of workers in the traded goods sector, \( X \). To overcome the unfavorable productivity effect of developing medical tourism to the country, governments can introduce complementary policies to promote medical tourism, such as redistributing the revenue generated from medical tourism into the public healthcare system. Cuba has been successful in using income generated from its health spa and medical tourism to reinvest in its public health system (Lunt et al., 2015). One policy option to mitigate the adverse effect of medical tourism is the tax-subsidy scheme, in which a tax is imposed on medical tourism revenue and the tax revenue is then used to cross-subsidize the provision of domestic public health services (Whittaker, 2015).

This section considers this tax-subsidy scheme. Under this scheme, the government introduces a production subsidy, \( s \), to the healthcare service sector, \( Y \), and the associated welfare (see Equation [3]) generated by the sector becomes: 

\[
W = CS + \pi_Y + sY = u(D_Y) - C'(w_S, r, Y) + sY.
\]

To maximize welfare, marginal cost pricing in sector \( Y \) follows:

\[
p(Y) + s = m(w_S).
\]

\[ (3') \]
As expected, this production subsidy can affect the production of the public healthcare sector, \( Y \).

To finance the subsidy cost, a tax can be levied on foreign tourists (such as a visa fee), in which the financing constraint is:

\[
sY = tT, \tag{18}
\]

where \( t \) denotes a tax on foreign tourists.

Under this tax/subsidy scheme, from Equations (3') and (4), the subsidy to production adds another dimension to affect the provision of public healthcare services:

\[
\frac{\partial Y}{\partial s} = -\frac{1}{p'} > 0. \tag{19}
\]

This output effect is illustrated by a right shift of schedule \( YY \) to \( YY'' \) in the northeast quadrant in Figure 1 (from point \( b \) to \( c \)). As a result, by attracting more healthcare workers to the public healthcare sector, the output of medical tourism falls:

\[
\frac{\dot{Z}}{\dot{s}} = -\left(\frac{\lambda_{SY}}{\lambda_{SZ}}\right)\left(\frac{\dot{Y}}{\dot{s}}\right) < 0. \tag{20}
\]

By considering this negative output effect on medical tourism, its market equilibrium condition in Equation (1) becomes:

\[
D_d(q) + D^*_d(q, T) = Z(q, s). \tag{1'}
\]

with \( \partial Z/\partial s < 0 \) by Equation (20). By differentiating Equation (1'), the price effect of an expansion of medical tourism can be solved as:

\[
dq/dT = \left[\partial D^*_d/\partial T - (\partial Z/\partial s)(ds/dT)/B. \right. \tag{16'}
\]

Differentiating \( sY = tT \) from Equation (18) and using \( Y = Y(q, s) \) leads to

\[
ds/dT = [t - s(\partial Y/\partial q)(dq/dT)][Y + (\partial Y/\partial s)] > 0. \tag{21}
\]

This suggests that the greater the tax revenue from medical tourism, the larger the production subsidy rate given to the public health sector.\(^7\) Therefore, Equation (16’) leads to: \( dq/dT > 0 \). Using \( Y = Y(q, s) \) leads to:

\[
dY/dT = (\partial Y/\partial q)(dq/dT) + (\partial Y/\partial s)(ds/dT). \tag{22}
\]
That is, an expansion of the medical tourism sector can increase the provision of public healthcare services (that is, \( dY/dT > 0 \)) if the subsidy-induced output effect is strong. In this case, as depicted in Figure 1 by shifting the iso-unit cost curve \( cX' \) outwards to \( cX'' \), the increase in medical tourism activities can raise the wage rate of production workers.

Under the tax-subsidy scheme, the welfare effect of the expansion of medical tourism becomes:

\[
dV/dT = t + DZ\frac{dq}{dT} + \left(\frac{wL}{a}\right)a'L(dY/dT),
\]

(23)

where \( dq/dT > 0 \). Medical tourism directly gives a tax revenue (volume-of-trade) effect and indirectly yields a favorable term-of-trade effect by exporting medical services to foreign tourists. Further, the tax-financed subsidy can raise labor productivity if the subsidy-induced output effect on public healthcare provision is strong \( (dY/dT > 0) \). In this case, the expansion of medical tourism can unambiguously improve social welfare of the host country \( (dV/dT > 0) \).

