

# Turning the Big Mac Index into the Medical MAC Index

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## Abstract

**Objective:** The purpose of this study was to create a global medical earnings index, called the Medical MAC Index, to enable a comparison of what medical specialists earn in the countries included in the study.

**Design:** The study gathered data on the earnings of specialist anaesthetists employed in state hospitals with five years' work experience, across 49 developed and developing countries.

**Setting and subjects:** The earnings of anaesthetists were deemed to be indicative of all medical specialities because anaesthesia is one of the largest specialities, and most state hospitals do not distinguish between medical specialities from an earnings perspective. It is likely that a specialist with five years' work experience would have reached the higher echelons of state salary scales, but it is unlikely that he or she would have moved into a management role yet.

**Outcome measures:** To calculate a Medical MAC Index for a specific country, the net earnings of anaesthetists in the countries included in the study were converted into USA dollars, and adjusted using Xpator's purchasing power parity model, and then compared to the net earnings of an anaesthetist in that specific country. The specific country was the baseline. Countries above the line pay more, and those below the line, less.

**Results:** The Medical MAC Index for South Africa showed that medical specialists employed by the state in South Africa earn more than they would in most developing countries, but their earnings lag behind those of many developed countries.

**Conclusion:** South Africa could become more competitive if tax incentives were used to manipulate the data.

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## Introduction

Many developing countries experience a high attrition rate with regard to their healthcare professionals. This paper suggests that one contributing factor to this phenomenon could be the remuneration offered by developing countries, compared to that offered in more developed countries.

The attrition rate of health professionals leaving South Africa is conservatively estimated at 25%.<sup>1</sup> While earnings may not be the primary reason that doctors emigrate, it is likely to play a part in their decision to leave, and then to stay away. Pendelton, Crush and Lefko-Everett showed that 53% of doctors in South Africa were dissatisfied with remuneration, and that only 22% were satisfied.<sup>2</sup>

One of the authors of this paper is a South African anaesthetist working in Australia, who has also spent considerable time conducting locum work in the UK, and who obtained registration in Ireland. He has always been interested in comparing the earnings of anaesthetists working in different locations. This resulted in this observational study, whereby he created a medical earnings index capable of showing which countries pay their medical professionals more or less than others.

The results of this study may be of benefit to other medical specialists interested in working in different locations. In addition, the study and supporting data may potentially have greater relevance, namely to help decision-makers in countries that do not pay that well to consider alternative

ways of becoming attractive destinations for medical specialists; for example, by using experience-oriented work packages or tax incentives.

A medical earnings index needs to include earnings data for medical professionals across a large number of countries to enable meaningful comparisons. However, comparing salaries among countries using market exchange rates and applying the relevant tax rate is less than ideal as these net earnings do not reflect cost-of-living differences between the countries. For example, US\$250 000 earnings/annum in one country could potentially buy much more than the same amount in another. This is because property and rental prices, as well as health care, energy, travel and entertainment costs may be higher in another country. It is for this reason that purchasing power parity models were chosen to adjust earnings data to enable cost-of-living differences to be taken into account. These models compare what the same basket of goods would cost in different countries. The most well-known of the purchasing power parity models is the tongue-in-cheek Big Mac Index, that is published annually by *The Economist*.<sup>3</sup>

In this observational study, the concept of the Big Mac Index was extended to a Medical MAC Index. In anaesthesia, "MAC" refers to the "minimum alveolar concentration" of the anaesthetic vapour that prevents a reaction to standard surgical stimulus in 50% of patients; hence the play on words.

## Literature review

Other studies that compared the salaries of medical professionals have been conducted before. An Internet search has revealed that the Organisation for Economic Co-operation and Development (OECD) produces statistics on specialist doctor salaries on a regular basis. The study was most recently updated in 2011 and included salaries from a select number of member countries. Market exchange rates were applied to the relevant salaries, and a purchasing power parity model was used to factor cost-of-living differences into the comparison. However, it appears that the purchasing power parity model that was used was similar to the IMF's implied purchasing power parity model. The basket of goods used in this latter model is more relevant to low-income earners.

In addition, a study in the Netherlands compared the salaries of Dutch doctors to those of doctors in the Netherlands' five neighbouring countries, and also included data from the OECD health statistics. Again, the purchasing power parity model that was used for this study focused on a basket of goods that was more relevant to low-income earners.

