Working Paper

Measuring and valuing the Social Impact Of Wages –

The Living Wages Global Dataset And The Health Utility Of Income

June 26, 2018

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Content

1. Context

Income can be either by labor or by capital (stock, built capital, etc), or both. The fraction of the world population benefiting from capital income is much smaller than the fraction receiving labor wages. Picketty (2013) showed that despite a relatively constant past equilibrium between capital and labor wages, recent trends have shown an increasing imbalance in favor of capital wages. This is reflected by global inequalities illustrated for instance by the fact that 82% of the all wealth created in the last year (2017) went to the top 1%, while the bottom 50% saw no increase at all (Oxfam, 2018). Actually, 42 individuals now own the same wealth as the bottom 3.7 billion people (Credit Suisse, Oxfam 2018). Some levels of inequalities are inevitable and even beneficial, however the current level of wage inequalities negatively impacts our society and our capacity to grow our economy in the future. The World Bank (2018) has shown that human capital represents 70% of the wealth of high-income countries (OECD), while only 41% of low-income countries. Worldwide, 64% of the wealth is represented by human capital, and this human capital is strongly correlated to GDP per capita figures. Sustainability, interpreted as the long-term growth of wealth and thus GDP growth, relies on investing in so-called human capital i.e. education, employment, working environment and conditions, etc.

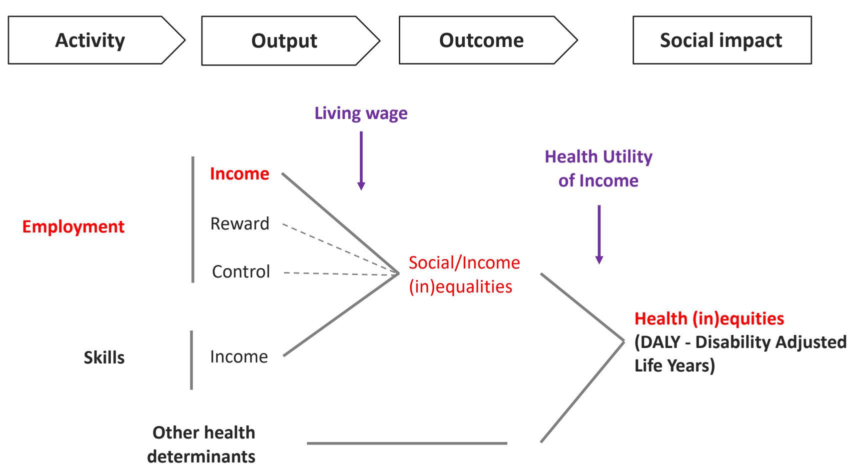
One of the drivers of human capital is income, among other drivers (e.g., education, access to health care etc.). Income, as provided through employment conditions and the environment, has been recognized by the World Health Organization (WHO) as one among various social determinants of health. The WHO showed in particular that income inequalities within a country correlate more strongly with the quality of life and life expectancy than GDP per capita. More simply said, our level of income influences how long we live.

The concept of living wage developed long ago by the ILO and other organizations, is a key method to assess wages. The living wage should provide a satisfactory standard of living to the workers and their families (ILO, 2011). Recent developments in this field (Anker, 2017) have established a global framework to measure it. Receiving a wage below a living wage threshold will ultimately lead to a reduced quality of life and life expectancy. On the contrary, receiving a wage above the living wage threshold will positively influence your life quality and expectancy. Some datasets have shown that differences in life expectancy can reach 13 years in the US for instance (NAS, 2015), between the low- and high-income population group, and 13 years in France (INSEE, 2018).

Given the rising interest of the private sector (and other sectors) to measure its value and impact beyond traditional financial metrics, we have developed in this white paper a **global dataset of living wages** per country as well as a measure of the human health impact of wages, called the **Health Utility of Income** (HUI):

- The **global dataset of living wages** will hopefully support companies to benchmark the wage levels provided in their direct operations as well as through their value chains. It is, to our knowledge, the first global dataset published. Despite inherent uncertainty and geographical variability, we believe that this dataset allows to operationalize one step further the concept of living wage within the private sector.
- The **Health Utility of Income (HUI)** will support businesses in valuing their impact on society, often referred to as impact valuation (IVR, 2017), and in line with the Natural and Social Capital Protocols (NCC 2017, WBCSD 2017). Companies and governments often claim they want to create jobs and contribute to the GDP. Depending on the conditions of those jobs, in particular for low-income jobs, below the living wage threshold, a negative impact might occur for the individual. While the GDP reflects national wealth, it does not inform about the quality of jobs created. Actually, an increase of GDP can happen by depleting various capitals, including human capital. This report challenges the classic assumption that job creation always has a positive impact on society.

The global dataset of living wages and the Health Utility of Income are part of the same impact pathway; however they play different roles. The figure below illustrates the social impact of employment through wages (or income). The latter is considered as an output of employment, yet it could generate a positive or negative impact. Only a comparison with a living wage could provide this insight. The difference between the provided wages and living wages indicate the level of income inequalities, which in turn generates health inequities. In order to translate income inequalities into health inequities, the Health Utility of Income factors are required.



