

**Github Repository:** [https://github.com/UC-Berkeley-I-School/Project2\\_Adhan\\_Arroyo\\_Yilmaz](https://github.com/UC-Berkeley-I-School/Project2_Adhan_Arroyo_Yilmaz)

## I. Overview

### Background

In 1901, archeologists rediscovered the Louvre stele on which legal text from Ancient Babylon, The Code of Hammurabi, was inscribed, dating back to 1780 BCE. In that text lies the first recorded mention of divorce in known human history. There are six laws mentioning divorce and none give women the right to initiate without admitting fault. One of the divorce laws translates to “If a free man’s wife wishes to divorce him, the man may divorce her and give her no settlement. If the man does not wish to divorce her, he may marry another woman and keep his first wife in his house as a slave.” This inequality survived across time and space and, almost four millennia later, still exists in many religions and cultures across the world. Our goal with this project is to see if the gap between women’s happiness and overall happiness is related to the marriage and divorce rates of several countries, taking into consideration varying traditions and laws. As we look at our findings, we keep in mind that correlation does not equal causation, but we can still arrive at meaningful conclusions.

### Questions

- Primary: Is there a relationship between women’s happiness, overall happiness, and divorce/marriage rates across regions and/or countries?
  - How do marriage and divorce rates vary based on regional areas?
  - Do cultural norms impact divorce rates?
  - Which is related to divorce rates more, overall happiness rates or women’s happiness rates? Is it a positive or negative correlation?

## II. Dataset

We chose three datasets to help us answer our question. We merged them into a single dataframe for our analysis. The datasets are:

1. [Divorce and Marriage Rates by Country](#)
  - a. **Source:** Kaggle
  - b. **Size:** 105 rows (1 per country)
  - c. **Variables (Columns):** Country/region, Continent, Marriage, Divorce, Actual      Percent, Data Source Year
2. [Women's Happiness Rate by Country](#)
  - a. **Source:** CEO World Magazine
  - b. **Size:** 156 rows (1 per country)
  - c. **Variables (Columns):** Rank, Country, Score
3. [Overall Happiness Rate by Country](#)
  - a. **Source:** CEO World Magazine
  - b. **Size:** 146 rows (1 per country)
  - c. **Variables (Columns):** Rank, Country, Score

## III. Predictions

Our prediction is that countries with a smaller difference between marriage and divorce rates (in other words, a higher proportion of divorces per marriage) will have a smaller gap between overall happiness and women's happiness, resulting in happier women. This is because if women are given the freedom to initiate divorce without social consequences, we would expect higher divorce rates since a higher proportion of the population would have the right or feel safe or empowered to leave a marriage. We would expect this higher level of autonomy for women would also reflect in higher rates of women's happiness.

Another prediction is that the higher the happiness rate, the higher the divorce rate will be. A high happiness rate indicates a good economy or at least an economy people feel satisfied with. Women are more likely to not remain in an unhappy marriage if they do not have to worry about their economic situation after divorcing.

### Expected Covariates

- **Culture** - we predict that cultural norms in a country are a factor in the marriage and divorce rates of a country. And in turn, a factor in the gap between overall happiness and women's happiness. Cultural norms can be dramatically shaped by the beliefs of a dominant religion or resident's access to the internet. For instance, we predict that a country with a higher proportion of people following traditional values and having less exposure to globalized trends accessed through the internet will have culture as an additional factor to divorce/women's happiness
- **Data Source Year of Marriage/Divorce rates** - Since the marriage and divorce rates are sourced from each country with different census or survey dates, the rates come from different years. Global events that may have happened between these years may have a confounding impact on people's decision to get married or divorced.
- **Standard of Marriage/Divorce Rates** - Additionally, we expect that the definition of divorce and the accuracy of these metrics across more than 100 nations would vary. These unknown variations may lead to differences in the interpretation of the impact of these rates.
- **Men's Decision To Divorce:** Since the majority of marriages are heterosexual unions, men would have an impact on divorce rates as well. We might get a confounding impact as we're looking at only the divorce rates without breaking down who initiates the process.