So, while studies have compared the salaries of medical professionals, none have been as broad in scope as this

one. This study included 49 countries in an attempt to create a global medical earnings index, and it is hoped that it will be extended over time. Another limitation of the previous studies relates to the purchasing power parity models used. Both utilised purchasing power parity models that were more relevant to low-income earners, whereas this study selected Xpatulator's purchasing power parity model because the basket of goods selected in this model was more relevant to high-income earners.

## Method

As one of the authors was an anaesthetist, it was relatively easy to gather data on the earnings of anaesthetists across the globe. However, anaesthesia is one of the largest medical specialities in the world, and most state hospitals do not make a distinction between medical specialists from an earnings perspective. It follows that data on the earnings of anaesthetists could be used to create a yardstick that would have relevance to most medical specialities.

Earnings data were collected on the salaries of anaesthetists working in state hospitals with five years' experience from 49 countries, using a variety of qualitative research techniques. These included Google and Yahoo search engines, relevant salary and pay scales, statistics and data from various governmental websites, advertisements for specialist posts in the various countries, and newspaper articles. In an effort to ensure the accuracy of the gathered earnings data, all earnings data included in the study were validated by anaesthetists and anaesthetic bodies in the relevant countries.

The choice to use salaries based on five years' work experience was made because salaries increase incrementally after a doctor specialises, and at five years, most specialists would have reached the top range of state salaries, but it is unlikely that they would have moved into a management role yet, with the associated salary hikes.

The scope of the countries covered by this observational study include developed and developing countries. The intention is to increase the number of countries included over time, as salary data are updated.

Actual tax rates for the relevant countries were applied to the gathered earnings data. The tax rates were calculated using data from the website: [www.taxrates.cc](http://www.taxrates.cc).<sup>4</sup>

The market exchange rates were taken as an average for the period January 2012 to August 2012, using the website [www.oanda.com](http://www.oanda.com).<sup>5</sup>

## Purchasing power parity

Comparing salaries in USA dollars is superficial because it costs more to live in certain countries. For example, earning

US\$248 000/annum in the USA cannot be regarded as less than US\$288 000/annum in Hong Kong, because tax rates differ and it is much more expensive to live in Hong Kong. In fact, applying a model that takes into account the cost-of-living differences for high-income earners in the USA and Hong Kong would mean that the net earnings in the USA would reduce to US\$161 000/annum, and the net earnings in Hong Kong to US\$128 000/annum. So while Hong Kong medical specialists earn more, their earnings do not buy as much as their USA counterparts.

The models that compare cost-of-living differences across countries are called purchasing power parity models.

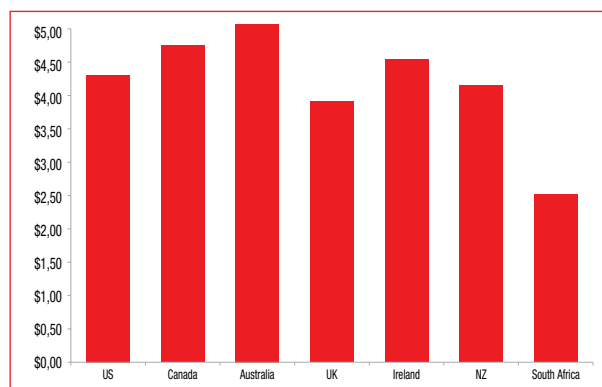
“Purchasing power parity” can be defined as the rate at which the currency of one country would have to be converted to that of another country to buy the same amount of goods and services in each country.<sup>6</sup>

The Big Mac Index can be used to illustrate the above. For example, if a hamburger is sold in London for £2 and for US\$4 in New York, then this would imply a purchasing power parity of 2. In other words, the purchasing power parity exchange rate would be US\$2 to £1.

The Big Mac Index is published annually by *The Economist* as an informal way of measuring the purchasing power parity of different countries, and comparing them to the market exchange rates to determine whether or not a currency is over- or undervalued on the financial markets. Figure 1, Table I and Figure II illustrate how the Big Mac Index works. The data was obtained from *The Economist's* 2012 Big Mac Index.<sup>3</sup>

From Figures 1 and 2, we can see that the South African Rand is significantly undervalued, and the Australian and Canadian dollars, as well as the Euro (in Ireland), are overvalued.