An illustration of the use of those two datasets is provided in this paper.

2. Global Dataset of Living Wages

Many different publications have developed living wage concepts and applications. Recently, Anker & Anker 2017 set the global standard of living wages assessment. This publication has been supported by ISEAL (International Social and Environmental Accreditation and Labelling Alliance) with members such as Fair Trade, FSC, UTZ-RainForest Alliance, RSPO, etc.) and the Global Living Wages Coalition. ISEAL has used the standard to develop very specific living wage case studies for example in Bangladesh, Ethiopia, Kenya, Pakistan and Brazil. To our knowledge, no database currently provides data points for all countries in the world.

A living wage is defined as (Anker & Anker, 2017):

> *Remuneration received for a standard work week by a worker in a particular place sufficient to afford a decent standard of living for the worker and her or his family. Elements of a decent standard of living include food, water, housing, education, health care, transport, clothing, and other essential needs, including provision for unexpected events. (Global Living Wage Coalition, 2016)*

We would like to call out that this definition does not yet include retirement provisions. The cost of living calculated in the context of a living wage needs to factor in the number of full-time equivalent workers[1] per family, as well as any statutory payroll deductions and taxes, to obtain the gross living wage, referred more generally to as “living wage.” Further information on the calculation of a living wage is provided in the appendix 6.1.

The calculation of the cost of living is complex and requires to consider the number of members in a family, the dietary requirements and costs of food, housing and utilities, and so on. These costs vary per location. In theory, the living wage is only valid for a limited geographical scope which is much smaller than a country.

Accessing data on local costs is the main barrier to calculate living wages for a large number of locations. Our objective is however to calculate such a dataset for all countries, despite the data limitations and despite the fact that an average living wage per country will only be a first approximation and will need to be refined for specific locations within a country. This first estimate of a living wage can be used to prioritize country risks or to inform sourcing needs for multinational companies for instance. Once the biggest gaps are identified, a refined calculation of living wage would however be required.

The Living Wage Global Dataset (LWGD) features estimates based on locally-relevant data rather than macro-economic models. The hierarchy is as follows:

a) Living wage estimates at country level when it exists already (bottom-up)
b) Data that allows to calculate living wages (bottom-up)
c) Macro-economic model (top-down)

[1] By workers, we mean any type of labor activity which provides an income (white or blue collar, freelance, migrand worker, part-time or full time, etc.

We used two main data sources for the bottom-up part of the LWGD. On the Wage Indicator website[2], the Global Labor Organization (GLO) published an estimate of living wages for 57 countries based on proprietary surveys. No other significant dataset was found despite stand-alone initiatives, such as an estimate for the UK (D'Arcy and Finch 2016).

To cover more countries, an additional dataset was used from Numbeo[3], a website which collects the prices of different items in all countries around the world. The data collected is still limited and does not allow calculating a living wage. Other data sources and assumptions were used as well which are described in appendix 6.2. This bottom-up model based on Numbeo data allowed to cover an additional 47 countries, on top of the 57 already covered in the dataset from the GLO.

In order to still provide an estimate for the countries not covered, a top-down approach was developed, which consists of extrapolating the living wage estimates using a model that correlates existing data points to one or more parameter(s). In our case, we used the Purchasing Power Parity (PPP) from the Word Bank (2016) or more precisely a derived index based on PPP called "Price level ratio of PPP conversion factor (GDP) to market exchange rate." The PPP parameter considers the fact that USD1 spent in the United States will not buy as many goods as the same US1 spent in Mali or China. Using PPP allows to compare local price levels for different countries.

The correlation indicated a coefficient of determination (R^2) of 0.749 which is considered a good correlation, although further improvements could be considered. This top-down model allowed to cover an additional 76 countries on top of the 104 already covered by the bottom-up approach, reaching 180 countries in total.

Figure 1 provides an overview of the modeling approach for creating the living wage global dataset. It highlights the prioritization level which indicates the different sources of data from bottom-up (step A and B) to top-down (step C).

[2] wageindicator.org (2017)

