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Cities, health and well-being: methodology for an international analysis

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Cities, health and well-being: Methodology for an international analysis

This research project is part of a wider research strand underway at LSE Cities that seeks to explore the relationships between the design of the built environment, health and well-being in cities with a particular focus on how urban density affects the experiences of different population groups. This theme will form the basis of the 11th Urban Age conference in Hong Kong on 16-17 November 2011. This particular aspect of the research strand is focused on the international comparison of cities in terms of health, wider socioeconomic data and density. Other aspects exist which are focussing on intra-urban spatial analysis of the same issues, design analysis, and qualitative research into the subjective experiences of living at high densities in Hong Kong.

The aim of this paper is to present the methods used to build a dataset of health, socioeconomic and density data for more than a hundred cities worldwide, and to invite feedback and discussion in light of the experimental nature of this work. This is the first attempt to estimate HDI and net density at the metropolitan level for a geographically representative sample of comparable metropolitan regions. There are many difficulties facing such an attempt, and what I have developed here is a very experimental estimation technique that attempts to make best possible use of available resources. The first section of the paper will present the way in which I have constructed a new spatial unit 'the Extended Metropolitan Region' (EMR) based on existing sub-national administrative districts, in order to allow for comparability across cities with varying shapes, sizes and administrative organisations. The section that follows then explains the methods I have used to estimate EMR-level health, education and wealth indices inspired by the Human Development Indices from the data available for sub-national administrative districts in each national context. A final section details the estimation procedure I have developed to measure net density for the same set of EMRs. While the aim of the research project is ultimately to find ways to link the Human Development Indices and net density estimates at the EMR-level, this analysis has not yet been completed. This present paper will therefore focus on the exploratory methodologies I have developed to collect and construct the estimates of HDI and density for 129 EMRs.

1 Geographical comparability: the selection of administrative units

1.1 The construction of a new spatial unit

When comparing cities, it is of crucial importance that the definition of the city be similar in all places, i.e., that the statistical indicators relate to the same type 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 organise 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. We can thus not rely exclusively on a definition of an administrative city or of a metropolitan region if we want to do international comparison. In order to come up with a suitable alternative, 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. What needs to be ensured is that the relationship between a particular city and the administrative unit remains relatively fixed for each national context we investigate. To do this, each national context has to be evaluated separately, and it must be asked whether administrative divisions in that country can be used to attain an understanding of that country's cities. Because the administrative units in each national context with relevant data can potentially be quite big (especially in developing or federal nations where there is no guarantee of data collection or comparability at the local scale), we are forced to find the lowest common denominator. This means that the proxy for the city constructed using administrative units can far exceed in both population and area terms what is usually thought of as the city.

In order to make sure that this proxy for the city constructed using administrative units maintains a relatively consistent relationship to its city in different national contexts, I compare the population obtained through the proxy with the population of its urban agglomeration[1] contained in the UN World Urbanisation Prospects

[1] An urban agglomeration is the UN population Division's definition of a metropolitan region: "The term 'urban agglomeration' refers to the population contained within the contours of a contiguous territory in-habited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the suburban areas lying outside of but being adjacent to the city boundaries. Whenever possible, data classified according to the concept of urban agglomeration are used. However, some countries do not produce data according to the concept of urban agglomeration but use instead that of metropolitan area or city proper. If possible, such data are adjusted to conform to the concept urban agglomeration. When sufficient information is not available to permit such an adjustment, data based on the concept of city proper or metropolitan area are used. The sources

(WUP) database[2]. This database is useful because it builds comparable measures of the metropolitan population of global cities. In each national context, the method employed will be that of constructing a proxy for the city using administrative units such that:

1. The administrative units are the basis for the collection of statistical data
2. The proxy for the city based on the administrative units contains the largest spatial extent of a city (evaluated using Google Earth) whose urban agglomeration population is over 750,000 in 2010
3. The proxy's population in 2010 does not exceed the population of the urban agglomeration in 2010 by more than a factor of 2[3].

I am thus collecting data for a new type of geographical unit, which I will now refer to as the extended metropolitan region (EMR)[4], which can be defined as the administrative unit or combination of administrative units which contain(s) the largest spatial extent of the city yet do(es) not exceed the population of the urban agglomeration by more than a factor of 2.

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 strongly determined by the availability of data. The next section will illustrate how EMRs were constructed by looking at the case of Bangladesh, and a full list of the areas used to construct the EMRs can be found in the table below.

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listed online indicate whether data were adjusted to conform to the urban agglomeration concept or whether a different concept was used."

[2] United Nations World Urbanisation Prospects, the 2009 revision, available online at: http://esa.un.org/unpd/wup/index.htm

[3] This threshold was relaxed in four distinct case s (see table below): 1. The UN WUP urban agglomeration population is based on the concept of city proper because of a lack of data; 2. The UN WUP urban agglomeration uses a very limited definition of the city's metropolitan region which leave out a large section of its built-area (as seen on Google Earth or through national definitions of the metropolitan region); 3. The metropolitan region is constructed by combining cities not featured in the UN WUP database (cities under 750,000); 4. Statistical data was only available for larger administrative entities, and the threshold was relaxed to accommodate metropolitan regions that were of geographical relevance or of a certain level of development.

[4] The term 'Extended Metropolitan Region' is commonly used in the study of Asian urbanisation to speak of the wider metropolitan regions of cities in Eastern and South-Eastern Asia. The areas constructed here can also be understood as wider metropolitan regions but differ from the areas discussed in that literature by their method of construction. The term 'extended metropolitan region' has been used here because of its simplicity.

Nation	Extended Metropolitan Region (EMR)	EMR 2010 Population Estimate	UN WUP Urban Agglomeration 2010 Population	EMR to Urban Agglomeration 2010 Ratio	Rationale for relaxing factor 2 threshold	Administrative Sub-Divisions constituting each EMR
Côte d'Ivoire	Abidjan	7,845,100	4,125,174	1.90		Regions: *Abidjan, Agneby, Sud Comoe, Sud Bandama, Lagunes*
Kenya	Nairobi	7,806,748	3,523,349	2.22	UN WUP definition of metropolitan area very limited	Province: *Nairobi* - Districts: *Nakuru, Machakos, Kiambu*
Canada	Toronto	6,456,145	5,449,456	1.18		Health Regions: *Toronto, York, Peel, Halton, Durham, City of Hamilton*
Mali	Bamako	4,414,117	1,698,520	2.60	UN WUP based on administrative city population; data only avalaible at larger administrative level	Regions: *Bamako, Koulikoro*
Morocco	Casablanca	5,619,089	3,283,605	1.71		Regions: *Grand Casablanca, Chaouia-Ouardigha*
Morocco	Rabat	2,648,773	1,802,331	1.47		Region: R*abat-Salé-Zemmour-Zaer*
Peru	Lima	10,054,952	8,940,555	1.12		Departments: *Lima, Callao*
Japan	Tokyo	42,607,376	36,668,510	1.16		Prefectures: *Tokyo, Saitama, Chiba, Kanagawa, Gunma, Tochigi, Ibaraki*
Japan	Osaka	18,488,755	13,141,483	1.41		Prefectures: *Osaka, Kyoto, Hyogo, Nara*
Iran	Tehran	14,795,116	7,241,004	2.04	UN WUP based on administrative city population	Province: *Tehran*
Iran	Mashhad	5,940,766	2,652,183	2.24	data only avalaible at larger administrative level	Province: *Masshad*
Philippines	Manila	23,065,889	11,628,288	1.98		Provinces: *Metro Manila, Bulacan, Rizal, Laguna, Cavite*
Pakistan	Karachi	14,270,132	13,124,793	1.09		District: *Karachi*
Pakistan	Lahore	13,335,777	7,131,864	1.87		Districts: *Lahore, Sheikupura*
Pakistan	Islamabad-Rawalpindi	5,814,142	2,881,484	2.02	UN WUP based on administrative city population	Province: *Islamabad Capital Territory* - District: *Rawalpindi*
Pakistan	Faisalabad	7,055,417	2,849,206	2.48	UN WUP based on administrative city population	District: *Faisalabad*
Mexico	Mexico City	35,418,952	23,357,776	1.52		States: *Mexico, Federal District, Morelos, Puebla, Hidalgo, Tlaxcala*
Mexico	Guadalajara	7,350,682	4,402,412	1.67		State: *Jalisco*
Mexico	Monterrey	4,653,458	3,895,876	1.19		State: *Nuevo Leon*
Nigeria	Lagos	15,373,213	10,577,672	1.45		States: *Lagos, Ogun*
Nigeria	Abuja	4,957,411	1,995,187	2.48	data only avalaible at larger administrative level	States: *Abuja, Nassarawa*
Nigeria	Ibadan	6,322,614	2,836,665	2.23	data only avalaible at larger administrative level	State: *Oyo*
Nigeria	Kano	10,643,633	3,394,649	3.14	data only avalaible at larger administrative level	State: *Kano*
Zimbabwe	Harare	3,847,834	1,631,594	2.36	UN WUP based on administrative city population; data only avalaible at larger administrative level	Provinces: *Harare, Mashonaland East*
Zambia	Lusaka	2,467,467	1,450,759	1.70		Districts: *Lusaka, Kafue, Chibombo, Chongwe*
Vietnam	Hanoi	9,633,100	2,814,417	3.42	UN WUP definition of metropolitan area very limited	Provinces: *Hanoi, Ha Tay, Vinh Phuc, Bac Ninh, Hung Yen*
Vietnam	Ho Chi Minh City	12,592,100	6,167,090	2.04	UN WUP based on administrative city population	Provinces: *Ho Chi Minh, Long An, Dong Nai, Binh Duong*
Venezuela	Caracas	5,091,372	3,089,964	1.65		States: *Capital District, Miranda*
Uzbekistan	Tashkent	4,789,500	2,209,647	2.17	UN WUP based on administrative city population	Provinces: *Tashkent City, Tashkent*
Ukraine	Kiev	4,506,900	2,804,781	1.61		Provinces: *Kiev City, Kiev*
Uganda	Kampala	3,840,400	1,597,916	2.40	UN WUP based on administrative city population	Districts: *Kampala, Mukono, Wakiso*
Turkey	Istanbul	15,613,932	10,524,625	1.48		Provinces: *Istanbul, Kocaeli, Tekirdag*
Turkey	Ankara	4,771,716	3,906,044	1.22		Province: *Ankara*

Nation	Extended Metropolitan Region (EMR)	EMR 2010 Population Estimate	UN WUP Urban Agglomeration 2010 Population	EMR to Urban Agglomeration 2010 Ratio	Rationale for relaxing factor 2 threshold	Administrative Sub-Divisions constituting each EMR
Thailand	Bangkok	14,190,762	6,976,471	2.03	UN WUP definition of metropolitan area very limited	Provinces: *Bangkok, Samut Prakan, Nonthaburi, Pathum Thani, Samut Sakhon, Nakhon Pathom, Samut Songkhram, Chachoengsao, Phra Nakhon So Ayuttahaya, Chon Buri, Ratchaburi*
Tanzania	Dar es Salaam	4,149,873	3,349,134	1.24		Regions: *Dar es Salaam, Pwani*
Syria	Damascus	4,477,000	2,597,093	1.72		Governorates: *Damascus, Rural Damascus*
Syria	Aleppo	4,744,000	3,086,729	1.54		Governorate: *Aleppo*
South Africa	Johannesburg	11,191,700	9,443,061	1.19		Province: *Gauteng*
South Africa	Cape Town	5,223,900	3,404,807	1.53		Province: *Western Cape*
Serbia	Belgrade	2,253,185	1,117,200	2.02	UN WUP based on administrative city population	Districts: *City of Belgrade, South Banat, Srem*
Senegal	Dakar	4,514,693	2,862,879	1.58		Regions: *Dakar, Thies*
Russia	Moscow	17,928,071	10,549,892	1.70		Federal City: *Moscow* - Province: *Moscow*
Russia	Saint Petersburg	6,137,260	4,575,272	1.34		Federal City: *Saint Petersburg* - Province: *Leningrad*
United Kingdom	London	14,830,051	8,631,325	1.72		NUTS3 Units: *UKI11, UKI12, UKI21, UKI22, UKI23, UKJ11, UKJ13, UKJ23, UKJ41, UKJ42, UKH21, UKH23, UKH31, UKH32, UKH33*
France	Paris	12,177,135	10,485,263	1.16		NUTS3 Units: *FR101, FR102, FR103, FR104, FR105, FR106, FR107, FR108*
Netherlands	Amsterdam-Rotterdam-Utrecht-The Hague (Randstad)	6,969,690	2,058,877	3.39	combines cities under 750,000 not included in UN WUP	NUTS3 Units: *NL322, NL323, NL324, NL325, NL326, NL327, NL334, NL335, NL336, NL310, NL331, NL332, NL333*
Italy	Rome	4,101,228	3,362,252	1.22		NUTS Unit: *ITE43*
Spain	Madrid	6,418,863	5,851,288	1.10		NUTS3 Unit: *ES300*
Germany	Berlin	4,945,877	3,449,540	1.43		NUTS3 Units: *DE300, DE423, DE412, DE42A, DE424, DE421, DE428, DE413, DE414, DE426*
Greece	Athens	4,123,518	3,257,213	1.27		NUTS3 Unit: *GR300*
Poland	Warsaw	2,472,713	1,712,264	1.44		NUTS3 Units: *PL127, PL129, PL12A*
Portugal	Lisbon	2,845,126	2,823,965	1.01		NUTS3 Units: *PT171, PT172*
Hungary	Budapest	2,930,934	1,706,177	1.72		NUTS3 Units: *HU101, HU102*
Sweden	Stockholm	1,990,493	1,285,387	1.55		NUTS3 Unit: *SE110*
Romania	Bucharest	1,948,038	1,934,433	1.01		NUTS3 Units: *RO321, RO322, RO314*
Unites States	Los Angeles	17,950,451	12,762,091	1.41		California Congressional Districts (CD): *23-48*
Unites States	New York	23,514,804	19,425,069	1.21		New York CDs: *1-19, 22* - New Jersey CDs: *4-13* - Connecticut CDs: *3-5*
Unites States	Chicago	11,599,646	9,203,838	1.26		Illinois CDs: *1-11, 13-14,16* - Indiana CDs: *1-2*
Unites States	Dallas	7,731,414	4,950,619	1.56		Texas CDs: *3-6, 12, 17, 24, 26, 30, 32*
Unites States	Philadelphia	7,903,476	5,625,504	1.40		Pennsylvania CDs: *1,2, 6-8, 13, 16* - New Jersey CDs: *1-3* - Delaware CD: *1*
Unites States	Washington DC - Baltimore	9,489,664	6,779,875	1.40		District of Columbia - Maryland CDs: *1-8* - Virginia CDs: *1, 8, 10-11*
Unites States	Miami	7,432,017	5,749,900	1.29		Florida CDs: *15-23, 25*
Unites States	Atlanta	7,506,267	4,691,356	1.60		Georgia CDs: *3-9, 11, 13*
Unites States	Boston	9,073,643	4,593,361	1.98		Massachusetts CDs: *2-10* - New Hampshire CDs: *1-2* - Rhode Island CDs: *1-2*
Unites States	San Francisco-San Jose	9,143,536	5,258,893	1.74		California CDs: *1, 6-17*

Nation	Extended Metropolitan Region (EMR)	EMR 2010 Population Estimate	UN WUP Urban Agglomeration 2010 Population	EMR to Urban Agglomeration 2010 Ratio	Rationale for relaxing factor 2 threshold	Administrative Sub-Divisions constituting each EMR
Indonesia	Jakarta	34,772,342	10,254,334	3.39	UN WUP based on administrative city population	Provinces: *Jakarta, Banten* - Districts: *Kota Bogor, Kota Bekasi, Bogor, Bekasi, Kota Depok, Karawang*
Indonesia	Surabaya	8,728,602	2,508,768	3.48	UN WUP based on administrative city population	Districts: *Kota Surabaya, Gresik, Sidoarjo, Pasuruan, Kota Pasuruan, Mojokerto, Kota Mojokerto*
Indonesia	Medan	5,255,905	2,131,060	2.47	UN WUP based on administrative city population	Districts: *Kota Medan, Deli Serdang, Kota Binjai, Kota Tebing Tinggi, Langkat*
Indonesia	Makassar	2,579,112	1,294,366	1.99		Districts: *Kota Makassar, Maros, Gowa, Takalar*
India	Delhi	30,141,583	22,156,810	1.36		State: *Delhi* - Districts: *Faridabad, Ghaziabad, Baghpat, Gautam Buddha Nagar, Gurgaon, Jhajjar, Sonepat*
India	Hyderabad	9,306,634	6,750,650	1.38		Districts: *Hyderabad, Rangareddi*
India	Ahmadabad	8,595,678	5,717,173	1.50		Districts: *Ahmadabad, Gandhinagar*
India	Surat	6,079,231	4,167,553	1.46		District: *Surat*
India	Bangalore	10,576,167	7,217,570	1.47		Districts: *Bangalore, Bangalore Rural*
India	Hubli-Dharwad	1,846,993	946,140	1.95		District: *Dharwad*
India	Kochi	3,279,860	1,609,575	2.04	data only avalaible at larger administrative level	District: *Ernakulam*
India	Indore	3,272,335	2,173,029	1.51		District: *Indore*
India	Bhopal	2,368,145	1,842,502	1.29		District: *Bhopal*
India	Mumbai	26,167,972	20,040,868	1.31		Districts: *Mumbai City, Mumbai Suburban, Thane, Raigad*
India	Pune	9,426,959	5,001,785	1.88		District: *Pune*
India	Ludhiana	3,487,882	1,759,665	1.98		District: *Ludhiana*
India	Jaipur	6,663,971	3,130,928	2.13	UN WUP definition of metropolitan area very limited	District: *Jaipur*
India	Chennai	12,397,681	7,546,954	1.64		Districts: *Chennai, Thiruvallur, Kancheepuram*
India	Lucknow	4,588,455	2,872,957	1.60		District: *Lucknow*
India	Kolkata	33,084,734	15,552,080	2.13	data only avalaible at larger administrative level	Districts: *Kolkata, Howrah, North 24 Parganas, South 24 Parganas, Hugli*
Australia	Sydney	7,253,400	4,428,978	1.64		State: *New South Wales*
Argentina	Buenos Aires	18,485,510	12,969,681	1.43		Provinces: *Autonomous City of Buenos Aires, Buenos Aires*
Brazil	Brasilia	4,164,421	3,716,996	1.12		Municipalities: *23 of the Região Integrada de Desenvolvimento do Distrito Federal e Entorno, Anápolis, Paracatu, Arinos, Uruana de Minas*
Brazil	Porto Alegre	4,264,436	3,979,561	1.07		Municipalities: *32 of the Região Metropolitana de Porto Alegre, Lindolfo Collor, São Sebastião do Caí, Pareci Novo, Palmares do Sul, Balneário Pinhal, Cidreira, Osório, Tramandaí, Imbé, Xangri-lá, Capão do Leão, Igrejinha, Três Coroas, Harmonia, Bom Princípio, Feliz*
Brazil	Sao Paulo	26,193,667	24,134,141	1.09		Municipalities: *39 of the Região Metropolitana São Paulo (RMSP), 9 of the Região Metropolitana da Baixada Santista, 5 of the Microrregião de Jundiaí, 15 of the Microrregião de Sorocaba, 8 of the Microrregião de São José dos Campos, 19 of the Região Metropolitana de Campinas*
Brazil	Curitiba	3,446,485	3,168,980	1.09		Municipalities: *26 of the Região Metropolitana de Curitiba, Morretes, Antonina, Paranaguá, Pontal do Paraná, Guaratuba, Matinhos, Itapoá*
Brazil	Rio de Janeiro	13,331,714	11,711,233	1.14		Municipalities: *19 of the Região Metropolitana do Rio de Janeiro, Saquarema, Araruama, Iguaba Grande, São Pedro da Aldeia, Arraial do Cabo, Cabo Frio, Armação dos Búzios, Mangaratiba, Angra dos Reis, Petrópolis, Teresópolis, Cachoeiras de Macacu, Rio Bonito, Nova Friburgo*
Brazil	Belo Horizonte	5,453,312	4,882,977	1.12		Municipalities: *34 of the Região Metropolitana de Belo Horizonte, Barão de Cocais, Belo Vale, Bonfim, Fortuna de Minas, Funilândia, Inhaúma, Itabirito, Itaúna, Moeda, Pará de Minas, Prudente de Morais, Santa Bárbara, São José da Varginha, Sete Lagoas, Cachoeira da Prata, Itaú de Minas, Carmo do Cajuru*

