

# Health and Wealth: How They Changed From 2000-2015 Around The World

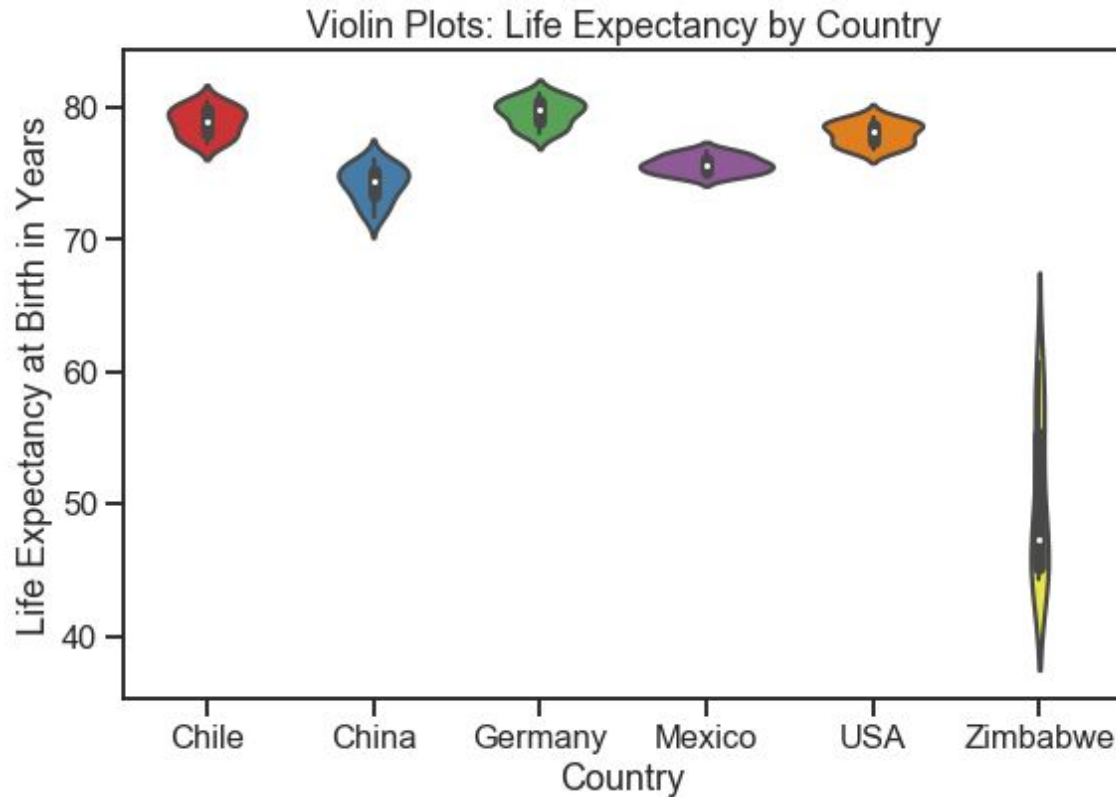
Health and wealth are key measures of national well-being, since a lack of either could undermine a country's stability(1, 2). But their importance may also stem from their intersection. For example, greater wealth could contribute to better healthcare and more health-related education. Likewise, improved health and longevity could increase economic productivity. While the relationship seems obvious in theory, in practice common measures of national *wealth* and *health* may only be weakly related -- or not at all.

We explored changes in -- and the relationship between -- two measures, one for health and one for wealth, in six countries from 2000 to 2015 using publically available datasets from the [World Bank](#)(3) and [World Health Organization](#)(4). The countries represented most of the continents and included Chile, China, Germany, Mexico, the United States of America (USA), and Zimbabwe. Gross Domestic Product (GDP) was used as a proxy for *wealth*, since it is a comprehensive measure of economic success(5); while Life Expectancy at Birth Year (LEABY) was employed as a proxy for *health*(6). Both are commonly used, but there are important caveats we'll address later.

