International Equity Portfolio Project [Phase 1,2,3,4]

Step #0 BEFORE you start this Project … might be a good idea to read/do these

This Project is not very difficult, requires little originality but is tedious and requires you to follow these lengthy step-by-step instructions. So, before you start, it helps to read the following before organizing and implementing your calculations/plots in **Excel** and compiling the required results in your **PDF Deliverables** file:

1. **About observing academic conduct.** Read *Page 2 and 8*. It affects how you do this project and whether you will be accorded credit for your work or even failing the course.

2. **About grading policy for this project.** See *Page 3 and 4*. Know where/how to earn points while implementing your project. PS: if you follow (no originality required) all the project's instructions and do them accurately and correctly, you should "get at least 85%" of this project score.

3. **About project delivery dates. There are TWO due dates.** See *Page 2* and project's posting in *BlackBoard*.

4. **About what to submit for the project.** This affects your project grading score.
    a. See *Step #18.* There is a list of items you need to gather/compile for submission …
    b. … it also explains the file-naming conventions of your submitting project files.
    c. See the pages after *Step #18* for *Sample Deliverables*. It will help you organize your Excel worksheets based on your project Steps and the required calculated data summary tables and plots.

5. **About where to submit for the project.** DO NOT email your project as an attachment to the instructor/TA.
    a. See *Step #18.* In particular, see sub-item [g].
    b. At about the time the project is due, course *BlackBoard's* left-hand-side menu will have either an *Assignments > Submit International Portfolio Project* or *Submit Portfolio Projects Here* menu links for submitting your files. Additional instructions on doing so will be provided there.

6. **About the project's foreign stock market selection and its data.** You are NOT starting from scratch.
    a. You will be provided with an instructor-given personalized *"starter template and data" Excel file* See *Page 8*.
    b. See *Step #1 sub-part [a]* for *suggested pre-screened foreign stock markets* that will meet the project's requirements -- to save you foreign stock markets selection time.
    c. For stock **data requirements** in your project, see *Step #1* sub-parts *[a] through [e]*.
    d. See previously completed *Domestic Portfolio Project* on **how to download stock market data**.

7. **About the project's Steps.** Described in detailed step-by-step instructions, please follow them (requires no originality on your part) and work through them sequentially from *Step #1 through Step #18*.

8. **About advice for this course's TWO portfolio projects**
    a. Yes, this project is a LOT of work and very TIME CONSUMING; each is *"only 10% of the course grade".*
    b. You are **almost certain to earn at least 8%** of the overall course grade; just follow the instructions.
    c. The same goes for the first half of semester's *Domestic Equity Portfolio Project* …
    d. … at least **another 8%** of the overall course grade.
    e. **BOTH portfolio projects will help raise your overall course score** -- exam(s) have a much lower average score.
    f. But you need to put in your **OWN** time, effort **unassisted and observing stated Academic Conduct spelled out in this assignment document**, submitted on time …
    g. … and it could be the difference between passing or failing this course.

9. **Any further questions.** Please ask instructor during classroom sessions.

International Equity Portfolio Project [Phase 1,2,3,4]

<*updated 06/09/2025 7pm*; *ALL Phases are released at once due to short time frame of the entire project's due date.*

About the Project, Observing Academic Conduct, Doing Your Own [unassisted] Work
please read pages 1,2,3,4 carefully before starting the project

- For this entire project (all Phases), you may use/assume the following [based on 06/09/2025]. No need to change it if your assignment is done over a few days or a few weeks; it won't impact your actual/final calculations significantly:
  - ✓ **Risk-free Rate k_{RF}**, also notated as **RFR = 4.50%** [U.S. 10-year T-Bill?].
- The entire project has **4 Phases**. Each Phase will keep pace with successive lecture Modules. There are **two due dates**:
  1. Phase1 Step #1, check due date on this in BlackBoard's Documents section's project folder.
  2. The entire project [at end of Phase4] is due any time ON/BEFORE our Exam.
  - ➢ This project is time-consuming. It is recommended that you **start early, finish and submit** early to remove distraction and allow more time for you to focus on your exam (which carries a lot more points than this project).
- See BlackBoard *Announcements, Assignments* or *Documents* section for specific **due dates** and instructions.