Nation	Extended Metropolitan Region (EMR)	EMR 2010 Population Estimate	UN WUP Urban Agglomeration 2010 Population	EMR to Urban Agglomeration 2010 Ratio	Rationale for relaxing factor 2 threshold	Administrative Sub-Divisions constituting each EMR
Brazil	Salvador	3,924,954	3,574,804	1.10		Municipalities: *13 of the Região Metropolitana de Salvador, Saubara, Salinas da Margarida, Catu, Entre Rios, Jaguaripe, Santo Amaro, Alagoinhas, Itanagra, Araças*
Brazil	Recife	4,054,966	3,688,428	1.10		Municipalities: *14 of the Região Metropolitana do Recife, Vitória de Santo Antão, Paudalho, Goianá, Sirinhaém, Rio Formoso, Tamandaré, Condado*
Brazil	Fortaleza	3,950,596	3,610,379	1.09		Municipalities: *15 of the Região Metropolitana de Fortaleza, Paracuru, Paraipaba, Beberibe, Acarapé, Barreira, Redenção, Palmácia, Fortim, Aracati, São Luiz do Curu, Pentecoste, Umirim*
Bangladesh	Dhaka	17,614,436	14,648,354	1.20		Districts: *Dhaka, Naray Angonj, Gazipur*
Bangladesh	Chittagong	9,424,237	4,961,826	1.90		District: *Chittagong*
Bangladesh	Khulna	3,004,191	1,682,330	1.79		District: *Khulna*
China	Beijing	17,487,816	12,385,263	1.41		Province: *Beijing*
China	Shanghai	19,553,651	16,575,110	1.18		Province: *Shanghai*
China	Tianjin	12,142,489	7,884,473	1.54		Province: *Tianjin*
China	Guangzhou-Shenzen-Dongguan	40,437,810	31,800,702	1.27		Sub-Provinces: *Guangzhou, Shenzhen, Dongguan, Huizhou, Zhongshan, Foshan*
China	Shenyang-Fushun	9,587,314	5,165,771	1.86		Sub-Provinces: *Shenyang, Fushun*
China	Dalian	6,296,304	3,305,864	1.90		Sub-Province: *Dalian*
China	Jinan	6,877,240	3,237,414	2.12	data only avalaible at larger administrative level	Sub-Province: *Jinan*
China	Nanjing	8,060,882	4,518,826	1.78		Sub-Province: *Nanjing*
China	Wuhan	9,202,994	7,681,099	1.20		Sub-Province: *Wuhan*
China	Harbin	10,350,973	4,251,063	2.43	UN WUP definition of metropolitan area very limited	Sub-Province: *Harbin*
China	Chengdu	13,184,294	4,960,893	2.66	UN WUP definition of metropolitan area very limited	Sub-Province: *Chengdu*
China	Hefei	5,130,599	2,403,907	2.13	UN WUP definition of metropolitan area very limited	Sub-Province: *Hefei*
China	Xi'an	8,611,430	4,746,755	1.81		Sub-Province: *Xi'an*
China	Nanchang	4,836,946	2,701,478	1.79		Sub-Province: *Nanchang*
China	Kunming	6,435,490	3,115,793	2.07	data only avalaible at larger administrative level	Sub-Province: *Kunming*
China	Guiyang	4,035,935	2,153,908	1.87		Sub-Province: *Guiyang*
China	Fuzhou	7,252,632	2,786,585	2.60	UN WUP definition of metropolitan area very limited	Sub-Province: *Fuzhou*
Burma	Yangon	7,122,722	4,349,604	1.64		Region: *Yangon*
Bolivia	La Paz	1,908,813	1,673,401	1.14		Municipalities: *La Paz, El Alto, Viacha, Achocalla, Mecapaca*
Bolivia	Santa Cruz	1,992,709	1,648,661	1.21		Municipalities: *Santa Cruz de la Sierra, Montero, La Guardia, Warnes, Cotoca, El Torno, Porongo*
Benin	Cotonou	1,523,836	844,000	1.81		Communes: *Cotonou, Sèmè-Kpodji, Abomey-Calavi, So -Ava, Aguegues*
Cambodia	Phnom Penh	2,746,038	1,562,498	1.76		Provinces: *Phnom Penh, Kandal*
Chile	Santiago	6,921,403	5,951,554	1.16		Region: *Santiago*
Colombia	Bogota	9,840,818	8,499,820	1.16		Departments: *Capital District, Cundinamarca*
Colombia	Medellin	6,065,846	3,593,821	1.69		Department: *Antioquia*
Congo, DRC	Kinshasa	9,426,523	8,753,869	1.08		Province: *Kinshasa*
Egypt	Cairo	24,243,250	11,001,378	2.20	UN WUP definition of metropolitan area very limited	Governorates: *Cairo, Qalyubia, Giza, Sharqia, Monufia*
Egypt	Alexandria	9,433,514	4,387,282	2.15	UN WUP definition of metropolitan area very limited	Governorates: *Alexandria, Beheira*
Hong Kong	Hong Kong	7,069,378	7,069,378	1.00		City-State
Singapore	Singapore	4,836,691	4,836,691	1.00		City-State

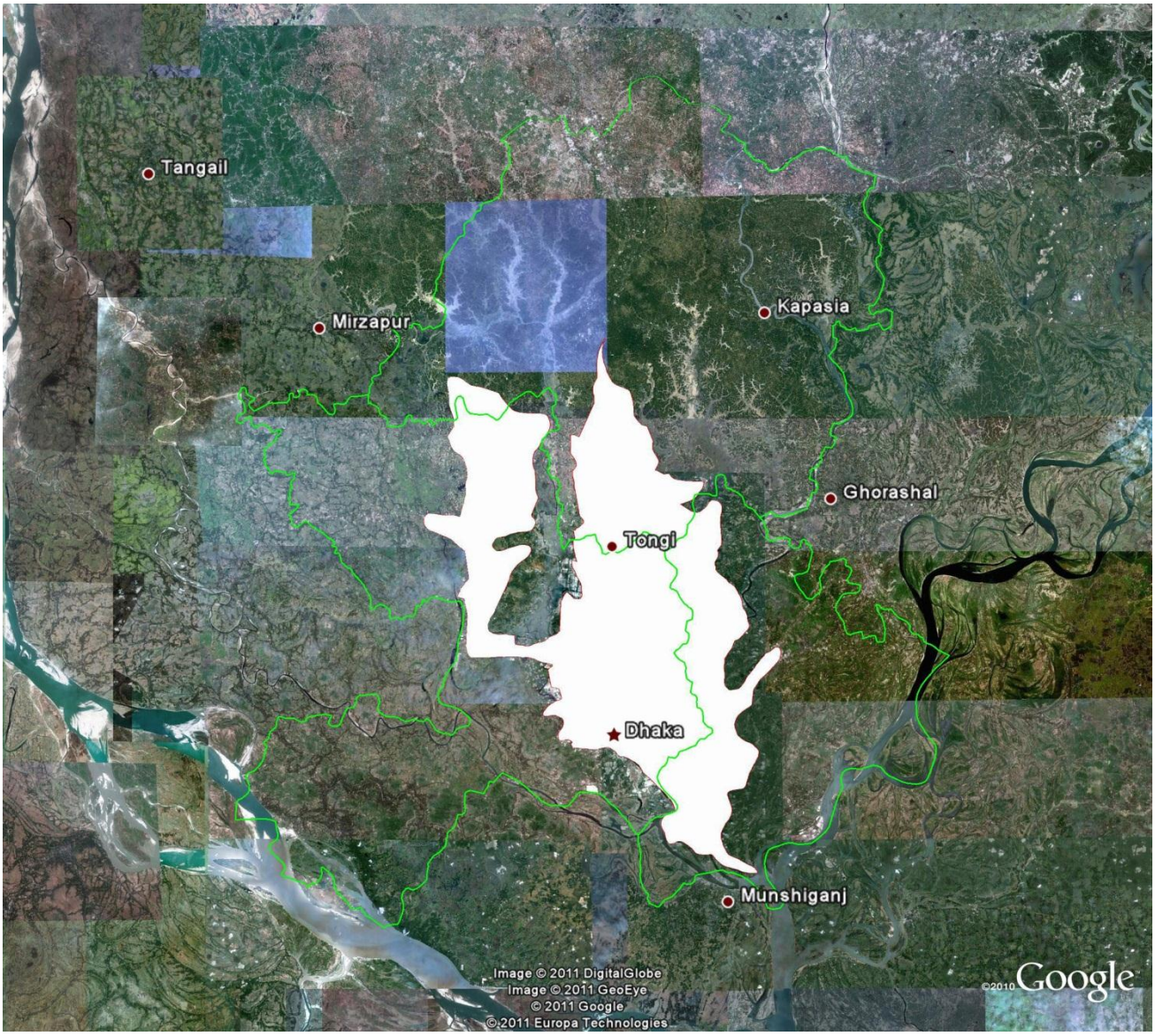
1.2 Example: Constructing Bangladeshi EMRs

From the WUP database, we see that Bangladesh had four urban agglomerations over 750,000 inhabitants in 2010: Dhaka with 14.6 million, Chittagong with close to 5 million, Khulna with 1.7 million and Rajshahi with just under 900,000 inhabitants. Bangladesh, a country of 164 million inhabitants in 2010 (WUP) is administratively divided into seven main divisions whose populations range from 10 to 46 million. The Dhaka division's 2010 population is estimated at 46 million and is thus much too large to be used as a proxy for Dhaka's metropolitan region, and the same holds for the other three cities under consideration in Bangladesh. The next administrative level in the country is the district (Zila), of which there are 64, while the next sub-division is the sub-district (Upazila), of which there are 493. Using the sub-district level would allow us to build finer proxies for the metropolitan areas. However, an investigation of Bangladesh's national statistical institute website[5] revealed that most indicators needed for our purposes are only available at the district level. It is thus necessary to use the districts as the basis from which to construct our proxies of the four metropolitan regions under consideration. What needs to be done is to check whether districts can be found such that they contain the largest geographical extent of the city yet do not exceed that city in population terms by over a factor of 2.

The first step is to import the district administrative boundaries into Google Earth (using the GADM global database of administrative boundaries[6]) and to look at the relationship between the geographical extent of a city on the satellite images and the administrative boundaries of the districts that surround it. In the case of Dhaka, we see that the city spills out from Dhaka district towards the South into Narayanganj district and towards the North into Gazipur district (see below, with the district boundaries in green and the main metropolitan area in white).

[5] The Bangladesh Bureau of Statistics, available online at: http://www.bbs.gov.bd/Home.aspx

[6] GADM database of Global Administrative Areas, available online at: http://www.gadm.org/

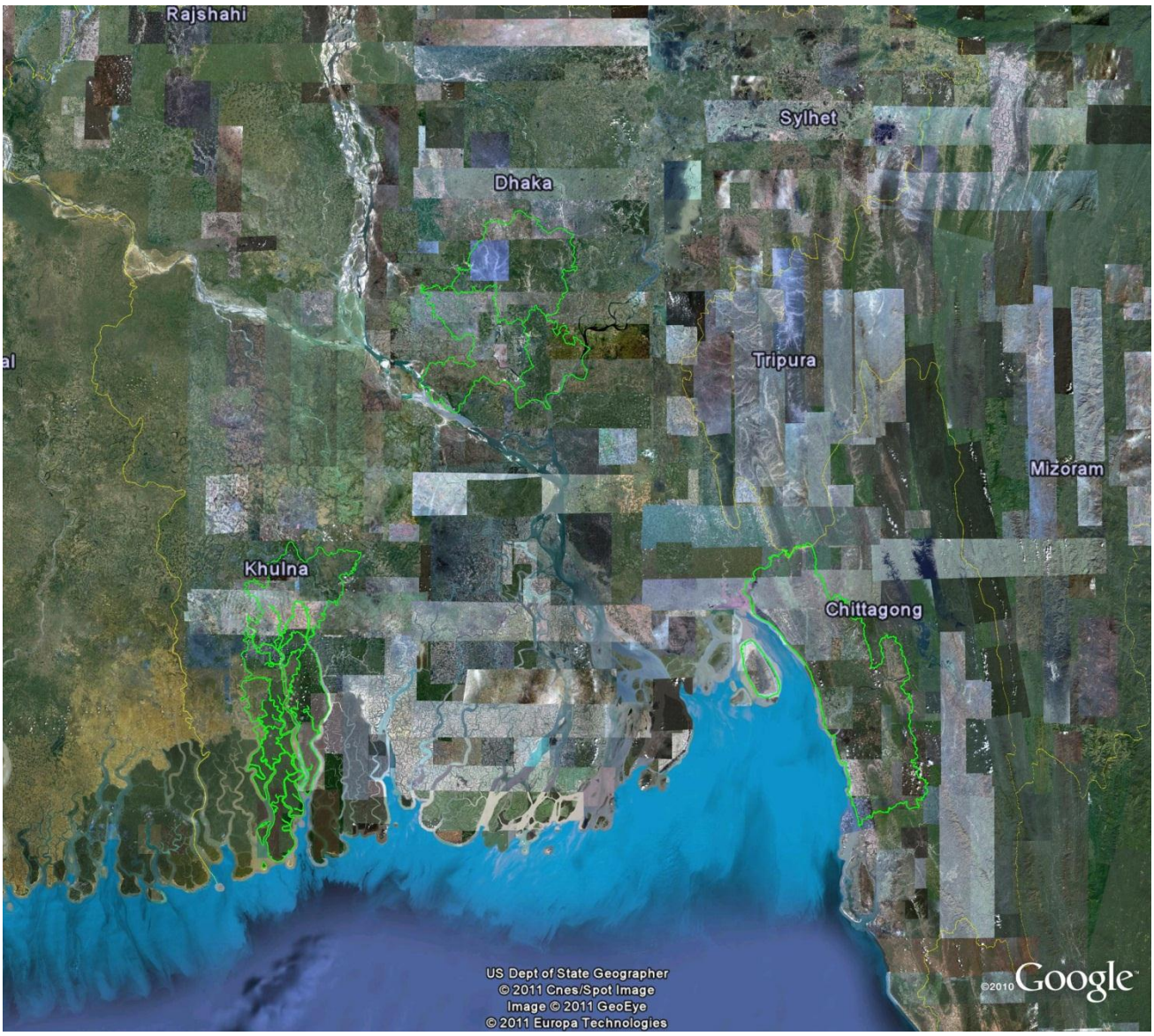


In order to capture the full extent of the city's built-up land, it is thus necessary to use three districts (Dhaka, Narayanganj and Gazipur) to construct a proxy for Dhaka's metropolitan region (Dhaka's EMR). This now needs to be validated using population figures. The WUP estimates the Dhaka urban agglomeration to be made up of close to 15 million inhabitants. However, Bangladesh's last population census was in 2001 and there were also no population projections calculated at the district level.

In order to estimate the population in each of these three districts for 2010 (which will also be crucial for the estimation of density), the annual geometric growth rate of the population of the corresponding WUP agglomeration was used to estimate the 2010 population of the districts. For example, according to the WUP, Dhaka's urban agglomeration grew from 10.3 million to 14.7 million between 2000 and 2010, an annual geometric growth rate of 1.036, and for 9 years this gave a growth rate of 1.37. This factor was applied to the 2001 population of the three districts, which yielded the following population estimates for

2010: Dhaka district had a population of 11.8 million, Narayanganj 3 million and Gazipur 2.8 million. Dhaka's EMR thus had an estimated population of 17.6 million in 2010, which exceeds the 14.6 million of Dhaka's WUP urban agglomeration in 2010 by a factor of 1.2. This is thus a valid construction for our purposes.