There are a number of limitations to using the Big Mac Index as a measure of purchasing power parity. The most important is that only one commodity is being measured (the



NZ: New Zealand, UK: United Kingdom, US: United States of America

Figure 1: Big Mac Index cost in dollars



NZ: New Zealand, PPP: purchasing power parity, UK: United Kingdom, US: United States of America

Figure 2: Percentage undervaluation

burger), whereas other purchasing power parity models use the price of a basket of goods to compare currencies. Jamal Haider, in a paper titled *Currency valuation and purchasing power parity*, concluded that the “Big Mac Index does poorly as a valuation tool, as well as a forecasting mechanism”.<sup>7</sup> Therefore, the authors considered an alternative means of measuring purchasing power parity.

The IMF publishes implied purchasing power parity data biannually in its world economic outlook.<sup>8</sup> The data are obtained from the International Comparisons Program (ICP),

Table I: Country data for Big Mac Index, depicting under- or overvaluation against the US dollar

Country	Big Mac Index price (local)	Big Mac Index (in US\$)	Implied PPP	Actual US\$ rate	Under- or over-valuation against the US\$ (%)
United States of America	4.2	4.2	1	1	0
Australia	4.8	4.94	1.14	0.97	17.62
Britain	2.49	3.82	0.59	0.65	-9.05
Canada	4.73	4.63	1.12	1.02	10.24
Ireland	3.49	4.43	0.83	0.79	5.48
New Zealand	5.1	4.05	1.21	1.26	-3.57
South Africa	19.95	2.45	4.75	8.14	-41.67

PPP: purchasing power parity

established by the UN and the University of Pennsylvania in 1968. Purchasing power parity, generated by the ICP, is based on a global survey of prices. Each of the 147 participating countries provides national average prices for 1 000 closely specified products. (The IMF implied purchasing power parity conversion data was taken from [www.economywatch.com](http://www.economywatch.com).)

An Xpatulator helpdesk operator explained how its salary purchasing power parity data differ from those of the IMF: “An immediate difference that comes to mind is that we measure the cost of living for high-income or professional expatriates, whereas the IMF data tend to be dominated by very low-income earners, particularly in developing countries” (e-mail from Xpatulator Helpdesk; 2012). He went on to explain that: “The basket of goods and services used in salary purchasing power parity calculations is derived on an international basis and includes certain items often excluded from expatriate cost-of-living data (most notably housing costs)”. He concluded that that Xpatulator’s salary purchasing power parity data provide a reasonably good picture of the differences in standards of living for individuals who are resident and paid in different countries. As doctors can be considered to be high-income professionals, the Xpatulator salary purchasing power parity index was chosen to be the most relevant model for the purposes of comparing the salaries of medical specialists across countries.

### Xpatulator basket groups

Xpatulator.com collects information on approximately 140 different goods and services. The price for the same quantity of each item was obtained. The data are thoroughly quality assured and manually checked, and moderated by Xpatulator analysts. For ease of use, the 140 goods and services were grouped into 13 basket groups (Table II).<sup>9</sup> To compare the cost of living, the total cost of the basket in each location is used. The difference in the cost of the basket at the ruling exchange rate is the cost-of-living difference.

### Limitations

While every attempt was made to ensure that the included data in the study and the results were as comprehensive, accurate and relevant as possible, certain constraints mean that the results need to be regarded as indicative, rather than as 100% accurate.