[3] https://www.numbeo.com

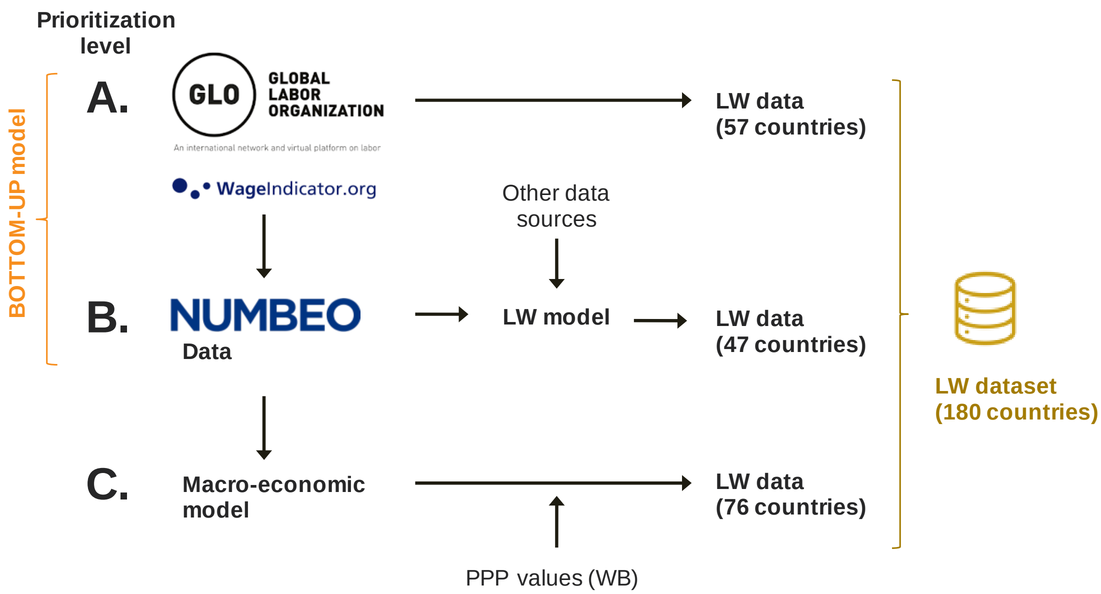


Figure 1 - Overview of the living wage global dataset modeling

The dataset ensured consistency of scope and modeling across different data sources, in particular regarding typical family composition and working family members. The dataset provides as well low and high estimates for each country covered, to address the difference that exists between living wages in urban and rural areas.

The dataset is available in an Excel table associated to this report, which provides the average living wage in local currency (together with minimum and maximum estimates) and in current USD (exchange rates are taken from the World Bank data for 2016). The data also provides an indication of the primary data source (GLO, Numbeo and macro-economic model). An underlying Excel model is also available upon request, in which detailed parameters can be updated to re-calculate living wages estimates.

The table below provides the annual living wages per worker for selected countries for 2017.

Country (data source: a: GLO, b: Numbeo, c: model)	Annual living wage (average, local currency)	Annual living wage (average, USD)
Afghanistan (c)	131'268	1'934
Bolivia (c)	35'775	5'177
Brazil (a)	20'712	5'934
China (b)	55'199	8'307
Cote d'Ivoire (c)	2'791'726	4'708
Denmark (b)	113'029	16'791
France (a)	14'886	16'510
Greece (a)	10'212	11'326
Guatemala (a)	33'084	4'353
Italy (a)	11'370	12'610

Mexico (a)	77'070	4'129
Norway (b)	163'977	19'521
South Africa (a)	87'888	5'975
Spain (a)	8'742	9'695
Switzerland (b)	24'634	25'003
United Kingdom (a)	8'988	12'136
United States (a)	16'182	16'182

The uncertainties underlying the calculation of a living wage need to be highlighted to ensure a proper use of the dataset. The following points need to be considered:

- Data for the bottom-up model is collected through surveys based on self-reported answers from anonymous contributors. The quality of data varies and cannot be verified.
- A living wage can vary depending on family composition, working family members, location and life events. For instance, an employee with or without family and children will have different costs of living in any given country. This needs to be accounted for when benchmarking a living wage.
- A living wage varies a lot depending on the location considered within a country, from city to city and from city to rural areas for instance. This parameter is difficult to model accurately without collecting primary data, despite the global dataset providing low and high estimates to cover partly this limitation.

Novartis example – Using a living wage to improve the working conditions of employees

Each year, Novartis Group companies review salaries for all of its associates and adjust salaries that fall below the living wage level. Novartis used the living wage dataset to benchmark salaries for the societal impact of living wage valuation. The analysis included all salaries provided to Novartis employees around the world, which are more than 120’000. Novartis has already implemented a living wage policy (see Human Rights Guideline and CR Guideline) to ensure no employee is paid below a living wage and adjust any salary where deviations from the policy occur. The new Living Wage Global Dataset provides a new point of comparison that Novartis can use for own operations and its supply chain.

3. Health Utility of Income (HUI)

The impact valuation of employment or income is not well developed in the field of social capital accounting in the corporate sector. Traditional economic approaches have been used in many social capital accounting applications by a number of large corporations. These approaches usually consider that all wages are generating a positive value. The valuation is based on the real financial value and usually applied in combination with a multiplier to account for the benefit of the first job created and for the indirect jobs created or sustained by this first job. A threshold and other multipliers have been used to account for the local context and different levels of wages, but still based on the assumption that every job created is a good one.

In this work, we developed an innovative model based on the social determinants of health and the concept of marginal utility of income. Social determinant of health studies have been widely developed among others by the WHO (2008, 2014, 2016). The basic idea is that our health (well-being) and life expectancy are defined by a variety of determinants, including behaviors, environmental factors, genetic disposition and of course social determinants. Among the social determinants, we can find early age development, education, work environment and conditions, retirement conditions and social protection/services. Working conditions, including incomes, play an important role but are only part of the picture. Further information on the social determinants of health and the role of income is provided in appendix 6.3.

