# Lifecycle and fixed portfolio allocation strategies: a performance comparison for emerging market countries

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**Lifecycle and Fixed Portfolio Allocation Strategies:**

**A Performance Comparison for Emerging Market Countries**

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**Abstract**

This study compares the performance of various fixed and lifecycle portfolio strategies for the accumulation phase of retirement planning in emerging market countries. With an expected utility framework and a bootstrapped Monte Carlo procedure, we find that the majority of emerging market investors with varying attitudes toward risk can maximize their expected utility by using lifecycle strategies instead of fixed allocation strategies. Most commonly, emerging market investors maximize expected utility with a lifecycle strategy using a 30 percent average equity exposure, though the results vary among countries.

**Keywords**: Emerging Markets, Fixed Allocations, Lifecycle Allocations, Pension Funds, Monte Carlo Simulations

**JEL Classification Codes**: D14, G11, G23, H55

## Introduction

The financial market turmoil in 2008-2009 has reminded policy makers of the uncertainty of returns on retirement savings in funded systems and in defined-contribution pension plans. Investment strategies as well as contribution amounts play a pivotal role in determining retirement incomes for such pension plans. There is a growing consensus that lifecycle strategies, with decreasing risk exposure as the individual ages, are better than fixed asset allocation strategies in delivering adequate retirement benefits from funded pension plans with a reasonable amount of risk. With lifecycle strategies, the investment portfolio gradually shifts over time to less risky assets as the target date approaches.

Burtless (2010) shows that lifecycle strategies provide a major advantage of lessening the variation in replacement rates for U.S. retirees. By employing an expected utility framework, Pfau (2010) demonstrates that conservative investors may favor lifecycle strategies over fixed allocation strategies. Later, Pfau (2011) confirms these findings by comparing the performance of fixed strategies, lifecycle strategies, and contrarian or reverse-glide path strategies with U.S. economic data, arguing that long-term savers with a reasonable amount of risk aversion would enjoy higher expected utility from using lifecycle strategies. On the other hand, Basu and Drew (2009) argue that contrarian strategies which increase equity holdings near retirement would provide a higher expected terminal wealth for investors than lifecycle strategies. They argue that this results from "the portfolio size effect", which explains how lifecycle strategies reduce stock allocations near retirement when the portfolio size is the largest, which deprives the investor from earning high absolute returns. Recently, Schleef and Eisinger (2011) argue that lifecycle asset allocation strategies do not provide adequate portfolio risk protection in terms of maximizing the probability of reaching a particular wealth accumulation target. This, however, assumes that investors are risk neutral, or at least that they are not concerned by how much their wealth may fall below the target.

The objective of this study is to compare the performance of fixed portfolio strategies with lifecycle portfolio strategies for 25 emerging market pension funds assuming investor risk aversion and diminishing marginal returns from wealth. Emerging market pension funds and investors are increasingly relying on advanced funding for retirements and are searching for better tradeoffs between risks and returns for portfolio strategies. To avoid focusing only on the distribution of retirement wealth or the probabilities of reaching certain fixed wealth accumulation goals, we use a utility-based approach, which permits us to assess how a retiree evaluates portfolio performance while taking into account risk aversion. Our simulation results justify the implementation of lifecycle strategies for retirement savers in emerging markets.

**Methodology**

In order to compare the performance of investment strategies on the basis of their expected utility, we employ the bootstrap Monte Carlo simulation procedure for a common hypothetical worker in each country. We assume that the common worker starts a 40-year career with an annual gross salary of 100 in each country's local currency. Salary grows annually by one percent in real terms. The worker saves 10 percent of his gross salary in his retirement savings account at the end of each year over 40 years. We further assume that there will be an annual administrative fee of 0.3 percent charged to the portfolio. Income from assets is assumed to be reinvested without deducting for income taxes. The portfolio is rebalanced at the end of each year to maintain the targeted asset allocation.