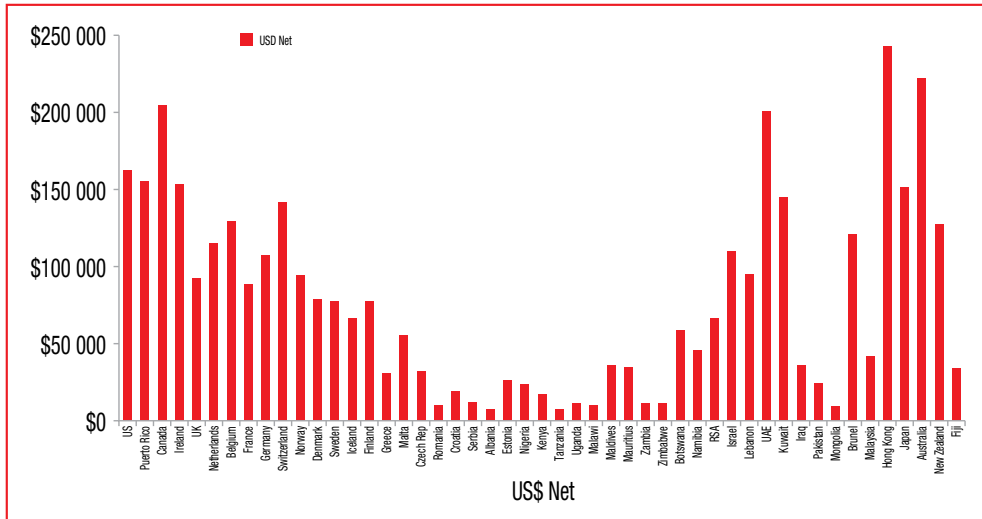
These constraints include:

- **Exact earnings:** Most of the earnings data were gathered qualitatively and were verified with the various anaesthetic bodies in the relevant country. They were verified as “in the ballpark of”, rather than accurate to the last dollar.

**Table II:** The 13 different basket groups<sup>9</sup>

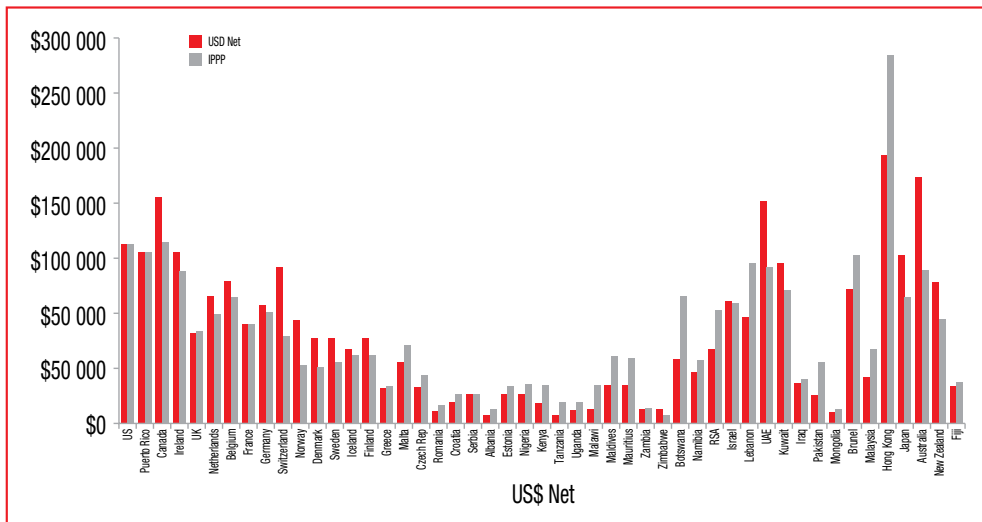
1. **Alcohol and tobacco:** Items such as beer, spirits, wine and cigarettes.
2. **Clothing:** Items such as business, casual and children’s clothing and footwear.
3. **Communication:** Items such as home telephone rental, Internet subscription, mobile tariff and data costs.
4. **Education:** Items such as crèche, preschool, primary school, high school and tertiary study fees.
5. **Furniture and appliances:** Items such as dining room table and chairs, home entertainment, kitchen appliances and sofas.
6. **Groceries:** Items such as consumables, cleaning products, dairy, fresh fruit and vegetables, general food products, snacks and soft drinks.
7. **Health care:** Items such as doctor visits, a hospital stay, non-prescription medicine and medical insurance.
8. **Household accommodation:** Items such as an apartment purchase, mortgage rates, rental and utilities.
9. **Miscellaneous:** Items such as dry cleaning, linen, magazines, newspapers, office supplies and postage stamps.
10. **Personal care:** Items such as cosmetics, hair care and toiletries.
11. **Recreation and culture:** Items such as books, cinema, and sport and theatre tickets.
12. **Restaurants, meals out and hotels:** Items such as daily hotel room rates, meals and beverages in restaurants, and take-away food and beverages.
13. **Transport:** Items such as fuel (petrol or gasoline), public transport, a vehicle purchase and maintenance.