In order to develop the HUI model, we used data from Eurostat (Corsini, 2010) and OECD (2015)[4] data which link life expectancy to education level, a good proxy of income. Isolated data exists for some countries on the direct link between income and life expectancy, for example for France (INSEE 2018). Figure 2 shows results for 19 countries for which data exists, split by gender. This dataset forms the basis of our model.

	Male	Female	Average
Czech Republic	17.8	5.2	11.5
Estonia	15.0	8.1	11.6
Hungary	12.1	5.5	8.8
Poland	11.6	5.0	8.3
Slovenia	9.1	4.4	6.8
Slovak Republic	6.9	3.5	5.2
Israel	5.8	4.7	5.3
Finland	5.5	3.5	4.5
Denmark	5.4	3.8	4.6
Mexico	5.2	4.6	4.9
Norway	5.1	3.9	4.5
Netherlands	4.5	4.2	4.4
Portugal	4.3	1.8	3.1
Sweden	3.7	3.0	3.4
Italy	3.6	1.8	2.7
Bulgaria	11.6	7.0	9.3
Greece	6.5	1.9	4.2
Croatia	5.9	2.0	4.0
Romania	9.9	4.1	7.0
OECD (15)	**7.7**	**4.2**	

Figure 2 - The table shows the gap in the expected years of life remaining at age 30 between adults with the highest level vs. lowest level of education.

Public data does not exist for all countries in the world. To overcome the data gap, we built a model estimating the health inequities related to income inequalities worldwide. When measured along income inequalities, health inequities are called a “social gradient”. A social gradient links health inequities (for instance life expectancy) with income differences. In short, people who are less advantaged in terms of socioeconomic position have worse health (and shorter lives) than those who are more advantaged.

The appendix 6.4 provides the detail of the calculation, data and assumptions. The results provided us with social gradients for all countries, expressed in DALYs per year of work. This DALY can also be expressed in monetary units using different valuation techniques. We used the productive value of life,

[4]http://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-2015_health_glance-2015-en

equivalent to approximatively USD 44’000/DALY, which is based on the OECD average GDP per capita. The social gradients calculated still need an extra step of modeling to be translated into Health Utility of Incomes.

From health inequities to the “health utility of income” (HUI)

We are departing from the assumption that the living wage, as described earlier in this report, is the threshold below which a negative impact can be observed and above which a positive impact occurs. This threshold has been recommended by other companies within the field of social capital accounting such as Nestlé and DSM. Setting a baseline is relatively subjective and is a choice that needs to be agreed upon.

Depending on the income a person receives, and its relative difference to the baseline, the health inequalities will vary. For a person earning USD 100’000 /year, the benefit of earning an additional USD 5’000 will be less than for a person earning USD 15’000 /year. This is why we cannot just apply the health inequities data at a flat rate for all wages paid by a company. This is the concept of marginal utility of income.

This relationship has been documented for other countries like the US (Andrew, 2015 and Layard, 2008), Australia, etc. Trends across countries are relatively similar. The marginal utility falls to a low level above an income representing 3 or 4 times the living wages, as illustrated in Figure 3.

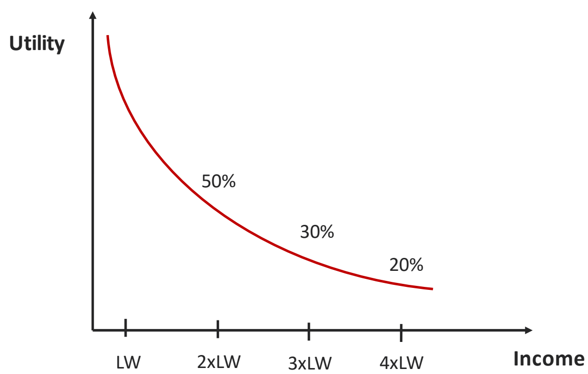


Figure 3 – Illustration of the utility of income plotted against typical income level defined as multiples of the living wages (LW). The % indicates the level of utility (100% being the maximum utility).

We allocated the health inequity data into different income gaps, below and above the living wage baseline, as illustrated in Table 1 following a typical curve of utility of income. According to this model, the health inequities linked to income inequalities are almost inexistent above a level of income which is four times the living wage.

The resulting factors obtained are called the Health Utility of Income (HUI) and are the main factors used in the impact valuation model for Novartis.

Table 1 - Application table of the health inequities in % per wage level to obtain the Health Utility of Income

Wage level	Below LW	LW	Up to 2 LW	Up to 3 LW	Up to 4 LW	Up to 5 LW
% of HUI to consider	- 100%	baseline	100%	50%	30%	20%

To illustrate the HUI, let’s consider a situation in Brazil with the living wage being USD 5’934 per year (source: LWGD). Let’s imagine the case of two employees, one being paid USD 5’228 per year (Joao) and the other USD 7’794 (Gabriel). The HUI is 3.2 USD/USD according to our model. This actually means that for every additional USD wage (very close to the level of the LW), a social value of USD 3.2 is created (a return on investment of 1:3.2). Figure 4 illustrates the result of the calculation of the social impact, looking first at the wage differential between the current wage and the living wage, and second multiply this difference with the HUI data to obtain the social impact. Joao has a negative social impact (his wage is lower than the LW), while Gabriel has a positive impact (his wage is higher than the LW).