The following proposition summarizes the above discussion on medical tourism:

**Proposition 2**: The development of medical tourism can help the host economy by increasing the wages of production workers and improving the welfare of the economy, if the country adopts a scheme of taxing foreign tourists and then financing the public healthcare sector.

### 4. Empirical estimation

#### 4.1. Direct revenue effect of medical tourism

To probe the economic impacts of medical tourism on the host country, this study employs a growth model similar to the one in Holzner (2011) and Solow (1956), as follows:

\[
g = f(y_0, k, l, x),
\]

(24)

where \( g \) denotes the growth rate of real output, \( k \) stands for physical capital, \( l \) represents labor inputs, and \( x \) expresses the other factors. Note that \( y_0 \), the initial output, signifies the catching-up between
the current position and steady state (c.f., Barro and Sala I-Martin, 1990; Baumol, 1986). From Equation (24), the estimated model is specified as:

\[ g_i = \alpha_0 + \alpha_1 y_{0i} + \alpha_2 m_{ti} + \alpha_3 k_i + \alpha_4 l_i + \varepsilon_i, \]  

(25)

where the subscript \( i \) corresponds to a country in this study’s sample. The variable, \( g_i \), captures the annual growth rate of per capita gross domestic product (GDP), adjusted by purchasing power parities (PPP) over 2007 to 2013. Note that it is calculated using the equation \( g_i = (1/6) ln(Y_{Ti}/Y_{0i}) \), where \( Y_{Ti} \) and \( Y_{0i} \) are the per capita real GDP at PPP in 2013 and 2007, respectively. The \( y_{0i} \) is 2007’s natural log of per capita GDP, used as a proxy of initial output. The key point is on the sign of the coefficient \( \alpha_2 \) of medical tourism, \( m_{ti} \), which is the natural log of the average medical tourism revenue over 2007 to 2013. In addition, as the measure of physical capital, \( k_i \), the natural log of average gross fixed capital as a percentage of GDP over 2007 to 2013 is adopted. Further, this study proxies the effective labor input, \( l_i \), described in Section 2, by the natural log of average labor productivity, which is measured by the average output at PPP per employed person from years from 2007 to 2012.

The data for real per capita GDP at PPP, gross fixed capital as a percentage of GDP, and labor productivity were acquired from the database of World Development Indicators (WDI), The World Bank, while the data for medical tourism revenues were manually extracted from health and wellness tourism reports from Euromonitor International. Although there are a limited number of reports at Euromonitor International, it is still considered to be the best available data source on medical tourism revenue. For this reason, the sample data consisted of 50 countries, including countries in Europe, the Asia-Pacific region, the American region, Africa, and the Middle East. This study dropped the data for Taiwan and Indonesia because data for Taiwan’s independent variables in WDI were unavailable while the majority of medical tourism sales data for Indonesia were missing. In addition, this study dropped Argentina because data for the real GDP per capita at PPP were missing. After removing Taiwan, Indonesia and Argentina, the final sample comprised 47 countries, including 23 countries in the European region, 10 in the Asia-Pacific region, eight in
the American region, and six in the Middle East and African region. Table 1 presents the country list in the sample, categorized by region and the summary statistics for the four study variables.

Table 1 indicates that the American region had the highest average medical tourism revenue, followed by the Middle East and Africa region, European region, and Asia-Pacific region. For the entire sample, the average and median medical tourism revenues were $254.49 million and $76.71 million, respectively. In terms of the annual real GDP growth rate, the Asia-Pacific region ranked first, followed by the American region, Middle East and Africa region, and European region. The average annual growth rate of real GDP for the entire sample was 0.82 percent, while the average per capita real GDP evaluated at PPP in 2007 was $28,591.47. Moreover, the average levels of gross capital formation as a percentage of GDP and GDP per person employed were 23.72 percent and $31,826.03, respectively.

