

Gharehgozli, Orkideh; Atal, Vidya

**Working Paper**

## "Big Mac real" income inequality: A multinational study

LIS Working Paper Series, No. 775

**Provided in Cooperation with:**

Luxembourg Income Study (LIS)

*Suggested Citation:* Gharehgozli, Orkideh; Atal, Vidya (2019) : "Big Mac real" income inequality: A multinational study, LIS Working Paper Series, No. 775, Luxembourg Income Study (LIS), Luxembourg

This Version is available at:

<https://hdl.handle.net/10419/228327>

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# LIS

## Working Paper Series

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### **“Big Mac Real” Income Inequality: A Multinational Study**

Orkideh Gharehgozli, Vidya Atal

October 2019



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# “Big Mac Real” Income Inequality: A Multinational Study

Orkideh Gharehgozli      Vidya Atal

Department of Economics  
Feliciano School of Business  
Montclair State University

## Abstract

Using the Big Mac Index, we offer a simple approach to study the real income inequality. We provide a multidimensional real income inequality analysis by exploring the Coefficient of Variation and the Big Mac Affordability of households across all income deciles of 28 countries for years 2000 to 2013.

**Keywords**— Big Mac Index, Income Inequality, Income Distribution Decile, Comparative Country Studies

**JEL Classification**— D31, O57

## 1 Introduction

The Big Mac Index was introduced by The Economist magazine in 1986 as an alternative to the consumer price index in which the market basket of question consisted of a single product—McDonald’s Big Mac burger. It provides a more digestible alternative to measure

and compare the purchasing power of currencies of different countries. Using this index simplifies the cross-country purchasing power parity across income deciles and more importantly, it tells us the real income of an average income holder in an income decile in terms of only one commodity (food).

This index has been popular among researchers since its introduction. For example, The Economist uses it to show whether a country’s currency is over or under-valued relative to the US Dollar. San Vicente Portes and Atal (2014) measured the effectiveness of the Big Mac Index in measuring a country’s inflation. Daniele and Malanima (2017) demonstrate, using the Big Mac Index, that the dispersion in real wages across regions in Italy is minimal, although nominal wages could be vastly different. Using a similar approach, Loveridge and Paredes (2018) show that “(living) costs in a metro-adjacent county are not different than areas that are much more rural” in the United States.

We utilize this index to study real income inequality by measuring and comparing the affordability of households in each income decile from each country in our analysis. Specifically, we aim to rank, compare, and contrast countries based on the average number of Big Macs an individual belonging to a given income decile can afford in a day, we call it the Big Mac Affordability (BMA) (see Atal (2014), and (Gharehgozli and Atal (2019) working paper, available upon request from authors).

The paper is arranged as follows. Section 2 describes the source of data. In Section 3, we provide a multidimensional income inequality comparison. We accomplish this by comparing Big Mac Affordability of income deciles across different countries, as well as contrasting different income deciles within specific countries. We also focus on some unique cases—individual countries—that provide a better idea of the potential causes behind increasing income inequality. Section 4 concludes.

## 2 Sample and Data

The income decile data presented in this study is extracted from the Luxembourg Income Study Database (LIS, 2019). It is the largest available database of harmonized micro-level income and wealth data consisting of about 50 countries over about 50 years. The database contains household and individual-level data on various sources of income, taxes and transfers. We use this data for our study of income inequality. The main variable of interest in this dataset is nominal “Equivalised Disposable Household Income” which is defined as the “total household monetary and non-monetary current income net of income taxes and social security contributions, equivalised by dividing by the square root of the number of household members.” For the United States, recorded data is available up until 2016, and up until 2013 for all other countries.

For the Big Mac Index, we use The Economist database which provides the nominal price of a Big Mac burger for about 57 countries going back to 1986 (Economist, 2019). The crosswalk of the two datasets provides time-series of data on 28 countries over a span of years from 1986 to 2013 (2016 for the U.S.A.). However, in order to avoid any significant number of missing data points, and to provide a more concise analysis, we only go as far back as 2000 in our study.