For each country, we consider 11 fixed asset allocation strategies for two domestic assets by varying each asset in 10 percentage point increments from zero to 100 percent. The fixed portfolio strategies are coded so that we can identify the asset mix of each strategy. For instance, the strategy "F100/0" maintains a 100 percent fixed allocation to equities and zero percent fixed allocation to bank deposits over a 40-year career path. These fixed allocation strategies will be compared to eight lifecycle strategies, which are depicted in Figure 1.

//Figure 1 About Here//

The lifecycle strategies are identified by their simple average stock allocation over the 40-year period. This is not a weighted average, and because portfolios will tend to be larger near retirement, the weighted average equity allocation will be less, but will differ for each simulation of asset returns. We construct eight lifecycles, namely "LC80", "LC70", "LC60","LC50", "LC40", "LC30", "LC20", and "LC10". The two-digit number represents the approximate unweighted average equity exposure of that strategy. For instance, the "LC80" strategy has an average exposure to equities of 80.29 percent.

Its exposure to equities is kept constant at 90 percent during the first 20 years, and then it drops in a linear fashion over the next 20 years to 53 percent at the retirement date. The exposures to equities in the “LC70”, “LC60”, “LC50”, and “LC40” strategies are kept constant at 82.5 percent, 72 percent, 64 percent, and 50.5 percent for the first 20 years, and then decrease linearly to 36 percent, 26.5 percent, 12 percent, and 11.5 percent, respectively, over the final 20 years before retirement. The initial allocations to equities in the “LC30”, “LC20”, and “LC10” strategies are 50 percent, 41.5 percent, and 21 percent. In these cases, however, the decrease begins immediately to 11.5 percent, zero percent, and zero percent, respectively, by retirement.

We simulate 10,000 scenarios for each country. Each scenario consists of real returns for a particular country’s two domestic assets over a 40-year period. For the bootstrap procedure, asset return data for each simulation are randomly drawn with replacement from the country’s historical data. To fill each 40-year sequence, 40 years are chosen randomly with replacement from the historical data and the asset returns for each of those years is incorporated into the simulations. The simulated returns match the average returns, volatilities, and contemporaneous correlations present in the historical data. However, this re-sampling method does not capture any serial correlation present in each time series. The advantage of the bootstrap approach is that it is a multi-period optimization procedure, which allows us to consider the asset allocation issue from a long-term perspective. Also, the bootstrap simulation procedure is non-parametric, it does not make any distributional assumptions about the normality of returns.

Allowing for diminishing marginal utility of wealth, the standard constant relative risk aversion [CRRA] utility function is used to compute the expected utility of wealth over the distribution of terminal wealth accumulations:

$$\begin{aligned} E[u(w_i)] &= \sum_{i=1}^{N}\left(\frac{1}{1\text{-}\gamma}w_i^{1-\gamma}\right) \quad \text{for } \gamma > 0,\ \gamma \neq 1 \\ &= \ln(w_i) \qquad\qquad \text{for } \gamma = 1 \end{aligned} \tag{1}$$

where $w_i$ represents the wealth accumulation at retirement in each of N=10,000 simulations. The variable $\gamma$ is the investor risk aversion, which we consider for a range from one to 10. A value of zero represents risk neutrality, and increasingly positive values indicate increasing risk aversion. For our baseline case we consider a risk aversion coefficient of five as representative of a relatively risk averse investor. We estimate the expected utility for each strategy across the spectrum of risk aversion coefficients by taking the mean utility from 10,000 simulations. The optimal portfolio strategy for each level of risk aversion is the strategy that provides investors with the highest expected utility. Accordingly, the portfolio strategies are ranked on the basis of the expected utility produced by each strategy for pension fund investors.