This study then estimated Equation (25) using ordinary least squares (OLS) with heteroscedasticity-consistent standard errors. In addition, to detect multicollinearity problem we computed variance inflation factor (VIF). We found that the VIF values for all independent variables were less than five (see Table 2). Thus, multicollinearity could be ruled out based on the VIF values. Table 3 presents the results of this estimation. The goodness of fit ($R^2$) of the model was 0.5698. The estimated coefficient on the initial value of real GDP per capita was negative and statistically significant, which provided evidence of convergence. This finding suggests that the poorer countries in the sample tended to grow more rapidly than the wealthier ones, which is consistent with those in the literature (e.g. Holzner, 2011; Mo, 2000; 2001; Papyrakis and Gerlagh, 2004; 2007). As expected, the estimated coefficients on physical capital investment and labor productivity were positive and statistically significant, confirming that both physical capital investment and labor productivity are crucial to output production. The estimated coefficient on medical tourism revenue was positive and statistically significant. This result suggests that, for a 1 percent rise in medical tourism revenue, one can expect to see a direct increase in the annual real GDP growth rate by 0.0024 percent after controlling for initial GDP, physical capital, and labor
productivity. This direct revenue increase echoes the terms-of-trade effect from medical tourism, as indicted in the first term on the right-hand side of Equation (17).

4.2. Indirect productivity effect

As suggested in Proposition 1 in Section 2, an expansion of the medical tourism sector can lower labor productivity via a crowding-out effect on public healthcare provision. In other words, the development of medical tourism can be detrimental to the host economy through a fall in labor productivity. To capture the indirect effect of medical tourism on labor productivity, this study estimated the following equation:

\[ l_i = \beta_0 + \beta_1 y_{0i} + \beta_2 m_{ti} + \beta_3 k_i + \mu_i, \]  

(26)

Table 4 presents the estimation of Equation (26) using OLS with heteroscedasticity-consistent standard errors. Again, we can rule out multicollinearity because the VIF values for all independent variables were also less than five. The negative estimated coefficient (-0.0368) of medical tourism revenue on labor productivity indicates that an expansion of medical tourism can cause a decline in labor productivity. This result supports the theoretical finding stated in Proposition 1, which may undermine the strength of the direct revenue effect generated from medical tourism for the host economy.

To quantify the overall (direct plus indirect) effect of medical tourism on the annual growth rate of the country’s real GDP, this study substituted the coefficients of labor productivity of Equation (26) into Equation (25) to obtain:

\[ g_i = (a_0 + a_4 \beta_0) + (a_1 + a_4 \beta_1) y_{0i} + (a_2 + a_4 \beta_2) m_{ti} + (a_3 + a_4 \beta_3) k_i + a_4 \mu_i + \epsilon_i, \]  

(27)

where the combined coefficient, \( \alpha_2 + \alpha_4 \beta_2 \), of medical tourism is comprised of the direct revenue effect, \( \alpha_2 \), and indirect productivity effect, \( \alpha_4 \beta_2 \), on the economy.

Table 5 presents the contributions of the overall (direct plus indirect) effect of medical tourism on the annual growth rate of real GDP. The calculations show that the combined total effect
of medical tourism revenue on the annual growth rate of real GDP \((\alpha_2 + \alpha_4\beta_2)\) was 0.0017. In other words, the total effect (direct and indirect) of a 1 percent rise in medical tourism revenue can yield a 0.0017 percent increase in the annual growth rate of real GDP. This figure agrees with the estimated coefficient of medical tourism revenue in Equation (27) using OLS with heteroscedasticity-consistent standard errors. The indirect effect of medical tourism revenue caused a drop in the annual real GDP growth rate by 0.00071 due to the decline in labor productivity. This means that it cancelled out about 29.6 percent of the positive direct effect of medical tourism revenue on annual real GDP growth. Accordingly, this represents an over-estimation of 29.6 percent of the contribution of medical tourism to the country, if the unfavorable indirect productivity effect is not considered.