## IV. Analysis

### Exploration

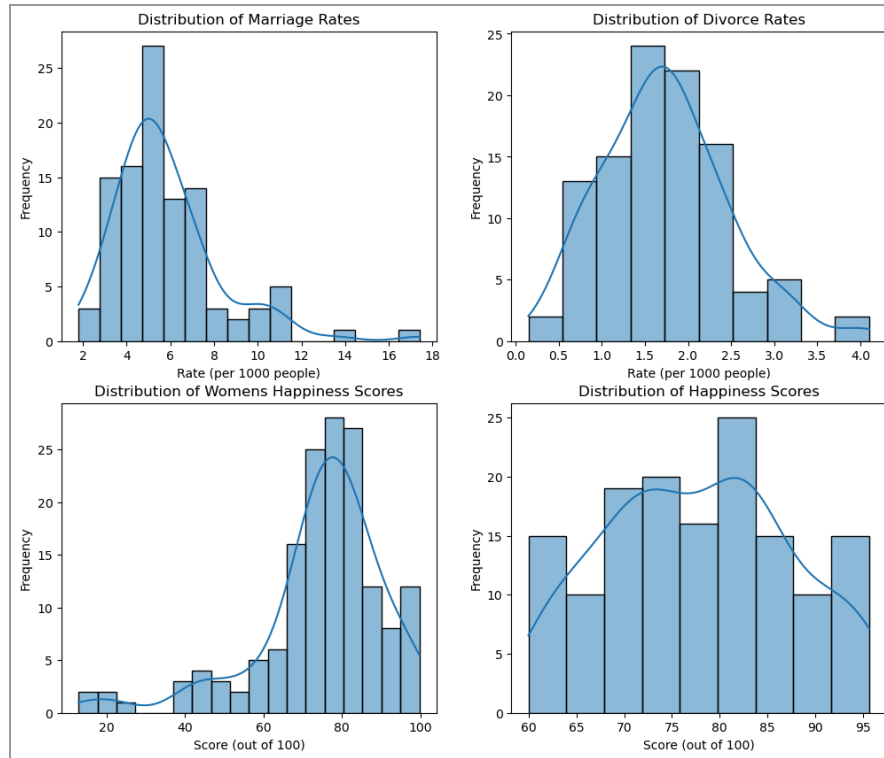
Our first goal was to understand the data we were working with. In particular, the distribution of our key variables across all countries to get a sense of any possible overarching trends. The key variables we initially identified are: marriage rate, divorce rate, women's happiness, and overall happiness. They are defined as:

- **Marriage Rate** - # of marriages per 1000 people
- **Divorce Rate** - # of divorces per 1000 people
- **Women's Happiness** - score out of 100 based on nine attributes: gender equality, percent of legislative seats held by women, sense of security among females aged 15+ while walking alone at night, income equality, concern for human rights, women's empowerment, average education level of women, percentage of women aged 25+ who are engaged in paid work, and level of women's inclusion in society.

- **Overall Happiness** - score out of 100 based on six attributes: GDP per capita, social welfare support, healthy life expectancy, freedom to make your own life choices, generosity of the general population, and perceptions of corruption levels

You can see the distribution of these variables across our three datasets in Table 1 below.

Image 1: Distribution of Key Variables



## High-Level Analysis

Next, we merged the datasets on the Country variable to get each country's marriage rate, divorce rate, womens happiness score & rank, and overall happiness score & rank into a single dataframe for easier analysis. We were left with a total of 182 rows that look like this (showing the first ten entries):