From the satellite imagery of Google Earth, Khulna, Chittagong and Rajshahi are all found to be contained within their respective districts. In order to know whether these districts can be used as proxies for their respective metropolitan regions, the same type of population test is needed. A comparison of the WUP urban agglomeration 2010 populations with the 2010 district figures (estimated in the same way as for Dhaka) reveals that Chittagong and Khulna districts exceeded the WUP defined agglomerations by factors of 1.9 and 1.8 respectively, while Rajshahi district was over three times larger than the corresponding WUP agglomeration. This means that Chittagong and Khulna districts can be used, but not Rajshahi district. Our investigation of Bangladesh will thus look at three cities by collecting data for 5 districts. Below is a snapshot from Google Earth of the districts for which data has been collected:



2 Measuring health and well-being using the Human Development Index

In order to get a comprehensive picture of the health and well-being of a population in a particular place, I chose to measure the Human Development Indices of the EMRs presented above. A composite indicator, the latest version of the HDI combines a country's life expectancy at birth, the means years of schooling its population receives, the years of schooling its population is expected to receive and gross national income per capita (PPP 2008 $). The HDI is calculated by the United Nations Development Programme (UNDP) based on these four indicators for the same year (the latest is 2010). Any attempt to calculate the HDI of sub-national entities has to face the fact that there is no single indicator in either of the dimensions of health, education or wealth that is available on an international basis. This is also true for the selection of sub-national divisions that I am using as EMRs above[7]. This can be explained by the wide variety of circumstances existing at a global level, 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 research project, it will thus be necessary to estimate EMR level HDIs based on the data that is available at a sub-national level in each national context for the three dimensions of health, education and wealth.

The overall strategy of the EMR HDI estimation technique consists in using the national performance as a benchmark against which to measure the performance of the sub-national divisions that make up the EMR under consideration. In practice, this means calculating the ratio between EMR and national performance in each of the three dimensions and applying that ratio on the national level health, education and wealth HDI sub-indices. The next section will explain how and why I have departed slightly from the UNDP's indicators and formulas for the national HDI calculation. This will be followed by a detailed presentation of how I have calculated the ratios between EMR and national performance in each of the three dimensions, accompanied by the example of the health dimension for the three Bangladeshi EMRs introduced above.

[7] While there are 57 out of 129 EMRs for which a life expectancy figure is available for the 1999-2011 period, 55 out of 129 with an adult literacy rate figure for 1999-2009 and 55 that have a GDP per capita (various currencies and calculation methods) for the 1999 to 2010 period, there is only one EMR (Dakar) for which all three all available simultaneously. If GDP PPP per capita is used instead (available for 14 EMRs over 2003-2010), it is possible to construct 9 EMR level HDIs using the same indicators. However, more than 10 years separate some of the figures and the number of comparable EMR level HDIs that it is possible to construct using exactly the same indicators drops to 6 if only data from 2006-2011 is used.

2.1 Calculating the national HDI sub-indices

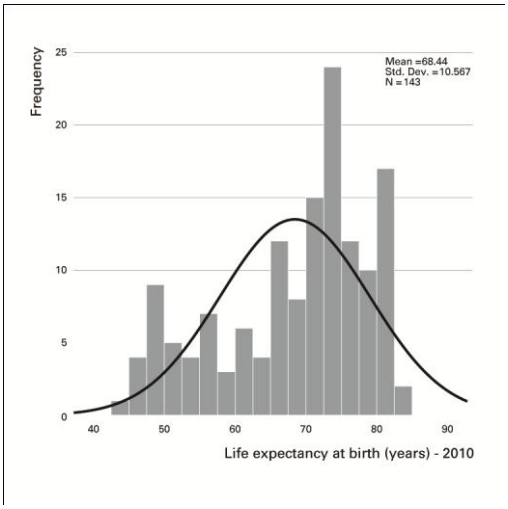
The three HDI sub-indices of health, education and wealth played a key role in the estimation of EMR level HDIs. This is because they served as benchmarks from which to evaluate the performance of the EMRs in each of these dimensions. Accordingly, I wanted these national level HDI sub-indices to represent an as accurate as possible picture of the situation in the country under consideration. In order to make this process more accurate and internationally comparable, the UNDP recently revised[8] the set of indicators it uses to measure the HDI as well as the standardisation techniques it uses to compare countries against each other on these indicators. The most important change is in the education dimension, as they have replaced the literacy rate and the gross enrolment ratio with estimates of the mean years of schooling and the expected years of schooling of the national population. I chose to follow the UNDP's change of indicators for education and I also used the UNDP indicator for the wealth dimension, namely, 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 by the infant mortality rate[9]. Both of these indicators were weighted equally, and the choice to use both indicators to measure national health performance is due to the wide differences in national performance on 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.

I thus assessed national performance based on 5 indicators. In contrast to the UNDP which has developed a unique standardisation procedure for each of the indicators it uses, I decided to use a single standardisation technique for all 5 indicators, based on the minimum and maximum values achieved on each indicator by the

[8] For the 2010 Global Human Development Report, available online at: http://hdr.undp.org/en/media/HDR_2010_EN_TechNotes_reprint.pdf

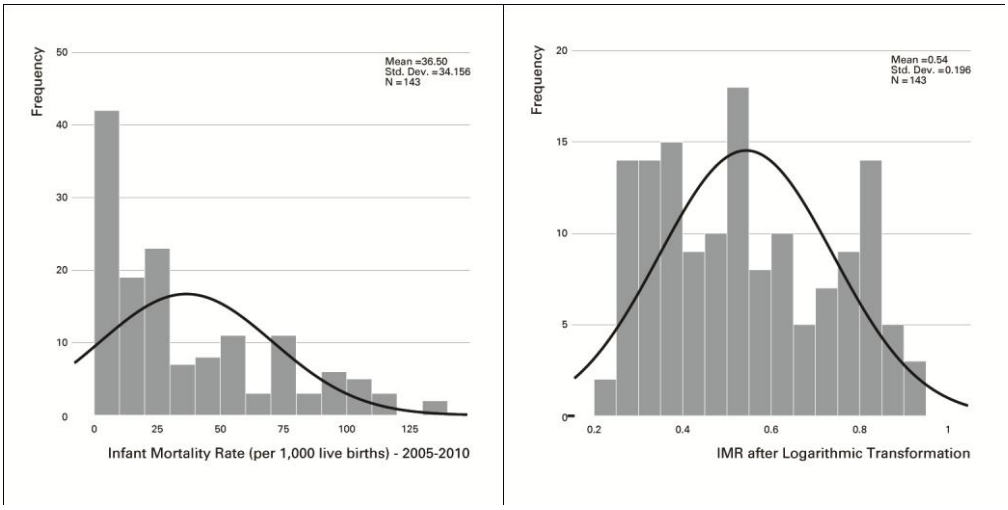
[9] From the United Nations World Population Prospects database, available online at: http://esa.un.org/unpd/wpp/Excel-Data/mortality.htm

143 countries in my sample[10]. In order to make sure the standardised values obtained on each indicator either follow a normal distribution or were relatively well spread out over the 0 to 1 range, the frequency distribution of each of the 5 indicators was 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.

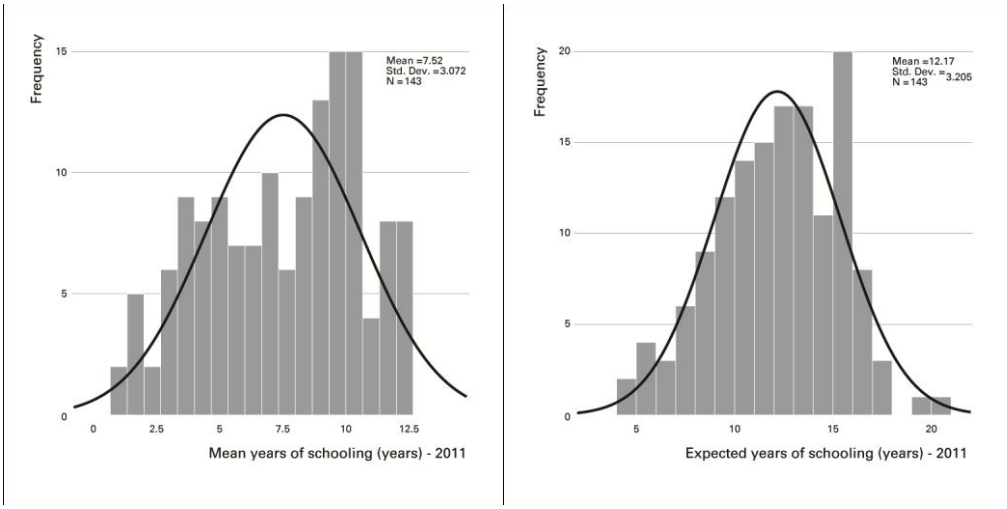
The frequency distribution for the infant mortality rate, in contrast, showed a large range of values[11] and a large concentration of values at the lower end and low frequencies in the middle and higher end of the distribution (see below, on the left). The UNDP does not use the infant mortality rate 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).



[10] For each of the 5 indicators, the standardisation procedure takes this format: $x - x_{min} / x_{max} - x_{min.}$

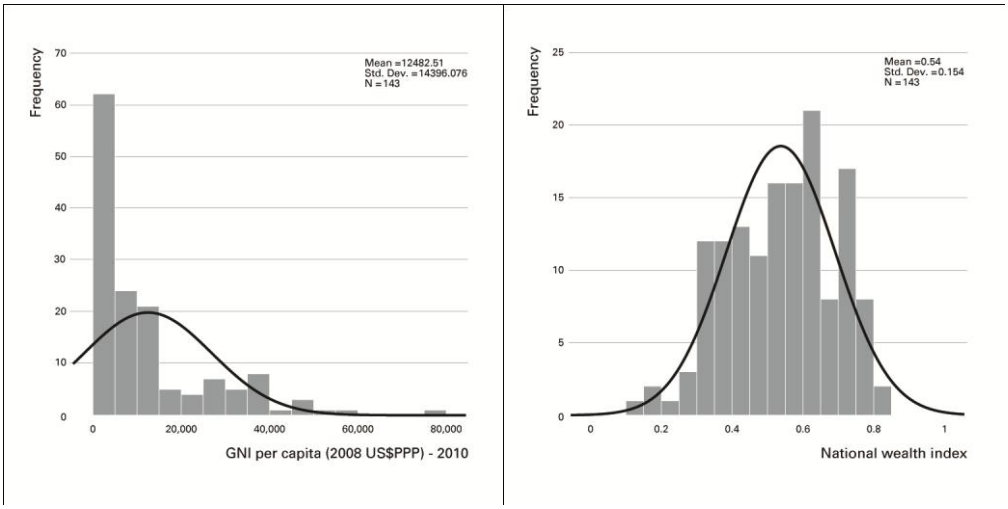
[11] A minimum of 1.9 per 1,000 live births (Singapore) and a maximum of 135.9 per 1,000 live births (Afghanistan)

The frequency distributions for the education indicators used by the UNDP – the mean and expected years of schooling of its adult population – can be seen in the graphics below. The expected years of schooling presents a normal distribution (0.364 on the Shapiro-Wilk normality test) and the standardisation procedure can thus be applied without transformation. While the mean years of schooling (does not present a normal distribution (less than 0.001 on the same test), the frequency distribution for this latter indicator is spread out enough to allow for the standardisation procedure to be applied without transformation. In not using any transformation procedure for the education indicators, I am following the UNDP's methodology.



The frequency distributions for the GNI per capita values and for these values after a logarithmic transformation are shown below. As mentioned above, the UNDP uses the logarithmic transformation to normalise the GNI per capita figures (0.017 on the Shapiro-Wilk normality test) and I have adopted this procedure here. Thus, to get the wealth sub-index value for the countries in my sample, I took the logarithm of the actual value and applied to the values I obtained the standardisation procedure detailed above. This procedure allows for a very large range of values[12] to be more evenly distributed across the 0 to 1 range. This technique also recognises that the marginal utility of extra per capita income decreases with increasing per capita income levels.

[12] For national income per capita, the minimum value was 176 (Zimbabwe) and the maximum value was Qatar (79,426).



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[13]. I wanted to ensure that the average values of the health, education and wealth dimensions were similar in order to minimize any influence on the weighting of the indicators on the final HDI value that could have emerged from the different numerical ranges in each dimension[14]. The HDI sub-indices for health, education and wealth are obtained by taking the geometric mean of the indicators within that dimension, and the final national level HDI was calculated by taking the geometric mean of the three sub-indices. The table below shows the values of the five indicators used to calculate the national level HDI, the value achieved by each country in the three sub-indices and overall HDI, as well as the rank achieved by each country in this version of the HDI compared to the rank of that country in the UNDP's 2010 HDI. Some countries show a large change in ranks as compared to the UNDP HDI. Given that there has been no modification to the indicators used by the UNDP and their transformation in the education and wealth dimensions, this difference in ranks has to be imputed to the addition of the infant mortality rate to the life expectancy to measure the health dimension.

[13] For life expectancy, the maximum value was increased by 10% and the minimum was decreased by 7%, yielding a range of standardised values with maximum 0.834, minimum 0.062 and average 0.539. For the infant mortality rate, the corresponding figures are 4%, 32%, 0.943, 0.230 and 0.544. For mean years of schooling: 10%, minimum value set to 0, 0.909, 0.086 and 0.541. For expected years of schooling: 10%, minimum value set to 0, 0.909, 0.191 and 0.541. For per capita income: 12.5%, 21%, 0888, 0.041 and 0.537.

[14] For all 143 countries in the sample, the average value of the health sub-index is 0.538 (0.539 for life expectancy and 0.544 for the infant mortality rate), the average value of the education sub-index is 0.536 (0.541 for mean years of schooling and 0.541 for expected years of schooling), and the average value of the wealth sub-index is 0.537.