**Data**

Data is available through the end of 2009 for all 25 countries. In order to avoid extremely high and low return outliers caused by hyperinflation, we consider the data since 1992 for Argentina and since 1995 for Brazil, in spite of the longer data availability for those countries. For all other countries, we use the longest time period in which all the relevant data could be collected. The starting dates do differ across the 25 countries though, ranging from 1988 to 1998. Domestic equity returns are calculated by taking the annual percentage change at year end in local currency for the MSCI standard core gross indices for each country. For fixed income, we use bank deposit rates from the International Monetary Fund's International Financial Statistics [IMF IFS], except for a few cases in which data is collected from national sources. Also, for Pakistan, we use the call money rate as a proxy for its domestic deposit rate. To compute real returns, we use annual consumer price index data provided in the IMF IFS database.

//Table 1 About Here//

Table 1 provides the time period covered for each country and the summary statistics of the relevant variables. For all the emerging market countries considered, except Poland where average returns are about the same, local stocks provide higher real returns with higher volatilities compared to local bank deposits. Correlations between the two assets are generally low, which implies the potential for diversification benefits.

**Results**

//Table 2 About Here//

Table 2 shows that, with two exceptions, for all of the risk aversion coefficients considered, a lifecycle strategy tends to provide higher utility than any fixed strategy except for cases in which either a fixed 100/0 or fixed 0/100 does better. An all-stock fixed strategy does provide higher expected utility for aggressive investors in some countries. A lifecycle strategy incorporating leverage could be devised in these cases. In Poland, as well, investors see little reason to invest in equities, and a fixed strategy with only bonds does perform best. Otherwise, for the most part, a lifecycle strategy provides higher expected utility for moderate and conservative investors. More conservative investors do tend to favor lifecycle strategies with lower average stock allocations.

//Table 3 About Here//

Table 3 provides a detailed ranking of expected utility for the 8 lifecycle and 11 fixed allocation strategies for an investor with risk aversion of 5. All countries except Poland have a lifecycle strategy ranked first, and 12 of the 25 countries maximize expected utility with the LC30 strategy. As shown in Table 3, the best three portfolio choices out of 19 possibilities for pension fund investors in Chile, Czech Republic, Egypt, Peru, and Russia are lifecycle strategies. For all other countries but Poland, two of the best three choices are lifecycle strategies.

Moving to the last three rankings [$19^{th}$, $18^{th}$, $17^{th}$], the strategies “F100/0”, “F90/10”, and “F80/20,” which are the most aggressive fixed strategies considered, respectively become the last three portfolio choices for the majority of emerging market pension funds. Also, the most conservative fixed strategies “F10/90” and “F0/100” are within the bottom three rankings for pension funds in Chile, Czech Republic, Mexico, Peru, and South Africa. When compared with fixed allocation strategies, lifecycle strategies provide the potential to ensure a higher level of welfare for emerging market pensioners.

## Conclusion

This study extends the current debate on lifecycle asset allocation strategies by considering their role for emerging market pension funds. The study justifies that emerging market retirement savers with varying attitudes toward risk can maximize their expected utility by using lifecycle strategies. Particularly, conservative pension fund investors tend to find one of the lifecycle strategies to be most suitable. However, people may not behave in ways fully consistent with the expected utility framework used in this study. Future research should check the robustness of these findings by using alternative approaches recommended in behavioral finance to elicit member’s utility functions. Also, other factors like planned withdrawal rates during retirement and accessibility to other social security benefits should be taken into consideration. Subject to these limitations, we can conclude that the lifecycle approach has much to recommend it for retirement savers in emerging market countries.