Image 2: First 10 Entries in Merged DataFrame

	Country	Continent	Marriage	Divorce	Actual	Percent	Data Source Year	Womens Happiness Rank	Womens Happiness Score	Overall Happiness Rank	Happiness Score
0	Albania	Europe	8.1	1.7	4.76	20.99	(2018)	44.0	82.87	83.0	75.56
1	Algeria	Africa	10.1	1.6	6.31	15.84	(2013)	104.0	72.74	81.0	76.31
2	Armenia	Europe	6.0	1.0	6.00	16.67	(2011)	43.0	82.95	79.0	76.40
3	Australia	Oceania	4.6	2.0	2.30	43.48	(2017)	16.0	92.08	12.0	92.79
4	Austria	Europe	5.3	1.8	2.94	33.96	(2018)	12.0	95.20	11.0	93.12
5	Azerbaijan	Asia	9.7	1.5	6.47	15.46	(2011)	50.0	82.24	140.0	62.22
6	Bahamas	North America	6.1	1.0	6.10	16.39	(2007)	74.0	77.55	NaN	NaN
7	Belarus	Europe	9.2	4.1	2.24	44.57	(2011)	77.0	77.28	141.0	62.12
8	Belgium	Europe	3.9	2.1	1.86	53.85	(2016)	22.0	89.11	17.0	91.30
9	Bermuda	NaN	10.6	2.7	3.93	25.47	(2009)	NaN	NaN	NaN	NaN

As you can see from the NaN values, there are some countries with missing women's happiness scores or overall happiness scores. For the purpose of our analysis, we chose to only account for the countries with values for all of our key variables (marriage, divorce, women's happiness, and overall happiness), so we removed any row with NaN values in those key variables, leaving us with a total of 79

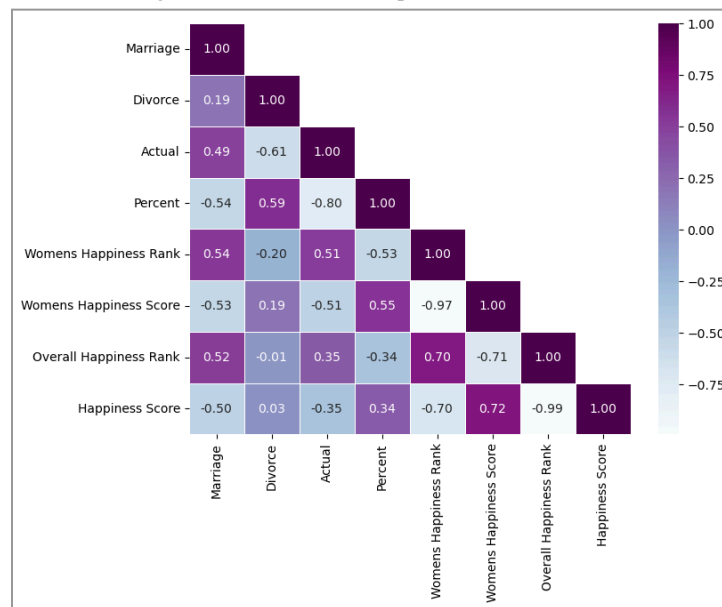
countries to analyze. We chose this over using mean imputation to avoid skewing our regional and cultural analysis further in our analysis since some of our key variables, specifically marriage rates and women's happiness have skewed distributions. From this final, cleaned up dataset, we first checked the descriptive statistics around our key variables:

Table 1: Descriptive Statistics around Key Variables

	Marriage Rate	Divorce Rate	Women's Happiness	Overall Happiness
<b>Mean</b>	5.77	1.78	83.37	82.76
<b>Median</b>	5.20	1.70	82.87	82.86
<b>Standard Deviation</b>	2.24	0.71	8.85	8.78
<b>Min</b>	1.80	0.40	61.62	60.64
<b>Max</b>	13.50	4.10	99.70	95.67

Then, we took a look at the correlation between all of the variables to see if there are any significant relationships to focus on:

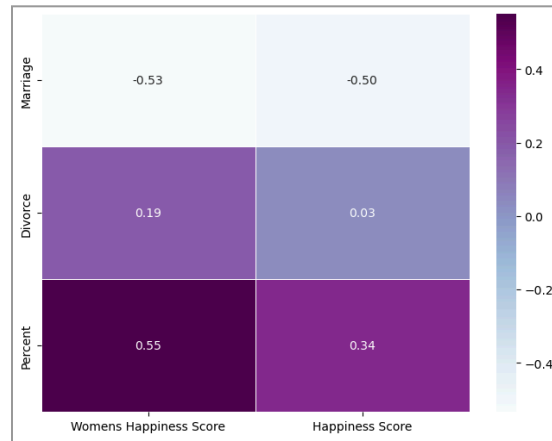
Image 3: Correlation Heatmap between All Variables