	Joao	**LW = 5’934 USD/year**	**Gabriel**
Salaries	5’228 USD/year		7’794 USD/year
Δ with LW	-706 USD/year		1’860 USD/year
HUI (100%)		3.2 USD/USD or 7.25e-5 DALY/USD	
Impact valuation	**- 2'259 USD/year**		**5'952 USD/year**
	0.05 DALY/year (-18 days of life)		0.13 DALY/year (+47 days of life)

Figure 4 - Illustration of the application of the HUI data to two different persons working in Brazil

The full dataset is **available in an Excel table with this report**, and provides the HUI per wage levels, as well as the life expectancy gap per country.

Novartis example – Valuing the social impact of Novartis and its supply chain

Social impacts, both negative and positive, are a key element of the Financial, Environmental and Social (FES) impact valuation, the Novartis version of the Triple Bottom Line approach. Separate notes will become available on elements of environmental and financial (economic) impact.

Novartis employs approximatively 120’000 employees, for which wage and salary data is known. Novartis is committed to providing its associates with a living wage. Based on the global living wage dataset and HUI approach, the social impact of living wages was calculated for 75 countries in which Novartis operates, in 2017.

Primary data on wages and salaries in the supply chain is not readily available. However, this is required to extend the social impact of living wages to the supply chain and inform about the quality of jobs created through the purchase of goods and services. To extend this assessment to the supply chain of Novartis, we used spend data linked to an input-output model providing socio-economic indicators (Exiobase) to estimate the number of indirect jobs linked to Novartis. The input-output model also allowed classifying the number of jobs per skill level, which was used to define the salary levels to be used with the HUI factors. This was done for a total of 167 countries.

According to our economic impact analysis for 2017 based on the World Input-Output database, Novartis spend generated 360´000 jobs in its supply chain. The Exiobase analysis suggests the following skill distribution: 65% high-skilled jobs, 14% medium-skilled jobs and 21% low-skilled jobs. Jobs were identified per sector, but more importantly for our model, per country as this informs the reference levels of wages. The wage levels were defined using the World Income Inequalities Database (WIID). For low-skilled jobs, we used the average income considering quintiles 1 and 2. For medium-skilled jobs, we used the quintile 3, while for high-skilled jobs we considered quintile 5.

Overall, the impact of Novartis supply chain generated a USD 5.6bn net positive societal impact, with a negative impact of USD 0.4bn and a positive impact of USD 6.0bn. The low-skilled jobs were estimated to have a negative social impact value of USD 0.2bn and a positive social impact value of USD 0.2bn. The medium-skilled jobs created contributed negatively with USD 0.2bn and positively with USD 0.3bn. The high-skilled jobs contributed only positively with USD 5.5bn.

The direct employment impact of Novartis generated a positive impact value of USD 1.0bn, while seeing a very small negative impact of USD 1.4m (less than 0.2%) linked to the cases of salaries below the living wage threshold. These cases are considered temporary and were followed-up in accordance to the Novartis living wage policy.

The top ten countries with the highest social impact in the Novartis supply chain were not where the highest spend was found. Those countries are (in bracket the spend ranking): USA (1), China (6), Singapore (16), Germany (3), Switzerland (2), Brazil (18), Indonesia (43), United Kingdom (4), Austria (5) and Spain (11). There were 21 countries for which the social impact of living wages was positive for both the Novartis supply chain and Novartis operations. All of them were in Europe.

Negative impact values for low-skilled jobs in the supply chain were found in India (77% of the total negative impact driven by the IT and the chemical sector), China (11%), Brazil (3.2%), South Africa (2.5%), Turkey, Iceland, Singapore, Ukraine, Indonesia and Mexico (top 10).

This social impact of living wages provides important insight into social hotspots in the supply chain and will inform the interaction with suppliers.

This innovative work led to the development of a Living Wage Global Dataset and valuation factors, called Health Utility of Income, assessing the impact of wages on human capital. We believe that the global dataset of living wage is the first to be published publicly covering almost all countries in the world. Similarly, assessing wage impact on human health goes far beyond what the private sector has done until now when considering economic and social impact. It is however a big step forward to think that wages can impact our well-being and life expectancy, and this might be a barrier for the adoption of such advanced methodology.

It is clear that more development needs to happen in this field, covering both living wage dataset developments and health utility of income. Living wages should be even more location specific, and embed different family and employment contexts. Health utility of income should focus on better understanding the correlation of income with health, and fill data gaps with either better primary data or better models.