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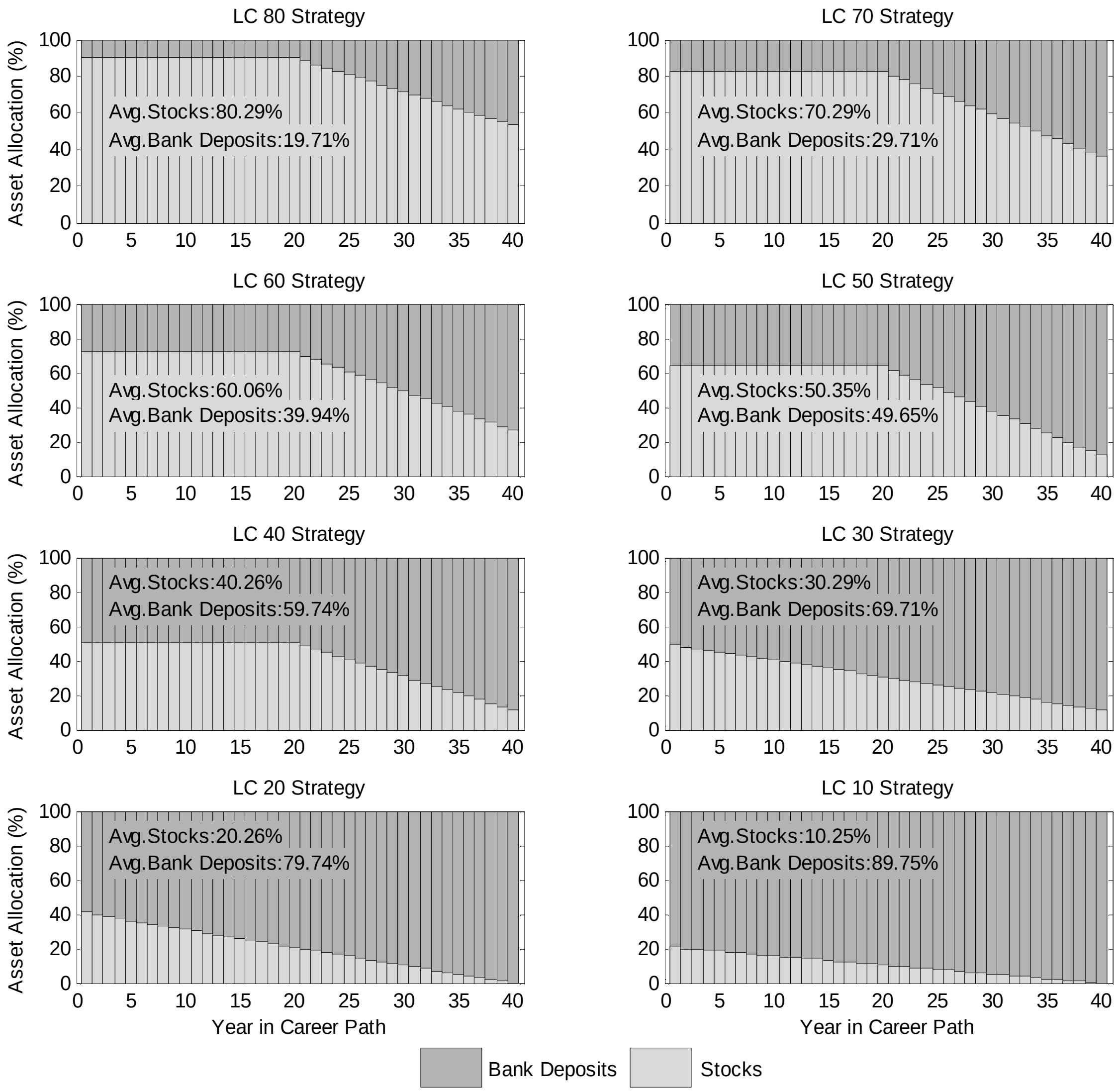
**Figure 1**: Lifecycle Portfolio Strategies: Asset Allocations over a 40-year Career