	Life expectancy at birth (years) - 2010	Infant mortality per 1,000 live births - 2005-2010	Mean years of schooling of adults (years) - 2011	Expected years of schooling of adults (years) - 2011	GNI per capita (2008 US$ PPP) - 2010	LSE Cities national health index	LSE Cities national education index	LSE Cities national wealth index	UNDP 2010 national health HDI sub-index	UNDP 2010 national education HDI sub-index	UNDP 2010 national wealth HDI sub-index	LSE Cities-UNDP difference in national health index ranks	LSE Cities-UNDP difference in national education index ranks	LSE Cities-UNDP difference in national wealth index ranks
Norway	81.0	3.0	12.6	17.3	58,810	0.831	0.837	0.822	0.965	0.943	0.906	-5.0	0.0	0.0
Australia	81.9	4.7	12.0	20.5	38,692	0.803	0.887	0.770	0.979	1.001	0.842	10.0	0.0	0.0
Sweden	81.3	2.6	11.6	15.6	36,936	0.843	0.760	0.764	0.969	0.857	0.835	-4.0	0.0	0.0
Japan	83.2	2.6	11.5	15.1	34,692	0.853	0.744	0.756	0.999	0.839	0.825	2.0	0.0	0.0
Hong Kong	82.5	2.0	10.0	13.8	45,090	0.866	0.664	0.789	0.989	0.749	0.865	-1.0	0.0	0.0
Ireland	80.3	4.0	11.6	17.9	33,078	0.802	0.815	0.750	0.955	0.918	0.818	-1.0	0.0	0.0
Singapore	80.7	1.9	8.8	14.4	48,893	0.861	0.638	0.799	0.961	0.719	0.878	-10.0	0.0	0.0
Finland	80.1	2.8	10.3	17.1	33,872	0.824	0.751	0.753	0.951	0.847	0.821	-12.0	0.0	0.0
Netherlands	80.3	4.4	11.2	16.7	40,658	0.790	0.772	0.776	0.955	0.871	0.849	5.0	0.0	0.0
Germany	80.2	3.7	12.2	15.6	35,308	0.804	0.780	0.758	0.953	0.880	0.828	-5.0	0.0	0.0
New Zealand	80.6	5.1	12.5	19.7	25,438	0.780	0.888	0.717	0.959	1.002	0.777	12.0	0.0	0.0
France	81.6	3.5	10.4	16.1	34,341	0.821	0.734	0.755	0.975	0.828	0.823	4.0	0.0	0.0
Luxembourg	79.9	2.3	10.1	13.3	51,109	0.833	0.655	0.804	0.948	0.738	0.885	-15.0	0.0	0.0
Canada	81.0	5.2	11.5	16.0	38,668	0.788	0.766	0.769	0.966	0.863	0.842	11.0	0.0	0.0
United States	79.6	6.8	12.4	15.7	47,094	0.750	0.792	0.794	0.943	0.893	0.872	4.0	0.0	0.0
Switzerland	82.2	3.7	10.3	15.5	39,849	0.808	0.713	0.773	0.984	0.804	0.846	8.0	0.0	0.0
Korea	79.8	3.8	11.6	16.8	29,518	0.795	0.791	0.736	0.946	0.892	0.800	-3.0	0.0	0.0
Denmark	78.7	4.0	10.3	16.9	36,404	0.784	0.745	0.762	0.929	0.840	0.832	-7.0	0.0	0.0
Belgium	80.3	3.8	10.6	15.9	34,873	0.800	0.734	0.757	0.954	0.828	0.826	0.0	0.0	0.0
Spain	81.3	3.8	10.4	16.4	29,661	0.812	0.736	0.736	0.970	0.830	0.801	3.0	0.0	0.0
Italy	81.4	3.5	9.7	16.3	29,619	0.823	0.711	0.736	0.972	0.802	0.801	2.0	0.0	0.0
Israel	81.2	3.8	11.9	15.6	27,831	0.807	0.770	0.728	0.968	0.868	0.791	3.0	0.0	0.0
Austria	80.4	4.0	9.8	15.0	37,056	0.800	0.686	0.764	0.956	0.773	0.835	2.0	0.0	0.0
Greece	79.7	4.6	10.5	16.5	27,580	0.784	0.744	0.727	0.944	0.839	0.790	0.0	0.0	0.0
United Kingdom	79.8	4.9	9.5	15.9	35,087	0.778	0.695	0.757	0.946	0.783	0.827	4.0	0.0	0.0
Slovenia	78.8	3.5	9.0	16.7	25,857	0.793	0.695	0.719	0.930	0.783	0.780	-8.0	0.0	0.0
Czech Republic	76.9	3.2	12.3	15.2	22,678	0.783	0.773	0.703	0.901	0.872	0.760	-6.0	0.0	0.0
Portugal	79.1	4.5	8.0	15.5	22,105	0.772	0.631	0.700	0.935	0.712	0.756	1.0	0.0	0.0
Qatar	76.0	8.8	7.3	12.7	79,426	0.687	0.545	0.859	0.886	0.614	0.952	-1.0	0.0	0.0
Slovakia	75.1	6.3	11.6	14.9	21,658	0.710	0.742	0.697	0.872	0.836	0.752	-8.0	0.0	0.0
Estonia	73.7	4.7	12.0	15.8	17,168	0.699	0.780	0.668	0.850	0.879	0.717	-20.0	0.0	0.0
Hungary	73.9	5.8	11.7	15.3	17,472	0.703	0.755	0.670	0.852	0.851	0.719	-18.0	0.0	0.0
Poland	76.0	6.1	10.0	15.2	17,803	0.724	0.696	0.673	0.886	0.785	0.722	-5.0	0.0	0.0
Chile	78.8	7.2	9.7	14.5	13,561	0.734	0.673	0.639	0.930	0.759	0.680	1.0	0.0	0.0
Croatia	76.7	6.0	9.0	13.8	16,389	0.732	0.630	0.662	0.897	0.710	0.710	-4.0	0.0	0.0
Lithuania	72.1	6.5	10.9	16.0	14,824	0.663	0.746	0.650	0.824	0.841	0.694	-31.0	0.0	0.0
Latvia	73.0	7.5	10.4	15.4	12,944	0.676	0.715	0.633	0.839	0.806	0.673	-22.0	0.0	0.0
Montenegro	74.6	8.7	10.6	14.4	12,491	0.683	0.699	0.628	0.863	0.789	0.668	-7.0	0.0	0.0
Argentina	75.7	13.4	9.3	15.5	14,603	0.655	0.679	0.648	0.881	0.766	0.692	4.0	0.0	0.0
Uruguay	76.7	13.1	8.4	15.7	13,808	0.659	0.650	0.641	0.897	0.733	0.683	6.0	0.0	0.0
Malaysia	74.7	7.7	9.5	12.5	13,927	0.684	0.616	0.642	0.866	0.695	0.684	-6.0	0.0	0.0
Romania	73.2	13.9	10.6	14.8	12,844	0.626	0.709	0.632	0.842	0.799	0.672	-5.0	0.0	0.0
Belarus	69.6	6.8	9.3	14.6	12,926	0.642	0.659	0.633	0.785	0.743	0.673	-35.0	0.0	0.0
Bulgaria	73.7	10.2	9.9	13.7	11,139	0.658	0.659	0.614	0.850	0.743	0.650	-12.0	0.0	0.0
Mexico	76.7	16.7	8.7	13.4	13,971	0.638	0.611	0.642	0.897	0.689	0.685	15.0	0.0	0.0
Costa Rica	79.1	9.9	8.3	11.7	10,870	0.713	0.560	0.611	0.935	0.631	0.646	7.0	0.0	0.0
Serbia	74.4	11.8	9.5	13.5	10,449	0.653	0.640	0.606	0.860	0.722	0.640	-4.0	0.0	0.0
Panama	76.0	18.2	9.4	13.5	13,347	0.616	0.636	0.637	0.885	0.717	0.678	17.0	0.0	0.0
Russian Federation	67.2	11.3	8.8	14.1	15,258	0.568	0.631	0.653	0.747	0.712	0.699	-21.0	0.0	0.0
Bosnia and Herzegovina	75.5	13.4	8.7	13.0	8,222	0.650	0.601	0.576	0.878	0.677	0.603	6.0	0.0	0.0
Macedonia, FYR	74.5	14.7	8.2	12.3	9,487	0.637	0.567	0.594	0.863	0.639	0.625	3.0	0.0	0.0
Trinidad and Tobago	69.9	26.6	9.2	11.4	24,233	0.534	0.581	0.711	0.790	0.655	0.770	4.0	0.0	0.0
Ukraine	68.6	12.9	11.3	14.6	6,535	0.590	0.727	0.548	0.769	0.820	0.568	-25.0	0.0	0.0
Venezuela	74.2	17.0	6.2	14.2	11,846	0.610	0.530	0.622	0.858	0.598	0.660	5.0	0.0	0.0
Albania	76.9	18.3	10.4	11.3	7,976	0.636	0.612	0.572	0.900	0.690	0.599	20.0	0.0	0.0
Peru	73.7	21.2	9.6	13.8	8,424	0.566	0.650	0.579	0.849	0.733	0.607	17.0	0.0	0.0
Brazil	72.9	23.5	7.2	13.8	10,607	0.572	0.562	0.608	0.837	0.634	0.643	7.0	0.0	0.0
Belize	76.9	17.2	9.2	12.4	5,693	0.632	0.604	0.530	0.900	0.681	0.547	20.0	0.0	0.0
Colombia	73.4	19.1	7.4	13.3	8,589	0.587	0.563	0.582	0.845	0.635	0.610	5.0	0.0	0.0
Kazakhstan	65.4	27.0	10.3	15.1	10,234	0.496	0.706	0.604	0.718	0.796	0.637	-11.0	0.0	0.0
Iran	71.9	27.2	7.2	14.0	11,764	0.541	0.568	0.621	0.821	0.641	0.659	4.0	0.0	0.0
Tunisia	74.3	20.8	6.5	14.5	7,979	0.596	0.548	0.573	0.860	0.618	0.599	10.0	0.0	0.0
Thailand	69.3	12.4	6.6	13.5	8,001	0.605	0.532	0.573	0.780	0.599	0.599	-27.0	0.0	0.0
Turkey	72.2	24.0	6.5	11.8	13,359	0.572	0.495	0.637	0.826	0.558	0.678	0.0	0.0	0.0
Sri Lanka	74.4	12.4	8.2	12.0	4,886	0.650	0.562	0.511	0.861	0.633	0.523	-2.0	0.0	0.0
Jordan	73.1	21.0	8.6	13.1	5,956	0.589	0.602	0.536	0.840	0.679	0.554	2.0	0.0	0.0
Jamaica	72.3	24.4	9.6	11.7	7,207	0.568	0.600	0.560	0.828	0.676	0.583	5.0	0.0	0.0
Armenia	74.2	26.2	10.8	11.9	5,495	0.583	0.642	0.526	0.858	0.723	0.541	15.0	0.0	0.0
Algeria	72.9	25.0	7.2	12.8	8,320	0.562	0.544	0.578	0.837	0.613	0.605	12.0	0.0	0.0
Azerbaijan	70.8	41.1	10.2	13.0	8,747	0.506	0.652	0.584	0.805	0.735	0.613	9.0	0.0	0.0
Georgia	72.0	29.3	12.1	12.6	4,902	0.559	0.699	0.512	0.823	0.788	0.524	4.0	0.0	0.0
China	73.5	22.0	7.5	11.4	7,258	0.586	0.524	0.561	0.846	0.591	0.584	7.0	0.0	0.0
El Salvador	72.0	21.5	7.7	12.1	6,498	0.575	0.546	0.547	0.822	0.615	0.567	-5.0	0.0	0.0
Dominican Republic	72.8	29.6	6.9	11.9	8,273	0.558	0.513	0.577	0.835	0.579	0.604	13.0	0.0	0.0
Suriname	69.4	21.6	7.2	12.0	7,093	0.540	0.527	0.558	0.781	0.595	0.581	-3.0	0.0	0.0
Maldives	72.3	9.8	4.7	12.4	5,408	0.630	0.434	0.524	0.828	0.490	0.539	-15.0	0.0	0.0
Moldova	68.9	15.5	9.7	12.0	3,149	0.575	0.610	0.457	0.774	0.688	0.456	-18.0	0.0	0.0
Philippines	72.3	23.0	8.7	11.5	4,002	0.563	0.565	0.486	0.828	0.637	0.493	8.0	0.0	0.0
Paraguay	72.3	32.0	7.8	12.0	4,585	0.539	0.547	0.503	0.827	0.617	0.514	12.0	0.0	0.0
Egypt	70.5	25.9	6.5	11.0	5,889	0.550	0.479	0.535	0.800	0.540	0.552	-2.0	0.0	0.0
Turkmenistan	65.3	50.5	9.9	13.0	7,052	0.432	0.640	0.557	0.717	0.722	0.580	-3.0	0.0	0.0
Syrian Arab Republic	74.6	15.0	4.9	10.5	4,760	0.636	0.404	0.508	0.864	0.455	0.519	6.0	0.0	0.0
Mongolia	67.3	36.0	8.3	13.5	3,619	0.485	0.598	0.474	0.748	0.675	0.477	-1.0	0.0	0.0
Gabon	61.3	51.1	7.5	12.7	12,747	0.383	0.551	0.631	0.654	0.621	0.671	-2.0	0.0	0.0
Bolivia	66.3	45.6	9.2	13.7	4,357	0.446	0.635	0.497	0.733	0.716	0.506	0.0	0.0	0.0
Indonesia	71.5	28.8	5.7	12.7	3,957	0.538	0.479	0.485	0.815	0.540	0.491	6.0	0.0	0.0
Honduras	72.6	28.1	6.5	11.4	3,750	0.539	0.487	0.478	0.832	0.549	0.483	17.0	0.0	0.0
Botswana	55.5	40.7	8.9	12.4	13,204	0.355	0.593	0.635	0.562	0.669	0.676	-11.0	0.0	0.0
Viet Nam	74.9	20.4	5.5	10.4	2,995	0.602	0.427	0.450	0.869	0.481	0.448	16.0	0.0	0.0
Namibia	62.1	37.8	7.4	11.8	6,323	0.424	0.528	0.544	0.666	0.595	0.563	-9.0	0.0	0.0
Nicaragua	73.8	21.5	5.7	10.8	2,567	0.591	0.444	0.431	0.851	0.500	0.424	7.0	0.0	0.0
Uzbekistan	68.2	48.7	10.0	11.5	3,085	0.464	0.606	0.454	0.762	0.683	0.453	4.0	0.0	0.0
Kyrgyzstan	68.4	36.4	9.3	12.6	2,291	0.491	0.610	0.417	0.766	0.688	0.407	2.0	0.0	0.0
Morocco	71.8	34.1	4.4	10.5	4,628	0.536	0.382	0.505	0.820	0.431	0.515	8.0	0.0	0.0
Guatemala	70.8	30.1	4.1	10.6	4,694	0.525	0.375	0.506	0.803	0.423	0.517	7.0	0.0	0.0
Cape Verde	71.9	20.6	3.5	11.2	3,306	0.580	0.355	0.463	0.822	0.400	0.463	-8.0	0.0	0.0
South Africa	52.0	54.8	8.2	13.4	9,812	0.294	0.593	0.598	0.506	0.669	0.631	-6.0	0.0	0.0
Tajikistan	67.3	56.0	9.8	11.4	2,020	0.435	0.596	0.401	0.749	0.672	0.387	6.0	0.0	0.0
India	64.4	52.9	4.4	10.3	3,337	0.413	0.381	0.464	0.702	0.429	0.465	-1.0	0.0	0.0
Lao PDR	65.9	44.5	4.6	9.2	2,321	0.449	0.367	0.418	0.726	0.414	0.409	-4.0	0.0	0.0
Sao Tome and Principe	66.1	51.7	4.2	10.2	1,918	0.420	0.372	0.395	0.729	0.419	0.379	2.0	0.0	0.0
Cambodia	62.2	62.4	5.8	9.8	1,868	0.380	0.427	0.391	0.667	0.481	0.375	2.0	0.0	0.0
Bangladesh	66.9	49.0	4.8	8.1	1,587	0.450	0.352	0.371	0.743	0.397	0.350	-1.0	0.0	0.0
Ghana	57.1	49.6	7.1	9.7	1,385	0.350	0.468	0.354	0.587	0.528	0.329	-4.0	0.0	0.0
Pakistan	67.2	70.9	4.9	6.8	2,678	0.405	0.325	0.436	0.746	0.367	0.431	9.0	0.0	0.0

	Life expectancy at birth (years) - 2010	Infant mortality per 1,000 live births - 2005-2010	Mean years of schooling of adults (years) - 2011	Expected years of schooling of adults (years) - 2011	GNI per capita (2008 US$ PPP) - 2010	LSE Cities national health index	LSE Cities national education index	LSE Cities national wealth index	UNDP 2010 national health HDI sub-index	UNDP 2010 national education HDI sub-index	UNDP 2010 national wealth HDI sub-index	LSE Cities-UNDP difference in national health index ranks	LSE Cities-UNDP difference in national education index ranks	LSE Cities-UNDP difference in national wealth index ranks
Congo	53.9	72.4	5.9	9.3	3,258	0.283	0.419	0.461	0.537	0.473	0.461	-1.0	0.0	0.0
Myanmar	62.7	55.0	4.0	9.2	1,596	0.399	0.343	0.372	0.676	0.386	0.351	1.0	0.0	0.0
Nepal	67.5	38.7	3.2	8.8	1,201	0.477	0.302	0.336	0.751	0.341	0.307	2.0	0.0	0.0
Madagascar	61.2	44.8	5.2	10.2	953	0.399	0.411	0.307	0.653	0.463	0.272	-6.0	0.0	0.0
Kenya	55.6	64.7	7.0	9.6	1,628	0.308	0.463	0.374	0.563	0.522	0.354	-2.0	0.0	0.0
Swaziland	47.0	75.9	7.1	10.3	5,132	0.213	0.484	0.517	0.427	0.545	0.531	-10.0	0.0	0.0
Yemen	63.9	53.3	2.5	8.6	2,387	0.411	0.263	0.422	0.694	0.296	0.413	-1.0	0.0	0.0
Comoros	66.2	72.2	2.8	10.7	1,176	0.391	0.312	0.334	0.731	0.352	0.304	10.0	0.0	0.0
Togo	63.3	74.0	5.3	9.6	844	0.354	0.402	0.292	0.685	0.453	0.253	7.0	0.0	0.0
Cameroon	51.7	94.1	5.9	9.8	2,197	0.237	0.429	0.412	0.502	0.484	0.400	0.0	0.0	0.0
Benin	62.3	85.1	3.5	9.2	1,499	0.329	0.320	0.364	0.670	0.361	0.341	7.0	0.0	0.0
Mauritania	57.3	77.3	3.7	8.1	2,118	0.307	0.310	0.407	0.590	0.350	0.395	4.0	0.0	0.0
Uganda	54.1	79.2	4.7	10.4	1,224	0.275	0.397	0.339	0.540	0.447	0.310	1.0	0.0	0.0
Senegal	56.2	55.2	3.5	7.5	1,816	0.319	0.290	0.388	0.573	0.327	0.371	-3.0	0.0	0.0
Papua New Guinea	61.6	50.1	4.3	5.2	2,227	0.400	0.269	0.413	0.658	0.303	0.402	-5.0	0.0	0.0
Lesotho	45.9	76.9	5.8	10.3	2,021	0.199	0.435	0.401	0.410	0.491	0.387	-8.0	0.0	0.0
Nigeria	48.4	96.1	5.0	8.9	2,156	0.205	0.375	0.409	0.450	0.423	0.397	0.0	0.0	0.0
Rwanda	51.1	100.1	3.3	10.6	1,190	0.247	0.337	0.335	0.492	0.380	0.306	-4.0	0.0	0.0
Malawi	54.6	95.2	4.3	8.9	911	0.272	0.348	0.302	0.548	0.393	0.265	3.0	0.0	0.0
Côte d'Ivoire	58.4	77.2	3.3	6.3	1,625	0.312	0.258	0.374	0.607	0.291	0.354	3.0	0.0	0.0
Tanzania	56.9	64.5	5.1	5.3	1,344	0.320	0.295	0.350	0.585	0.333	0.325	-3.0	0.0	0.0
Zambia	47.3	94.9	6.5	7.2	1,359	0.194	0.387	0.352	0.432	0.437	0.326	-2.0	0.0	0.0
Liberia	59.1	88.6	3.9	11.0	320	0.315	0.372	0.171	0.619	0.419	0.104	4.0	0.0	0.0
Guinea	58.9	93.2	1.6	8.6	953	0.294	0.209	0.307	0.615	0.236	0.272	9.0	0.0	0.0
Afghanistan	44.6	136.0	3.3	8.0	1,419	0.146	0.291	0.357	0.390	0.328	0.333	0.0	0.0	0.0
Ethiopia	56.1	72.5	1.5	8.3	992	0.303	0.197	0.312	0.572	0.223	0.278	1.0	0.0	0.0
Sierra Leone	48.2	113.7	2.9	7.2	809	0.194	0.258	0.287	0.447	0.290	0.246	1.0	0.0	0.0
Burundi	51.4	101.1	2.7	9.6	402	0.227	0.287	0.200	0.496	0.324	0.139	1.0	0.0	0.0
Central African Republic	47.7	105.4	3.5	6.3	758	0.190	0.268	0.279	0.438	0.302	0.236	1.0	0.0	0.0
Angola	48.1	104.3	4.4	4.4	4,941	0.194	0.249	0.513	0.444	0.281	0.525	-1.0	0.0	0.0
Guinea-Bissau	48.6	118.7	2.3	9.1	538	0.186	0.257	0.236	0.452	0.289	0.184	9.0	0.0	0.0
Zimbabwe	47.0	59.3	7.2	9.2	176	0.225	0.463	0.097	0.427	0.522	0.012	-10.0	0.0	0.0
Congo DRC	48.0	115.8	3.8	7.8	291	0.184	0.305	0.159	0.443	0.344	0.089	5.0	0.0	0.0
Mali	49.2	101.4	1.4	8.0	1,171	0.194	0.187	0.333	0.462	0.211	0.303	8.0	0.0	0.0
Chad	49.2	131.2	1.5	6.0	1,067	0.186	0.170	0.321	0.462	0.192	0.289	9.0	0.0	0.0
Burkina Faso	53.7	78.9	1.3	5.8	1,215	0.244	0.153	0.338	0.533	0.172	0.309	2.0	0.0	0.0
Mozambique	48.4	88.0	1.2	8.2	854	0.212	0.178	0.294	0.449	0.201	0.255	-2.0	0.0	0.0
Niger	52.5	95.9	1.4	4.3	675	0.237	0.141	0.264	0.514	0.159	0.219	3.0	0.0	0.0

2.2 Computing EMR to national performance ratios in health, education and wealth

The national sub-indices in health, education and wealth (whose methods of calculation were presented above) are the basis from which the EMR-level HDIs were estimated. The main estimation procedure I used to do this is to apply the percentage by which a particular EMR over or under performs its national context in the health, education and wealth dimensions to the corresponding national-level sub-indices. The EMR level HDI sub-indices can thus be seen as qualifications of the national sub-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: as shown above, 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 in the three dimensions. 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 changes 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, rather than to restrict myself to the last couple of years. This is thus an exploratory methodology that uses the limited available sub-national data to estimate EMR HDIs.