- **Countries:** Only 49 countries were included. Spanish-speaking countries did not respond to requests for information. The intention is to grow the number of countries included in the study over time, as more information becomes available.
- **Private practice:** Some countries provide an opportunity for medical specialists employed by the state to work in private practice some of the time. This allows medical specialists to enhance their income significantly. This dimension was not taken into account in this study. However, the intention is to consider this in the future.
- **Benefits:** Some countries offer benefits beyond income that enhance the quality of life of their medical specialists. One such benefit is pension contributions. Pension savings have significant value for medical specialists in countries whose social services are limited and affect retirement standards. In addition, some medical employers use their pension scheme as a staff recruitment and retention tool, e.g. the National Health Service in the UK.<sup>10</sup> Unfortunately, these kinds of benefits are not obvious from any qualitative research that has



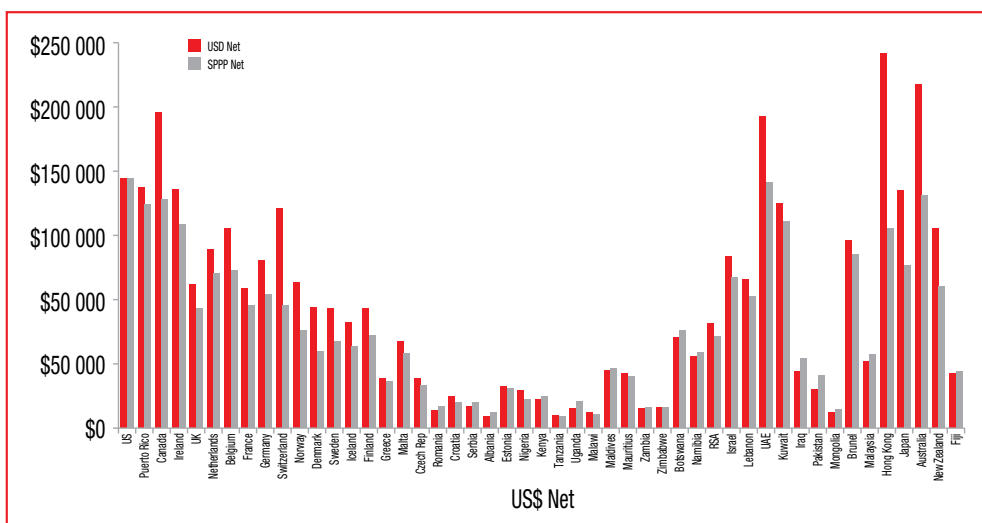
Czech Rep: Czech Republic, UK: United Kingdom, US: United States of America, RSA: Republic of South Africa, UAE: United Arab Emirates

**Figure 3:** Net salary in USA dollars



Czech Rep: Czech Republic, IPPP: implied purchasing power parity, UK: United Kingdom, US: United States of America, RSA: Republic of South Africa, UAE: United Arab Emirates

**Figure 4:** Net salary in USA dollars, applying the International Monetary Fund implied purchasing power parity model



Czech Rep: Czech Republic, UK: United Kingdom, US: United States of America, RSA: Republic of South Africa, SPPP: salary purchasing power parity, UAE: United Arab Emirates

**Figure 5:** Net salary in USA dollars, applying Xpatulator's salary purchasing power parity

been carried out. Also, they have not been forthcoming in discussions with anaesthetic bodies. As such, no monetary value has been added to earnings to allow for this.

## Results

The results are shown in Figures 3, 4 and 5. Figure 3 depicts net salary (after tax) for each country converted into USA dollars, using market exchange rates. Figure 4 compares the net earnings in USA dollars and applies the IMF's implied purchasing power parity model to the earnings. When the IMF's implied purchasing power parity model is used, earnings for the developing nations increase relative to the original earnings (in USA dollar terms). Figure 5 depicts the salary purchasing power parity model applied to the net salary in USA dollars. Another scenario emerges. Counterintuitively, the earnings for medical professionals in developing nations do not rise as expected relative to the original earnings. This is because Xpatulator's basket of goods is determined with high-income earners in mind, and the cost of the goods included in the analysed basket tend to be more expensive in developing countries.

When the IMF implied purchasing power parity model was used, the earnings for many developing countries increased, and the earnings for many developed countries reduced.