## 3 Big Mac Real Income Inequality

We look into the real income inequality in terms of Big Mac Affordability (BMA) of the 28 countries under study. We define BMA as the total number of Big Mac burgers an average individual can afford in each country in each income decile per day. We use three ways to compare real income inequality across countries – (a) measure the ratio of BMA of the bottom decile to the top decile of income distribution; (b) measure the BMA ratio of the

9<sup>th</sup> decile to the top one in order to gauge the concentration of income distribution; (c) to remove the effect of the magnitude of a country's wealth, we calculate the Coefficient of Variation (COV) to measure the *dispersion* of the BMA across deciles, which is defined as the standard deviation divided by the overall average.

For both measures (a) and (b), the smaller the number, the higher the inequality. And for measure (c), the higher the number, the higher the inequality. One might ponder over the reliability of these measures, especially COV, as measures of inequality against the one used most widely—the Gini coefficient. We plot all four of these measures for 28 countries for the year 2010 in Figure 1.<sup>1</sup> Panel 1 plots the ratio between bottom to top decile, panel 2 has 9<sup>th</sup> to the top decile, panel 3 plots the COV and panel 4 has the Gini Coefficient. It is evident from this figure that in general both the Gini coefficient and COV rise and fall together, confirming a very high correlation. Also note that the lower share of bottom to top or 9<sup>th</sup> to top decile is associated with a lower COV and Gini coefficient, hence a higher income inequality. This demonstrates the reliability of our inequality measures, and they are more easily comprehensible.

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<sup>1</sup>We use 2011 data for Brazil and 2009 data for Hungary because 2010 data for these countries were not available.