The first questions were simply, *how do countries compare?* And then *have these measures changed since the turn of the millenium?* We then consider whether the measures are related.

## Median Life Expectancy

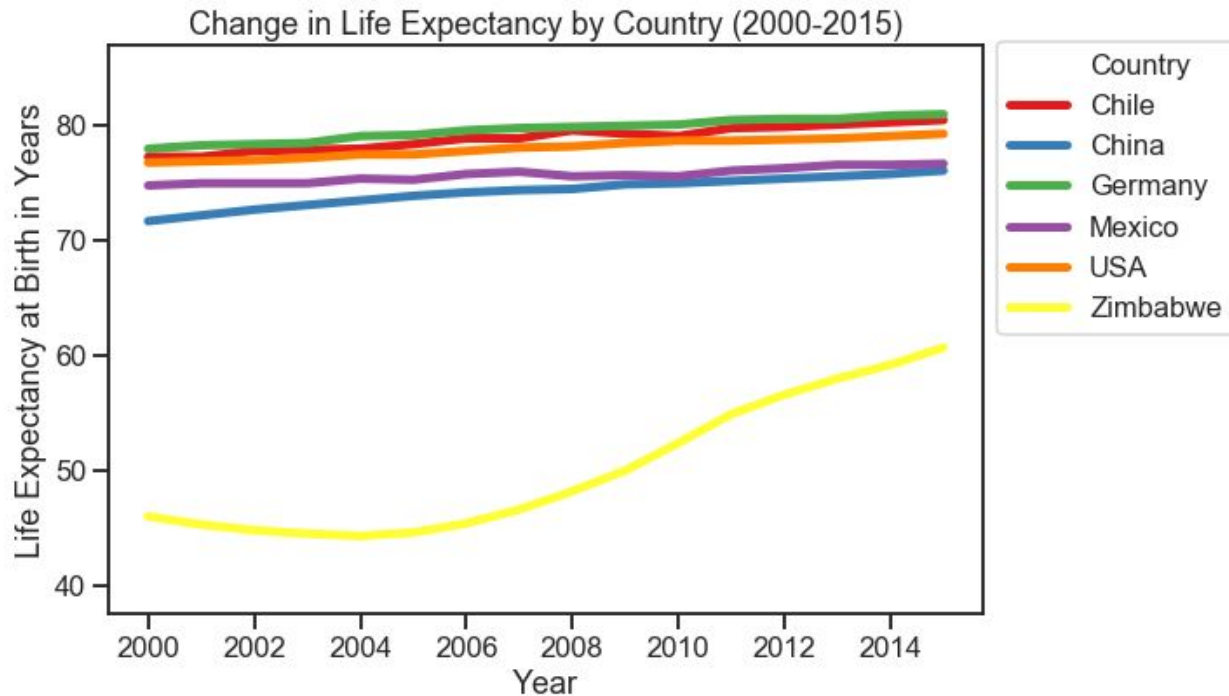
Most countries had relatively similar LEABYs, with medians hovering around 75-80 years. Of these, Germany and Chile had the longest LEABY, and four of the five had peak LEABYs at the higher end of the age distribution; whereas Mexico was more normally distributed around the median. The real standout, however, is Zimbabwe, with a median LEABY of less than 50 and a remarkably wide distribution, likely the result of high infant and child mortality as well as high rates of HIV infection among children and young adults(7). But trends over the last several years give reason to be encouraged that the situation is improving.



## Changes in Life Expectancy

All six countries exhibited at least some increase in LEABY over the 16 year period we examined, but some showed more impressive gains than others. Mexico's gain was minimal, whereas China started the millennium with a LEABY of just over 70 and now boasts one on par with Mexico around 75. Zimbabwe is again the standout. After a decline from 2000 to 2004, Zimbabwe has seen a sharp increase in LEABY, rising from around 40 to near 60 years.