**Source**: Own calculations as explained in text.

**Table 1:** Summary Statistics for Real Asset Returns in Emerging Market Countries (%)

| Country | Start Year (End Year=2009) | Local Stocks | | Local Bank Deposits | | Inflation Rate | | Correlation between Local Stocks and Local Bank Deposits |
|---|---|---|---|---|---|---|---|---|
| | | Mean | Std | Mean | Std | Mean | Std | |
| Argentina | 1992 | 11.5 | 37.8 | 3.6 | 6.4 | 7.2 | 8.1 | -0.15 |
| Brazil | 1995 | 19.1 | 47.8 | 9.5 | 7.3 | 11.0 | 15.6 | 0.30 |
| Chile | 1988 | 18.0 | 29.5 | 3.4 | 3.4 | 8.4 | 6.9 | -0.09 |
| China | 1993 | 4.7 | 45.9 | -0.2 | 3.8 | 4.9 | 7.2 | 0.31 |
| Columbia | 1993 | 18.7 | 41.3 | 4.4 | 3.4 | 11.6 | 7.2 | -0.59 |
| Czech Rep. | 1995 | 11.7 | 30.4 | -1.0 | 1.6 | 4.5 | 3.4 | 0.56 |
| Egypt | 1995 | 30.0 | 62.6 | 1.3 | 5.2 | 7.3 | 5.0 | 0.09 |
| Hungary | 1995 | 18.4 | 47.6 | 0.8 | 2.6 | 10.4 | 7.6 | -0.23 |
| India | 1993 | 13.9 | 39.8 | 1.2 | 2.6 | 6.8 | 3.0 | 0.04 |
| Indonesia | 1988 | 23.9 | 67.2 | 4.6 | 5.9 | 11.2 | 11.1 | 0.09 |
| Israel | 1993 | 8.9 | 30.1 | 2.8 | 2.8 | 5.0 | 4.3 | 0.34 |
| Jordan | 1988 | 6.7 | 29.6 | 1.0 | 5.2 | 5.5 | 6.1 | 0.20 |
| Korea | 1988 | 10.7 | 37.4 | 2.8 | 1.9 | 4.6 | 2.2 | 0.04 |
| Malaysia | 1988 | 12.0 | 35.1 | 1.8 | 1.5 | 2.9 | 1.3 | 0.06 |
| Mexico | 1988 | 18.6 | 34.6 | -1.2 | 7.1 | 17.7 | 23.7 | 0.26 |
| Morocco | 1998 | 7.9 | 22.8 | 2.6 | 1.6 | 1.9 | 1.1 | -0.30 |
| Pakistan | 1993 | 16.5 | 53.6 | 0.3 | 3.3 | 8.6 | 4.6 | 0.16 |
| Peru | 1993 | 21.0 | 38.0 | -0.4 | 7.0 | 8.2 | 11.9 | 0.04 |
| Philippines | 1988 | 10.8 | 44.1 | 1.7 | 2.4 | 7.4 | 3.6 | -0.08 |
| Poland | 1994 | 2.0 | 34.3 | 2.1 | 2.2 | 9.4 | 9.9 | -0.14 |
| Russia | 1995 | 14.4 | 60.0 | -9.9 | 11.5 | 34.2 | 49.4 | 0.19 |
| S. Africa | 1993 | 10.4 | 22.8 | 3.7 | 2.4 | 6.9 | 2.5 | -0.06 |
| Sri Lanka | 1993 | 12.7 | 55.8 | -0.1 | 4.1 | 10.3 | 4.7 | 0.45 |
| Thailand | 1988 | 15.1 | 51.0 | 2.5 | 2.9 | 3.8 | 2.2 | 0.08 |
| Turkey | 1988 | 39.1 | 120.6 | 2.0 | 8.4 | 52.1 | 31.2 | 0.04 |