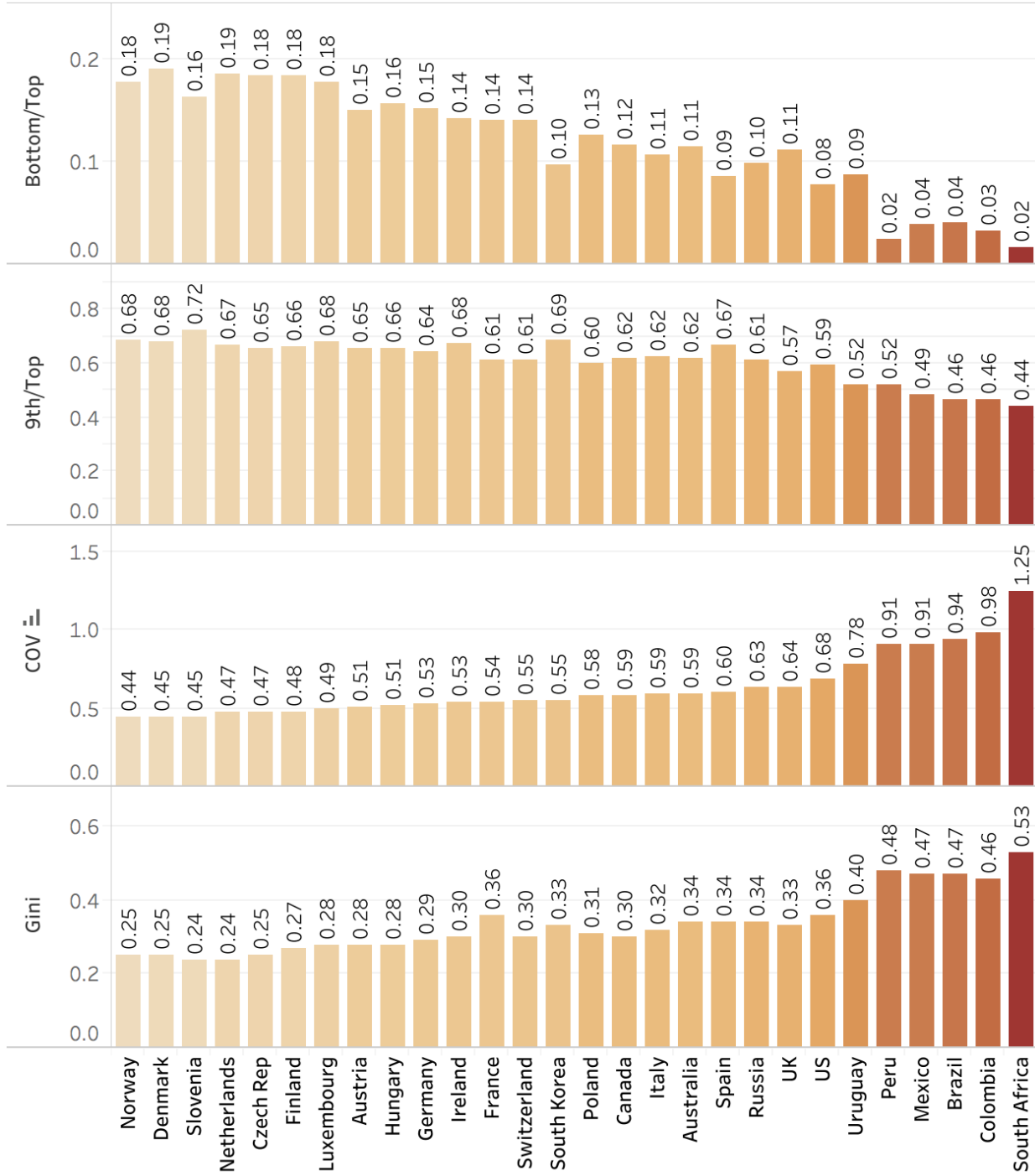


Figure 1: Coefficient of Variation, Gini Coefficient, Share of Bottom to Top, and Share of the 9<sup>th</sup> to the Top Decile.

The purpose here is to provide the overall ranking of inequality of the countries in terms

of the number of Big Macs affordable. As evident from Figure 1, the ratio of bottom to top decile’s affordability for Denmark is one of the highest (19%), and it was as high as 24% in 1995. In other words, the people in the bottom decile earned more than one fifth of what the people in the top decile earned. During 2000-2013, this ratio was higher than 10% for Canada and all the European countries in our analysis (it fell under 10% for Spain in 2010); for South Korea, it was close to 10%. However, for the U.S.A., this ratio has been declining steadily over 30 years. In 1986, the lowest income decile earned 9% of income of the people in the top decile, whereas in 2016 the ratio dropped to less than 7%. Although Russia and Uruguay started at a lower ratio than the U.S.A., they crossed the U.S.A. in the mid-2000s and on average their share is higher. The Latin American countries (except for Uruguay) are doing worse in terms of bottom to top decile income ratio; their people in the bottom decile earn less than 5% of income of people in their top decile. For South Africa, the ratio is the worst—at only 2 percent.

We also measure the gap between the 9<sup>th</sup> and the 10<sup>th</sup> deciles of individual countries, which can tell us about how far apart a country’s upper class is from the upper middle class. On average during 2000-2013, Canada, South Korea and all European countries’ 9<sup>th</sup> decile income holders made more than 60% of the 10<sup>th</sup> decile except for Poland and UK (59% and 57%, respectively). For Denmark, it has been as high as 72% in 2004. However, for the U.S.A., this ratio has not crossed 60% in the last two decades, and it fell down to 56% in 2016.

### **3.1 More Equal versus Less equal**

In this section, we focus on specific countries to expand our research on income dispersion with a “within country” analysis. We first start with Denmark and Mexico. We choose Denmark because, with the exception of 2007 where Slovenia outperforms it, Denmark had



the highest measure of bottom to top decile shares for the years covered. Denmark also is the second highest in ranking of the 9<sup>th</sup> to top decile share after Slovenia. Both Gini coefficient and the COV for Denmark are among the lowest for all the years in our analysis: 2000-2013. We pick this country to represent a “more equal” country, and following the same logic, we pick Mexico to represent a “less equal” country. Mexico’s bottom decile’s share of the top decile’s income and 9<sup>th</sup> to top decile are among the lowest, while the Gini coefficient and the COV are among the highest, as can be seen in Figure 1 in the previous section.<sup>2</sup> Figure 2 below provides the number of Big Macs affordable to the bottom 2 and top 2 deciles of the two countries mentioned above (Denmark and Mexico) over time. For Denmark (left panel of the figure), the first decile in 2000 could afford 8.4 Big Mac burgers per day while the top decile could afford almost 4.5 times of that—36.6 burgers. We also provide the overall average which is the average number of Big Macs affordable to the individuals of the country regardless of income decile. The overall average BMA for Denmark in 2000 was 19.3 burgers. These numbers are higher for all deciles and the overall average when we look at 2013, however the growth in the number of Big Macs for the top decile is larger (37% increase as opposed to 14% increase for the bottom decile and 24% increase in overall average) suggesting a widening of income inequality; the Gini coefficient and the COV both increase for this country over this period of time. Even then, Denmark is still one the most equal countries in our analysis.

