

WHAT CONSTITUTES A METROPOLITAN HEALTH ADVANTAGE?

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Summary: This paper presents a methodology to construct comparable estimates of health and wealth performance for 126 metropolitan regions globally that puts spatial comparability on an equal footing with data comparability. It will be used to investigate the relationship between health and wealth performance at the metropolitan scale and to offer a method to distinguish between metropolitan regions that enjoy a health advantage from those which suffer from a health disadvantage. A metropolitan health advantage is defined as maintaining or improving on the balance between health and wealth outcomes that exists at the national level when moving to the metropolitan scale. An initial finding is that metropolitan regions with a health advantage were found to exist in national contexts with lower levels of inequality.

Key Words: Comparative, metropolitan regions, health advantage, wealth, inequality

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I. INTRODUCTION

This paper presents a methodology to construct comparable estimates of health and wealth performance for 126 metropolitan regions globally that puts spatial comparability on an equal footing with data comparability. It has been developed as part of a larger research project at LSE Cities on Cities, Health and Well-being. The dataset will be used to investigate the relationship between health and wealth at the metropolitan scale and to offer evidence on which to ground an analysis of the urban health advantage (Vlahov et al 2005) in a way that cuts across developmental levels and geographical boundaries (Robinson 2006). The point of departure is the construction of a new spatial unit, the Extended Metropolitan Region (EMR), based on sub-national administrative units that proxy the maximum spatial extent of the city under consideration. A standardised ratio of EMR to national performance is then computed in the health and wealth dimensions based on available data in each national context and applied to internationally comparable national-level indicators to obtain an estimate of EMR performance in the health and wealth dimensions. EMRs are then divided into groups based on the effect these performances have on the ratio between health and wealth outcomes at the national level. An initial finding is that EMRs which improved on the national health to wealth ratio were found to exist in national contexts with lower levels of inequality than the EMRs in which this ratio was deteriorated when moving to the metropolitan scale.

II. ESTIMATING METROPOLITAN HEALTH AND WEALTH PERFORMANCE

There have been no attempts to compare metropolitan regions that both take seriously the spatial extent of cities on the ground and the possibilities that exist in using available data to estimate their performance in the fields of health and wealth. The issue of spatial comparability is increasingly coming to the fore, with most comparisons of cities now done at the metropolitan rather than city level. While this has solved some problems, the next section will show that issues of spatial comparability do remain. The collection of socio-economic for cities has likewise become increasingly popular, with UN-Habitat leading the field for cities of the global south. No attempts have been made, however, to go beyond the direct comparison of indicators and to develop estimation techniques that would allow for the comparison of metropolitan regions that cut across geographical boundaries and wealth levels. What this paper presents is a methodology to construct estimates of the performance of metropolitan regions that seeks to account for both spatial and data comparability. It relies on sub-national entities as proxies for a city's maximal spatial extent and exploits the data available at that level to estimate their health and wealth performance in relation to their national contexts. This methodology has just been developed and is thus by nature exploratory. We welcome all critiques and suggestions that could lead to methodological or analytical improvements. Its purpose is to open new possibilities for research

that are predicated on comparing urban entities of a similar nature to capture characteristics that cut across them.

1. A New Spatial Unit

In order to construct comparable estimates of metropolitan health and wealth performance, the first step is to define what is meant by a metropolitan region. This is because comparisons across metropolitan regions are only valid if they represent the same kind of entity: administrative cities with administrative cities, metropolitan regions with metropolitan regions, etc. The difficulty with this in practice is that no two countries administratively organize their territories in the same way: some define metropolitan regions, some do not, some create administrative boundaries around the central area of their cities, and some do not, etc. It is thus not possible to rely on existing spatial units if we want to be able to compare the same type of urban entity in all places.

The use of existing spatial units in international comparisons of cities and metropolitan regions undermines many such efforts. An awareness of the differences between the administratively defined entity (whether it be a city or a metropolitan region) and the reality on the ground is key to approaching spatial comparability. This is because a city's spatial extent, in terms of the urban fabric that constitutes it, has not consideration for administrative boundaries. When studies such as Mercer's Quality of Life index, Kearney's Global City Index, the Economist Intelligence Unit's Green City Indices or Angel et al's Atlas of Global Urban Expansion (2010) compare cities or metropolitan regions, they are in fact comparing different types of spatial units. Even the United Nation's World Urbanisation Prospects database, a key reference in the comparison of metropolitan regions (or urban agglomerations as they refer to them), is forced by missing data to substitute cities for metropolitan regions. This means that the city of Jakarta's population of 10 million is compared, as a metropolitan region, to Tokyo's 37 million, when Indonesian estimates for the Jakarta metropolitan region range from 28 to 34 million inhabitants. Needless to say that any values of indicators that take Jakarta as a 10 million city or a 30 million metropolitan region will be wildly different. Studies which uncritically use the World Urbanisation Prospect database, such as Pricewaterhouse Coopers (2009) and McKinsey (2012), are thus also affected by these inconsistencies. The issue of the spatial comparability of metropolitan regions is thus of critical importance to any attempt at constructing comparable measures of metropolitan performance.