Given that this estimation procedure relies on different indicators in different national contexts, what is crucial here is the standardisation technique used to evaluate the relationship between the EMR and the national average on a particular indicator. What is needed is a way to make sure that the ratio between different figures represents an accurate picture of the relationship between an EMR and its national context, no matter the numerical distribution of the indicator used. This is problematic because of the wide range of distributions different indicators can take[15]. For this estimation technique to produce results that allow for valid comparisons to be made across different national contexts, it is crucial to make sure that the ratios calculated between indicators at the EMR and national levels are comparable across indicators with different numerical distributions. To do this, I have grouped indicators according to the numerical distributions they tend to take and have developed different standardisation procedures to calculate the EMR to national ratio for each one of those groups.

[15] The important point here is that a ratio between two numbers (let's say between a city and national value on an indicator) depends on the set of possible values that this indicator can take. For example, if an indicator is a percentage out of 100 (like the literacy rate), the possible values the ratio between literacy rates can take is very different from the possible values the ratio of an indicator like the GDP per capita (which has no upper bound) can take. For example, Shenzhen's GDP per capita is four times that of China, but is close to impossible for a portion of a country to have four times the proportion of literates than in the country as a whole (the largest ratio I have found so far is between Cotonou with a literacy rate of 71.6 against Benin's 45.6 average, a ratio of only 1.6).

A first group is made up of all variations on the life expectancy. I have chosen to take the simple ratio (z_1) 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[16].

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. This is also the trickiest group because ratios can vary widely depending on the position of the indicators in question within the 0 to 100 range (a difference of 10% between EMR and national figures means much more at the bottom of the distribution – 30% in relation to 20% or 1.5 - than it does at the top of the distribution – 90% in relation to 80% or 1.125). To deal with this issue, I had first divided up this group into those indicators whose values lay at the bottom of the distribution and those whose values lay at the top of the distribution, and had devised different ratio standardisation procedures for these two groups. However, the necessary arbitrariness of any cut-off point meant indicators that had similar distributions could end up yielding very different ratios. I have since abandoned this approach and focused on finding one ratio standardisation procedure for all percentages and decided to use different indicators to balance out inconsistencies stemming from different numerical distributions. In this way, I am triangulating the EMR to national ratio based on indicators with different numerical distributions, and thus ratios in part determined by them, and empirically choosing indicators to balance out the inconsistencies I can see emerging from these problematic ratios (this will be illustrated by the example of Bangladesh in the next section). The ratio standardisation procedure I have developed for this group (z_2) is the ratio of the square roots of the EMR and national values[17]. 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.), measures of health (infant mortality rate, doctors per 10,000) and measures of education (average years of education). The ratio standardisation procedure chosen here (z_3) takes the logarithm of the EMR value (raised or decreased by as many orders of magnitude as it is necessary to get the national value to a magnitude of 10^2) and divides by

[16] $z_1 = x^{EMR} / x^{nation}$

[17] $z_2 = (x^{EMR} \text{ ^ } ½) / (x^{nation} \text{ ^ } ½)$

the logarithm of the national value (raised or decreased by as many orders of magnitude as it is necessary to get it to a magnitude of 10^2)[18].

In order to average out the inconsistencies that may arise from the use of standardised ratios coming from different ratio standardisation procedures, or from different numerical distributions within these, I have sought as many indicators as were available for each of the three dimensions in each national context. I then assessed which indicators should be used for each national context for each of the three dimensions. To do this, I identified the indicators that were available in a significant number of national contexts and that were adequate to assess health outcomes at the EMR level. In the health dimension, for example, these were the life expectancy and the infant mortality rate as a first priority, followed by the child immunisation rate and the percentage of births assisted by a trained professional. All other health indicators (such as doctors and hospital beds per capita) were grouped in a third tier. Having identified these main indicators in each dimension, I laid out a systematic procedure by which to calculate the standardised ratios, based on the hierarchy of indicators established for each dimension. If the first tier indicators are available in a particular national context, those are used exclusively to determine EMR to national performance. In the health dimension, this means that if life expectancy and the infant mortality rate are both available for a particular EMR and its national context, then only those two indicators are used to assess the extent by which the EMR under- or over-performs its national context (by taking the geometric mean of the equally weighted EMR to national standardised ratios), even if other indicators may be available in that national context. If only one of these two priority indicators are available, then the standardised EMR to national ratio for that indicator is given a 50% weight and the geometric mean of the standardised EMR to national ratios of all other adequate and available indicators in that national context is given the other 50%. If none of the two priority indicators are available (in health, this is only the case for Nigeria, Indonesia, India, Pakistan and Burma), then the all existing and appropriate indicators for that dimension are used (by taking the geometric mean of the standardised EMR to national ratios of all adequate and available indicators). The final EMR to national factors in each dimension is then applied to the national sub-index for that dimension to obtain the EMR level health, education and wealth sub-indices. The composite EMR level HDI is simply the geometric mean of the three EMR sub-indices.

In order to test whether any of the steps taken in the EMR HDI estimation technique had any effect on the values of the standardised EMR to national factors, I ran a stepwise multiple regression for each dimension, with the health, education and wealth EMR to national factors as their respective dependent variables and the ratio between the UN WUP urban agglomeration and EMR population and the percentage of the

[18] $z_3 = \log (x^{EMR} * 10^y) / \log (x^{nation} * 10^y)$ where y is the exponent necessary to get $(x^{nation} * 10^y)$ to magnitude 10^2

national population that each EMR represents as their independent variables. The ratio between the UN WUP urban agglomeration and the EMR population (for which a factor of 2 was set as a guideline threshold, but which was relaxed in a number of cases) could impact the EMR to national factors because EMRs which exceed their corresponding UN WUP urban agglomeration to a larger extent will include more rural or sparsely inhabited land, which usually perform less well compared to the national average than more urbanised territory. The percentage of the national population living in an EMR could also have an impact on the EMR to national standardised ratios, 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. The most prominent example of this is in China: each of the 333 Prefecture-level administrative units (Sub-Provinces) publishes a statistical yearbook (either in Mandarin or English) but the information within all of these (usually not strictly similar) is not collected in one single place. The proportion of the national population contained in the EMRs in the sample ranges from 45.7% in Buenos Aires EMR to 0.15% in India's Hubli-Dharwad, with an average of 11% over all 129 EMRs. For education and wealth, these two independent variables did not have any significant effect on the EMR to national ratios. In health, only the EMR to WUP ratio was significant (p score of 0.044) but its correlation coefficient was too low to be deemed as having an important impact on the EMR to national ratios (adjusted r^2 of 0.028). This shows that there is no systematic bias in the estimation procedures devised to make best use of available resources.

Below is a table showing, for each EMR, the corresponding national sub-indices, the factors by which it under or over performs its national context in health, education and wealth and the EMR level estimates of the health, education and wealth sub-indices obtained by multiplying the latter by the former. Another table below shows the indicators I have used to assess EMR to national performance in each national context as well as their sources (all data or hyperlinks are available on request).

Extended Metropolitan Region (EMR)	Nation	EMR population	LSE Cities national health index	LSE Cities national education index	LSE Cities national wealth index	EMR to Nation health factor	EMR to Nation education factor	EMR to Nation wealth factor	LSE Cities EMR health index	LSE Cities EMR education index	LSE Cities EMR wealth index
Buenos Aires	Argentina	18,485,510	0.650	0.679	0.639	1.010	1.007	1.044	0.656	0.684	0.668
Sydney	Australia	7,253,400	0.801	0.887	0.753	1.006	1.005	0.998	0.806	0.892	0.751
Dhaka	Bangladesh	18,105,000	0.452	0.352	0.382	1.080	1.061	1.041	0.488	0.374	0.397
Chittagong	Bangladesh	7,509,000	0.452	0.352	0.382	1.048	1.031	1.068	0.473	0.363	0.407
Khulna	Bangladesh	2,294,000	0.452	0.352	0.382	1.060	1.070	0.994	0.479	0.377	0.379
Cotonou	Benin	1,523,836	0.358	0.320	0.375	1.039	1.246	1.080	0.372	0.399	0.405
La Paz	Bolivia	1,908,813	0.453	0.635	0.499	1.028	1.042	1.040	0.466	0.662	0.519
Santa Cruz	Bolivia	1,992,709	0.453	0.635	0.499	1.095	1.042	1.151	0.496	0.662	0.574
Brasilia	Brazil	4,164,421	0.574	0.562	0.602	1.033	1.024	1.089	0.593	0.576	0.656
Porto Alegre	Brazil	4,264,436	0.574	0.562	0.602	1.033	1.032	1.085	0.593	0.580	0.653
Sao Paulo	Brazil	26,193,667	0.574	0.562	0.602	1.019	1.031	1.105	0.585	0.580	0.666
Curitiba	Brazil	3,446,485	0.574	0.562	0.602	1.026	1.034	1.095	0.589	0.582	0.659
Rio de Janeiro	Brazil	13,331,714	0.574	0.562	0.602	1.006	1.032	1.058	0.577	0.580	0.637
Belo Horizonte	Brazil	5,453,312	0.574	0.562	0.602	1.048	1.032	1.054	0.601	0.580	0.635
Salvador	Brazil	3,924,954	0.574	0.562	0.602	1.019	1.020	0.997	0.585	0.574	0.601
Recife	Brazil	4,054,966	0.574	0.562	0.602	1.040	0.998	0.951	0.597	0.561	0.572
Fortaleza	Brazil	3,950,596	0.574	0.562	0.602	1.052	0.996	0.919	0.604	0.560	0.553
Phnom Penh	Cambodia	2,746,038	0.386	0.427	0.400	1.045	1.104	1.191	0.403	0.471	0.477
Toronto	Canada	6,456,145	0.783	0.766	0.753	1.007	1.033	1.006	0.788	0.791	0.757
Santiago	Chile	6,921,403	0.734	0.673	0.631	1.030	1.014	1.039	0.756	0.682	0.655
Beijing	China	17,487,816	0.585	0.524	0.558	1.077	1.026	1.172	0.630	0.538	0.654
Shanghai	China	19,553,651	0.585	0.524	0.558	1.057	1.018	1.200	0.618	0.534	0.670
Tianjin	China	12,142,489	0.585	0.524	0.558	1.040	1.018	1.149	0.608	0.534	0.641
South Guangdong	China	40,437,810	0.585	0.524	0.558	1.026	1.034	1.193	0.600	0.542	0.666
Shenyang-Fushun	China	9,587,314	0.585	0.524	0.558	1.053	1.025	1.129	0.616	0.537	0.630
Dalian	China	6,296,304	0.585	0.524	0.558	1.049	1.020	1.176	0.613	0.535	0.656
Jinan	China	6,877,240	0.585	0.524	0.558	1.037	1.011	1.119	0.607	0.530	0.624
Nanjing	China	8,060,882	0.585	0.524	0.558	1.044	1.019	1.153	0.610	0.534	0.643
Wuhan	China	9,202,994	0.585	0.524	0.558	1.046	1.018	1.114	0.612	0.533	0.622
Harbin	China	10,350,973	0.585	0.524	0.558	1.019	1.021	1.042	0.596	0.535	0.581
Chengdu	China	13,184,294	0.585	0.524	0.558	1.037	1.021	1.052	0.607	0.535	0.587
Hefei	China	5,130,599	0.585	0.524	0.558	1.036	1.004	1.071	0.606	0.526	0.598
Xi'an	China	8,611,430	0.585	0.524	0.558	1.042	1.028	1.024	0.610	0.539	0.572
Nanchang	China	4,836,946	0.585	0.524	0.558	1.011	1.022	1.079	0.592	0.536	0.602
Kunming	China	6,435,490	0.585	0.524	0.558	1.037	1.008	1.021	0.607	0.529	0.570
Guiyang	China	4,035,935	0.585	0.524	0.558	1.028	1.008	0.983	0.601	0.528	0.549
Fuzhou	China	7,252,632	0.585	0.524	0.558	1.001	1.017	1.067	0.585	0.533	0.596
Bogota	Colombia	9,840,818	0.597	0.563	0.578	1.023	1.077	1.078	0.611	0.606	0.623
Medellin	Colombia	6,065,846	0.597	0.563	0.578	0.997	1.001	1.018	0.596	0.564	0.588
Kinshasa	Congo DRC	9,426,523	0.183	0.305	0.185	1.179	1.177	1.161	0.215	0.360	0.214
Abidjan	Côte d'Ivoire	7,845,100	0.331	0.258	0.384	1.075	1.192	1.090	0.356	0.308	0.419
Cairo	Egypt	24,243,250	0.543	0.479	0.534	0.997	1.038	1.020	0.541	0.497	0.545
Alexandria	Egypt	9,433,514	0.543	0.479	0.534	1.016	1.035	1.024	0.551	0.496	0.547
Paris	France	12,177,135	0.822	0.734	0.739	0.997	1.010	1.057	0.819	0.742	0.781
Berlin	Germany	4,945,877	0.803	0.780	0.742	1.006	1.016	0.962	0.808	0.792	0.714
Athens	Greece	4,123,518	0.779	0.744	0.713	0.993	1.040	1.055	0.774	0.773	0.752
Hong Kong	Hong Kong	7,069,378	0.875	0.664	0.770	-	-	-	0.875	0.664	0.770
Budapest	Hungary	2,930,934	0.700	0.755	0.660	1.023	1.026	1.099	0.717	0.775	0.725
Delhi	India	30,141,583	0.421	0.381	0.468	1.046	1.121	1.197	0.440	0.427	0.560
Hyderabad	India	9,306,634	0.421	0.381	0.468	1.274	1.108	1.205	0.536	0.422	0.564
Ahmadabad	India	8,595,678	0.421	0.381	0.468	1.210	1.125	1.187	0.510	0.428	0.555
Surat	India	6,079,231	0.421	0.381	0.468	1.175	1.102	1.138	0.495	0.420	0.533
Bangalore	India	10,576,167	0.421	0.381	0.468	1.272	1.140	1.202	0.536	0.434	0.562
Hubli-Dharwad	India	1,846,993	0.421	0.381	0.468	1.192	1.075	1.023	0.502	0.410	0.479
Kochi	India	3,279,860	0.421	0.381	0.468	1.350	1.182	1.142	0.569	0.450	0.534
Indore	India	3,272,335	0.421	0.381	0.468	1.200	1.113	1.136	0.505	0.424	0.532
Bhopal	India	2,368,145	0.421	0.381	0.468	1.142	1.109	1.144	0.481	0.422	0.535
Mumbai	India	26,167,972	0.421	0.381	0.468	1.278	1.148	1.201	0.538	0.437	0.562
Pune	India	9,426,959	0.421	0.381	0.468	1.235	1.132	1.161	0.520	0.431	0.543
Ludhiana	India	3,487,882	0.421	0.381	0.468	1.206	1.131	1.239	0.508	0.431	0.580
Jaipur	India	6,663,971	0.421	0.381	0.468	0.997	1.065	1.068	0.420	0.405	0.500
Chennai	India	12,397,681	0.421	0.381	0.468	1.357	1.144	1.166	0.571	0.436	0.546
Lucknow	India	4,588,455	0.421	0.381	0.468	1.078	1.089	1.093	0.454	0.415	0.512
Kolkata	India	33,084,734	0.421	0.381	0.468	1.118	1.076	1.123	0.471	0.410	0.525
Jakarta	Indonesia	34,772,342	0.542	0.479	0.488	1.063	1.063	1.036	0.576	0.509	0.505
Surabaya	Indonesia	8,728,602	0.542	0.479	0.488	1.020	1.064	1.001	0.553	0.510	0.488
Medan	Indonesia	5,255,905	0.542	0.479	0.488	1.078	1.104	1.023	0.584	0.529	0.499
Makassar	Indonesia	2,579,112	0.542	0.479	0.488	1.084	1.044	1.012	0.587	0.500	0.493
Tehran	Iran	14,795,116	0.551	0.568	0.614	1.005	1.046	1.032	0.554	0.594	0.634
Mashhad	Iran	5,940,766	0.551	0.568	0.614	0.938	1.008	0.986	0.517	0.573	0.605
Rome	Italy	4,101,228	0.820	0.711	0.722	1.008	1.044	1.030	0.827	0.742	0.743