Overall, the work provided in this paper covers part of the need of the private sector to benchmark direct operations and even the entire value chain, and to value their impact on society linked to employment. Wages are one key value of our economic system, and they should provide positive societal value.

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6. Appendix

6.1. Living wages additional information

Figure 5 provides an overview of the component accounted for to calculate a living wage.

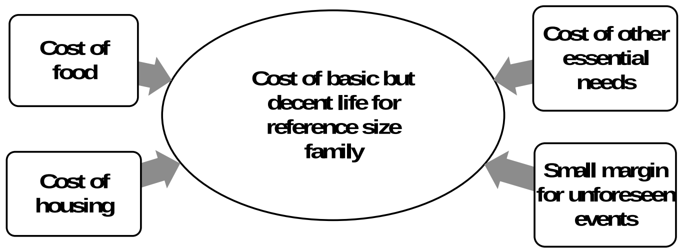

Figure 5 - Components accounted for in the calculation of a living wage (source: Anker & Anker, 2017)

Figure 6 illustrates the calculation of the net living wage and the gross living wages based on the cost of basic but decent life for a family. The net living wage accounts for the number of full-time workers per family, which is an important parameter in calculating the living wage. To translate the net living wage into a gross living wage, the statutory payroll deductions and taxes need to be accounted for. This gross living wage is comparable in most cases to the gross wages paid to workers by companies.

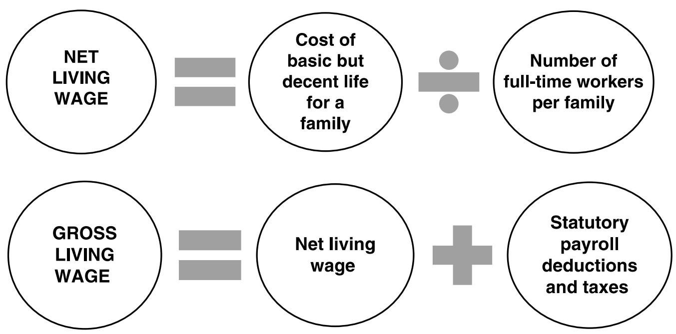

Figure 6 - From cost of basic but decent life to the net and gross living wage (Anker & Anker, 2017)

When comparing living wages with corporate gross wages, other parameters need to be factored in. All additional predictable revenues and in-kind contributions that the employee can rely on can be added to the corporate wage estimate, while all other non-guaranteed contributions such as bonuses, should not be considered.

To summarize, the main drivers of a living wages are:

- The local cost of living which varies mostly according to the location
- Family size (number of children)
- Number of workers per family
- Statutory payroll deductions and taxes

There are several limitations to the living wage concept:

- **Context and localization**: the costs of living vary depending on the context and location. This makes it difficult to assess for a wide area such as a country or even a city, as prices vary a lot within a same location. The living wage is thus an averaged estimate when considering an area.
- **Value-choices**: the Anker & Anker 2017 methodology tries to limit as much as possible the value choices that are embedded in the calculation of a living wage. However, some concepts are subjective such as a decent accommodation, nutrition, etc. This affects the comparability of living wages and their use in absolute terms too.
- **Social security**: social redistributions are not fully accounted for in the calculation of a living wage. These redistributions can represent a significant part of the income of low-income populations. However, excluding them from living wages make sense as it means that a living wage should provide enough income for a basic but decent life to be independent from social redistributions.
- **Data limitations**: much of the data used to calculate the living wage relies on estimates which vary with time and judgement.
- **Macro change**: the calculation of the living wage take into account existing price levels for goods and services. This implies that some employees in a given location are not paid a living wage. If all were paid a living wage, prices would go up.

6.2. Detailed assumptions for the living wage model based on Numbeo

To calculate the cost of food, the following items were selected from Numbeo: bread, egg, cheese, apple, orange, potato, lettuce, rice, tomato, banana, onion, beef round, chicken breast and milk. We used a daily requirement of 2’300 kCal per person and per day for an adult, without adjustment per country. The average dietary requirement of each item was used to re-calculate a possible diet composed of those items. We used the WHO’s requirements for a healthy diet which are: at least 10% of calories must come from proteins, some dairy should be included in the diet, 15-30% of calories must come from fats, 55-75% of calories must come from carbohydrates and at least 300 grams of vegetables and fruits per day. The resulting diet that we calculated is unlikely, but we assumed that substitutions of items might result in similar prices. We still assumed some degree of losses and higher prices for substitution of items, which together represent an additional 30% to the price of the total diet.

For housing, we factored in the cost of renting a 3 bedroom-apartment which is equivalent to 75% of the Numbeo data for the rent of a similar apartment outside cities. We added the cost of utilities (electricity, water and garbage), which we also took from Numbeo.

In order to estimate the cost of other essential needs, which are also called “Non Food Non Housing” (NFNH), we used the World Bank’s[5] global consumption database to estimate an average ratio of spending between health, education and clothes over food. We used the previously calculated food costs multiplied by this ratio to calculate the NFNH costs.

For unforeseen events, we used the recommendation from Anker & Anker 2017 which suggests adding 5% to all other costs, for all countries.