In order to avoid the problems highlighted above, I decided to construct a new spatial unit to be able to compare the maximum spatial extent of metropolitan regions across all world regions. In order to come up with a suitable alternative to existing classifications, it is necessary to step back and look at what is presented to us at a global scale: almost 200 countries, each sub-divided in their own particular way into varying levels of sub-national entities, and cities which are either contained within one unit or are spread out over many. From this perspective, it can be seen that it is the relationship between cities and these administrative divisions which is of crucial importance. Thus, in order to achieve geographical comparability, we must focus on establishing a consistent relationship between city and administrative boundary that is to be sought in the different national contexts. The new spatial unit at the heart of this project, 'the Extended Metropolitan Region' (EMR), depends on satellite imagery to ascertain a city's maximal spatial extent. This information was then used to decide which existing national administrative sub-

divisions that are the basis for statistical data collection could be used as a proxy for the city's maximal spatial extent.

In order to make sure that this proxy for the city constructed using administrative units maintained a relatively consistent relationship to its city in different national contexts, I compared the population obtained through the proxy with the population of its urban agglomeration contained in the United Nation's World Urbanisation Prospects database, supplemented by national metropolitan estimates where those of the UN were problematic. An EMR can thus be defined as administrative unit or combination of administrative units which contain(s) the largest spatial extent of the city yet stay(s) within reasonable bounds of the population of the urban agglomeration as defined by the UN (and national statistical institutes where necessary). This ratio is crucial because it affects the estimation procedure that will be detailed below and which relies on assessing the degree to which an EMR over or under performs its national context. The ratio between the EMR population and that of the UN or national metropolitan estimates could impact the degree to which an EMR under or over performed in relation to its national contexts because EMRs which largely exceed what is generally considered as the metropolitan region will include more rural or sparsely inhabited land, which usually perform less well compared to the national average than more urbanised territory. I thus made sure I included only EMRs which remained within reasonable bounds of the UN or national metropolitan estimate.

The percentage of the national population living in an EMR could also have an impact on the relation between EMR and national context, through the weight the EMR values would have on national averages. Indeed, because of data availability constraints, it was not possible to take the EMR value out of national averages: in many national contexts, no full dataset of all administrative units exists for all indicators, which means that the administrative units making up the EMRs had to be manually extracted. An EMR that makes up a very small percentage of the national population could, all others things held equal, see a much larger divergence from national conditions than an EMR which makes up a large percentage of the national population. There were four countries with large populations (China, India, the United States and Brazil) in which EMRs represented a percentage of the national population that was much smaller than in the other countries within my sample. This meant that the EMRs in these countries under or over performed their national context to a larger degree than other EMRs. To avoid this, I decided to use in these four countries. In China, provinces were used as national context and sub-provincial cities to build the EMRs, in India states and districts were used, in the U.S. the 9 regional divisions of the Census Bureau stood as national contexts and congressional districts were used for the EMRs, and in Brazil the 5 regions of the Brazilian Institute of Geography and Statistics (IBGE) and municipalities were used. Shifting down one level was found to be necessary to align the percentage of national population an EMR represented to the level of other EMRs.

With this method, a geographically representative sample of 126 EMRs from all world regions was assembled: 21 in Central and South America, 15 in East Asia, 8 in Eastern Europe, 11 in the Middle East and North Africa, 14 in North America and Australia, 21 in South Asia, 12 in South East Asia, 15 in Sub-Saharan Africa and 9 in Western Europe. To make data collection more manageable, only EMRs that exceeded the 1.5 million inhabitants mark were included. City states such Hong Kong and Singapore and were not included given that the focus here is on the

discrepancies that exist between metropolitan regions and their national contexts. National population figures were used as a guideline to decide how many EMRs each country should contribute to the dataset, but the final list of EMRs was determined by the countries where the necessary data was available. The list of EMRs in this database was arrived at by balancing the number of EMRs in the countries available in each main region with the overall number of EMRs per million inhabitants of the geographical region that country is located in. Here is a breakdown of the number of EMRs per million inhabitants in each of these regions: 1 EMR for 26 million inhabitants for the 11 national contexts in Central and South America, 1 EMR per 64 million for the 13 in East Asia, 1 EMR per 34 million for the 6 in Eastern Europe, 1 per 28 million for the 6 in the Middle East and North Africa, 1 per 29 million for the 8 in North America and Australia, 1 per 69 million for the 14 in South Asia, 1 per 57 million for the 8 in South East Asia, 1 per 29 million for the 11 in Sub-Saharan Africa, and 1 per 40 million for the 9 in Western Europe.