Extended Metropolitan Region (EMR)	Nation	EMR population	LSE Cities national health index	LSE Cities national education index	LSE Cities national wealth index	EMR to Nation health factor	EMR to Nation education factor	EMR to Nation wealth factor	LSE Cities EMR health index	LSE Cities EMR education index	LSE Cities EMR wealth index
Tokyo	Japan	42,607,376	0.862	0.744	0.740	1.001	1.016	1.006	0.863	0.756	0.744
Osaka	Japan	18,488,755	0.862	0.744	0.740	1.002	1.009	0.987	0.863	0.751	0.730
Nairobi	Kenya	7,806,748	0.316	0.463	0.384	1.077	1.093	1.145	0.340	0.506	0.440
Bamako	Mali	4,414,117	0.208	0.187	0.346	1.066	1.237	1.075	0.221	0.232	0.372
Mexico City	Mexico	35,418,952	0.640	0.611	0.634	1.008	1.022	1.016	0.645	0.624	0.645
Guadalajara	Mexico	7,350,682	0.640	0.611	0.634	0.995	0.996	1.018	0.637	0.608	0.646
Monterrey	Mexico	4,653,458	0.640	0.611	0.634	1.028	1.039	1.051	0.657	0.635	0.667
Casablanca	Morocco	5,619,089	0.529	0.382	0.506	1.078	1.107	1.051	0.571	0.423	0.532
Rabat	Morocco	2,648,773	0.529	0.382	0.506	1.011	1.118	1.057	0.535	0.428	0.535
Yangon	Myanmar	7,122,722	0.403	0.343	0.382	1.047	1.136	1.167	0.422	0.389	0.446
Randstad	Netherlands	6,969,690	0.790	0.772	0.758	1.009	1.004	1.014	0.797	0.775	0.769
Lagos	Nigeria	15,373,213	0.200	0.375	0.417	1.011	1.163	1.109	0.202	0.436	0.463
Abuja	Nigeria	4,957,411	0.200	0.375	0.417	1.052	1.052	1.116	0.210	0.395	0.466
Ibadan	Nigeria	6,322,614	0.200	0.375	0.417	0.968	1.083	1.048	0.193	0.406	0.437
Kano	Nigeria	10,643,633	0.200	0.375	0.417	0.834	0.887	0.904	0.166	0.333	0.377
Karachi	Pakistan	14,270,132	0.417	0.325	0.442	1.117	1.186	1.351	0.466	0.386	0.598
Lahore	Pakistan	13,335,777	0.417	0.325	0.442	1.081	1.131	1.242	0.451	0.368	0.550
Islamabad-Rawalpindi	Pakistan	5,814,142	0.417	0.325	0.442	1.205	1.200	1.221	0.503	0.390	0.540
Faisalabad	Pakistan	7,055,417	0.417	0.325	0.442	0.988	1.054	0.919	0.412	0.343	0.406
Lima	Peru	10,054,952	0.590	0.650	0.575	1.068	1.079	1.102	0.630	0.701	0.634
Manila	Philippines	23,065,889	0.571	0.565	0.489	0.989	1.093	1.121	0.564	0.618	0.548
Warsaw	Poland	2,472,713	0.720	0.696	0.662	1.014	1.021	1.121	0.730	0.711	0.743
Lisbon	Portugal	2,845,126	0.777	0.631	0.688	1.000	1.068	1.063	0.776	0.674	0.731
Bucharest	Romania	1,948,038	0.623	0.709	0.624	1.072	1.064	1.205	0.668	0.754	0.752
Moscow	Russia	17,928,071	0.576	0.631	0.644	1.045	1.036	1.077	0.602	0.654	0.694
Saint Petersburg	Russia	6,137,260	0.576	0.631	0.644	1.054	1.038	1.039	0.608	0.655	0.669
Dakar	Senegal	4,514,693	0.335	0.290	0.397	1.052	1.330	1.102	0.352	0.385	0.438
Belgrade	Serbia	2,253,185	0.649	0.640	0.601	1.005	1.055	1.027	0.652	0.676	0.617
Singapore	Singapore	4,836,691	0.860	0.638	0.780	-	-	-	0.860	0.638	0.780
Johannesburg	South Africa	11,191,700	0.283	0.593	0.593	1.045	1.044	1.048	0.295	0.619	0.622
Cape Town	South Africa	5,223,900	0.283	0.593	0.593	1.113	1.028	1.023	0.315	0.610	0.607
Madrid	Spain	6,418,863	0.813	0.736	0.722	1.008	1.040	1.045	0.820	0.765	0.754
Stockholm	Sweden	1,990,493	0.844	0.760	0.747	1.002	1.011	1.039	0.845	0.769	0.776
Damascus	Syria	4,477,000	0.630	0.404	0.509	1.020	1.064	1.068	0.643	0.430	0.544
Aleppo	Syria	4,744,000	0.630	0.404	0.509	0.987	0.902	0.961	0.621	0.364	0.489
Dar es Salaam	Tanzania	4,149,873	0.331	0.295	0.362	1.096	1.130	1.122	0.363	0.334	0.406
Bangkok	Thailand	14,190,762	0.592	0.532	0.569	1.030	1.052	1.106	0.610	0.559	0.630
Istanbul	Turkey	15,613,932	0.565	0.495	0.629	1.017	1.053	1.085	0.575	0.521	0.683
Ankara	Turkey	4,771,716	0.565	0.495	0.629	1.033	1.119	1.055	0.584	0.554	0.664
Kampala	Uganda	3,840,400	0.285	0.397	0.351	1.068	1.139	1.161	0.304	0.452	0.408
Kiev	Ukraine	4,506,900	0.582	0.727	0.546	1.042	1.063	1.102	0.606	0.772	0.602
London	United Kingdom	14,830,051	0.776	0.695	0.741	1.017	1.025	1.045	0.789	0.712	0.775
Los Angeles	United States	17,950,451	0.746	0.792	0.775	1.038	0.982	1.001	0.774	0.778	0.776
New York	United States	23,514,804	0.746	0.792	0.775	1.041	1.009	1.023	0.777	0.799	0.793
Chicago	United States	11,599,646	0.746	0.792	0.775	1.000	1.003	1.010	0.746	0.794	0.783
Dallas	United States	7,731,414	0.746	0.792	0.775	0.995	0.979	0.997	0.743	0.775	0.773
Philadelphia	United States	7,903,476	0.746	0.792	0.775	0.980	1.010	1.016	0.731	0.800	0.788
Washington DC - Baltimore	United States	9,489,664	0.746	0.792	0.775	0.984	1.021	1.040	0.734	0.808	0.807
Miami	United States	7,432,017	0.746	0.792	0.775	1.019	0.994	0.993	0.761	0.787	0.770
Atlanta	United States	7,506,267	0.746	0.792	0.775	0.982	1.000	1.004	0.733	0.792	0.779
Boston	United States	9,073,643	0.746	0.792	0.775	1.033	1.021	1.024	0.771	0.808	0.794
San Francisco-San Jose	United States	9,143,536	0.746	0.792	0.775	1.055	1.019	1.030	0.787	0.807	0.799
Tashkent	Uzbekistan	4,789,500	0.463	0.606	0.459	0.973	1.043	1.070	0.451	0.632	0.491
Caracas	Venezuela	5,431,709	0.615	0.530	0.615	0.994	1.003	1.026	0.611	0.531	0.631
Hanoi	Viet nam	9,633,100	0.605	0.427	0.455	0.999	1.107	1.105	0.604	0.472	0.503
Ho Chi Minh City	Viet nam	12,592,100	0.605	0.427	0.455	1.024	1.106	1.070	0.619	0.472	0.487
Lusaka	Zambia	2,467,467	0.183	0.387	0.363	0.994	1.056	1.105	0.182	0.409	0.402
Harare	Zimbabwe	3,847,834	0.201	0.463	0.126	0.986	1.072	1.026	0.199	0.496	0.129

	Health - indicators	*Health - Sources*	Education - indicators	*Education - sources*	Wealth - indicators	*Wealth - sources*
Argentina	Life expectancy 2000-2001; IMR 2004-2008	*Argentina National Institute of Statistics and Census (INDEC) web databases*	Literacy rate 2001; % of the populatio over 15 without education 2001; scolarisation rate of the population aged 6-17 2001	*Argentina National Institute of Statistics and Census (INDEC) web databases*	% of low quality housing 2001; GVA per capita at basic prices 2003	*Argentina National Institute of Statistics and Census (INDEC) web databases*
Australia	Life expectancy 2007-2009; IMR 2007-2009	*Australian Bureau of Statistics (ABS) web databases*	% of the population that has not attained grade 8 2006; % of the population with a formal qualification 2010; % of the population scoring highly in an the adult literacy and life skills survey	*Australian Bureau of Statistics (ABS) web databases*	GDP per capita at Current prices 2010; gross household disposable income per capita 2010; % of households with weekly family income below 500 Aus$ 2006	*Australian Bureau of Statistics (ABS) web databases*
Bangladesh	IMR 2009; Under-5 Mortality Rate 2009; Skilled attendant at delivery 2009; % of children aged 12-23 months currently vaccinated against childhood diseases 2006	*UNICEF MICS 2009; UNICEF MICS 2006 v2*	Literacy rate of the population over 7 2004; combined primary and secondary enrolment rate 2009	*Bangladesh Bureau of Statistics web database; UNICEF MICS 2009*	Poverty headcount 2005; % of the population using an improved sanitation facility 2009; % of the population using an improved water source adjusted for arsenic 2009	*Bangladesh Bureau of Statistics web database; UNICEF MICS 2009*
Benin	Probability of not surviving age 40 2006	*UNDP NHDR 2006*	Literacy rate of the population over 15 2006	*UNDP NHDR 2006*	% of the population without access to safe water 2006; % of the population that is underweight 2006; % of the population that does not meet the threshold of a decent standard of living 2006; poverty incidence 2006	*UNDP NHDR 2006*
Bolivia	Life expectancy 2001; % of women for whom none of her born children died in infancy 2001	*Bolivia National Statistics Institute's Population and Housing Census 2001; UNDP Bolivia Municipal HDR Report*	Literacy rate of the population over 15 2001; mean years of schooling 2001; combined kindergarten, primary and secondary educational enrolment rate 2001	*UNDP Bolivia Municipal HDR Report*	Per capita consumption in PPP USD 2001; % of households with dwellings with adequate sanitation 2001	*Bolivia National Statistics Institute's Population and Housing Census 2001; UNDP Bolivia Municipal HDR Report*
Brazil	Deaths of children 0-1 per 1000 persons of that age 2010	*Brazil Institute of Geography and Statistics (IBGE) 2010 Census*	Literacy rate of the population over 5 2010	*Brazil Institute of Geography and Statistics (IBGE) 2010 Census*	% of households receiving less than one minimum wage 2010; GDP per capita 2008-2010; % of households without exclusive use over a toilet 2010	*Brazil Institute of Geography and Statistics (IBGE) 2010 Census & web databases*
Burma	Proportion of 1 year olds immunised against measles 2005; % of births attended by skilled health personnel 2005	*UNDP Burma's Integrated Household Living Conditions Survey: Poverty Profile 2007*	Adult literacy rate 2005; net enrolment rate in primary education 2005; % of the population with at least middle school education 2005	*UNDP Burma's Integrated Household Living Conditions Survey: Poverty Profile 2007*	Poverty Headcount 2005; combined dwelling welfare index 2005	*UNDP Burma's Integrated Household Living Conditions Survey: Poverty Profile 2007*
Cambodia	Under-5 mortality rate 2005; % of mothers protected against tetanos 2005; % of women who did not receive a post-natal check-up 2005; % of children aged 12-23 months currently vaccinated against childhood diseases 2005	*DHS 2005*	Literacy rate 2008; Net primary school admission 2004; % of the population with at least lower secondary education 2008	*Cambodia National Institute of Statistics 2008 Population Census; UNDP NHDR 2007*	Poverty headcount 2003-2004; % of dwellings with no toilets on premises 2008; composite child malnourishment index 2003	*Cambodia National Institute of Statistics 2008 Population Census; UNDP NHDR 2007; DHS 2005*
Canada	IMR 2011; life expectancy 2011; General physicians per 100,000 population 2011	*Statistics Canada Health Region Profiles 2011*	% of population 15+ with less than high school education 2006; post-secondary graduates aged 25 to 54 (%) 2011	*Statistics Canada Health Region Profiles 2011; Statistics Canada Community Profiles 2006*	Median earnings - Persons 15 years and over ($) 2006; % of all persons in low income category after tax 2006; Dwellings requiring major repair as a % of total occupied private dwellings 2006	*Statistics Canada Community Profiles 2006*
Chile	Potential years of life lost per 1,000 2003; IMR 2007	*UNDP NHDR 2004; Chile National Statistics Institute 2010 Statistics Compendium*	Literacy rate for the population over 24 2003; mean years of schooling for the population over 24 2003; gross educational enrolment rate 2003	*UNDP NHDR 2004*	Mean household income 2003; GDP per capita in constant prices 2007, poverty incidence 2003	*UNDP NHDR 2004; Chile National Statistics Institute 2010 Statistics Compendium*
China	Deaths of children 0-4 per 1000 persons of that age 2000; hospital beds per 1,000 persons 2008; doctors per 1,000 persons 2008	*China 2000 population census; National, Provincial and Sub-Provincial Statistical Yearbooks 2008*	Literacy rate of the population over 15 2000-2005; % of the population over 6 without schooling 2000	*China 2000 population census; China 2005 1% census*	GDP per capita 2008	*National, Provincial and Sub-Provincial Statistical Yearbooks 2008*
Colombia	Life expectancy 2000-2005; IMR 2000-2005	*Colombia National Department of Statistics (DANE) web databases*	Literacy rate 2005; % of the population with at least basic secondary education 2005	*Colombia National Department of Statistics (DANE) 2005 Population Census*	GDP per capita at current prices 2008; % of the population with unsatisfied basic needs 2005	*Colombia National Department of Statistics (DANE) web databases; DANE 2005 Population Census*
Congo, DRC	Life expectancy 2006;probability of not surviving past age 40 2006	*UNDP NHDR 2008*	Literacy rate 2006; combined gross primary, secondary and higher education enrolment rate 2006	*UNDP NHDR 2008*	GDP per capita 2006; % of the population without access to safe water 2006; % of the children below 5 that are malnourished 2006	*UNDP NHDR 2008*
Egypt	Life expectancy 2007; doctors per 10,000 2008; IMR 2008	*UNDP NHDR 2010*	Literacy rate of the population over 15 2007; combined gross educational enrolment ratio 2007-2008	*UNDP NHDR 2010*	GDP per capita PPP USD 2007-2008; poverty incidence 2008-2009	*UNDP NHDR 2010*
India	Either institutional delivery or home delivery attended by skilled health personnel % 2007-2008; % of children Getting Complete Immunization 2007-2008	*Census of India 2001; India Ministry of Health and Family Welfare's District Level Household and Facility Survey 2007-2008*	Literacy rate 2001; % of the population with at least primary education 2001	*Census of India 2001 District Profiles*	% of households occupying a permanent dwelling 2001; % of households with electricity in the dwelling 2007-2008; % of households with access to a toilet facility 2007-2008; % of households with access to an improved source of drinking water 2007-2008	*Census of India 2001 District Profiles; India Ministry of Health and Family Welfare's District Level Household and Facility Survey 2007-2008*
Indonesia	% of children receiving measles immunisation 2007; number of doctors per 100,000 2007	*Indonesia Ministry of Health's web database*	Literacy rate 2007; % of the population who have less than junior high school education 2010	*Indonesia Ministry of Labour's web database*	Average salary 2010; % of children that are malnourished 2007	*Indonesia Ministry of Labour's web database; Indonesia Ministry of Health's web database*
Iran	IMR 2006; life expectancy 2001	*Statistical Centre of Iran - ICPD/MDG database*	Literacy rate 2008	*Statistical Centre of Iran - ICPD/MDG database*	% with sustainable access to an improved water source 2008; number of persons per room 2005-2007; population below 1USD PPP per day 2001-2008	*Statistical Centre of Iran - ICPD/MDG database*