From this we discovered that there are actually five key variables to consider instead of four. The “percent” variable appears to show a moderately strong positive correlation at 0.55 with womens happiness, which is a much stronger correlation than divorce alone with any of the happiness scores and slightly stronger than marriage with womens happiness. Further analysis on the dataset revealed that  $percent = \frac{divorce\ rate}{marriage\ rate}$ . This insight allows us to analyze the relationship between the disparity in divorce and marriage rates and its impact on happiness scores, offering a more nuanced view. We then

created a heatmap to focus on the correlation between each of these key variables, grouped by marriage or happiness, to understand their relationships with one another:

Image 4: Correlation Heatmap between Key Variables



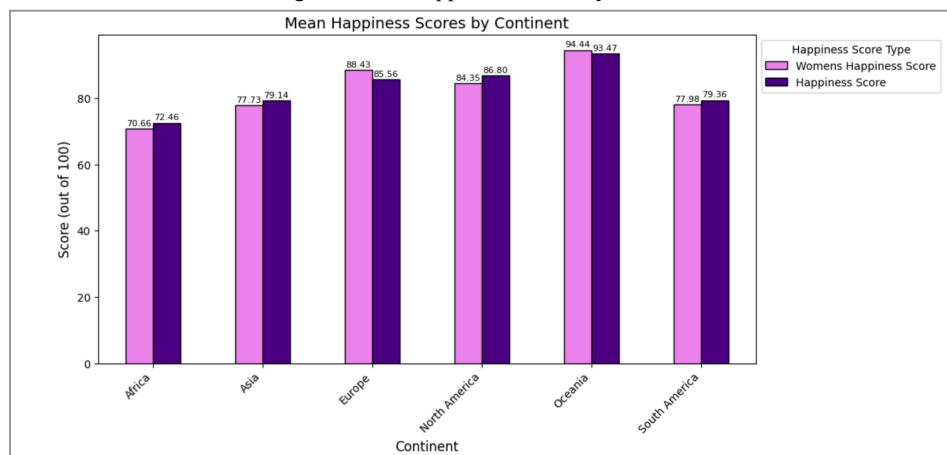
### Cross-Cultural Examination

To understand how divorce and marriage rates, as well as women's happiness, vary across different regions, we decided to conduct a cross-cultural examination focusing on how cultural, social, and legal norms may impact these variables. We focused both on broad regional differences and specific countries with notable cultural or legal variations.

#### By Region

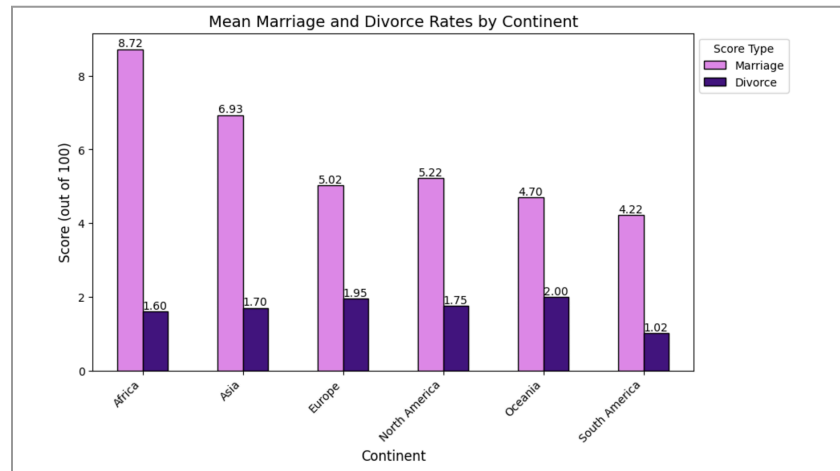
This analysis aimed to explore the relationship between Overall Happiness Scores and Women's Happiness Scores across different countries. By grouping countries by continent, we observed that Oceania consistently reports the highest scores in both categories, while African countries show the lowest. Across all continents, the scores are closely aligned, with Women's Happiness Scores slightly surpassing Overall Happiness Scores only in Europe and Oceania.