The 126 EMRs should be taken as the best estimates that can be constructed based on existing information if the requirement of spatial comparability is taken seriously. The full list of these EMRs and the administrative sub-divisions that constitute them can be found in Annex 1. While there are limitations inherent in producing such estimates, they have the advantage of taking the spatial extent of cities on the ground into consideration. They are comparable because they represent a consistent relationship between the form of the urban fabric on the ground and the administrative boundaries that abstractly divide up a territory that fabric is located in. The 126 EMRs represent the same type of urban entity: they contain the maximal spatial extent of the city and a degree of non-urbanised land that surrounds it.

2. Ensuring Data Comparability

Once the spatial comparability of the EMRs was established, a second methodological step was to guarantee the comparability of the data collected for the administrative divisions making up the EMRs. In order to make sure that these estimates were comparable across EMRs, I developed a two-tiered estimation technique. In the first instance, a standardised ratio between the performance of an EMR and that of its national context in a dimension was computed based on the systematic use of indicators available in that specific national context. This ratio, which tracks the degree to which a particular EMR over or under performs its national context in the dimensions of health and wealth, was then applied to internationally comparable national level health and wealth indicators. The EMR level health and wealth indices obtained can thus be seen as qualifications of the national indices that depend on how the EMR performs relative to its national context in that particular dimension. This estimation technique was found to be the best available at responding to the existing state of data at the sub-national level: there is no fixed set of indicators that exists for all sub-national entities needed, and much less for the same time period. The strength of this estimation technique is that it allows for different indicators within different national contexts to give us a picture of how EMRs perform relative to their nations. This allows for greater flexibility when faced with different indicators in different contexts, and also more flexibility with different time periods. Indeed, while the values of a particular indicator can change quite significantly over a period of time, the ratio between the EMR and national value of that indicator is likely to change much less. This has allowed me to look for data for the 2000 to 2010 period. I will now present the methods used to select the indicators at the EMR and

national levels and the standardisation techniques used to make them comparable, and then move in the following section to the selection of the internationally comparable national indicators.

2.1 Health and Wealth Indicators at the Metropolitan Level

A first step was to select, within each national context, a series of health and wealth indicators that were available for both the nation and the administrative sub-divisions used to build the EMRs in that national context. This was made necessary by the absence of single indicators in either of the dimensions of health or wealth available internationally for sub-national administrative units. This can be explained by the wide variety of circumstances existing globally, which are translated into different national statistical capacities as well as priorities in data collection. Not only do Bangladesh and the United Kingdom have different resources and capacities that will affect the type of data they can collect and their level of spatial disaggregation, but they are also not necessarily interested in collecting the same kinds of indicators. For the purposes of this study, it was thus necessary to use the indicators available at a sub-national level in each national context, even if they differed across countries, and to develop a mechanism to guarantee their comparability. This meant identifying the indicators in each dimension from which it was possible to systematically implement the following procedure:

1. From within the smallest possible set of all available and adequate indicators that cover the set of administrative units making up the EMRs, identify two priority indicators and a set of other second-order indicators, and;
2. In each national context, use only the two priority indicators if they are available and assign them a 50% weight each, or, if only one of the two priority indicators is available, use the one that is available, assign it a 50% weight and give the geometric average of all other second-order indicators present the other 50% (or 75% and 25% respectively if there is only one second-order indicator available), or, if none of the two priority indicators are available, use the geometric mean of all second order indicators present.

For health, the two priority indicators were the life expectancy and the infant mortality rate. Second-order indicators that could be used were immunisation rates, skilled assistance at delivery, doctors and hospital beds per capita, and the percentage of mothers protected against tetanus. For the wealth dimension, the two priority indicators were GPD per capita and income per capita. The second-order indicators that could be used were the poverty rate, household characteristics (access to safe water, sanitation or electricity) and indicators measuring malnourishment. This procedure allowed the standardised ratio between EMR and nation to be based on as limited a set of indicators as possible.

To standardise the ratio between the value obtained by the EMR on these indicators and that of its national context was problematic because of the wide range of distributions different indicators can take. For this estimation technique to produce results that allowed for valid comparisons to be made across different national contexts, it was crucial to make sure that the ratios calculated between indicators at the EMR and national levels were comparable across indicators with different numerical distributions. To do this, I grouped indicators according to the numerical distributions they tend to take and used different standardisation procedures to

calculate the EMR to national ratio for each one of those groups. A first group is made up of all variations on the life expectancy. I have chosen to take the simple ratio between EMR life expectancy and national life expectancy in this case because there are very few instances of a drastic difference between life expectancies at these two scales. A second group is made up of all indicators that are expressed as a percentage. This is the group with the most indicators, as they are usually derived from censuses and surveys. The ratio standardisation procedure I used for this group is the ratio of the square roots of the EMR and national values. Given the wide range of ratios that can be obtained from this group of indicators, I chose to use the square roots in order to reduce the overall size these ratios can take. A third group is made up of all indicators that lend themselves to a ratio standardisation procedure based on the logarithmic function, and thus indicators that are susceptible to decreasing marginal returns. These include measures of wealth (GDP per capita, household income per capita, etc.) and measures of health (infant mortality rate, doctors per 10,000). The ratio standardisation procedure chosen here takes the ratio of the logarithms of the EMR and national values (both raised or decreased by as many orders of magnitude as it is necessary to get the national value to a magnitude of 10^2).