4.3 Which countries benefit from medical tourism?

To investigate whether the economic impacts of medical tourism differs across different country groups, we classified the countries in our sample into OECD and non-OECD groups. Then we estimated Equations (25) and (26) for OECD and non-OECD groups separately using OLS with heteroscedasticity-consistent standard errors.

Table 6 shows that the coefficient of medical tourism revenue in Equation (25) was positive for both OECD and non-OECD groups. It was not statistically significant for the OECD group, but was statistically significant for the non-OECD group. In other words, medical tourism revenue has a positive and statistically significant impact on economic growth in non-OECD countries, but not in OECD countries. In addition, the magnitude of coefficient for the non-OECD group (0.0040 in Table 6) is larger than the one for the full sample (0.0024 in Table 3). This result suggests that, for a 1 percent rise in medical tourism revenue, one can expect to see a much larger direct increase in the annual real GDP growth rate by 0.0040 percent in non-OECD countries than countries in the full sample, after controlling for initial GDP, physical capital, and labor productivity.
In terms of indirect effect through labor productivity channel, we observed that medical tourism revenue was insignificant for the OECD group and significantly negative for the non-OECD group. Further, the absolute magnitude of coefficient for medical tourism revenue for the non-OECD group was larger than the one for the full sample. This means that an expansion of medical tourism in non-OECD countries can result in a much larger drop in productivity than the countries in the full sample.

Taking both the direct and indirect effects of medical tourism into account, we showed in Table 7 that the overall effect of medical tourism revenue on the annual GDP growth rate in non-OECD countries was 0.0021, which was 0.0019 less than the direct effect. In other words, the indirect effect of medical tourism through the labor productivity channel cancels out 47.5 percent of the positive direct effect of medical tourism revenue on annual real GDP growth. This result is consistent with the one obtained for the full sample, but the over-estimation of 47.5 percent of the economic contribution of medical tourism in non-OECD countries is much higher than the one (29.6 percent) in the full sample, if the unfavorable indirect productivity effect is not considered.

5. Concluding remarks

In recent years, medical tourism has emerged as a multibillion-dollar industry that is actively promoted by many developing countries striving to stimulate their economy. In response to this trend, there have been extensive discussions in the recent medical tourism literature on the costs and benefits of medical tourism on the host country. Evidence is mounting that medical tourism may exacerbate inequitable healthcare access problems in developing countries. However, due to the unavailability of reliable and robust data, it remains a challenge to systematically analyze these economic effects—especially the negative effects on the host country’s health system. This paper has sought to fill this research gap. It has provided both theoretical and empirical evidence for economic effects of medical tourism to the host country, by addressing the issue that developing medical tourism might yield a crowding-out effect on the provision of public healthcare services to
production workers in the host country. The theoretical results show that an expansion in medical tourism increases the wage rate of healthcare workers, but decreases the wage rate of production workers, thereby exacerbating inequality of the wages between highly skilled healthcare professionals and unskilled production labor. The results further indicate that an increase in medical tourism has a detrimental effect on the welfare of the host country through a decline in workers’ productivity caused by reduced public healthcare provision. Using the transmission channel approach, this study’s empirical findings support the theoretical predictions and implications. The empirical findings suggest that the economic contribution of medical tourism to the host country could be overestimated by 29.6 percent by ignoring the unfavorable indirect productivity effect caused by medical tourism. Further, the overestimation becomes much higher in non-OECD countries.