**Source**: Own calculations based on the historical economic data described in the “data” section.

**Table 2**: Optimal Investment Strategies for Various Levels of Risk Aversion

| Country | Risk Aversion Coefficient ( $\gamma$ ) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 10 |
| Argentina | LC80 | LC50 | LC30 | LC30 | LC30 | F10/90 |
| Brazil | LC70 | LC40 | LC30 | LC20 | LC10 | LC10 |
| Chile | F100/0 | F100/0 | LC80 | LC80 | LC70 | LC40 |
| China | LC50 | LC30 | LC20 | LC10 | LC10 | F0/100 |
| Columbia | F100/0 | LC70 | LC60 | LC40 | LC30 | LC30 |
| Czech Rep. | F100/0 | F100/0 | LC80 | LC70 | LC60 | LC30 |
| Egypt | F100/0 | LC70 | LC60 | LC40 | LC30 | LC20 |
| Hungary | F100/0 | LC70 | LC60 | LC40 | LC40 | LC30 |
| India | F100/0 | LC70 | LC50 | LC40 | LC30 | LC20 |
| Indonesia | LC80 | LC50 | LC30 | LC30 | LC30 | LC20 |
| Israel | F100/0 | LC60 | LC40 | LC30 | LC30 | LC10 |
| Jordan | F100/0 | LC70 | LC50 | LC30 | LC30 | LC20 |
| Korea | LC80 | LC50 | LC30 | LC30 | LC30 | F10/90 |
| Malaysia | F100/0 | LC80 | LC60 | LC40 | LC30 | LC20 |
| Mexico | F100/0 | F100/0 | F100/0 | LC80 | LC80 | LC60 |
| Morocco | F100/0 | LC80 | LC70 | LC50 | LC40 | LC30 |
| Pakistan | LC80 | LC60 | LC40 | LC30 | LC30 | LC20 |
| Peru | F100/0 | F100/0 | LC80 | LC70 | LC60 | LC40 |
| Philippines | LC80 | LC50 | LC30 | LC30 | LC30 | LC10 |
| Poland | F0/100 | F0/100 | F0/100 | F0/100 | F0/100 | F0/100 |
| Russia | LC80 | LC70 | LC60 | LC50 | LC50 | LC40 |
| South Africa | F100/0 | F100/0 | LC80 | LC60 | LC50 | LC30 |
| Sri Lanka | LC80 | LC60 | LC40 | LC30 | LC30 | LC10 |
| Thailand | LC80 | LC50 | LC30 | LC30 | LC20 | LC10 |
| Turkey | LC70 | LC40 | LC30 | LC20 | LC20 | LC10 |