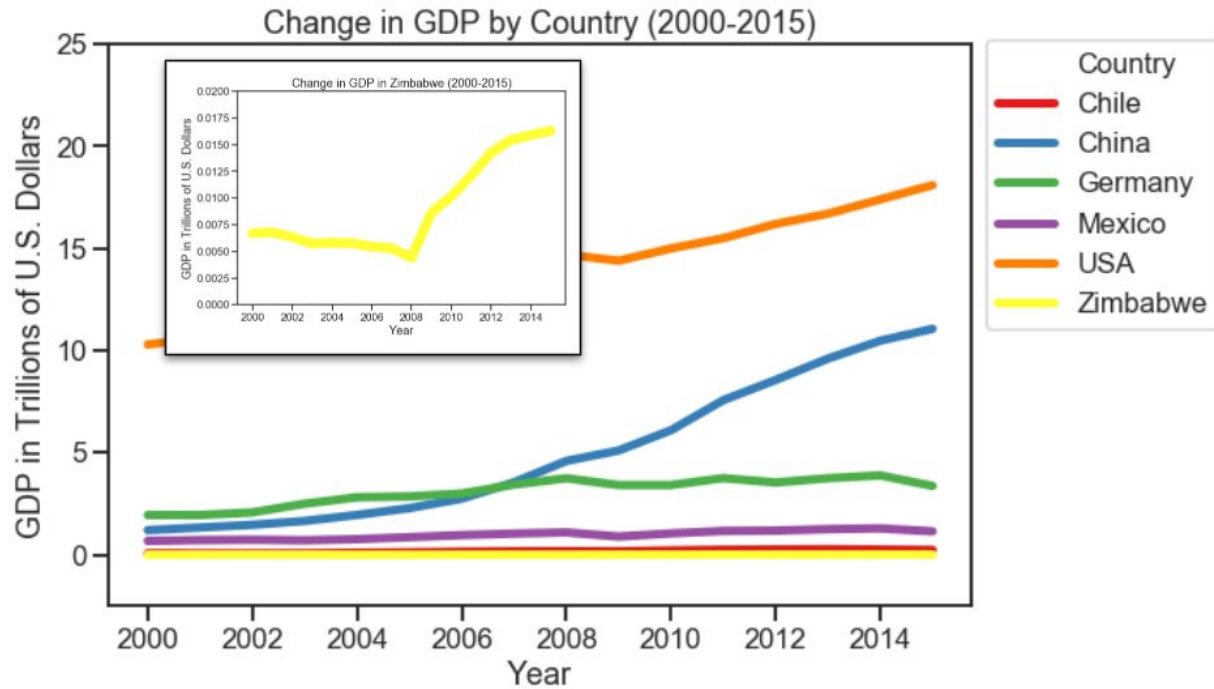
*(Note to Reviewer: This can also be seen in the FacetGrid in the [Appendix A](#), as requested by the assignment and to show that I was able to create one. But as a scientist, a FacetGrid is not the most effective way of conveying a comparison of changes over time between countries. The line graph presented below conveys the information more succinctly.)*