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<sup>2</sup>We chose not to focus on Brazil, Colombia, Peru, or South Africa even though they appear as more unequal countries because the data for Mexico is available over a wider range of time.

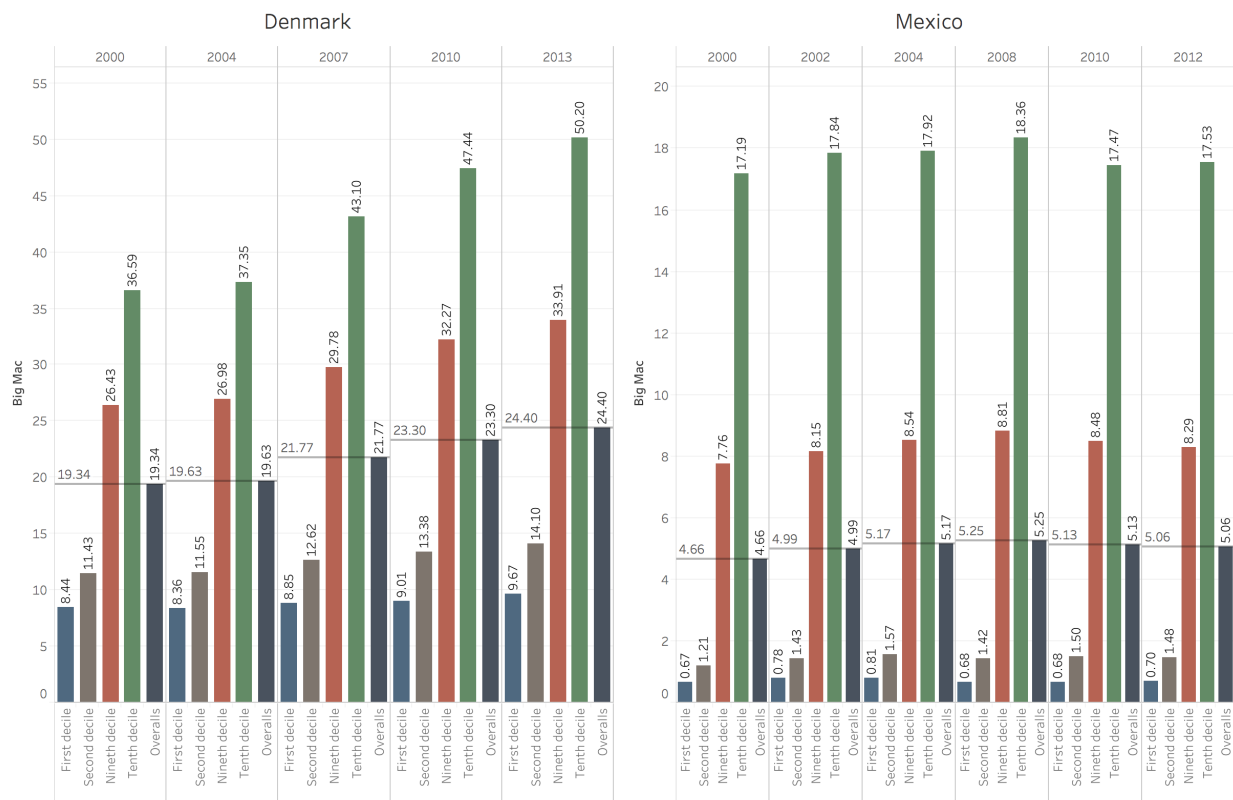


Figure 2: Denmark and Mexico: Number of Big Macs Affordable the First, Second, Ninth, and Tenth Decile.

