

Report DOPP Exercise 3

Topic 16 - Change of City Quality of Life Rankings over Time

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Executive Summary

We have been analysing data for various city and country rankings and indices, measuring overall quality of living (QoL). These data were merged with additional statistics for cities and countries related to health, environmental and economical situation. The main focus was on the ranking published by Mercer, ranking and indices published by Numbeo and statistics published by WHO, the United Nations, and other data collected by Gap Minder.

We found that the quality of living indices are going upwards - except for the last three years where there is a small downwards trend visible. Here one should also understand that the methodology of the rankings and indexes used is continuously adjusted.

There is a strong correlation between the rankings published by Mercer and the one calculated by Numbeo. Other city rankings (e.g. UN Habitat ranking) do not correlate so well.

The correlation of country-level statistics (e.g. GDP per capita, emission damage, health care system) to the city-level QoL ranking turned out to be surprisingly high. Almost 50% of the variance of the QoL index can be explained by country-level statistics.

Similarly, the correlation with country-level QoL rankings (e.g. the Numbeo country ranking) is again very high. We looked into cities which are not following the country trend, like Mumbai (vastly exceeding the QoL of India) and Rome (much lower QoL as Italy).

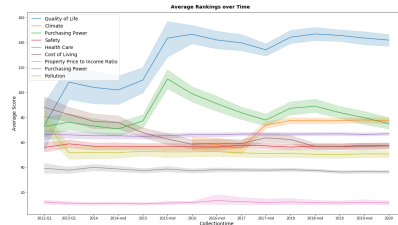
We found that the three major characteristics determining the livability of a city (according to these QoL rankings) are health care, cost of living and purchasing power. On the other hand the QoL rankings suffer from high pollution rates, high property-to-income-ratios and long commute times (inefficient traffic).

Most of the analysis was performed on the year 2012 where the most data was available. Additionally, some of the modelling has been performed on all available years.

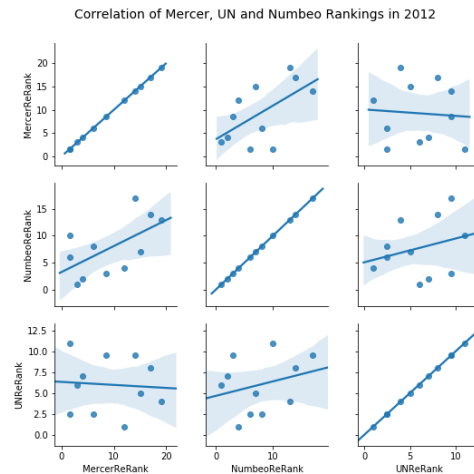
Questions answered

QoL Rankings / Indices over Time

The following plot shows the average index values over time for the Quality of Live (QoL) identified by Numbeo, together with the components which influence this index.



City QoL Rankings cross-correlation



With this plot we investigated the correlation of the rankings identified by Numbeo with those identified by Mercer as well as the UN Habitat data, specifically looking into the year 2012 (where the most data was available).

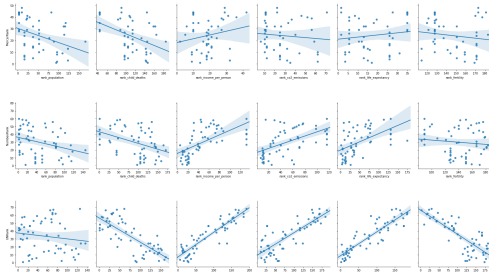
The correlation between Numbeo and Mercer is very clearly visible; the correlation to the UN Habitat ranking however is lower.

City QoL Rank vs. Country Statistics

We looked into the correlation of health-related, economical and environmental statistics of countries and

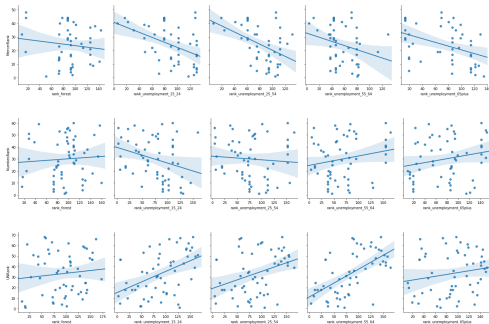
their influence on the Quality of Living for their cities.

The ranking datasets (from top: Mercer, Numbeo, UN) correlate differently with the Gapminder dataset containing population size, child deaths, income per person, CO2 emissions of the country, life expectancy and fertility:



We also looked into the correlation of available green area as well as various unemployment measures on the rankings.

One of the outstanding results here was that visually the Mercer rank was (slightly) negatively correlating with the available green area, while Numbeo and UN Prosperity rank was (slightly) positively correlated. Similarly there were differences in the influence (positive or negative) of unemployment.



This shows that the indices put different weights on the provided attributes.

City QoL Rank vs. Country QoL Rank

We compared every City QoL Ranking with Human Development Index as well as with Numbeo. The highest correlation was found between UN Prosperity and Human Development Index (HDI), with a correlation of 0.927 (using Spearman's rank correlation coefficient). Both indices are created by UN agencies, so we assume they use partially the same base indices in their calculation, explaining this high correlation value. When looking at Numbeo's *City Ranking* in correlation with the HDI *Country Ranking*, created from different entities, we still found a correlation of 0.748 based on Spearman.

Determining Factors for City QoL

We identified the following positive factors (ordered by relevance) for the Quality of Living on city level:

- *Purchasing Power, Cost of Living, Health Care and Safety.*

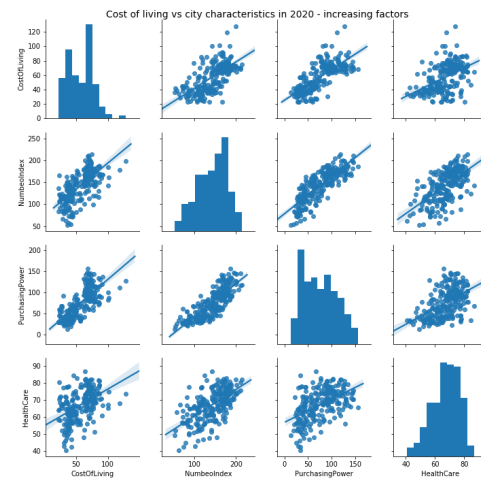
The following factors *reduce* the quality of living:

- *Pollution, Traffic Commute Time and Property Price to Income Ratio.*

We did not find a significant influence of *climate* on the quality of living.

Cost of Living vs. City Statistics

Purchasing Power and Healthcare are indicators that the cost of living will also be high.



Pollution, inefficient traffic, and a high property-price-to-income-ratio (*pptir*) correlate negatively with the cost of living index.

The *pptir* is an indication on how long an average family has to work to buy an average property (house/flat) in a city. It is interesting to see that there is a *negative* correlation between this indicator and the cost of living. It may seem counterintuitive that it is easier to buy a house when the cost of living is higher. Our interpretation was that areas with higher cost of living usually correlate with higher income, therefore reducing the *pptir* value.