	Health - indicators	*Health - Sources*	Education - indicators	*Education - sources*	Wealth - indicators	*Wealth - sources*
Ivory Coast	% of births attended by skilled professional 2005; IMR 2005; % of 12-23 months with all basic vaccinations 2006; % mothers protected against tetanos 2006	*MICS 2003, DHS 2005*	% with at least secondary education 2005; net enrolment ratio primary 2006; primary school achievement rate 2006	*DHS 2005; MICS 2003*	Poverty rate 2008; % 2 standard deviations below weight for age 2006; per capita income 2008; % of households with access to improved water 2006; % of households with a sanitary excrement disposal method 2006	*UNDP DSRP 2009; MICS 2003*
Japan	Physicians per 100,000 2008; Beds in general hospitals per 100,000 persons 2008; IMR 2009; life expectancy 2005	*Japan Statistics' Japan Statistical Yearbook 2011; Japan's Ministry of Health, Labour and Welfare; Statistic Japan's e-stat database*	Combined school absentees for elementary and junior high school 2008; % of people having completed up to elementary or junior high school only 2000	*Statistic Japan's e-stat database*	yearly income 2007; GDP per capita 2007; % of dwellings with bathrooms 2007	*Statistic Japan's e-stat database*
Kenya	Life expectancy 1999; probability of not surviving age 40 1999; % of 12-23 months with all basic vaccinations 2005; % of births attended by skilled professional 2005	*UNDP NHDR 2009; Kenya Integrated Household Budget Survey (KIHBS) 2005/2006*	Gross Enrolment Ratio 2005-2006; literacy rate 2005-2006; % of 6+ who ever attended school 2005; % children 3-5 attending school 2005	*UNDP NHDR 2009; Kenya Integrated Household Budget Survey (KIHBS) 2005/2006*	GDP per capita 2005-2006; % of dwellings with piped water 2005; % of dwellings without a toilet 2005; % children that are underweight 2008-2009	*UNDP NHDR 2009; Kenya Integrated Household Budget Survey (KIHBS) 2005/2006*
Mali	% of women who received antitetanos treatment in the last pregnancy 2006; % of births that were assisted by trained personnel 2006; % of 12-23 months with all basic vaccinations 2006; infanto-juvenile mortality rate 2006	*DHS 2006*	% of the population with at least secondary education 2006; combined primary and secondary enrolment rate 2006; literacy rate 2006	*DHS 2006*	Underweight children under 5 2006; children suffering from growth delay 2006; poverty incidence 2006; depth of poverty 2006; severity of poverty 2006	*Mali Statistical Institute's Malikunnafoni 2010 database*
Mexico	Life expectancy 2010; IMR 2010; medical personnel per 10,000 2009	*Mexico National Statistics and Geography Institute (INEGI) web databases*	Average years of education for the population aged 15+ 2010; literacy rate 2006; combined gross enrolment ratio 2006; % of the population with at least secondary education 2006	*UNDP NHDR 2011; Mexico National Statistics and Geography Institute (INEGI) web databases*	GDP per capita PPP USD 2006; % of households who have a kitchen in the dwelling 2010; % of households who have a sewer connection in the dwelling 2010	*UNDP NHDR 2011; Mexico National Statistics and Geography Institute (INEGI) web databases*
Morocco	IMR 2004; % of 12-23 months with all basic vaccinations 2004; % of mothers not protected against tetanos 2004	*Morocco Planning High Commission 2004 Population and Housing Census; 2003-2004 DHS*	% of the population with at least secondary education 2004; literacy rate 2004	*Morocco Planning High Commission 2004 Population and Housing Census*	% of households below poverty line 2004; % of households below vulnerability line 2004; % of households with tap water supply in the dwelling 2004; % of households with a toilet in the dwelling 2004	*Morocco Planning High Commission 2004 Population and Housing Census*
Nigeria	% of pregnant women who received anti-tetanus injections 2008; health care facilities per 100,000 2004; malaria cases per 1000 2006-2008; % children not immunised 2008; % of children who received Vitamin A injections 2008	*Nigeria National Bureau of Statistics' Social Statistics in Nigeria 2009*	Literacy rate 2007; combined gross enrolment ratio 2007; % of the population with least high school education 2006	*UNDP NHDR 2007; Nigeria National Bureau of Statistics' Social Statistics in Nigeria 2009*	GDP per capita USD 2007; % of the population using an improved source of drinking water 2007; incidence of poverty 2007	*UNDP NHDR 2007*
Pakistan	% of 12-23 months with all basic vaccinations 2006; children under 5 suffering from diahrrea in past 30 days as % of all under 5 2006-2007	*Pakistan Federal Bureau of Statistics' Pakistan Social and Living Standards Measurement Survey (PSLM) 2008-2009 Provincial/District*	Literacy rate of the population 15+; % of the population that has ever attended school 2006-2007	*Pakistan Federal Bureau of Statistics' Pakistan Social and Living Standards Measurement Survey (PSLM) 2008-2009 Provincial/District*	% households in dwellings without a toilet 2006-2007; % of households in dwellings with access to tap water 2006-2007	*Pakistan Federal Bureau of Statistics' Pakistan Social and Living Standards Measurement Survey (PSLM) 2008-2009 Provincial/District*
Peru	IMR 2005-2010; % of births that were assisted by trained personnel 2010; life expectancy 2005-2010	*Peru Institute of Statistics INEI; INEI Demographic and Family Health Survey ENDES 2010*	Literacy rate 2007; % with less than secondary school education 2007	*INEI 2007 Census*	% of dwellings with toilet connected to the sewer system 2007; % of dwellings with public water supply of drinkable water 2007; % of households with no electronic possessions 2007; real monthly income 2010	*INEI 2007 Census; INEI Evolucion de la Pobreza al 2010*
Philippines	Life expectancy 2006; IMR 1998	*UNDP NHDR 2009; Philippines National Statistics Office*	% of people with at least high school education; % of high school graduates; primary and high school enrolment rate	*UNDP NHDR 2009; Philippines National Statistics Office*	Poverty incidence 2006; per capita income in PPP USD 2006	*UNDP NHDR 2009; Philippines National Statistical Board's Philippine MDGs database*
Russia	Life expectancy 2007; IMR 2008; hospital beds per 10,000 2008; physicians per 10,000 2008	*UNDP NHDR 2009; Russian Federal State Statistics Service's web databases*	Literacy Rate 2007; % of the population aged 7-24 enrolled in education 2007;	*UNDP NHDR 2009*	GDP in PPP USD 2007; per capita income 2008; % of the population below subsistence income levels 2008; share of households whose dwellings are not connected to public water supply 2008	*UNDP NHDR 2009; Russian Federal State Statistics Service's web databases*
Senegal	Life expectancy 1999; % of 12-23 months with all basic vaccinations 2005; peri-natal mortality rate 2005; % of pregnancies where post-natal care provided 2005	*UNDP NHDR 2001; DHS 2005*	Literacy Rate 1999; combined gross enrolment rate 1999; % of the population with at least some secondary education 2005	*UNDP NHDR 2001; DHS 2005*	GDP per capita 1999; composite malnourishment index 2005; combined prevalence of anemia in children and women 2005	*UNDP NHDR 2001; DHS 2005*
Serbia	Life expectancy 2005-2007; infant deaths per 1,000 live births	*Statistical Office of the Republic of Serbia web databases*	Literacy rate for the population over 10 2002; % of the population over 15 with high school education 2002	*Statistical Office of the Republic of Serbia web databases*	Average wages and salaries 2009	*Statistical Office of the Republic of Serbia web databases*

	Health - indicators	*Health - Sources*	Education - indicators	*Education - sources*	Wealth - indicators	*Wealth - sources*
South Africa	Life expectancy 2003; IMR 2003	*UNDP NHDR 2003; DHS 2003*	Literacy rate 2003; combined primary, secondary and tertiary enrolment rate 2003; % of the population with at least grade 8 2003	*UNDP NHDR 2003; DHS 2003*	Per capita GDP at 1995 USD PPP 2003; composite malnourishment index 2003	*UNDP NHDR 2003; DHS 2003*
Syria	Maternal mortality rate 2008; % of births attended by a skilled professional 2006; average number of persons per hospital bed 2009	*UNDP Syria's Third National MDGs Progress Report 2010; Syrian Central Bureau Of Statistics web databases*	Adult literacy rate 2006; % of the populatio over 15 with more than high school education 2006	*Syrian Central Bureau Of Statistics web databases*	Average monthly household expenditure 2009; % of dwelings with an improved drinking water source 2006; % of dwellings with adequate sanitation infrastructure 2006	*UNDP Syria's Third National MDGs Progress Report 2010; Syrian Central Bureau Of Statistics web databases*
Tanzania	Life expectancy 1988; % of births delivered by a skilled professional 2010; % of 12-23 months with all basic vaccinations 2010	*UNDP NHDR 2002; DHS 2010*	Adult literacy rate 2000; % of the population with below primary education 2010; combined primary and secondary education enrolment 2010	*UNDP NHDR 2002; DHS 2010*	Mean monthly consumption expenditure per capita 2000; population without access to safe water % 2000; combined malnutrition index 2010	*UNDP NHDR 2002; DHS 2010*
Thailand	% of underweight births 2007; IMR 2007; population per physician 2007; population per hospital bed 2007	*UNDP NHDR 2009*	Mean years of schooling 2007; % of the population without any education 2007; % of the populatio with less than primary education 2007; combined gross enrolment rate 2007	*UNDP NHDR 2009*	Household income 2004-2007; poverty incidence 2007; GDP per capita 2007	*UNDP NHDR 2009*
Turkey	IMR 2010	*Turkish Institute of Statistics' web databases*	Literacy rate for the population over 6 2010; population 6+ with above high school education % 2010	*Turkish Institute of Statistics' web databases*	% of households with a toilet inside the dwelling 2000; GDP per capita 2001	*Turkish Institute of Statistics' web databases*
Uganda	hospital beds per 1000 2008-2009; measles immunisation rate 2009; deliveries in health facilities % 2009; life expectancy 2000	*UNDP NHDR 2007; Uganda Bureau of Statistics' 2010 Statistical Abstract*	Combined gross enrolment ratio 2009; literacy rate 2000; % of the population that has never been to school 2002; % of the population with more than primary education 2002	*UNDP NHDR 2007; Uganda Bureau of Statistics' 2010 Statistical Abstract*	Combined material welfare index 2002; combined dwelling welfare index 2000	*Uganda Bureau of Statistics' 2010 Statistical Abstract*
Ukraine	IMR 2009; physicians of all specialisations per 10,000 2009; hospital beds per 10,000 2009; incidence of active tuberculosis per 100,000 2009	*State Statistics Committe of Ukraine's Statistical Yearbook of Ukraine 2009 & web databases*	% of children enrolled in pre-school 2009; % of the population with at least secondary education 2001	*State Statistics Committe of Ukraine's Statistical Yearbook of Ukraine 2009 & web databases*	Per capita gross regional product 2008; average monthly nominal wages of employees 2009; per capita income 2009; % with average monthly per capita income below subsistence level 2010	*State Statistics Committe of Ukraine's Statistical Yearbook of Ukraine 2009 & web databases*
USA	Life expectancy 2010; IMR 2010	*Measure of America's American Human Development Project 2010-2011*	% of the population with less than high school education 2010; % of the population aged 3 to 24 enrolled in school 2010	*Measure of America's American Human Development Project 2010-2011*	Median Personal Earnings in 2009 USD 2010; % of the population under the federak poverty threshold 2010	*Measure of America's American Human Development Project 2010-2011*
Uzbekistan	Life expectancy 2004; people per doctor 2004; people per hospital bed; IMR 2004; maternal mortality rate 2004	*UNDP HDR 2006; UNDP MDGR 2006*	School Attendance Rates for the 8-14 2000-2001; UNDP educational level index 2004	*UNDP HDR 2006; UNDP MDGR 2006*	GDP per capita 2004; poverty incidence 2000-2001	*UNDP HDR 2006; UNDP MDGR 2006*
Venezuela	life expectancy 2008; hospital beds per 10,000 2003; neonatal IMR 2009	*Venezuela National Statistics Institute (INE) web databases*	Literacy rate 2001; combined gross enrolment ratio 2009; % of the population with at least middle school education 2001	*Venezuela National Statistics Institute (INE) web databases*	% of poor households 2007-2009; % households with access to electricity 2001; households with sewer disposal of waste 2001; % of households living in an inadequate dwelling 2001	*Venezuela National Statistics Institute (INE) web databases*
Vietnam	Life expectancy 1999; % of children born that ever survived 2010; patient beds under provincial departments of health per capita 2009; medical staff per capita 2009	*Vietnam General Statistical Office (GSO) web databases & 2009 Vietnam Population and Housing census; UNDP HDR 2001*	Graduates of upper secondary education compared with total candidates 2008-2009; % of the populatio over 5 that has never attended school 2009; population 18+ with higher secondary education as a % of those who went to school 2009; literacy rate for the populatio over 15 2009	*Vietnam General Statistical Office (GSO) web databases & 2009 Vietnam Population and Housing census; UNDP HDR 2001*	Monthly income per capita 2008; % of households living in a permanent house 2008; % of the population without access to sanitation 1999	*Vietnam General Statistical Office (GSO) web databases & 2009 Vietnam Population and Housing census; UNDP HDR 2001*
Zambia	IMR 2000; life expectancy with AIDS 2004; life expectancy without AIDS 2004;	*UNDP HDR 2007*	combined gross enrolment ratio 2004; literacy rate 2004	*UNDP HDR 2007*	Income per capita 2004; % of the population without access to safe water; % of the population below 5 years of age that is underweight 2004	*UNDP HDR 2007*
Zimbabwe	Life expectancy 2001; % in a cohort not surviving to age 40 2001; perinatal mortality 2005-2006; % of 12-23 months with all basic vaccinations 2005-2006; trained assistance during delivery 2005-2006	*UNDP HDR 2003; DHS 2005-2006*	Average years of schooling 2001; literacy rate 2001; % of the population with at least primary education 2005-2006; combined primary and secondary gross educational attendance 2005-2006	*UNDP HDR 2003; DHS 2005-2006*	Mean income PPP USD 2001; % of the population experiencing a living standard deprivation 2001; % population without access to safe water 2001; % of children under 5 that are underweight	*UNDP HDR 2003*
EUROPE (UK, France, Germany, Netherlands, Italy, Spain, Greece, Poland, Portugal, Hungary, Sweden, Romania)	Infant Mortality rate 2003-2006 (LUZ); life expectancy 2007 (NUTS 2)	*EUROSTAT's general and regional statistics web database, EUROSTAT's Urban Audit*	% of the population with less than ISCED97 level 3 education 2001 (NUTS3); % of the population 20-64 with upper secondary or tertiary education attainment 2010 (NUTS2); students in ISCED 3-4 as % of the population aged 15-24 2008 (NUTS 2); participation of adults aged 25-64 in education and training 2007 (NUTS2)	*EUROSTAT's general and regional statistics web database*	GVA per capita 2010 (NUTS3); net income 2007 (NUTS2)	*EUROSTAT's general and regional statistics web database*

2.3 Example: health indices of the three Bangladeshi EMRs

In order to flesh out some of the issues presented above, I have chosen to present the case of Bangladesh. The latest Human Development Report dates from 2000 and it does not contain any data at the district level, and neither do the various DHS surveys undertaken in Bangladesh. Some useful indicators were extracted from the UNICEFS's 2006 and 2009 Multiple Indicator Cluster Surveys (MICS) developed as part of its Monitoring the Situation of Children and Women work strand[19]. Other indicators were found at the district level through the results of the Bangladesh Bureau of Statistics 2001 population census[20], and at the division level from results of a 2005 Household Income & Expenditure Survey (HIES)[21]. The value on these indicators for Dhaka's EMR constructed above was obtained by a weighted average based on the population of each district for the corresponding year (the preliminary results of the 2011 population census were used[22]).

As concerns the health dimension, the indicators used to assess EMR performance in relation to national performance were the Infant Mortality Rate (IMR) and the percentage of births from women aged 15-49 that were assisted by a skilled personnel, both for the year 2009 from the 2009 MICS. Two more indicators at the district level were found in the 2006 MICS: the percentage of children aged 12-23 vaccinated against all basic childhood diseases and the percentage of mothers who were protected against tetanus, both for 2006. To calculate the standardised ratios, I used ratio standardisation procedure z_3 for the mortality rate and z_2 for the three survey-derived percentages.

Because only one of my two priority health indicators were available for the Bangladeshi EMRs (the infant mortality), I had to use all the indicators described above to estimate the EMR to national ratio in health. This meant weighting the standardised ratios for the infant mortality rate by 50 % (1.031 for Dhaka) and giving the other 50% to the geometric mean of the other three health indicators (child vaccination, assistance at d delivery, and mothers protected against tetanus – 1.128 for Dhaka). The final EMR to national standardised ratio for the health dimension in Bangladeshi context is then obtained by averaging out these two equally weighted components (yielding a health factor of 1.0795 for Dhaka).

This process allowed for a certain rebalancing of standardised ratios. Indeed, it can be seen from the table below (which presents the values for the three Bangladeshi EMRs on the four chosen indicators and their

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[19] Available online at: http://www.unicef.org/bangladesh/MICS-PP-09-v10.pdf, www.unicef.org/bangladesh/2006-08_MICS_2006.Vol_II.FinalJuly08.pdf

[20] Available online at: http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/SubjectMatterDataIndex/datasheet.xls

[21] Available online at: http://www.bbs.gov.bd/RptHIES6_2.aspx?page=/PageReportLists.aspx?PARENTKEY=67

[22] Available online at: http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/BBS/PHC2011Preliminary%20Result.pdf

corresponding EMR to national standardised ratios) that the ratios obtained for skilled assistance at delivery are much higher than the ratios for the other indicators (because of the issue inherent in the ratio standardisation procedure presented above). Balancing the indicators where ratios tend to be high with some where ratios tend to be low, such as indicators at the top of the percentage distribution or mortality rates, is thus a way to empirically rebalance the final dimension factors obtained.

	2011 Population	Infant Mortality Rate (per 1000 live births) - 2009			Skilled attendant at delivery (% of births) - 2009		Children aged 12-23 months currently vaccinated against childhood diseases (%) - 2006		Mothers protected against tetanus (%) - 2006		EMR to Nation health factor
Bangladesh	142,319,000	49	204.1	-	24.4	-	84	-	89.6	-	-
Dhaka	11,875,000	40	250.0	1.038	51.9	1.45844	89.9	1.03452	91.3	1.00944	1.0944
Naray Angonj	2,897,000	45	222.2	1.016	39.3	1.26912	84.2	1.00119	90.7	1.00612	1.0507
Gazipur	3,333,000	44	227.3	1.020	37.3	1.2364	86.4	1.01419	88.7	0.99497	1.0484
Dhaka EMR	18,105,000	41.5	240.8	1.031	47.2	1.39078	88.3	1.02553	90.7	1.00626	1.0795
Chittagong	7,509,000	40	250.0	1.038	32.4	1.15233	84.8	1.00475	93.6	1.02208	1.0479
Khulna	2,294,000	39	256.4	1.043	30.8	1.12352	100	1.09109	93	1.0188	1.0599
	BBS 2011 census	UNICEF MICS 2009			UNICEF MICS 2009		UNICEF MICS 2006 v2		UNICEF MICS 2006 v2		-

3 Estimating extended metropolitan net density

Once the administrative units to be focused on in a particular national context have been selected based on the criteria laid out in section 1, and once the EMR HDI sub-indices for the three dimensions have been calculated as described in section 2, the last step in the data collection process is to estimate the net density of the EMR. This will ultimately allow us to explore the potential relationships between density and HDI at the EMR level, although this work has not yet been progressed.

The net density is calculated by dividing the total population of the EMR by the total surface of land in that EMR that is urbanised, what is called the built-up area[23]. To do this, satellite imagery provided by Google Earth is used to trace around the built-up area in each EMR and to obtain a value in km^2 for the total built-up area in the EMR. Focusing only on the built-up area makes the density information obtained for the EMR much more precise. Indeed, if the total area of the EMRs is used to divide their population (thus yielding a figure for total density), then the values obtained would be made incomparable by the different degrees to which the EMRs contain open and non-urbanised land. Calculating net densities allows for the margin of error that results from the criteria used to select the administrative units making up the EMRs to be reduced, as it leads to comparing the same thing in all places: only the land that is built-up is traced and all the remaining open land is dropped from the density calculation.

In order for the process of tracing around the built-up land of each EMR to yield comparable estimates of net density at an international level, the technique used to calculate the total built-up area must be based on a set of criteria that have to be systematically applied in each national context. The difficulty with this exercise is to find one tracing technique that is flexible enough to accommodate the very different urban patterns that exist in the EMRs in my sample. I have tried many different estimation techniques, and it seems that the only comparable method I have found so far consists in tracing the built-up land with quite a high level of detail. It consists in dividing the built-up areas within the EMR into two groups. The first group, what can be called the core of the built-up area, is made up of the central built-up area (the furthest extent of the continuous built-up land around the main city or cities) and any other significant concentration of built-up land (such as satellite cities or independent towns). Whether a particular settlement is included in the core of the built-up area depends on its size: it needs to be significantly larger than what is considered to make up the peripheral built-up area in that EMR. The peripheral built-up area is the second type of built-up land that needs to be identified in the EMR before tracing begins. This is any organisation of built-up land that is

[23] Given that this work uses satellite imagery, without any indication of land uses, the general principle is that only buildings whose purpose is clearly not for residential, commercial or manufacturing purposes will be excluded. These can include airports, major parks, large scale commercial and industrial storage sites, etc.

physically separate from the central core (the furthest extent of the continuous built-up land around the main city or cities) and which is made up of individual elements too small to be included in the core built-up land. The rule of thumb I have used to decide whether an urban settlement should be included in the core or peripheral built-up area is to look at what constitutes the smallest type of element in the EMR's built-up land (this could be a village, a small town, a farming community, etc.). I then measure the size of a typical manifestation of that smallest element and decide that everything that is 10 times larger in surface should be included within the core built-up area and what is not should be peripheral built-up land. In the case of Mexico City, the smallest element (a small town) has a typical surface of around $2km^2$, and I have thus included everything larger than $20km^2$ in the core built-up land category. For Cairo, the smallest element (large village) has a typical surface closer to $1km^2$ and I thus included everything larger than $10km^2$ in the core built-up area.