To overcome the detrimental productivity effects of medical tourism on the host economy, this study proposes implementing a tax-subsidy scheme by countries aiming to benefit from developing a medical tourism industry. The proposed tax-subsidy scheme involves providing a subsidy to the domestic healthcare sector, which is financed by the revenue from a tax on medical tourism. With cross-subsidization, the development of the medical tourism sector can help improve welfare of the host country as well as increase the wages of production workers. In principle, this scheme is very similar to the policy adopted in Cuba, which has successfully channeled parts of the revenue generated from its health spa and medical tourism industry to fund investment in the public health system (Lunt et al., 2015). Given the importance of a mitigating policy to reverse the negative effects of medical tourism, further empirical investigation considering this mitigation policy is clearly warranted.
Appendix

By expressing the time derivative as a dot above a variable, the dynamic adjustments of
the domestic market of medical tourism can be specified as:

\[ \dot{q} = \alpha [D_x(q) + D_Z^*(q, T) - Z(q, s)], \]

\[ \dot{s} = \beta (tT - sY), \]

where \( \alpha > 0 \) and \( \beta > 0 \), signifying the corresponding adjustment coefficients. Undertaking linear
approximation of the adjustment equations around the equilibrium point led to:

\[
\begin{pmatrix}
\dot{q} \\
\dot{s}
\end{pmatrix} =
\begin{bmatrix}
-B & -\partial Z / \partial s \\
-s(\partial Y / \partial q) & -Y - s(\partial Y / \partial s)
\end{bmatrix}
\begin{pmatrix}
dq \\
ds
\end{pmatrix}
\]

Stability required that the signs of the principle minors follow:

\[ M_1 = -B < 0, \]

\[ M_2 = B[Y + s(\partial Y / \partial s)] - s(\partial Y / \partial q)(\partial Z / \partial s) > 0, \]

where \( B (= \partial Z / \partial q - \partial D_Z / \partial q - \partial D_Z^* / \partial q) > 0, \partial Y / \partial s > 0, \partial Y / \partial q < 0 \) and \( \partial Z / \partial s < 0. \)

Solving Equations (16’) and (21), we obtain:

\[ \frac{ds}{dT} = \frac{tB - s(\partial D_Z / \partial T)(\partial Y / \partial q)}{\Delta B[Y + s(\partial Y / \partial s)]} > 0, \]

\[ \frac{dq}{dT} = - \frac{(\partial D_Z^* / \partial T)[Y + s(\partial Y / \partial s)] - t(\partial Z / \partial s)}{\Delta B[Y + s(\partial Y / \partial s)]} > 0, \]

where \( \Delta = 1 - s(\partial Y / \partial q)(\partial Z / \partial s)/B[Y + s(\partial Y / \partial s)] > 0 \) by the stability condition.
References


Footnotes

1. Also see Chao and Yu (1994) for including quasi-linear preference in a general-equilibrium setup on international capital mobility with imperfect competition.

2. The results would remain the same qualitatively when foreign tourists demand all three goods (cf., Copeland, 1991).

3. This production-externality effect is due to reallocation of healthcare workers, and is different from the consumption-generated externalities from other types of tourism, like shopping or sports tourism. Despite the direct benefit of revenue, medical tourism can bring an unfavorable impact on labor productivity and hence income distribution of the economy. This point has been by and large ignored no matter in academic studies or policy makings on the effects of medical tourism.

4. Another measure of welfare is the sum of consumer surplus and operational profit (that is, producer surplus only, by ignoring the fixed cost). Both measures of welfare yield the same marginal cost pricing.

5. The expression of term $A$ is: $A = \lambda_{LX}(s_{KX} + \theta_{LX}s_{KY}) + \lambda_{KX}s_{LX} > 0$.

6. Note that $\sigma_X = e^X_{ct}X_{cw}/e^X_{ct}c^X_T$ represents the elasticity of substitution between domestic capital and production workers in sector $X$.

7. Mathematical derivations are given in appendix.

8. The transmission channel methodology is also used in Mo (2000, 2001), Papyrakis and Gerlagh (2004, 2007), and Holzner (2011).