Image 5: Mean Happiness Scores by Continent



Another comparison we were interested in exploring was Marriage and Divorce Rates across continents. With this view, marriage rates consistently surpass divorce rates across all continents, emphasizing a universal trend of more marriages occurring than divorces being recorded. The average ratio of marriage to divorce rates were plotted to capture this difference.

Image 6: Mean Marriage &amp; Divorce Rates by Continent

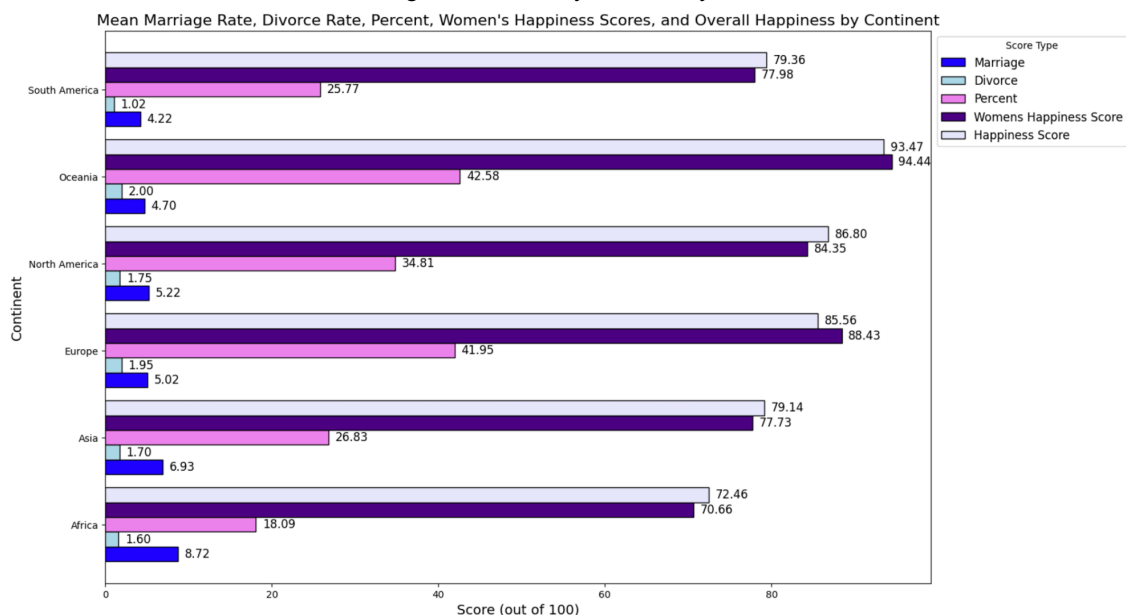


## Key Observations:

- Africa: Exhibits the highest marriage rate (8.72) but has one of the lowest divorce rates (1.60)
- Asia: Shows a high marriage rate (6.93) and a low divorce rate (1.70), similar to Africa
- Europe: The marriage rate (5.02) and divorce rate (1.95) are closer in comparison than other continents
- North America and Oceania: Relatively balanced marriage and divorce rates compared to other continents
- South America: Lowest marriage (4.22) and divorce (1.02) rates

In addition to the Marriage and Divorce Rates, the next step was to plot the Percent (Divorce Rate/Marriage Rate), Women's Happiness, and Happiness Scores across the various continents in order to identify regional trends and gain a deeper understanding of how these key variables interact within different cultural and socio-economic contexts. Below, we see a bar chart that displays how these variables differ across continents:

Image 7: Mean of Key Variables by Continent



We observe that the continent with the lowest overall happiness score and women's happiness score is Africa, followed closely by Asia and South America. These results align with our assumption that the more societal safety nets and the less traditional views regarding marriage are present in a society, the higher a woman's happiness score will be.