[5] http://datatopics.worldbank.org/consumption/

The cost of basic but decent life was then calculated based on the costs described above, that we adjusted to the typical family size per country, using the fertility rate dataset from the World Bank (2016). We adjusted the cost of food for children by assuming that those costs represent on average 70% of those of an adult.

The net living wage was estimated assuming that at least one adult is working full-time while the other works on average at a rate equivalent to the employment rate in the country. We used a dataset on unemployment from the World Bank (2016) to estimate this parameter. However, this leads most likely to an over-estimation of the real rate of employment for at least two reasons: unemployment is more prevalent for the poor than the rich, and the rate of unemployment does not capture well the informal economy, which in some countries represents an important fraction of the population.

The gross living wage was then estimated by assuming a flat rate of taxes across countries of 15%, knowing that this is only a very rough estimate. It was not possible at this stage to account for a more precise figure. Further developments will need be done in this field, for example based on taxation databases from the OECD or the World Bank.

6.3. Social determinants of health

Studies on social determinants of health have been widely developed among others by the WHO (2008, 2014, 2016). The basic idea is that our health (well-being) and life expectancy is defined by a variety of determinants as represented in Figure 7 for instance.

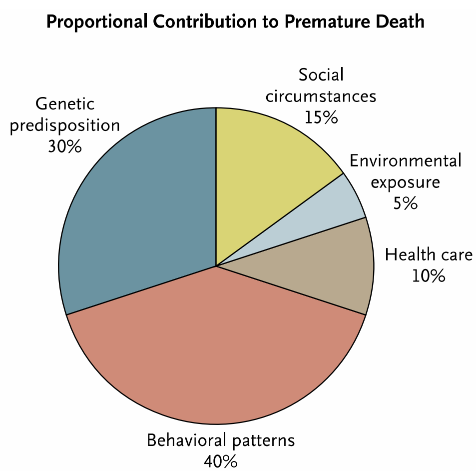

Figure 7 - Illustration of determinants of health shares per determinant group in the US (Schroeder 2007).

A group of determinants are the social ones, among which we typically find:

- Early childhood development
- Education
- Work environment and conditions (e.g., safety, wages, etc.)
- Retirement conditions
- Social protection and services

Each of these categories can be broken down into further sub-determinants. For instance, the WHO defines money, control and power as sub-determinants falling under work environment and conditions. The focus of this report is on the employment impact for Novartis based on income/wages. Figure 8 summarizes the breakdown from health determinants to social determinants and sub-determinants.

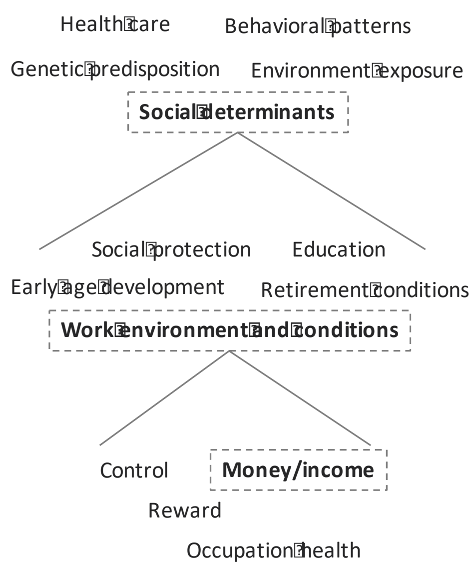

Figure 8 - Illustration of the break down from health determinants to social determinants and sub-determinants.

When looking at the specific link between income and health, one of the first links to explore is the link between a country's GDP and average life expectancy. This is summarized by the Preston curve (Preston, 2007). Typically, the log curve has a steep part at very low values of GDP or GNI per capita. When this latter increases, the life expectancy follows steeply. However, very soon, at a threshold of around USD 8'000/capita, the curve flattens indicating a weaker link. Despite this weaker link, when looking what is happening within a country in term of inequalities, the health inequities appears to be much more important than the correlation with the GDP/GNI. Literature (NAS, 2015, WHO and others) indicates for instance that the health inequities in the US can lead to approximatively 15 years of difference in life expectancy between the 10% poorest and the richest .

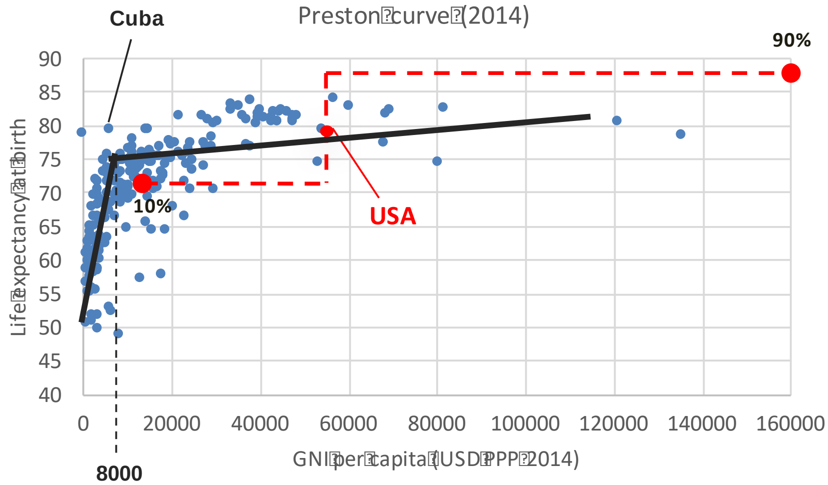

Figure 9 - One version of the Preston curve built using World Bank GNI per capita (2014) and life expectancy data from the UNPD. The health inequalities are highlighted for the USA.