9. We have estimated Equation (27) using OLS with heteroscedasticity-consistent standard errors. The medical tourism coefficient was statistically significant, and its magnitude of 0.0017 was smaller than 0.0024—the direct revenue effect stated in Table 3. This is caused by the negative effect of medical tourism on labor productivity, as evidenced in Table 4. The results of the regression analysis is available upon request.
10. We have estimated Equation (27) for OECD and non-OECD groups using OLS with heteroscedasticity-consistent standard errors. The medical tourism coefficient was positive but not statistically significant for OECD group, while it was positive and statistically significant for non-OECD group. The magnitude of the coefficient (0.0021) was the same as the magnitude of total effect in Table 7. The results of the regression analysis is available upon request.
Figure 1. A rise in medical tourism
### Table 1. List of countries and descriptive statistics

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of countries</th>
<th>Annual real GDP growth rate (%)</th>
<th>Average medical tourism revenue (USD millions)</th>
<th>Real GDP per capita at PPP in 2007 (USD)</th>
<th>Average gross fixed capital formation as % of GDP</th>
<th>Average GDP per person employed (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>23</td>
<td>-0.23</td>
<td>248.91</td>
<td>32,267.57</td>
<td>22.60</td>
<td>36,540.13</td>
</tr>
<tr>
<td>Asia-Pacific</td>
<td>10</td>
<td>2.18</td>
<td>177.32</td>
<td>29,141.44</td>
<td>25.75</td>
<td>33,938.88</td>
</tr>
<tr>
<td>America</td>
<td>8</td>
<td>2.08</td>
<td>332.193</td>
<td>16,752.41</td>
<td>23.86</td>
<td>23822.44</td>
</tr>
<tr>
<td>Middle East and Africa</td>
<td>6</td>
<td>0.87</td>
<td>300.92</td>
<td>29,368.55</td>
<td>24.47</td>
<td>20,905.33</td>
</tr>
<tr>
<td>Overall sample: Average values</td>
<td>47</td>
<td>0.82</td>
<td>254.49</td>
<td>28,591.47</td>
<td>23.72</td>
<td>31,826.03</td>
</tr>
<tr>
<td>Overall sample: Median values</td>
<td>47</td>
<td>0.88</td>
<td>76.71</td>
<td>28,063.27</td>
<td>23.25</td>
<td>30,756.33</td>
</tr>
</tbody>
</table>

Note: Countries in the European region include Austria, Belgium, Bulgaria, Croatia, the Czech Republic, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, Romania, the Russian Federation, the Slovak Republic, Slovenia, Spain, Switzerland, Turkey, and the United Kingdom. Countries in the Asia-Pacific region include Australia, the Hong Kong Special Administrative Region, India, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore, and Thailand. Countries in the American region include Brazil, Canada, Chile, Colombia, Ecuador, Mexico, Peru, and Venezuela. Countries in the Middle East and African region include Egypt, Israel, the UAE, Morocco, Saudi Arabia, and South Africa.

### Table 2. Variance inflation factor (VIF) of independent variables

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial real GDP per capita at PPP</td>
<td>3.64</td>
</tr>
<tr>
<td>Medical tourism revenue</td>
<td>1.10</td>
</tr>
<tr>
<td>Physical capital</td>
<td>1.07</td>
</tr>
<tr>
<td>Labor productivity</td>
<td>3.79</td>
</tr>
</tbody>
</table>
Table 3. Direct output regression as in Equation (25)

<table>
<thead>
<tr>
<th>Dependent variable: Annual real GDP growth rate</th>
<th>Equation (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0136 (0.0620)</td>
</tr>
<tr>
<td>Initial real GDP per capita at PPP</td>
<td>-0.0309 (0.0062)***</td>
</tr>
<tr>
<td>Medical tourism revenue</td>
<td>0.0024 (0.00057)***</td>
</tr>
<tr>
<td>Physical capital</td>
<td>0.0397 (0.0148)***</td>
</tr>
<tr>
<td>Labor productivity</td>
<td>0.0194 (0.0069)***</td>
</tr>
<tr>
<td>Adjusted R$^2$</td>
<td>0.5698</td>
</tr>
<tr>
<td>N</td>
<td>47</td>
</tr>
</tbody>
</table>

Notes: The robust standard error is reported in the parentheses. *** indicates statistical significance at 1% level.