The health and wealth factors, or the standardised ratios between EMR and national context, were arrived at by applying the standardisation techniques just presented to indicators selected systematically in each national context. These factors are then applied to the national health and wealth indices computed at the international level. It is to these that we now turn.

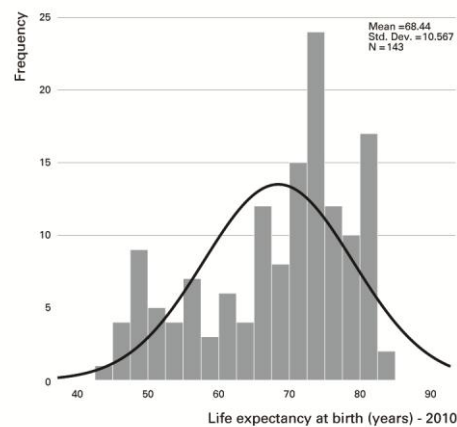
2.2 Internationally Comparable National Health and Wealth Performance Indices

Now that the systematic procedure used to select the indicators at the EMR level and the standardisation techniques used to make them comparable have been presented, we can move on to the national level indices to which the EMR health and wealth factors were then applied. To ensure that these national level indices represented an accurate picture of the situation in the country under consideration, I chose to follow the spirit of the UNDP's recently revised set of indicators and standardisation techniques (UNDP 2010). For the wealth index, I used the UNDP's indicator, gross national income per capita (PPP 2008 \$). To measure health, the UNDP uses a single indicator, the life expectancy of a country's population. In order to get a more complete picture of health performance at the national level, I chose to supplement the life expectancy with the infant mortality rate from the United Nation's World Population Prospects database. Both of these indicators were weighted equally. I chose to use both indicators to measure national health performance because of the wide differences in national performance that exist for two those indicators. Using only one or the other would have led to very different assessments of the health performance of the selected countries. Some, like Russia, perform much better internationally with respect to infant mortality (rank 44 out of 143) than life expectancy (rank 92), while others, like Albania rank higher in life expectancy (31st) than in infant mortality (60th). Only 7 countries rank equally on both measures, and all nations experience an average absolute rank difference of 11.2 between the ranks obtained on each individual indicator. Using both the life expectancy (the indicator used by the UNDP and also one of the indicators most commonly used to assess health levels), and the infant mortality rate (which is more health systems based and commonly used to measure progress in development), provides a more comprehensive assessment of national health performance than either one in isolation. Sources for the comparable figures of life expectancy, infant mortality rate and GNI

per capita for Chinese Provinces, Indian States, U.S. States and Brazilian Regions used here are in the bibliography.

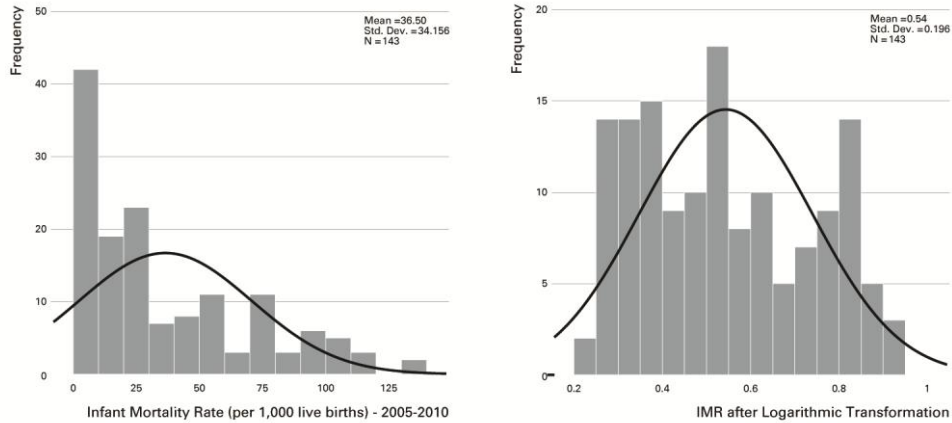
In contrast to the UNDP which has developed a different standardisation procedure for each of the indicators it uses, I decided to use a single standardisation technique for all 3 indicators, based on the minimum and maximum values achieved on each indicator by the 143 countries in my sample ($z = x - x_{\min} / x_{\max} - x_{\min}$). In order to make sure the standardised values obtained on each indicator either followed a normal distribution or were relatively well spread out over the 0 to 1 range, the frequency distributions of each of the 3 indicators were studied and transformations were used where necessary. For the life expectancy, the frequency distribution showed that the values were relatively well distributed, and I followed the UNDP in not applying any transformation to the data. The standardisation procedure based on the minimum and maximum values of the sample of 143 countries was applied to the life expectancy figures directly.