On the right panel of Figure 2, we look at these numbers for Mexico as opposed to Denmark. In 2000, the bottom decile's BMA was 0.67, less than even 1 burger daily. In 2012 (the last year of data availability for Mexico), the bottom decile still could not afford 1 burger per day. BMA increased by only 4% for this decile over 12 years. For the top decile it went up by 2% and overall average went up by 8.5%. Mexico's top decile BMA in 2000 was 17.2 and stayed almost the same over the next 12 years. Interestingly during that period, the BMA of the 2<sup>nd</sup> and 3<sup>rd</sup> decile increased by almost 22% and increased by 20% and 18% respectively for the 4<sup>th</sup> and 5<sup>th</sup> decile. Although the COV was high for Mexico, the rising income of the middle class led to a fall of COV by 7% during 2000-2012 (the Gini coefficient also fell).

### 3.2 Where Does the U.S.A. Stand?

As per the U.S.A. Congressional Research Service Report by Donovan et al. (2016), from the mid-1970s to 2000, income inequality in the U.S.A. has risen significantly because the top quintile's income increased more rapidly than the other four; from 2000 to 2015, income inequality increased further because the top two quintiles' income increased slowly whereas the bottom three quintiles' incomes fell.

A comparison of the U.S.A. to Russia, given the increasing income inequality in the U.S.A., proves to reveal an interesting picture. Income inequality has been increasing in the United States whereas it has been dramatically decreasing in Russia during 2000-2013. As shown in Figure 3, Russia's BMA has increased dramatically in all deciles and overall average has also gone up. This observation follows the fact that Russia experienced rapid economic growth in this period. Since 2013, there has been a negative shock to the economy. However, since the last year of data availability for our analysis for Russia is 2013, the data shown here indicates persistent positive growth. Russia appears to be an example of the suggested decrease in inequality associated with an economic growth (Kuznets, 1955). While Russia's top decile's BMA has increased by 326%, the bottom decile's BMA has increased by more than double of that, 692%. The 2<sup>nd</sup> and 3<sup>rd</sup> deciles' BMA increased by 560% and 532% respectively. As evident, Russia has experienced a more equal distribution of growth. Russia's COV fell by 22% and Gini coefficient decreased by 19%.