## Changes in GDP

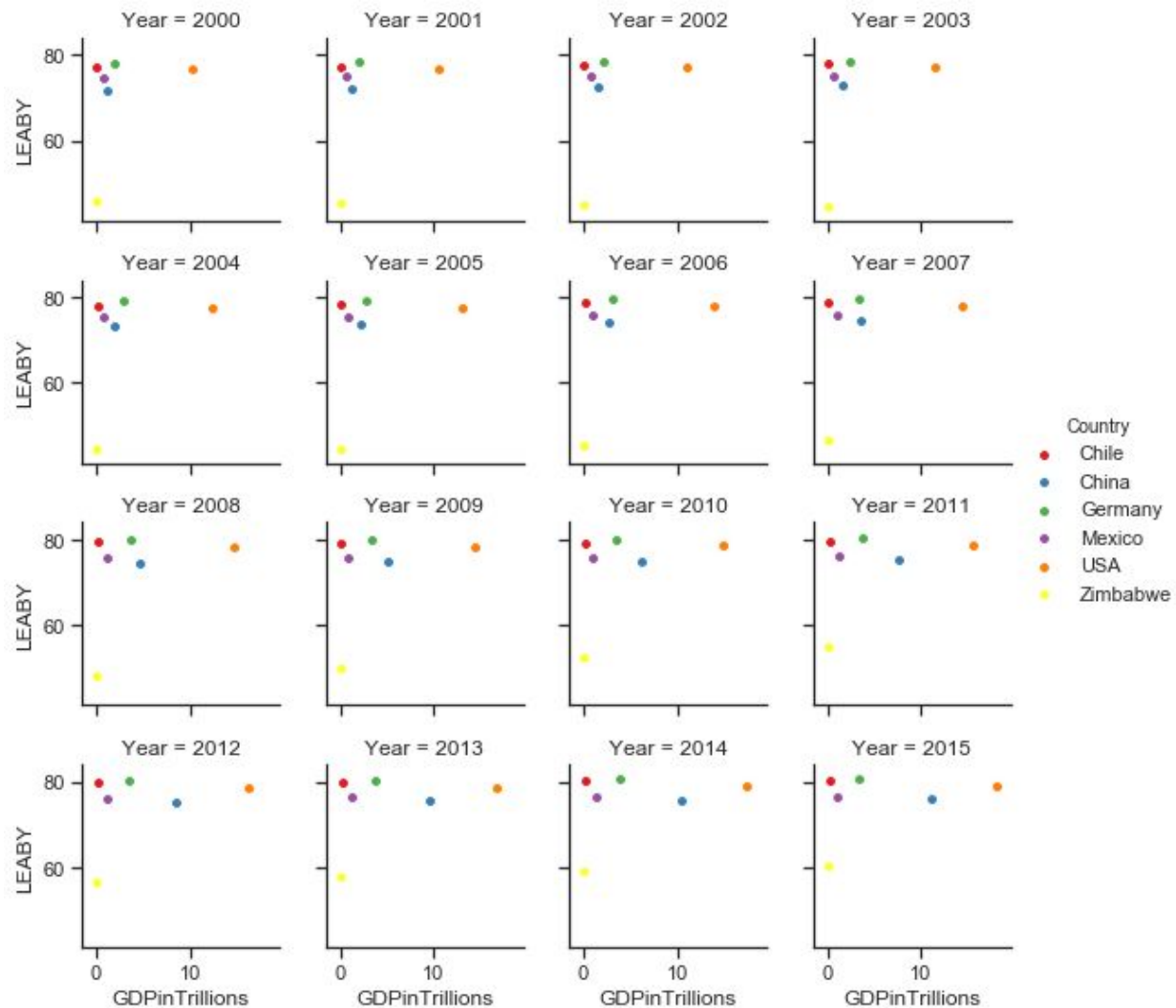
If wealth and health are related, then we would expect to see increases in national GDP to match the increases in LEABY. Overall, this expectation is borne out, with all countries seeing increases in GDP. By far, the USA and China saw the greatest increase in GDP, with the USA showing only a slight down-tick after the 2008 financial crisis, before rising steadily for the last decade. In raw dollars, the remaining countries only made modest gains. But a narrow focus on Zimbabwe (inset graph) reveals that this country saw an impressive rise in GDP after 2008, tripling the GDP from 2008 to 2015 (5 Billion to 15 Billion).

*(Note to Reviewer: This can also be seen in the FacetGrid in the [Appendix B](#), as requested by the assignment and to show that I was able to create one. But, again, a FacetGrid is not the most effective way conveying a comparison of changes over time between countries. The line graph presented below conveys the information more succinctly.)*



## GDP and Life Expectancy

On a country-by-country basis, both GDP and LEABY saw gains, suggesting a positive relationship between the two factors. But a scatterplot of the six countries illustrating GDP and LEABY reveals no obvious positive correlation. Yet, here again, we see Zimbabwe markedly increasing LEABY (yellow dot moving up the graph) and China becoming an economic juggernaut (blue dot moving from left-to-right) over the time period we explored.