Figure 1: Distribution of National Life Expectancy (2010)



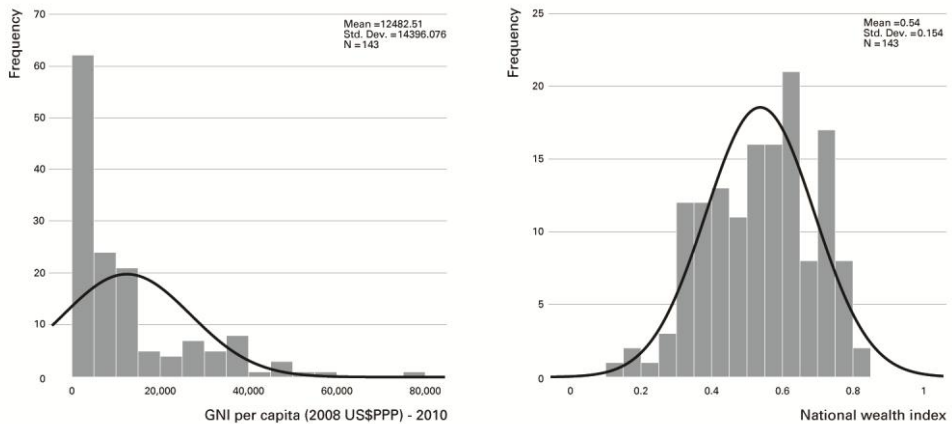
The frequency distribution for the infant mortality rate, in contrast, showed a large range of values (a minimum of 1.9 per 1,000 live births in Singapore and a maximum of 135.9 per 1,000 live births in Afghanistan) with a large concentration of values at the lower end and low frequencies in the middle and higher end of the distribution (see below, on the left). The UNDP does not use the infant mortality rate to assess national health performance, but it uses a logarithmic transformation to normalise GNI per capita figures at the national level. While the logarithmic transformation does not go so far as to normalise the infant mortality rate distribution, it is warranted in this case by the more even spread it gives the data, allowing to better account for differences in infant mortality rates at the national level (see below, right).

Figure 2: Distribution of national Infant Mortality Rates before and after a logarithmic transformation



The frequency distributions for the GNI per capita with and without a logarithmic transformation are shown below. As mentioned above, the UNDP uses the logarithmic transformation to normalise the GNI per capita figures and I have adopted this procedure here. This procedure allows for a very large range of values (a minimum value of USD 176 for Zimbabwe and a maximum of USD 79,426 for Qatar) to be more evenly distributed across the 0 to 1 range.

Figure 3: Distribution of national GDP per capita before and after a logarithmic transformation



In order to avoid values of 0 and 1, the minimum and maximum values of the data on which the standardisation procedure was applied were respectively decreased and increased by a small percentage. The values of these percentages were decided by looking at the average standardised value they would yield across 143 countries in the sample. I wanted to ensure that the average values of the health and wealth indices were similar in order to minimise any biases when comparing the values obtained by countries on these two indices.

We have now explained the methods through which estimates of the health and wealth indices of 126 EMRs have been constructed by making use of available data. Annex 2 lists the indicators and sources used in each national context to estimate the extent by which EMRs outperform their national contexts in health and wealth. And Annex 3 presents the dataset: EMR, region, EMR population, % of national population in the EMR, relation between the EMR's population and that of the corresponding UN WUP urban agglomeration (or national metropolitan estimate where necessary), health and wealth factors, national health and wealth indices and EMR health and wealth indices.

III. INVESTIGATING THE RELATIONSHIP BETWEEN HEALTH AND WEALTH AT THE EMR LEVEL

In this second section of the paper, we will be interested in comparing the ways in which EMRs perform in the health and wealth dimensions in comparison to their national contexts. In this analysis, the aim will be to find a way to differentiate EMRs that are successful in health from those that are unsuccessful in health. This will be done by comparing standardised measures of health and wealth performance at the EMR level in comparison to national averages. The analysis will hold all else constant and categorise EMRs solely on the basis of the relationship between these two performances. Once the successful EMRs in health have been separated out from the unsuccessful ones, we will look for differences between these two groups and emit hypotheses to explain them.

1. Is there a Health Advantage at the EMR Level?

Out of 126 EMRs, there are 15 with health outcomes worse than their national contexts and 12 with wealth levels lower than their national contexts. There is undeniably a health advantage at the EMR level but it seems to go hand in hand with a wealth advantage. Is the health advantage solely due to wealth?