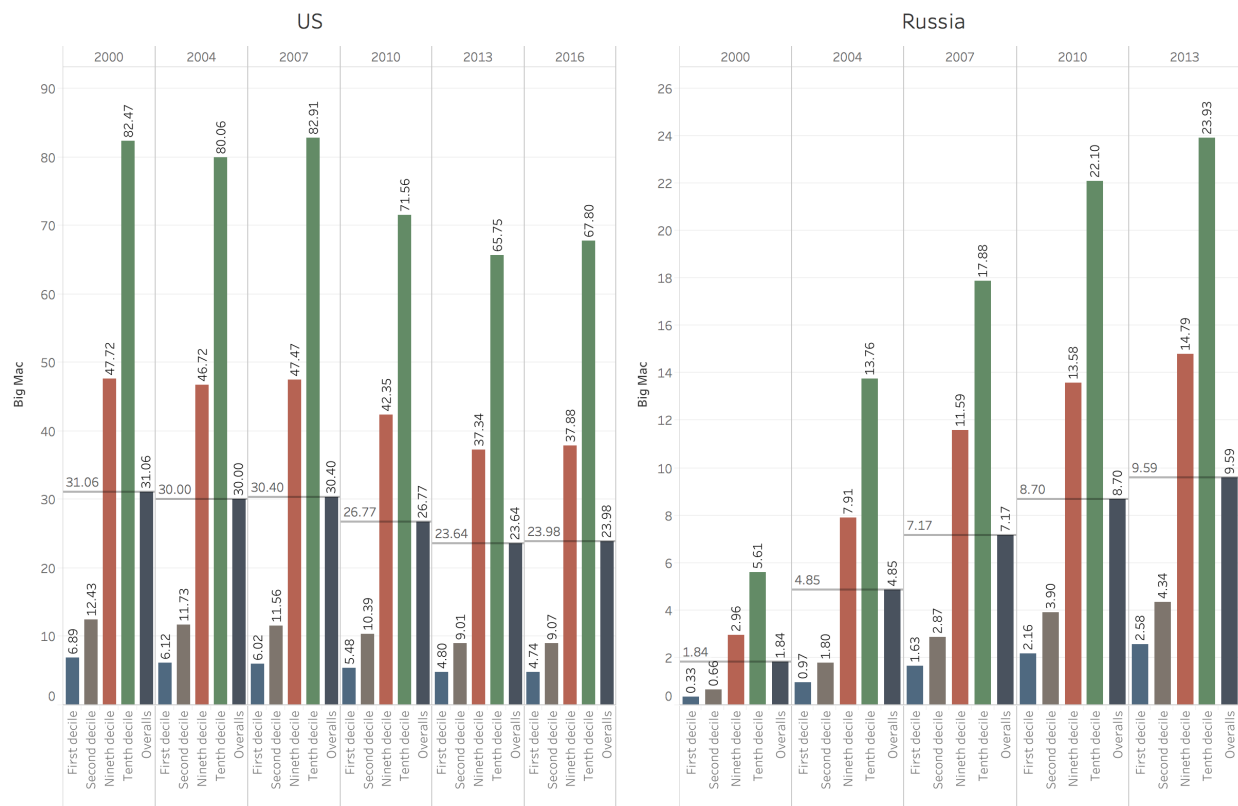


Figure 3: US and Russia: Number of Big Macs Affordable the First, Second, Ninth, and Tenth Decile.

The United States, on the other hand, has experienced the opposite, especially during and after the Great Recession, 2007 to 2013. All income deciles suffered from the recession; during this period, BMA decreased by 20% for the bottom and the top decile and somewhere between 22 to 24% for all other deciles, leading to a 22% decline in the overall average BMA. However, the recovery from the recession came in a much more skewed way. Whereas the BMA by the top decile increased by 3%, it *declined* by 1% for the bottom decile leading to 1.4% rise in overall average BMA. From 2000 to 2013, income inequality in the U.S.A., as measured by COV and Gini coefficient, has gone up by almost 8.5%.

Figure 4 summarizes our comparison across the four countries in a snapshot by providing the ratio of every decile to the top one in 2013. As we can see, Denmark had a bigger ratio

for all the deciles. For example, the ratio of the first (bottom) to top decile for Denmark was 19%, whereas for Mexico it was only 4%. Whereas the very first decile’s BMA in Denmark was almost one-fifth of the top decile’s, in Mexico that happens after the 5<sup>th</sup> decile and in the U.S.A. that happens after the 3<sup>rd</sup> decile. Denmark’s 6<sup>th</sup> decile’s BMA was 47% of that of their top one, whereas even the 8<sup>th</sup> decile’s BMA in the U.S.A. was less than that of their top one, and that ratio is achieved at the 9<sup>th</sup> decile in Mexico.