**Note**: Lifecycle portfolio strategies are shaded. **Source**: Same as Figure 1.

**Table 3**: Ranking of Portfolio Strategies based on Expected Utility for Pension Fund Investors ( $\gamma = 5$ )

| Country | **Lifecycle Portfolio Strategies** | | | | | | | | **Fixed Portfolio Strategies** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LC 80 | LC 70 | LC 60 | LC 50 | LC 40 | LC 30 | LC 20 | LC 10 | F 100/0 | F 90/10 | F 80/20 | F 70/30 | F 60/40 | F 50/50 | F 40/60 | F 30/70 | F 20/80 | F 10/90 | F 0/100 |
| Argentina | 15 | 13 | 11 | 9 | 7 | 1 | 3 | 6 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 5 | 2 | 4 | 8 |
| Brazil | 16 | 13 | 12 | 10 | 8 | 6 | 3 | 1 | 19 | 18 | 17 | 15 | 14 | 11 | 9 | 7 | 4 | 2 | 5 |
| Chile | 3 | 1 | 2 | 6 | 10 | 13 | 16 | 18 | 14 | 11 | 8 | 7 | 4 | 5 | 9 | 12 | 15 | 17 | 19 |
| China | 15 | 13 | 11 | 9 | 7 | 5 | 2 | 1 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 8 | 6 | 3 | 4 |
| Columbia | 15 | 12 | 8 | 5 | 2 | 1 | 7 | 11 | 19 | 18 | 17 | 16 | 13 | 9 | 4 | 3 | 6 | 10 | 14 |
| Czech Rep. | 7 | 3 | 1 | 2 | 4 | 10 | 13 | 16 | 19 | 17 | 14 | 11 | 9 | 6 | 5 | 8 | 12 | 15 | 18 |
| Egypt | 14 | 11 | 7 | 3 | 2 | 1 | 8 | 12 | 19 | 18 | 17 | 15 | 13 | 9 | 6 | 4 | 5 | 10 | 16 |
| Hungary | 15 | 11 | 7 | 4 | 1 | 2 | 8 | 12 | 19 | 18 | 17 | 16 | 13 | 9 | 6 | 3 | 5 | 10 | 14 |
| India | 15 | 12 | 8 | 5 | 2 | 1 | 6 | 10 | 19 | 18 | 17 | 16 | 14 | 11 | 7 | 3 | 4 | 9 | 13 |
| Indonesia | 15 | 13 | 11 | 8 | 7 | 1 | 2 | 6 | 19 | 18 | 17 | 16 | 14 | 12 | 9 | 5 | 3 | 4 | 10 |
| Israel | 15 | 13 | 11 | 8 | 6 | 1 | 2 | 7 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 5 | 3 | 4 | 9 |
| Jordan | 15 | 13 | 10 | 7 | 3 | 1 | 4 | 8 | 19 | 18 | 17 | 16 | 14 | 12 | 9 | 5 | 2 | 6 | 11 |
| Korea | 15 | 13 | 11 | 9 | 7 | 1 | 3 | 6 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 5 | 2 | 4 | 8 |
| Malaysia | 15 | 12 | 8 | 4 | 2 | 1 | 7 | 11 | 19 | 18 | 17 | 16 | 13 | 9 | 5 | 3 | 6 | 10 | 14 |
| Mexico | 1 | 2 | 5 | 10 | 12 | 14 | 16 | 18 | 8 | 7 | 4 | 3 | 6 | 9 | 11 | 13 | 15 | 17 | 19 |
| Morocco | 14 | 9 | 6 | 2 | 1 | 4 | 10 | 13 | 19 | 18 | 17 | 15 | 11 | 7 | 3 | 5 | 8 | 12 | 16 |
| Pakistan | 15 | 13 | 11 | 8 | 4 | 1 | 2 | 7 | 19 | 18 | 17 | 16 | 14 | 12 | 9 | 6 | 3 | 5 | 10 |
| Peru | 5 | 2 | 1 | 3 | 8 | 12 | 16 | 18 | 15 | 13 | 10 | 9 | 6 | 4 | 7 | 11 | 14 | 17 | 19 |
| Philippines | 15 | 13 | 11 | 8 | 7 | 1 | 2 | 5 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 6 | 3 | 4 | 9 |
| Poland | 15 | 13 | 11 | 9 | 8 | 6 | 4 | 2 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 7 | 5 | 3 | 1 |
| Russia | 14 | 8 | 4 | 1 | 2 | 3 | 10 | 12 | 19 | 18 | 17 | 16 | 15 | 11 | 7 | 5 | 6 | 9 | 13 |
| South Africa | 12 | 7 | 2 | 1 | 4 | 8 | 13 | 16 | 19 | 17 | 14 | 11 | 9 | 5 | 3 | 6 | 10 | 15 | 18 |
| Sri Lanka | 15 | 13 | 11 | 8 | 5 | 1 | 2 | 6 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 7 | 3 | 4 | 9 |
| Thailand | 15 | 13 | 11 | 9 | 6 | 2 | 1 | 5 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 7 | 3 | 4 | 8 |
| Turkey | 15 | 13 | 11 | 9 | 6 | 4 | 1 | 3 | 19 | 18 | 17 | 16 | 14 | 12 | 10 | 7 | 5 | 2 | 8 |

**Note**: The rankings 1, 2, and 3 are shaded in gray color varieties and the rankings 17, 18, and 19 are shaded in black.

**Source**: Same as Figure 1