When Xpatulator's salary purchasing power parity model was used, earnings adjusted quite differently, with the more poorly paid countries' earnings not increasing as much as they did when the IMF implied purchasing power parity model was used, and in some cases, reducing.

## Creating a Medical MAC Index

To calculate a Medical MAC Index for a specific country, the net earnings of anaesthetists in the countries included in the study, converted into USA dollars and adjusted using

the salary purchasing power parity index, were compared to the net earnings of an anaesthetist in that specific country. For example, Figure 6 shows the Medical MAC Index for South Africa. All countries above the 0% line pay their medical specialists more than South Africa, and would be an attractive destination for South African doctors. It can be concluded that South African medical specialists are relatively underpaid compared to specialists in most developed nations. This can partially explain the "brain drain" to these countries. However, countries below the 0% line pay their medical specialists less than those in South Africa, and South Africa would be an attractive destination for doctors in those countries.

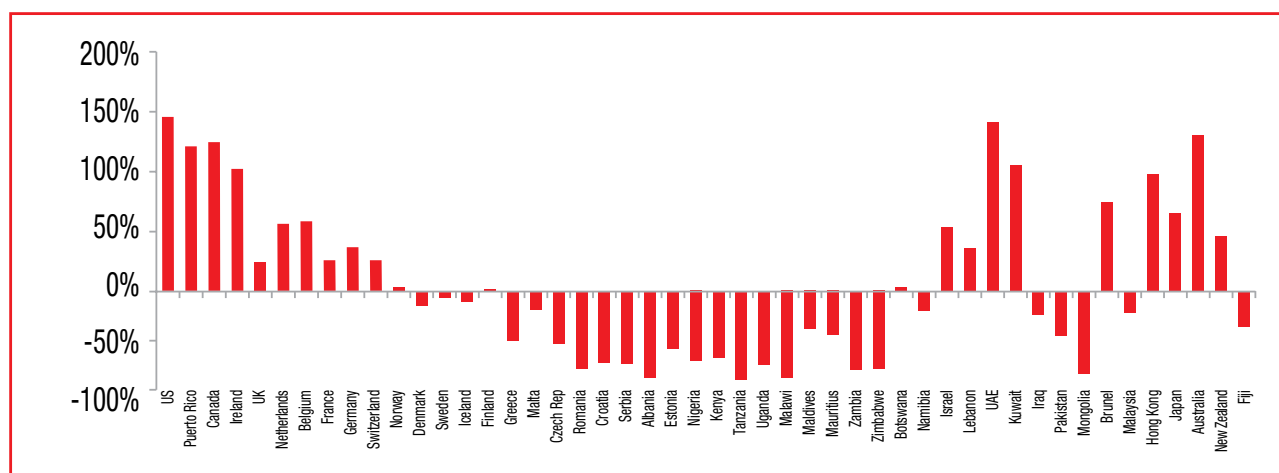
Therefore, these data could have implications for policy-makers trying to retain medical staff in South Africa, and for recruiters trying to attract medical staff to South Africa.

A MAC Index can be calculated for any of the included countries in the study. In addition, the same percentage points could be applied to the salaries of any medical specialist in any of the countries included in the study.

If South Africa wanted to make it more attractive for its medical professionals to remain in South Africa, it has an opportunity to use the gathered information, and to experiment with a few scenarios. For example, the Medical MAC Index in Figure 6 shows net earnings. If gross earnings (before tax) were to be used for South African earnings only, the MAC Index would change considerably.

Figure 7 illustrates that by adjusting tax rates, using tax incentives or tax breaks for doctors working in areas of need, the salaries paid to South African doctors could rival, and even exceed, that of doctors in a number of developed countries. This scenario playing could have numerous implications for progressive policy-makers in South Africa.