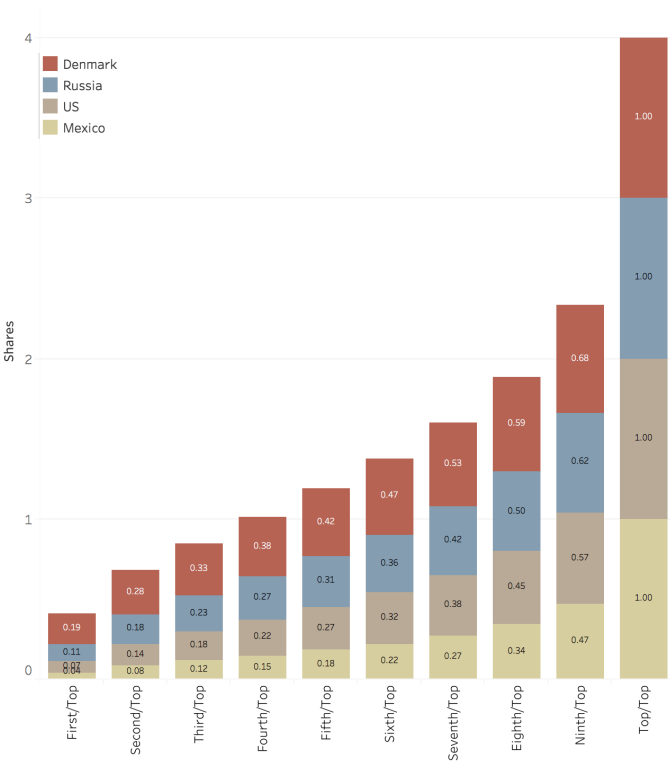


Figure 4: Denmark, Russia, US, and Mexico: Share of Each Decile to the Top decile From Poor to Rich.

Finally, we take a closer look at the United States. Figure 5 provides the share of all deciles to the top decile from 1986 to 2016 as well as the number of Big Mac burgers affordable to each decile over these years. The first thing we can confirm in this graph is that the Gini coefficient and the COV both follow an upward trend suggesting an increase in income inequality during the three decades. What seems to be the underlying reason is

the drop in the share of lower, middle and upper-middle classes' income to the uppermost class (top decile). Over the three decades, the Big Mac Affordability, which is a measure of real income in some sense, has *declined by more than 10 percent* for all the bottom nine deciles,<sup>3</sup> whereas it has increased *only* for the top decile, that too by more than 5 percent!

Next, we divide the timeline into three sections – before the recession (1986-2007), immediate response to the recession (2007-2010), and long run response to the recession (2010-2016). Even though before the recession all deciles and specifically the middle income deciles were experiencing a growth in their affordability and income overall, we still have an increase in the COV and income inequality. This is a result of the rapidly growing real income of the top decile causing a decline in the share of the middle income deciles to the top. In the immediate aftermath of the recession (2007 - 2010), there is a drop in all income deciles. However, the drop is more severe for the top decile, hence the immediate drop in income inequality. After 2010, the top decile recovers faster and the share of all deciles to the top decile follow a downward trend and we have an increase in the income inequality.

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<sup>3</sup>It has declined by more than 15 percent for the bottom 7 deciles from 1986 to 2016.