The separation between core and peripheral built-up land is thus not what is usually thought of as the urban vs. suburban split. I have decided to include suburban development in the core built-up land because I didn't want density levels of a piece of built-up land to determine whether it was core or periphery. While this process could have been relatively easy in developed city contexts where different density levels can be clearly determined, this such a much more difficult thing to do in less developed contexts where density is as much determined by urban form as it is by household size and intensity of occupation. The split I have used here is much more between the most urbanised portions of the EMR's built-up and those which are more rural in their organisation. The importance of this split is as much analytical as it is practical. Indeed, while it is relatively easy to trace the core areas of the built-up area with high levels of detail (these are areas where the boundaries of the built-up land are well defined and where there is an obvious continuity of development), it is much more difficult to trace the peripheral areas with great detail. Indeed, these are mostly made up of constellations of hundreds of small villages or cities which need to be traced individually.

In order to make this work more manageable, I have decided to use two different tracing procedures for the core and peripheral areas of the built-up area. For the core area, I traced the outline of the built-up area with a high degree of precision (with an eye altitude ranging from 2 to 6 km depending on the quality of the satellite image). For the peripheral built-up area, I traced around the built-up area with a similar level of detail but allowed for the linear connection between the isolated pieces of built-area. This means that I connected the isolated villages using a linear pattern. This allowed for much faster tracing than it would have been the case if I had to trace each piece of built-up land separately. To account for the extra land included in the estimation of peripheral built-up land that follows from this estimation technique, I decided to only count half of the area that is traced in this way. The final estimation of the total built-up land of an EMR is

thus the sum of the core built-up area surface traced (in km^2) and of half the peripheral built-up surface traced (in km^2).

I arrived at this final technique while tracing and this means that I need to revisit some of the tracing I have already done. The table below shows the results of the tracing I have been able to do so far (EMRs in light green are those where the data is final, those in the darker shade of green need to be adjusted for comparability). Some examples of what the tracing output looks like can be found below this data table, with the core built-up area in the darker shade of colour, the peripheral built-up area in the lighter shade and the administrative boundaries of the EMR in light grey. I have started checking the estimates of net density I have obtained through this tracing process with the data obtained by other researchers through remote sensing. LSE Cities has been involved in the detailed study of more than 15 urban areas and has calculated their net densities with high degrees of precision. Though the focus of that exercise has been much more on the city or limited metropolitan scale, the relationship between the net densities of different cities found through remote sensing is similar to the one I found through the tracing estimation. A much more global exercise can be found in the *Atlas of Urban Expansion*[24], in which medium resolution satellite images were used to estimate the size of built-up land in a sample of 120 cities globally. While they have not chosen the areas to analyse according to a criteria of international comparability, and are thus comparing areas of very different natures (mostly administrative cities), I have seen nothing in their data which casts any doubts on the final results of the net density estimation technique I have developed here.

[24] Available online at: http://www.lincolninst.edu/subcenters/atlas-urban-expansion/global-sample-cities.aspx

Extended Metropolitan Region	EMR Population - 2010	Estimate of the built-up area of the EMR: core (km²)	Estimate of built-up area of the EMR: periphery (km²)	Estimate of total built-up area of the EMR (km²)	Net density estimate (people/km²)
Karachi	14,270,132	469	38	488	29,233
Mumbai	26,167,972	464	878	903	28,979
Lahore	13,335,777	404	164	486	27,434
Alexandria	9,433,514	216	279	356	26,506
Hong Kong	7,069,378	273	0	273	25,933
Kinshasa	9,426,523	350	36	368	25,640
Kano	10,643,633	262	325	424	25,076
Faisalabad	7,055,417	163	249	288	24,519
Medellin	6,065,846	187	187	281	21,602
Kolkata	33,084,734	647	1,882	1,588	20,836
Cairo	24,243,250	804	799	1,203	20,152
Manila	23,065,889	1,086	125	1,149	20,081
Bogota	9,840,818	401	187	494	19,915
Surat	6,079,231	116	457	344	17,662
Dhaka	18,105,000	327	1,450	1,052	17,211
Hanoi	9,633,100	167	818	576	16,739
Tehran	14,795,116	700	429	915	16,171
Surabaya	8,728,602	340	413	547	15,965
Khulna	2,294,000	28	240	148	15,495
Bangalore	10,576,167	451	509	705	15,005
Makassar	2,579,112	103	151	179	14,445
Bhopal	2,368,145	76	184	168	14,109
Damascus	4,477,000	163	309	318	14,092
Hyderabad	9,306,634	400	531	665	13,994
Yangon	7,122,722	395	236	513	13,893
Jakarta	34,772,342	1,856	1,309	2,510	13,853
Ahmadabad	8,595,678	231	783	622	13,812
Lucknow	4,588,455	185	298	334	13,744
Pune	9,426,959	294	786	687	13,722
Wuhan	9,202,994	372	600	672	13,696
Ibadan	6,322,614	423	90	468	13,511
Jaipur	6,663,971	206	575	494	13,498
Chennai	12,397,681	442	964	923	13,427
Indore	3,272,335	93	302	244	13,411
Singapore	4,836,691	361	0	361	13,398
Islamabad-Rawalpindi	5,814,142	339	194	435	13,354
Phnom Penh	2,746,038	132	151	207	13,237
Lagos	15,373,213	928	492	1,174	13,100
Delhi	30,141,583	1,076	2,454	2,303	13,088
Dakar	4,514,693	196	303	347	13,005
Lima	10,054,952	680	200	779	12,900
Abuja	4,957,411	320	133	386	12,845
Mashhad	5,940,766	304	359	483	12,301
Chittagong	7,509,000	129	984	621	12,097
Abidjan	7,845,100	336	626	649	12,095
Casablanca	5,619,089	251	439	470	11,947
Istanbul	15,613,932	914	849	1,339	11,664
Ho Chi Minh City	12,592,100	879	410	1,084	11,618
Hubli-Dharwad	1,846,993	44	245	166	11,103
Guiyang	4,035,935	83	567	367	11,000
Caracas	5,431,709	325	380	515	10,554
Kampala	3,840,400	270	205	372	10,317
Ludhiana	3,487,882	138	414	345	10,120
Fuzhou	7,252,632	240	965	722	10,049
Rabat	2,648,773	122	290	267	9,915
Bamako	4,414,117	272	353	448	9,851
Kochi	3,279,860	215	242	336	9,775
Chengdu	13,184,294	515	1,687	1,358	9,708
Medan	5,255,905	277	549	552	9,523
Madrid	6,418,863	322	754	699	9,186
Cotonou	1,523,836	132	69	166	9,166
Sao Paulo	26,193,667	2,727	384	2,919	8,974
Salvador	3,924,954	224	440	443	8,853
Aleppo	4,744,000	120	844	542	8,751
Xi'an	8,611,430	384	1,229	998	8,629
Guangzhou-Shenzen	40,437,810	1,946	5,743	4,817	8,395
Mexico City	35,418,952	2,760	2,924	4,222	8,388
Dar es Salaam	4,149,873	327	375	515	8,063
Santiago	6,921,403	794	171	879	7,871
Nanjing	8,060,882	335	1,400	1,035	7,790
Guadalajara	7,350,682	654	585	946	7,769
Lusaka	2,467,467	197	247	320	7,713
Recife	4,054,966	285	506	538	7,540
Kunming	6,435,490	276	1,179	866	7,434
La Paz	1,908,813	217	87	260	7,343

Extended Metropolitan Region	EMR Population - 2010	Estimate of the built-up area of the EMR: core (km²)	Estimate of built-up area of the EMR: periphery (km²)	Estimate of total built-up area of the EMR (km²)	Net density estimate (people/km²)
Tianjin	12,142,489	617	2,294	1,764	6,883
Rio de Janeiro	13,331,714	711	2,488	1,955	6,819
Beijing	17,487,816	1,278	2,789	2,673	6,544
Osaka	18,488,755	2,201	1,310	2,856	6,474
Paris	12,177,135	1,266	1,256	1,894	6,429
Shanghai	19,553,651	1,665	2,766	3,048	6,415
Harare	3,847,834	449	308	603	6,379
Ankara	4,771,716	350	808	754	6,330
Athens	4,123,518	288	739	657	6,274
Nairobi	7,806,748	805	975	1,293	6,039
Rome	4,101,228	281	830	696	5,895
Tokyo	42,607,376	6,300	2,216	7,408	5,752
Santa Cruz	1,992,709	291	112	347	5,740
Nanchang	4,836,946	197	1,304	849	5,699
Monterrey	4,653,458	689	268	823	5,651
Buenos Aires	18,485,510	2,958	629	3,272	5,650
Bangkok	14,190,762	1,616	1,797	2,515	5,643
Hefei	5,130,599	398	1,028	912	5,624
London	14,830,051	2,508	320	2,668	5,559
Moscow	17,928,071	1,588	3,330	3,253	5,511
Dalian	6,296,304	231	1,825	1,144	5,506
Lisbon	2,845,126	174	753	550	5,169
Tashkent	4,789,500	614	641	935	5,124
Cape Town	5,223,900	781	498	1,030	5,070
Jinan	6,877,240	345	2,046	1,367	5,029
Randstad	6,969,690	882	1,157	1,461	4,771
Fortaleza	3,950,596	335	1,067	868	4,552
Johannesburg	11,191,700	1,945	1,086	2,488	4,499
Belo Horizonte	5,453,312	491	1,532	1,257	4,339
Bucharest	1,948,038	212	477	450	4,328
Budapest	2,930,934	343	740	713	4,113
Harbin	10,350,973	306	4,450	2,531	4,090
Stockholm	1,990,493	173	640	493	4,037
Porto Alegre	4,264,436	585	997	1,083	3,937
Shenyang-Fushun	9,587,314	500	3,879	2,439	3,930
Belgrade	2,253,185	137	922	598	3,769
Saint Petersburg	6,137,260	481	2,371	1,666	3,684
Brasilia	4,164,421	425	1,423	1,136	3,665
Berlin	4,945,877	629	1,485	1,371	3,607
Warsaw	2,472,713	253	1,058	782	3,161
Toronto	6,456,145	1,859	372	2,045	3,156
Curitiba	3,446,485	440	1,377	1,128	3,056
Kiev	4,506,900	277	2,590	1,572	2,867
San Francisco-San Jose	9,143,536	2,859	767	3,242	2,820
New York	23,514,804	5,910	5,321	8,571	2,744
Los Angeles	17,950,451	5,682	2,550	6,957	2,580
Chicago	11,599,646	4,259	1,153	4,835	2,399
Sydney	7,253,400	2,864	1,383	3,556	2,040
Dallas	7,731,414	3,113	1,841	4,033	1,917
Washington DC-Baltimore	9,489,664	4,258	1,644	5,080	1,868
Boston	9,073,643	3,776	2,376	4,964	1,828
Miami	7,432,017	4,115	427	4,328	1,717
Philadelphia	7,903,476	4,018	1,198	4,617	1,712
Atlanta	7,506,267	5,481	2,813	6,888	1,090

FINAL DATA
AWAITING FINAL CONFIRMATION

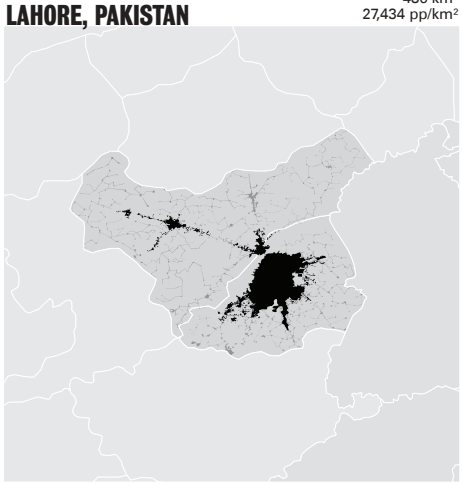
Built-up area of the EMR
Peripheral
Core

Administrative units
Outside country
Outside EMR
EMR
Sea

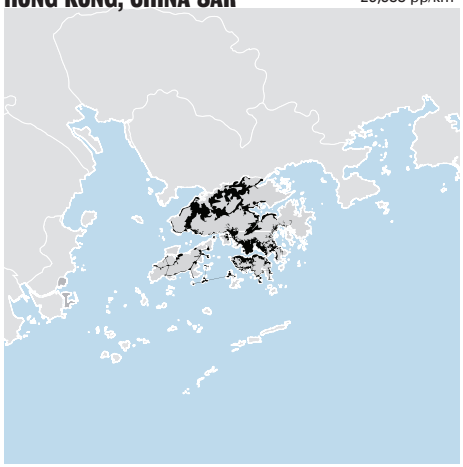
25 km 50 km

>25,000 PP/KM²

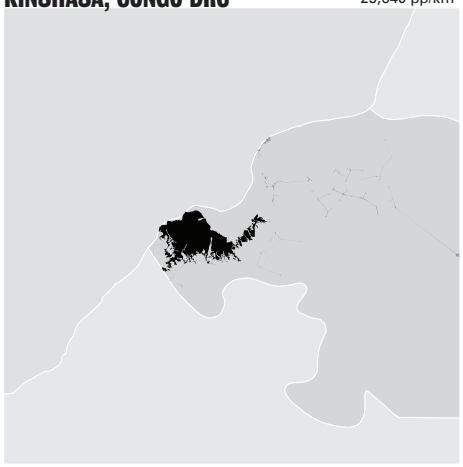
LAHORE, PAKISTAN
13,335,777
486 km²
27,434 pp/km²



HONG KONG, CHINA SAR
7,069,378
273 km²
25,933 pp/km²

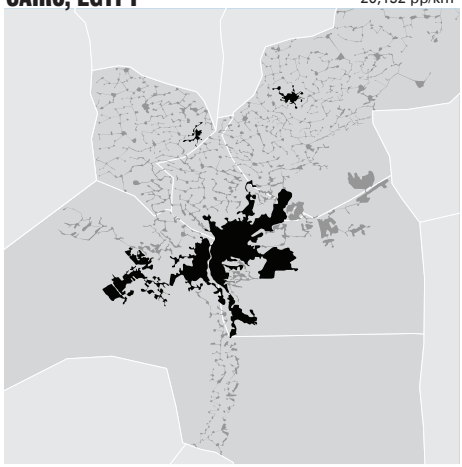


KINSHASA, CONGO DRC
9,426,523
368 km²
25,640 pp/km²

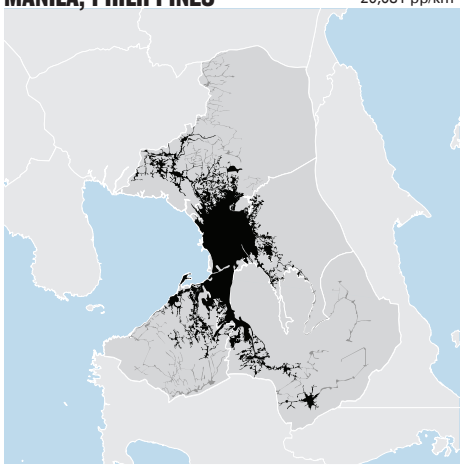


20,000 PP/KM²

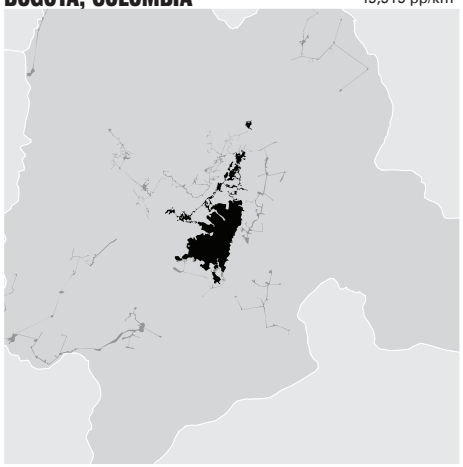
CAIRO, EGYPT
24,243,250
1,203 km²
20,152 pp/km²



MANILA, PHILIPPINES
23,065,889
1,149km²
20,081 pp/km²

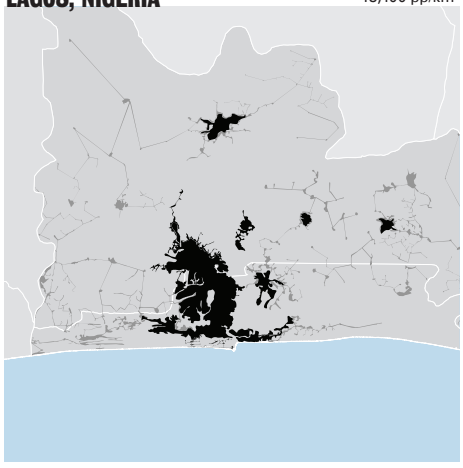


BOGOTÁ, COLOMBIA
9,840,818
494 km²
19,915 pp/km²

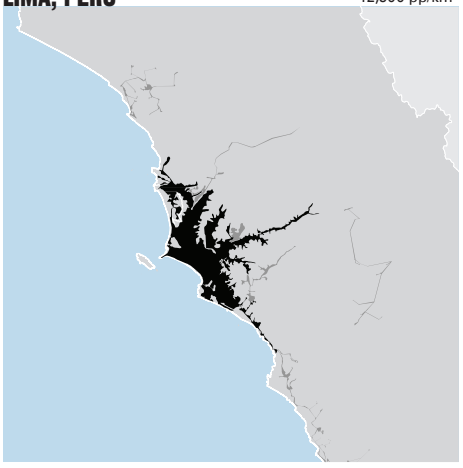


11,000–13,000 PP/KM²

LAGOS, NIGERIA
35,418,952
1,174 km²
13,100 pp/km²



LIMA, PERU
10,054,952
779 km²
12,900 pp/km²



HO CHI MINH CITY, VIETNAM
12,592,100
1,084 km²
11,618 pp/km²