### *Focus on Select Countries*

After analyzing trends by continental region, we further explored the dataset by focusing on specific countries within each region. The selection was intentional: the Netherlands represented the country with the highest Women's Happiness Score, while Iran had the lowest, and Albania's score was the median of the dataset. These three countries fell into Western Europe, the Middle East, and Southeastern Europe, respectively. To broaden the analysis, we also included Japan (East Asia), Mexico (Latin America), and Egypt (North Africa). The diversity of these countries, in terms of geographical location and sociopolitical/economic context, provides a comprehensive outlook on the key variables and external factors we aim to analyze.

Below is a table showcasing the Divorce/Marriage Ratio, Overall Happiness, and Women's Happiness Scores for the selected countries with the **Lowest** and **Highest** for each key variable:

Table 2: Key Variables by Country

Country	Divorce/Marriage Ratio	Overall Happiness	Women's Happiness Score
Albania	20.99	75.56	82.87
Japan	35.42	82.86	93.69
Iran	14.29	72.65	61.62
Netherlands	46.85	95.07	99.7
Mexico	17.31	84.52	83.72
Egypt	17.27	67.93	68.58

To better understand how these selected countries compare to all of the countries in the dataset, we created separate bar plots for each of the selected countries and visually compared their scores to the averages of other countries, highlighting the differences in key variables like marriage rate, divorce rate, percent (divorce/marriage), women's happiness, and overall happiness.

Image 8: Mean Percent (Divorce/Marriage) by Country

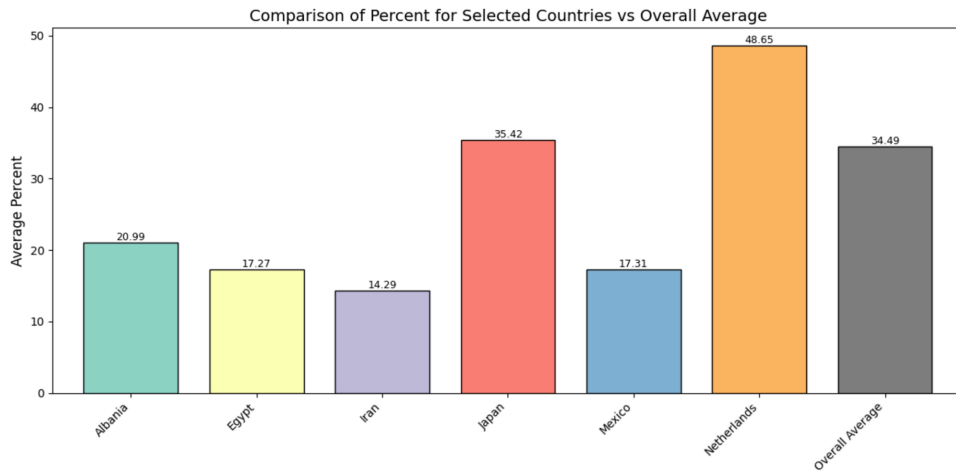
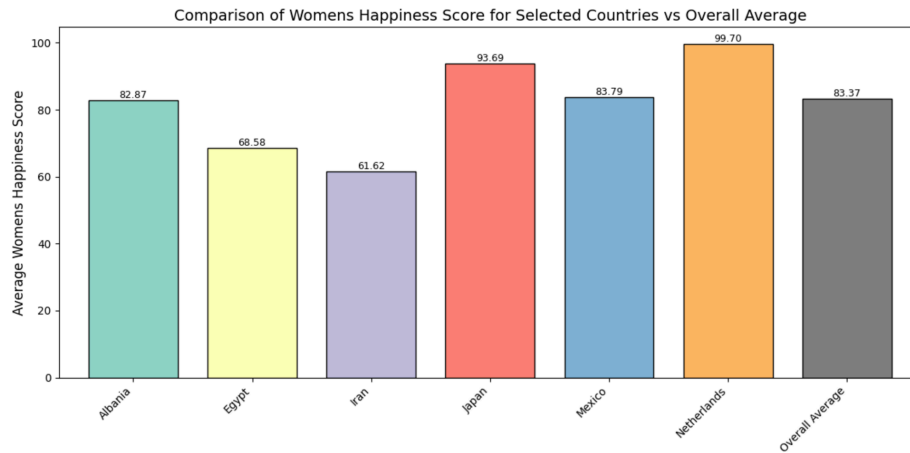