A multiple regression model was used to ascertain the influence of the difference in wealth between national context and EMR and the respective difference in health. The dependent variable that will be investigated here is the degree to which EMRs outperform their national context in the dimension of health, what we called the health factor above (the standardised ratio between EMR and national performance on the indicators available in its national context). As mentioned above, calculating the health factor was crucial to achieving data comparability because it was then applied to internationally comparable national-level data to produce an estimate of EMR performance. However, this factor cannot be used here directly as the dependent variable because it shows a clear link to developmental levels: developing countries tend to show a much larger gap between EMR and national health performance than in developed countries. In order to standardize the extent to which EMRs outperform their national context across different developmental levels, the difference in the number of points between the index created out of the internationally comparable national-level data and that index once it has been multiplied by the EMR health factor will be used. This indicator thus measures the extent to which EMRs outperform their national context in health with respect to their level of

development. For simplicity, we will call this variable the health performance of an EMR. The same technique is used to obtain the wealth performance of an EMR. We are thus investigating the relation between an EMR's health performance and its wealth performance.

Other available indicators were included in the model. The first are variables that were used to control that there were no systematic biases in the estimation of the EMR health and wealth performance: EMR population as a percentage of national population and the ratio between EMR population and that of its corresponding urban agglomeration from the UN WUP database (corrected with national estimates where necessary). A second set of variables were used to investigate what drives health performance at the EMR level: EMR population level, population growth of the UN WUP urban agglomeration that corresponds to the EMR for the 1950 to 2010 period, estimates of EMR net density¹ and EMR wealth performance. As can be seen from the results below, only EMR wealth performance had any significant effect on health performance at that same scale, explaining over 40% of the variation in health performance alone.

Table 1: Summary output of regressing EMR health performance against population indicators, net density and wealth performance

SUMMARY OUTPUT								
Regression Statistics								
Multiple R		0.6736						
R Square		0.4538						
Adjusted R Square		0.4264						
Standard Error		19.7297						
Observations		127						
ANOVA								
		df	SS	MS	F	Significance F		
Regression		6	38801.9295	6466.9882	16.6135	0.0000		
Residual		120	46711.1861	389.2599				
Total		126	85513.1156					
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	4.0777	9.4969	0.4294	0.6684	-14.7256	22.8810	-14.7256	22.8810
EMR to Urban Agglomeration population ratio (2010)	-5.6686	5.2798	-1.0736	0.2851	-16.1222	4.7851	-16.1222	4.7851
Urban Agglomeration population growth rate (1950-2010)	-0.0564	1.1828	-0.0477	0.9620	-2.3982	2.2853	-2.3982	2.2853
EMR Population (2010)	0.0000	0.0000	1.8603	0.0653	0.0000	0.0000	0.0000	0.0000
% of national population in EMR (2010)	-0.2346	0.2012	-1.1661	0.2459	-0.6330	0.1637	-0.6330	0.1637
Net density estimate (2011)	0.0005	0.0003	1.4310	0.1550	-0.0002	0.0011	-0.0002	0.0011
Wealth Performance (2000-2011)	0.5412	0.0599	9.0349	0.0000	0.4226	0.6597	0.4226	0.6597

It is thus essential to take EMR wealth performance into consideration when discussing the issue of health advantage at the EMR level given how important the relation between EMR and national context in wealth outcomes is for health outcomes. We cannot discuss EMR health advantages in isolation: they need to be juxtaposed to the EMR wealth advantages.

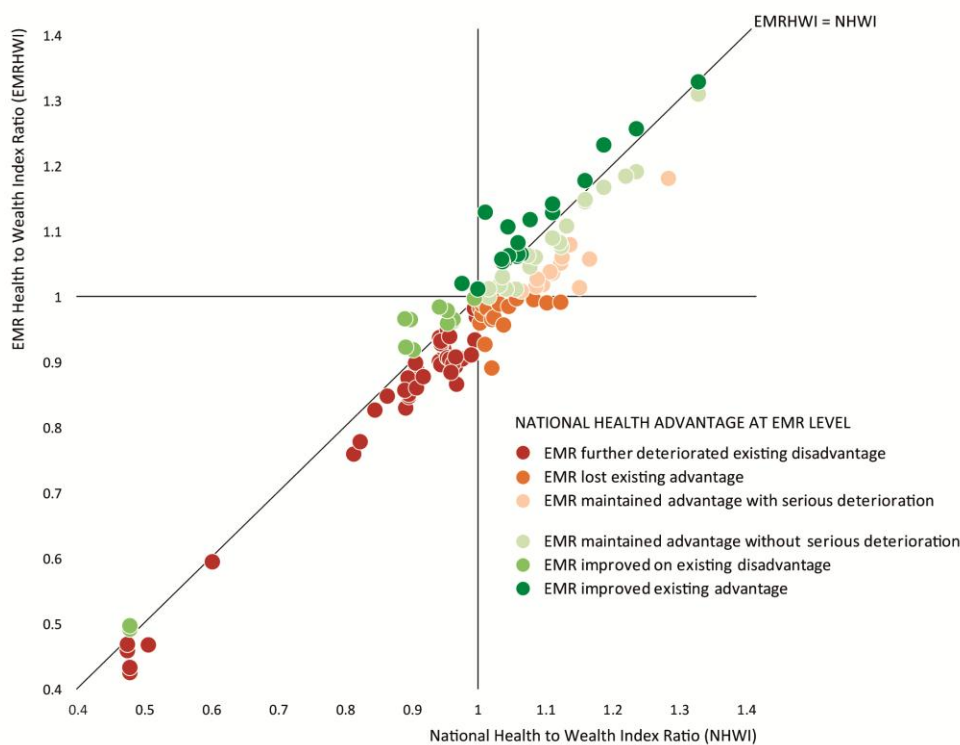
2. Improving, Maintaining or Deteriorating the National Health to Wealth Ratio