## GDP and Life Expectancy in Context

While China's economic growth is remarkable, perhaps the most heartening finding is the increase in LEABY in Zimbabwe. It is unlikely there is a simple, unidirectional, causal relationship between GDP and LEABY, but they are likely connected, as reported by the *Financial Times* in April 2016(7). After the 2008 financial crisis, Africa saw an enormous commodity boom due to the continent's abundant natural resources. The influx of foreign money and rise in GDP allowed Zimbabwe and other African nations to improve healthcare systems and partner with nonprofits, like the Bill and Melinda Gates Foundation. Coupled with improved anti-retroviral agents and immunization campaigns, this investment in healthcare allowed Zimbabwe to reduce infant and child mortality and dramatically extend the lives of those living with HIV/AIDS. Together these changes likely contributed to the increase in the reported LEABY.

## Limitations

While the data and historical context suggest an interesting relationship between national health and wealth, caution must always be taken with correlations. There are also issues with the representativeness of the datasets. While almost every continent is represented, countries on each continent vary widely on many factors that influence GDP and health. Our analysis would have been greatly improved if we had included more countries and possibly a longer time-frame.

There is also the problem of using LEABY and GDP as proxy measures of health and wealth. At best, they are only loosely approximate individual health and wealth. For example, as noted by the *Bureau of Economic Analysis's* primer on measuring the economy, GDP can be influenced by inflation; so a rise in GDP may not indicate a rise in purchasing power on the part of the government or the citizens(5). There's also unevenness. GDP is a single number that does not account for who is producing the output(5).

LEABY is also only one number among many that could be used to approximate national health. LEABY is not the same as QALE (quality-adjusted life expectancy), which is "used in the population health literature as a summary measure of current health status." (6, *Section 5.2*). Thus an analysis of national health based on LEABY alone will skew the interpretation of how healthy a country's people actually are.

Finally, we need to consider how the data are presented. As noted above, in terms of presenting the data effectively, the combined line-graphs better convey a comparison of changes over time between countries than the panelled graphs of a FacetGrid. Further, the violin plots are helpful in seeing the distribution and median of life expectancies when considering 2000-2015 together, but they do not illustrate changes over time. This means the broad distribution in LEABY seen for Zimbabwe was partially due to a steady improvement since 2008, but that is not visible in the violin plot. Finally, a fuller analysis would examine the percentage change in GDP and LEABY from 2000-2015. This would make countries like the USA and Zimbabwe more comparable.

*(Note to Reviewer: As an academic and given the quality of the datasets we needed to use to complete the assignment, I did not feel comfortable posting to a blog hosting site like Medium. The analyses above are legitimate as far as they go, but the datasets -- and thus the analyses -- are not nuanced enough for public consumption.)*