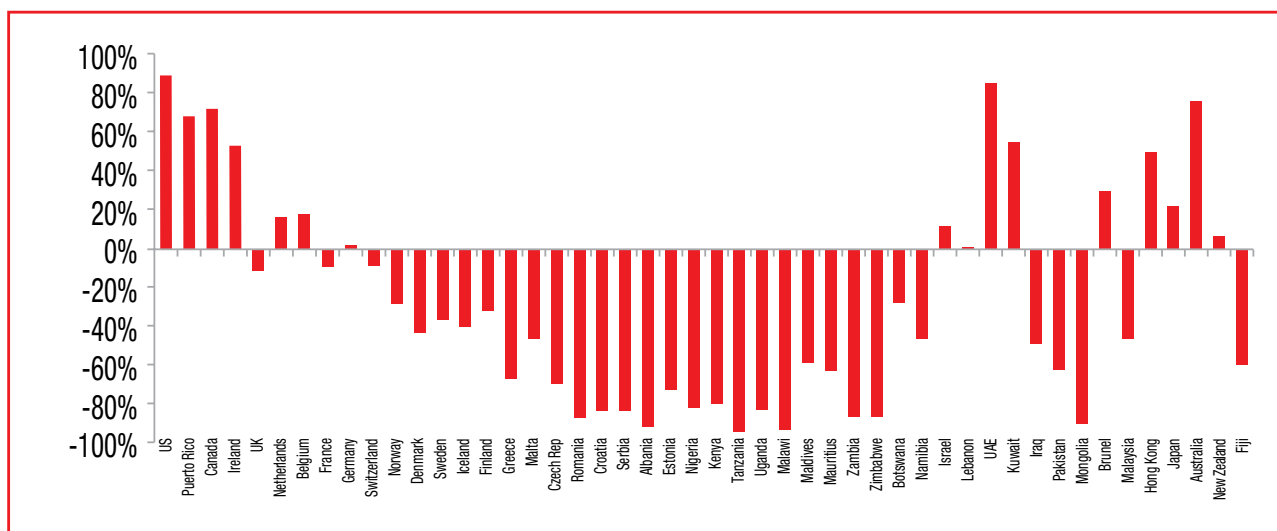
In this scenario, South African medical specialists would earn more than those in the UK, and only marginally less



Czech Rep: Czech Republic, UK: United Kingdom, US: United States of America, RSA: Republic of South Africa, UAE: United Arab Emirates

**Figure 6:** The Medical MAC Index for South Africa





Czech Rep: Czech Republic, UK: United Kingdom, US: United States of America, RSA: Republic of South Africa, UAE: United Arab Emirates

**Figure 7:** The Medical MAC Index for South Africa using gross South African earnings

than those in New Zealand, normally popular destinations for South African medical professionals.

## Conclusion

Through this study, a medical earnings index for the 49 included countries was created by gathering salary data, applying the relevant country's tax rates, and employing a meaningful purchasing power parity model to compare earnings, after taking cost-of-living differences into account.

This index shows which countries pay their medical professionals more than the relevant country, and which countries pay less.

The first Medical MAC Index was created for South African medical specialists because South Africa has a high medical professional attrition rate. This index showed that medical specialists employed by the state in South Africa earn more than they would in most developing countries, but that their earnings lag behind those in many developed countries.

However, by manipulating the data using various earning scenarios and by adjusting tax rates, the salaries in South Africa could become more competitive. This study showed how much more attractive South Africa could become to medical professionals around the globe if tax incentives were given to medical specialists employed by the state.

The authors intend to continue to build on the data included in this study, and to create medical MAC indices for all countries included in the study, as well as to add additional data on new countries as they become available. In addition, the authors wish to explore the complexities of how private practice earnings could change the various indices.

Should you be interested in receiving updates, contributing to the body of knowledge, requesting specific supporting data, or even registering an interest in the study and its results, visit [www.MACIndex.net](http://www.MACIndex.net)

## References

1. Theron N, editor. The human resource supply constraint: the case of doctors. Stellenbosch: Econex; 2010.
2. Pendleton W, Crush J, Lefko-Everett K. The haemorrhage of health professionals from South Africa: medical opinions. Queen's University [homepage on the Internet]. 2007. c2012. Available from: <http://www.queensu.ca/samp/sampresources/samppublications/policyseries/Acrobat47.pdf>
3. The Big Mac Index. The Economist [homepage on the Internet]. 2012. Available from: <http://www.economist.com/blogs/graphicdetail/2012/01/daily-chart-3>
4. Tax rates [homepage on the Internet]. c2012. Available from: [www.taxrates.cc](http://www.taxrates.cc)
5. OANDA Forex Trading and Exchange Rate Services [homepage on the Internet]. c2012. Available from: [www.oanda.com](http://www.oanda.com)
6. Callen T. Purchasing power parity: weights matter. Washington: International Monetary Fund, Finance and Development; 2012.
7. Haider JI. Currency valuation and purchasing power parity. Washington: International Finance Corporation (World Bank); 2011.
8. International Monetary Fund [homepage on the Internet]. c2102. Available from: [www.imf.org](http://www.imf.org)
9. Xpatulator [homepage on the Internet]. c2012. Available from: [www.xpatulator.com](http://www.xpatulator.com)
10. NHS Pension Scheme. NHS Employers. c2013 [homepage on the Internet]. Available from: [http://www.nhsemployers.org/payandcontracts/nhspensionschemereview/pages/nhspension\\_scheme.aspx](http://www.nhsemployers.org/payandcontracts/nhspensionschemereview/pages/nhspension_scheme.aspx)