Table 4. Indirect productivity effect as in Equation (26)

<table>
<thead>
<tr>
<th>Dependent variable: Labor productivity</th>
<th>Equation (26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>4.3427 (1.6377)**</td>
</tr>
<tr>
<td>Initial real GDP per capita at PPP</td>
<td>0.6722 (0.0915)***</td>
</tr>
<tr>
<td>Medical tourism revenue</td>
<td>-0.0368 (0.019)*</td>
</tr>
<tr>
<td>Physical capital</td>
<td>-0.2318 (0.277)</td>
</tr>
<tr>
<td>Adjusted R$^2$</td>
<td>0.7176</td>
</tr>
<tr>
<td>N</td>
<td>47</td>
</tr>
</tbody>
</table>

Notes: The robust standard error is reported in the parentheses. *, **, and *** indicate statistical significance at 10%, 5% and 1% level, respectively.
Table 5. Total effect of medical tourism

<table>
<thead>
<tr>
<th>Direct effect (a)</th>
<th>Indirect effect via productivity decline (b)</th>
<th>Total effect (c) = (a) + (b)</th>
<th>(b)/(a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0024</td>
<td>0.0194*0.0368 = -0.00071</td>
<td>0.0024-0.00071 = 0.0017</td>
<td>-0.00071/0.0024= -0.2958</td>
</tr>
</tbody>
</table>
Table 6. Direct and indirect effects of medical tourism: OECD vs. non-OECD countries

Panel A: Dependent variable is Annual real GDP growth rate

<table>
<thead>
<tr>
<th></th>
<th>OECD</th>
<th>Non-OECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.0462 (0.1161)</td>
<td>-0.0941 (0.0651)</td>
</tr>
<tr>
<td>Initial real GDP per capita at PPP</td>
<td>-0.0475 (0.0130)***</td>
<td>-0.0348 (0.0075)***</td>
</tr>
<tr>
<td>Medical tourism revenue</td>
<td>0.0017 (0.0011)</td>
<td>0.0040 (0.00073)***</td>
</tr>
<tr>
<td>Physical capital</td>
<td>0.0438 (0.0195)**</td>
<td>0.0217 (0.0123)*</td>
</tr>
<tr>
<td>Labor productivity</td>
<td>0.0375 (0.0143)**</td>
<td>0.0372 (0.0108)***</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.3792</td>
<td>0.7482</td>
</tr>
<tr>
<td>N</td>
<td>27</td>
<td>20</td>
</tr>
</tbody>
</table>

Panel B: Dependent variable is Labor productivity

<table>
<thead>
<tr>
<th></th>
<th>OECD</th>
<th>Non-OECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.2798 (1.5461)**</td>
<td>4.9453 (1.6398)***</td>
</tr>
<tr>
<td>Initial real GDP per capita at PPP</td>
<td>0.7036 (0.1087)***</td>
<td>0.5057 (0.1361)***</td>
</tr>
<tr>
<td>Medical tourism revenue</td>
<td>-0.0149 (0.0129)</td>
<td>-0.0512 (0.0198)**</td>
</tr>
<tr>
<td>Physical capital</td>
<td>0.0143 (0.2786)</td>
<td>0.0491 (0.2285)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.6679</td>
<td>0.5958</td>
</tr>
<tr>
<td>N</td>
<td>27</td>
<td>20</td>
</tr>
</tbody>
</table>

Notes: The robust standard error is reported in the parentheses. *, **, and *** indicate statistical significance at 10%, 5% and 1% level, respectively.
Table 7. Total effect of medical tourism for non-OECD countries

<table>
<thead>
<tr>
<th>Direct revenue effect (a)</th>
<th>Indirect effect via productivity decline (b)</th>
<th>Total effect (c) = (a) + (b)</th>
<th>(b)/(a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0040</td>
<td>0.0372* -0.0512 = -0.019</td>
<td>0.0040 - 0.0019 = 0.0021</td>
<td>-0.0019/0.0040 = -0.475</td>
</tr>
</tbody>
</table>