6.4. Health inequity gradients

For income inequalities, we used the World Income Inequalities Database[6] (WIID) from the United Nations University. This database provides incomes deciles and quintiles for nearly all countries. To calculate the income gap linked used in the health inequities gradient, we applied the quintile shares provided by the WIID to the GPD (World Bank, 2016) and population (UN, 2016). The health inequity gradient over the income inequalities is calculated as the ratio of the average income between quintile 1 and quintile 4, assuming that health inequities are not influenced above the Q4 average income (also in line with the concept of decreasing utility of income).

The social gradients measured in DALY/USD or USD/USD, when the DALYs are valued economically, are presented in Figure 10. This figure shows the gradient per year of work and not for the full working life, using a working life of 45 years for all countries. The valuation of DALYs is based on the productive value of life using the OECD average GDP per capita (approximately USD 44'000 /DALY). Other valuations exist, in particular the statistical value of life, based on the willingness-to-pay valuation, which is significantly bigger (approximately USD 190'000 /DALY).

[6] https://www.wider.unu.edu/project/wiid-world-income-inequality-database

Location Country Name	DALY/USD per year of work	USD/USD per year of work
Bulgaria	2.34E-05	1.03
Croatia	5.54E-06	0.24
Czech Republic	1.19E-05	0.52
Denmark	1.47E-06	0.06
Estonia	1.10E-05	0.48
Finland	1.78E-06	0.08
Greece	3.81E-06	0.17
Hungary	1.20E-05	0.53
Israel	2.55E-06	0.11
Italy	1.42E-06	0.06
Mexico	1.09E-05	0.48
Netherlands	1.65E-06	0.07
Norway	9.27E-07	0.04
Poland	1.15E-05	0.50
Portugal	2.73E-06	0.12
Romania	1.32E-05	0.58
Slovak Republic	5.40E-06	0.24
Slovenia	5.51E-06	0.24
Sweden	1.09E-06	0.05

Figure 10 - Results of the calculation of the health inequities gradient along the income inequalities (or social gradient) expressed in DALY per dollar of gross yearly income.

We observed that for most countries listed here, the gradient is below 1 USD/USD which might reflect that either the valuation of DALYs is underestimated, or that the countries selected are mainly developed with a low level of impact due to income inequalities. However, for some countries (e.g., Bulgaria), the ratio is above 1 USD/USD. In the final results of the HUI, the maximum ratio reaches 19 USD/USD.

When estimating the gradient for other countries, it was correlated with a range of parameters (GDP, life expectancy, education level, social protection index, etc.). The best correlation found so far was with the Human Development Index (HDI) from the UNPD as shown in Figure 11. As the correlation is not perfect (R^2 = 0.529), we recommend developing in the future a better understanding of the driving parameters of the health inequities gradient across countries.

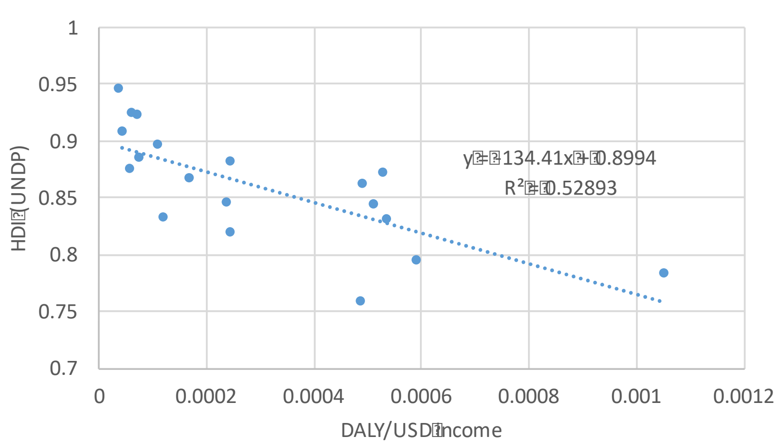

Figure 11 - Correlation between the HDI and the health inequities gradient

We then made a back calculation of the full health inequity gap (in DALYs) using the correlation between health inequity and social gradient for all countries for which no primary data exists. This generated data points for all 189 countries covered in the dataset. This information is useful to assess the impact on the population due to economic inequalities; however this data needs an extra step before being used in an impact valuation method. This step involves the adaptation of the social gradient to the concept of marginal utility of income.