**Executive summary: Turning the Big Mac Index into the Medical MAC Index**

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The purpose of this study was to create a global medical earnings index, called the Medical MAC Index, to enable a comparison of what medical specialists earn in the countries included in the study.

This index should be of interest to medical professionals who are considering working in different locations. In addition, the results could assist policy-makers and other decision-makers in health care, to make decisions about how to use earnings to attract and retain medical staff.

The study analysed earnings data for medical professionals across 49 countries, and converted their after-tax earnings into USA dollars. However, comparing net salaries in USA dollars was not relevant because it costs more to live in certain countries than it does in others, i.e. a similar salary in USA dollars could result in a different standard of living in another country. Property and rental prices, as well as health care, energy, travel and entertainment costs, differ significantly from one country to another. It is for this reason that purchasing power parity models were chosen to adjust earnings data to enable cost-of-living differences to be taken into account. These models compare what the same basket of goods would cost in different countries.

Xpulator's salary purchasing power parity model was selected over the International Monetary Fund's (IMF) implied purchasing power parity model for the purposes of this study because it focused on analysing how far a USA dollar would go when buying a basket of goods that was more relevant to high-income earners. This model was applied to the net earnings of the countries included in the study to show which countries pay more or less than others. The result was the capability to develop a medical earnings index for each country included in the study. The medical earnings index was named the Medical MAC Index, extending the concept of the Big Mac Index that is published by *The Economist* annually.

In terms of methodology, the study gathered data on the earnings of specialist anaesthetists employed in state or government hospitals with five years' work experience, across 49 developed and developing countries. The earnings of anaesthetists were deemed to be indicative of all medical specialities because anaesthesia is one of the largest specialities, and most state or government hospitals do not distinguish between medical specialities

from an earnings perspective. In addition, it is likely that a specialist with five years' work experience would have reached the higher echelons of state or government salary scales, but is it unlikely that he or she would have moved into a management role yet, with the associated salary hikes. It follows that data on the earnings of anaesthetists could be used to create a yardstick with relevance to most medical specialities.

To calculate a Medical MAC Index for a specific country, the net earnings of anaesthetists in the countries included in the study, converted into USA dollars and adjusted by the salary purchasing power index, were compared to the net earnings of an anaesthetist in that specific country. The specific country was the baseline or 0% line. Countries above the line pay more, and those below the line, less. The same percentage points could be applied to the salary of any medical specialist in any of the included countries in the study to create a Medical MAC Index that is specific to them.

The first published Medical MAC Index was for South Africa, because it is experiencing an especially high attrition rate of medical specialists.

The South African Medical MAC Index shows that medical specialists are relatively underpaid compared to those in most developed countries, which can partially explain the "brain drain" to these countries. However, South Africa would be an attractive destination from an earnings perspective for medical specialists who earn less. Therefore, this data could have implications for policy-makers trying to retain medical staff in South Africa, and for recruiters trying to attract medical staff to South Africa.

The analysis also showed that if South Africa wanted to make it more attractive for its medical professionals to remain in South Africa, it has an opportunity to use the gathered information and experiment with a few scenarios. For example, if gross earnings were used for South African earnings only, the MAC Index would change considerably. The analyses illustrated that by adjusting tax rates (using tax incentives or tax breaks for doctors working in areas of need) the salary paid to a South African doctor could rival, or even exceed, that of a doctor in a number of developed countries. This scenario playing could have considerable implications for progressive policy-makers in South Africa.