As such, what we need to look at is not health advantage per se, but how the move from the national level to the EMR level affects the ratio between health and wealth that exists at the

¹ The methodology used to estimate net density for the 126 EMRs can be found in Paccoud (2011)

national level. Seen through this perspective, an EMR that is successful in health is one that either improves the national balance between health and wealth at its own scale or maintains the health advantage existing at the national level. In contrast, an EMR that is unsuccessful in health is one that either loses the national health advantage, one that maintains it at the cost of a strong deterioration or one that further deteriorates an already unfavourable health to wealth balance. We will look at each of these cases in turn and then present an interesting finding that emerges from the contrast of these two groups of EMRs. The graphic below is a representation of these different types of EMRs and Annex 4 presents all of the data used in this analysis.

Figure 4: The EMR effect on the national health to wealth ratio



2.1 EMR Improved Existing Advantage

There are 50 EMRs out of 126 that can be labelled as successful in health, combining those who improved on the national health to wealth ratio and those that roughly maintained the existing ratio. A total of 30 EMRs improved on the national health to wealth ratio. For 16 of them, the national health index is higher than the national wealth index and this health advantage is further strengthened at the EMR level. This is the case of Kinshasa for example. While the DRC only does slightly better in health (0.183) than in wealth (0.181), Kinshasa's health index is markedly higher than its wealth index (0.234 against 0.207). Another example in this category is Casablanca, in which a national advantage in health (0.529 to 0.506) is further improved upon at the EMR level (0.571 to 0.536).

2.2 EMR Improved on Existing Disadvantage

For the other 14 EMRs, the health index was lower than the wealth index at the national but the move to the EMR level is accompanied by an improvement in the health to wealth ratio. While the ratio between Russia's health and wealth index is 89.1 (0.576 in health, 0.647 in wealth), for Saint Petersburg EMR this increases to 92.4 (0.608 and 0.657 respectively). The most extreme case here is that of Surat: the State of Gujarat in which it sits has a health index of 0.450 and a wealth index of 0.505 (a ratio of 89), while these figures are 0.533 and 0.551 respectively for Surat EMR (a ratio of 96.7).

2.3 EMR Maintained Advantage without Serious Deterioration

The remaining 20 EMRs saw a deterioration of the balance between health and wealth indices at the national level, but this deterioration was not serious enough to overturn it. Santiago is one such EMR: while Chile's health index surpasses its wealth index (0.734 to 0.633), Santiago's wealth performance is higher than its health performance (22.7 to 19.7). This means that the ratio between health and wealth at the EMR level is 99.1% lower than that of Chile as a whole (1.15 to 1.16). London is in the same situation, with a health index of 0.789 and a wealth index of 0.779, while the UK's health index of 0.776 is larger than its wealth index (0.745). London's higher wealth performance in comparison to its health performance (34.2 to 13) means that the ratio of health to wealth index is lower by 97.2% when moving to the EMR level. The limit to the decrease in the health to wealth index ratio when moving from the national to the EMR level was set at 95.9%: any EMR whose health and wealth performance caused the health to wealth index ratio at the EMR level to be less than 95.9% of what it was at the national level was deemed to have significantly deteriorated this ratio and was moved to the next category we will present in detail (95.9% is a natural break in the data, see Annex 4).

2.4 EMR Maintained Advantage with Serious Deterioration

We now move to those EMRs that have been labelled as unsuccessful in health, starting with the 11 EMRs who saw a deterioration of the health to wealth ratio that caused this ratio at the EMR level to be less than 95.9% of what it was at the national level. These are still EMRs where the national health index is higher than the national wealth index, but where the health performance of the EMR is much lower than its wealth performance, thus causing a serious deterioration to the health advantage at the national level. The health to wealth ratio in Manila is 105.9 (0.564 to 0.533), but is 116.6 at the national level: this ratio is 90.8% lower in Manila due to a health performance of -6.4 and a wealth performance of 43.6. The situation in Paris is similar, with the health to wealth ratio 93.8% lower at the EMR level (1.04) as compared to 1.11 for France. This is due to Paris underperforming France in health (-2.6) and significantly surpassing it in wealth (46.1).