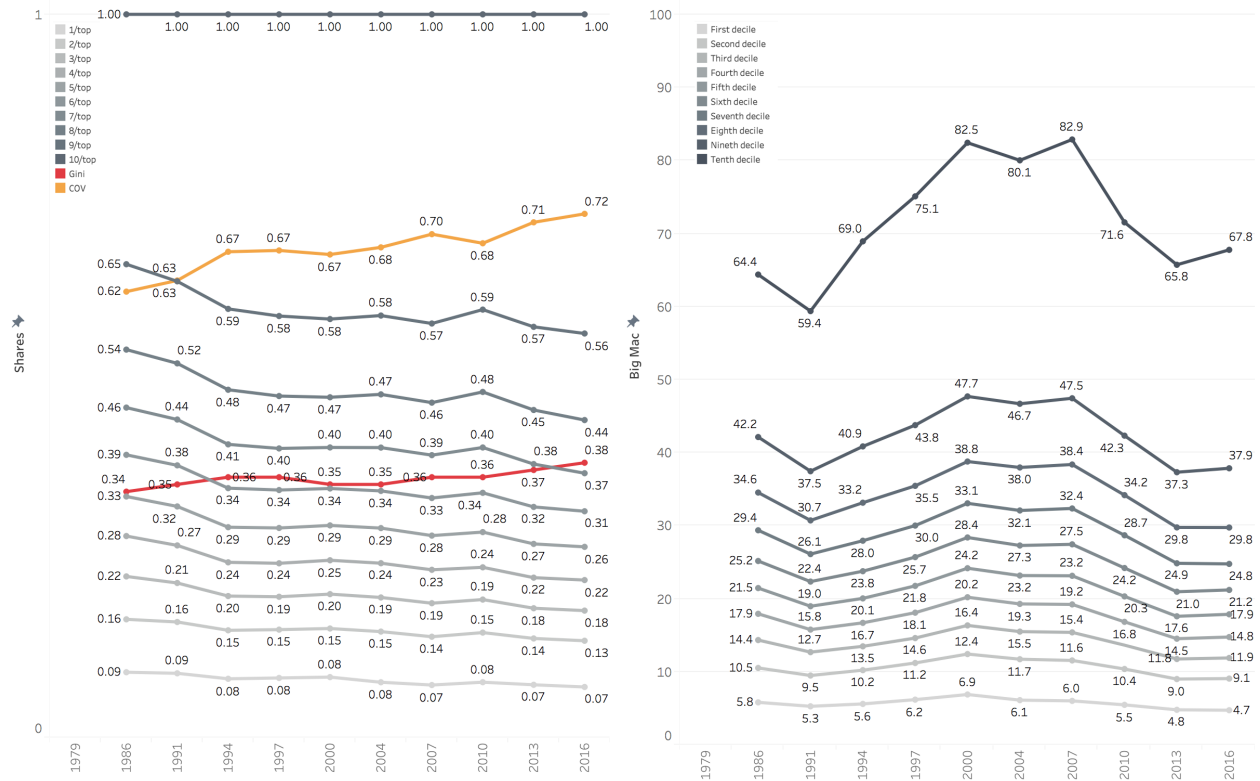


Figure 5: US: Shares of Each Decile to the Top Decile on the Left. Number of Big Mac Burgers Affordable to Each Decile on the Right, Over Years (1986 to 2016).

Underlying causes behind this rising real income inequality in the U.S.A. can be summarised as follows: (1) changes in labor income (wages and salaries), (2) changes in capital income (capital gains, dividends and business income), and (3) changes in taxes. As demonstrated in Hungerford (2011), “changes in capital gains and dividends were the largest contributors to the increase in the overall income inequality.” He stressed further that although changes in tax policies have also contributed to the widening income inequality, “overall income inequality would likely have increased even in the absence of tax policy changes.” More government investment into education and vocational training programs for people in the lower income deciles would increase earnings and investment opportunities and would be a more effective solution than tax policies.

## 4 Conclusion

In this paper, we explored household income of 28 countries over the period 2000 to 2013. Using the Big Mac index, we measured the Big Mac Affordability (BMA) of individuals belonging to different income distribution deciles in these countries. We provided a comparison of income inequality across countries by looking into BMA and measuring the Coefficient of Variation as a measure of dispersion, and the share of different deciles to the top. We looked more into a few of the most interesting countries in our analysis—Denmark, Mexico, Russia and the U.S.A.—in order to have explanations for the wide range of income inequality we observed in the previous section in the 28 countries.

We compared Denmark and Mexico as representatives of the “more equal” and “less equal” countries and we found a visible difference in the share of each decile to the top decile of income between these countries. Denmark as a representative “more equal” country was experiencing an increase in the income inequality whereas Mexico as a representative “less equal” country was experiencing a downward trend of income inequality during the period of our analysis. We then focused on the United States, and also studied how they compared to Russia, a country that was experiencing a dramatic growth during the period of study. The income inequality in Russia was correlated inversely with its growth. In comparison, in the the U.S.A., the overall growth and income inequality has been positively correlated. For a short period of time during the recession of 2007-09 in the U.S.A., a drop in the income inequality was observed, but then it rose back again between 2010 to 2016 with a rapid increase in the top decile’s affordability as opposed to all other deciles.

Throughout this study, we measured real income using the price index of a market basket consisting of only one good—the Big Mac burger by McDonald’s, which gave us the opportunity to have interesting observations. Although, it has been argued that there is a significant difference between the consumption basket of non-durable goods for the poor and



the rich. Broda and Romalis (2009) find that during the years spanning 1994-2005, the price of non-durable goods that were consumed disproportionately more by the poor had been declining. Bergh and Nilsson (2014) explain that, due to widening inequality, as the number of poor rises, the market for products targeted towards them gets larger and more profitable. Because of a more price-elastic demand of low-income people, prices for these products fall, leading to increased affordability by the poor. By looking at the prices of Big Mac burgers only, our current study has excluded this possibility, though we leave this job for our future work.

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