Image 9: Mean Women's Happiness Score by Country



## V. Findings

### High-Level

At a high-level view, the correlations between marriage, divorce, and the percent of divorces to marriages with women's happiness scores and overall happiness scores vary. With a moderate negative correlation of -0.53 with women's happiness score and -0.50 with overall happiness score, higher marriage rates appear to be associated with lower happiness (Image 4). Women's happiness is only slightly more impacted compared to overall happiness - a negligible 0.03 difference in correlation. This suggests that when marriage is expected, hence the higher rates, happiness scores significantly drop.

As for divorce rates, it has a weak positive correlation with women's happiness score and overall happiness scores at 0.19 and 0.03, respectively, which suggests that divorce rates alone have a minimal association with happiness rates (Image 4). However, the difference between women's happiness and overall happiness correlations with divorce is 0.16, which is much more significant than the 0.03 difference with their correlation with marriage rates.



The significant impact of divorce rates on women's happiness in particular is further highlighted by the correlation between the divorce rate to marriage rate ratio (percent) and the two happiness scores. With women's happiness, percent has a moderate positive correlation at 0.55, while having a slightly lower moderate positive correlation with overall happiness at 0.34 (Image 4). In summary, marriage rates are negatively associated with happiness, while a higher proportion of divorces relative to marriages positively correlates with happiness, particularly for women.

### Cross-Cultural

In examining the relationship between marriage, divorce rates, and happiness across regions, we observed significant regional differences in cultural values and norms that seem to influence both divorce rates and happiness scores. Below are the key insights from different regions:

- Western Europe:** This region generally shows a higher divorce/marriage ratio (42.58%) compared to other regions (Image 7). Countries such as the Netherlands, which has the highest women's happiness score (99.7), tend to have more liberal marriage laws and higher divorce rates (Image 9). This suggests that greater autonomy for women in marital decisions may be linked to higher happiness, as women feel empowered to leave unsatisfactory relationships without significant societal backlash. Additionally, strong social safety nets in these countries could help mitigate the negative impacts of divorce, contributing to more positive outcomes for overall happiness.
- Middle East:** In contrast, Iran presents a more complex picture. While Iran has a low divorce/marriage ratio (14.29%), its women's happiness score is the lowest overall (61.62) (Image 8, Image 9). This could be attributed to the legal restrictions on divorce and social constraints placed on women. In Iran, divorce laws are heavily influenced by religious and cultural norms, which often favor men as the initiators of divorce, making it harder for women to leave unsatisfactory marriages. Despite the low divorce rate, which typically indicates a more stable marriage culture, women in Iran face significant social and legal obstacles that limit their autonomy, both in marriage and in broader aspects of their lives. As a result, women's happiness is negatively impacted, contributing to a higher discrepancy between overall happiness and women's happiness.
- East Asia:** Japan stands out as a unique case with a low divorce rate and a high women's happiness score. The divorce rate in Japan is lower than in many Western countries, yet women in Japan report higher levels of happiness. At the same time, Japan has a marriage rate of 4.8, which is 0.97 lower than the average (5.77) across all other countries in the dataset (Image 11). This suggests that the cultural values and social systems in Japan, which provide strong support for women and allow for more balanced gender roles, may contribute to higher happiness scores. Women's ability to navigate marriage and divorce decisions within a supportive societal framework could help explain these positive outcomes in Japan.
- Southeastern Europe:** Albania presents an interesting case with a moderate divorce/marriage ratio of 20.99%, which is higher than Iran's but lower than many Western countries (Image 8). Interestingly, Albania has a women's happiness score (82.87) that is notably higher than that of Iran and similar to Mexico, indicating that despite the relatively higher divorce rate, women in Albania experience greater well-being (Table 2). This suggests that societal factors, such as gender equality and the balance between liberal and traditional values, may play a larger role in

shaping women's happiness than divorce rates alone. The relatively high women's happiness score, combined with a moderate divorce rate, suggests that Albania may have more progressive social norms, which help reduce the negative impacts of divorce on women's well-being.