2.5 EMR Lost Existing Advantage

In addition to these 12 EMRs, 18 can be said to have lost the health advantage existing at the national level. This means that these EMRs outperformed in wealth as compared to health to the point of reversing the balance between health and wealth that existed at the national level. The case of Salvador is a good illustration of this: while the North Eastern region of Brazil that surrounds it has a higher health than wealth index (0.529 to 0.519), Salvador has a much higher wealth index (0.617 to 0.551) owing to a wealth performance of 98.4 compared to 21.4 for health. The health to wealth ratio which was over 1 at the national level (1.02) is now only 0.89. The difference in ratios is also clearly marked for Bangkok (1.04 for Thailand, but only 0.96 for Bangkok) whose wealth performance of 66 far outstrips that of health (17.6).

2.6 EMR Further Deteriorated Existing Disadvantage

The final type of EMR that is unsuccessful in health is that which further deteriorates an already unfavourable health to wealth balance: higher performances in wealth than in health at the EMR level push the national health to wealth ratio even lower. This is by far the situation that concerns the largest proportion of EMRs (47 out of 126). Most of the sub-Saharan EMRs in my sample are in this situation (12 out of a total of 15). Lagos, for example, has a wealth performance of 44.8 but a health performance of only 0.7. This means that Nigeria's already very low health to wealth ratio (0.48) is further exacerbated at the metropolitan level (0.43). There are also 12 South Asian EMRs in this category, out of a total of 21. Chennai's health performance is 5.6, as compared to 49 in wealth which pushes the health to wealth ratio for Tamil Nadu (0.99) down to 0.91. Six of the ten U.S. EMRs are also in this situation. The Washington DC – Baltimore EMR, with a wealth performance of 37.6 and a health performance of 3.4, has a health to wealth ratio of 0.9, as compared to the South Atlantic region's 0.94.

Now that we have discussed each of these types of EMRs in turn, we can now step back from the categories and present some characteristics that differentiate successful and unsuccessful EMRs in health, as we have defined these above. First, successful EMRs have a significantly larger health performance (25.7 compared to 15.2) but a significantly lower wealth performance (21.3 to 45.1). And while there is no significant difference between these two groups of EMR in terms of metropolitan wealth index (0.612 for the successful group, 0.595 for the unsuccessful one), there is a large and significant difference in the metropolitan health index (0.644 and 0.544 respectively). There thus seems to be a trade-off between health and wealth performance here. There is also a significant difference in terms of the 1950 to 2010 population growth rates of the corresponding urban agglomerations: those in the unsuccessful group had a higher population growth rate over that period (3.6 as compared to 2.9% annually). But the most interesting contrast concerns the national Gini index of income inequality (average for 2000 to 2006 from the UNU-WIDER database). The EMRs that are successful in health have a significantly lower national Gini index (37.5 on average) compared to their unsuccessful counterparts (43.5 on average). We can only hypothesise as to the factors underlying this contrast: is this just a reflection of the fact that there is an inherent link between better health outcomes in relation to wealth outcomes at the national level and income inequality? Or is it that a relatively low level of national inequality creates the context for improvements in the health to wealth ratio at the metropolitan level, while higher levels of national inequality tend to create a context in which this ratio deteriorates? Further research is necessary here in order to achieve a more detailed understanding of the relationship between income inequality and the ability of EMRs to improve on the national health to wealth ratio.

IV. CONCLUSIONS

In this paper, we have argued that any discussion of the health advantage at the metropolitan level needs to take into account the wealth advantage at that same scale. This means that attempts at identifying metropolitan regions that are successful in health must look at the relationship between their health and wealth advantages over their national context. The first half of the paper presented an estimation technique of the health and wealth performance of metropolitan regions that put both spatial and data comparability on the same footing. In its second half, these estimates were used to categorize EMRs according to how their health and wealth performance affected the ratio between health and wealth outcomes at the national level. While the dataset is a reflection of the methodological decisions taken as part of the estimation technique, this categorization of EMRs is a strong indication that a comparative gesture that focuses on what unites EMRs of all developmental levels and geographic regions can produce relevant knowledge. The number of EMRs in the sample gives a degree of robustness to the role of inequality on the effect on the national balance between health and wealth of a move to the EMR level, but further research is needed to better understand the dynamics at work here.

The limitations of this approach emerge from its reliance on estimates. This has been shown to be necessary to compare the performance of metropolitan regions in a way that takes the nature of the entities to be compared seriously. The difficulties encountered in accessing comparable data at a sub-national level signals a need for greater coordination between national statistical offices to produce sub-national data that can be directly compared across national contexts. The example of the standardization of data collection at a sub-national level carried out by Eurostat through its Nomenclature of Territorial Units for Statistics is one which needs to be extended out to other world regions. This study has presented a possible way in which the lack of data at a sub-national level can be bypassed, which can hopefully open new avenues of research.

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