You will be using **your instructor-given personalized copy of the "starter template and data" Excel file** to complete all the steps in the project:

1. **IMPORTANT:** This is an individual project. DO NOT RECYCLE YOUR FRIEND'S PAST SEMESTER's PROJECT -- THEY ARE DIFFERENT -- do not look at them for project guidance and process; it is an **Academic Conduct violation.**
2. i.e. **DO YOUR OWN WORK from scratch from your given Excel; no help from others**. ALL THE GUIDANCE for your (this semester's) project is in this document and the Sample Deliverables attached at the end of this document -- **you should follow these instructions to the latter**. Not doing so would lead to point deductions in the project.
3. To enforce **Academic Code of Conduct**, **you MUST start your project by using your instructor-given personalized "starting template & data" Excel file which will be sent to you via BlackBoard's *Internal Messages***. Your personalized template file contains cookies and meta-data to individually track and watermark your own copy of the Excel file; use them as is.
4. **DO NOT rename** your given Excel file**.**
5. **DO NOT delete** those existing **worksheets and its red banner**. Use your given personalized template data file and work with it by adding all the necessary steps and worksheets to complete the project.
6. **DO NOT start from your own new Excel file** and copy over those worksheets.
7. **DO NOT cut-paste** all or part of your work from other Excel files or worksheets that is not from your given personalized "starting template & data" Excel file.
8. **YOU DO NOT NEED TO DOWLOAD ANY DATA.** To save you time to work on your International Portfolio construction, the instructor have downloaded a set of **Foreign Exchange (FX)** currency data, **foreign stock market index** data, **foreign stock market index mutual funds** and **foreign market exchange-traded funds (ETF)** data. These data have been "cleaned up" and **date-synchronized** across all countries.
9. Not following all of the above instructions will lead to **ZERO score** in this individual project.
10. Any **violation** of Academic Conduct during this Project will lead to an automatic **failure** in this course.

Color-coding Conventions for Foreign Market Plots

You MUST use the following color-codes for the corresponding plots in Steps #4, #5, #6, #7 [**or face point deductions**]:

Black	**dashed black** line for ***HQ [US]***, **dotted black** line for ***VBMFX***, **solid black** line for benchmark ***SP500***.
Blue	**Market B**.
Yellow	**Market C**.
Red	**Market D**.
Turquoise	**Market E**.
Green	**Market F**. If needed. PS: needed in this semester.

Where B, C, D, E, F are your chosen markets **arranged in alphabetical order**, e.g. "BZ, CN, GM, …, UK", etc.
PS: Market "A" is the HQ [US]. For additional guidance on this convention, see respective steps and the posted "Sample Deliverables".

Grading policy for this project

A. **Due Dates.** This project have two due dates which will impact your score for this assignment. Please check this assignment's course BlackBoard *Documents* folder for actual due date:

1) **Phase 1 Step #1.** This is typically due at the end of the first week from which it is assigned.
   a) **Propose** the required number of markets in your International Portfolio.
   b) Use course BlackBoard's ***Internal Messages*** to notify instructor of your choices.
   c) **10-point deduction** for "bad" or "rejected" choice(s) of your international markets from your proposal. See Step #1, in particular, item [a] for guidance.

2) **Entire Project.** This is typically due any time ON/BEFORE our Exam.
   a) See Step #18 *"The Entire Project's Deliverables"* for guidance.