- **Latin America:** Mexico has a divorce/marriage ratio of 17.31% with a women's happiness score of 83.79 (Table 2, Image 9). This unusual observation might be due to the country's sentiments toward marriage. Divorce is usually seen as a last resort to extreme circumstances. Women are encouraged to stay with their family and maintaining it together is usually the main priority of their adult life. The high women's happiness score might be tied to these generally conservative beliefs. It is also important to keep in mind that countries in the Latin American continent tend not to report accurate numbers or measurements as well as more developed countries, so this score might not be reliable.
- **North Africa:** Egypt has a divorce/marriage ratio of 17.27 (Image 8). The overall happiness score is 67.93 and the women's happiness score is 68.58. On a cultural level, Egypt is transitioning from a more traditional society to a more modern society. In general, there is a lot of scrutiny and expectation of how a woman should behave. Because of this, a lot of women in Egypt tend to marry young. Divorce is frowned upon as it is along many other countries in the North Africa region. Women in Egypt were granted the ability to file for divorce just this century so it may be more years till we can see more significant data regarding marriage to divorce ratio.

#### **List of Assumptions/Risks**

- **Data Span:** The analysis uses divorce and marriage data from 2005-2021 which is 16 years of data varying for each country. In this analysis, we have assumed that trends within this period remain consistent across countries. The Women's Happiness and Overall Happiness datasets only span the year of 2024, so this comparative analysis across the datasets assumes a similar, predicted trend for marriage and divorce patterns.
- **Missing Data:** Countries with missing values were excluded, which may limit the generalizability of results and overlook countries with unique factors influencing marriage and divorce.
- **Insufficient Data:** In some cases, limited data could lead to unreliable conclusions, as small sample sizes may not provide enough statistical backing.
- **Cultural Context:** The analysis assumes that national averages reflect the broader cultural and social norms, though these may vary within different regions or demographics of each country.

## VI. Appendix

Image 10: Mean Happiness Score by Continent

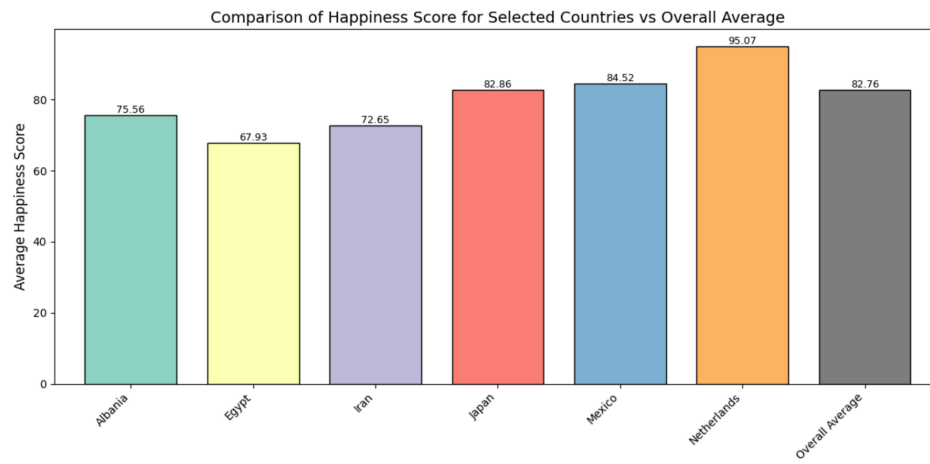


Image 11: Mean Marriage Score by Continent