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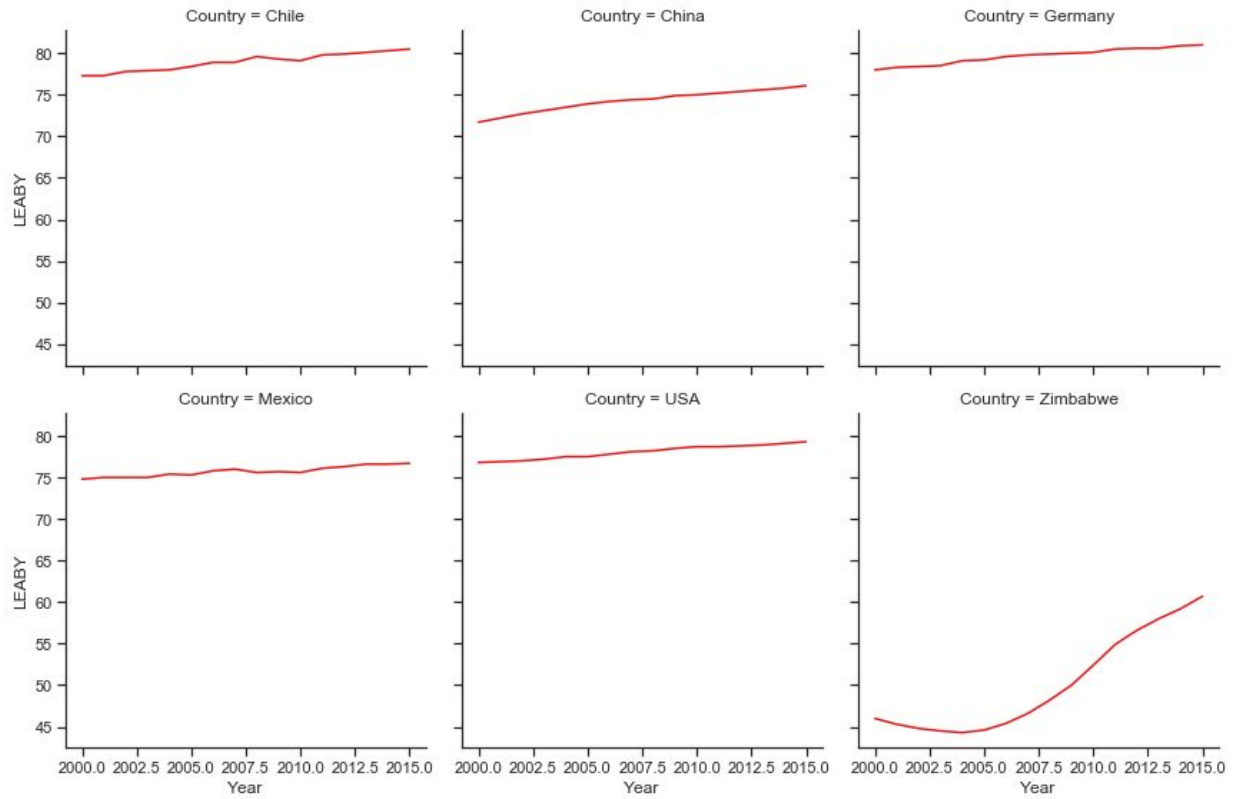
(1) World Economic Forum. *Poor countries have the least-developed financial systems – that has to change* (2016):

<https://www.weforum.org/agenda/2016/08/poor-countries-have-the-least-developed-financial-systems-that-has-to-change/> (Accessed 1/29/2019)

- (2) Pearson and Haile. *Weaknesses in Primary Health Care Threaten Public Health Security and Stability*. Center for Arms Control and Non-Proliferation (2008):  
<https://armscontrolcenter.org/weaknesses-in-primary-health-care-threaten-public-health-security-and-stability/> (Accessed 1/29/2019)
- (3) GDP Source: [World Bank](#) national accounts data, and OECD National Accounts data files. (Accessed 1/26/2019)
- (4) Life expectancy Data Source: [World Health Organization](#) (Accessed 1/26/2019)
- (5) Bureau of Economic Analysis. *Measuring the Economy: A Primer on GDP and the National Income and Product Accounts* (December 2015).  
<https://www.bea.gov/resources/methodologies/measuring-the-economy> (Accessed 1/29/2019)
- (6) National Research Council (US) Panel to Advance a Research Program on the Design of National Health Accounts. *Accounting for Health and Health Care: Approaches to Measuring the Sources and Costs of Their Improvement*. (2010):  
<https://www.ncbi.nlm.nih.gov/books/NBK53336/> (Accessed 1/26/2019)
- (7) Johnson. *Africa's life expectancy jumps dramatically*. Financial Times (April 26, 2016),  
<https://www.ft.com/content/38c2ad3e-0874-11e6-b6d3-746f8e9cdd33> (Accessed 1/26/2019)

## Appendix A: The facet grid of line graphs mapping Life Expectancy by country

As noted in the post above, Zimbabwe shows the most dramatic increase in Life Expectancy.



## Appendix B: The facet grid of line graphs mapping GDP by country

As noted in the post above, China shows the most dramatic increase in GDP.