B. **Point Deductions.** The following is a checklist, not exhaustive, are typical areas where a project loses points:

1) **Late on due dates** above [A1] and/or [A2] -- 10-point deduction for each day past due.
2) **Unsuccessful Phase 1 Step #1 market(s) proposal** -- 10-point deduction for "bad" or "rejected" choice(s) of your international market(s) from your proposal.
   a) See Step #1. Proposed markets must meet requirements [a] …
   b) … when in doubt, pick suggested, pre-screened list of markets from Step #1[a].
3) **Academic Conduct**. Did you observed project instructions stated in Page 2?
   a) Straightforward requirement: ***"do your own work unassisted"***.
   b) Did you recycle past semester's work? It is not your work and they are different.
   c) Did you use your instructor-given personalized *"starting template & data"* Excel file?
   d) Did you observe **Page 2, items [1] through [10]**?
   e) **Violation** of Academic Conduct in this project is an automatic 0-point for project and a **failing grade** in this course.
4) **Project Submit Files**. See Step #18 *"The Entire Project's Deliverables"* for guidance.
   a) You will be submitting two files -- an Excel file and a PDF file.
   b) File-naming convention is IntlPortf-*LnameFname*. For example:
      - If name is SMITH, John, then two files will be IntlPortf-*SmithJ*.xlsx and IntlPortf-*SmithJ*.pdf
      - If name is ZHOU, Ziruo, then two files will be IntlPortf-*ZhouZR*.xlsx and IntlPortf-*ZhouJR*.pdf
   c) In any case, your filename prefix is already determined for you based on your instructor-given personalized *"starting template & data"* Excel file. DO NOT rename it.
   d) **10-point deduction** for not following above file-naming convention.
5) **Deliverables worksheet** in your project's Excel file.
   a) In your given *instructor-given personalized starter template and data* Excel file, you may create as many worksheets as needed to organize, calculate, tabulate the steps in this assignment …
   b) … however, you must consolidate your results in the ***"Deliverables"*** **worksheet**.
   c) This worksheet is already part of your instructor-given personalized *"starting template & data"* Excel file -- use it; don't create or cut-paste a new one.
   d) **Link your calculated results from other worksheets to this Deliverables worksheet**.
      i. For example, if you have created a new worksheet called *"Step 10"* to *Calculate the Market ETF Portfolio* and then to Summarize/Compile these calculated data, then its results should be tabulated in "***Deliverables" worksheet*** and linked from "Step 10" worksheet to "Deliverables" worksheet, e.g. Deliverables worksheet's cell E-19 is set equal to "Step 4" worksheet's cell L-10, "VBMFX's Period 2 CBI", etc.

ii. For example, if you have created a new worksheet called *"Step 4"* to calculate and then *Plot the various Indexes [CBI] of U.S., non-U.S*, Global Funds, then you should "redirect this plot" to the "Deliverables" worksheet.

e) **DO NOT cut-paste calculated data values or plots from other worksheets to the "Deliverables" worksheet** -- it makes it difficult for the grader to *"trace"* the calculated values back to its original source.

f) **When in doubt, follow exactly the *Sample Deliverables*** provided in the pages after Step #18 *"The Entire Project's Deliverables"*.

6) **Other common areas of point deductions** in project deliverables:

a) In short, **see *Sample Deliverables*** -- did you leave out any of those items shown?

b) Did you follow *color-code conventions for the markets*? See Page 2.

c) Did you arrange your chosen markets in *alphabetical order* in your Deliverables data summary tables, Step #10, #12, #13? PS: once alphabetized, each market will be assigned according to the color-code convention in 6(b) and as stated at the bottom of Page2.

d) Were there any calculation errors?

e) Were the summarized tables of calculations messy, sloppy, and disorganized?

f) For plots, did you scale it properly?

g) For the plots, did you label them appropriately?

h) PS: just follow the ***Sample Deliverables*** at the end of this document; you should be fine.

i) PS: your calculated data, table summaries, and plots will be different from the Sample Deliverables due to the different set of Markets you selected for your portfolio.

C. Final word about the two Portfolio Projects

1) Yes, this project is a LOT of work and very TIME CONSUMING; it is *"10% of the course grade".*

2) You are **almost certain to earn at least 8%** of the overall course grade; just follow instructions.

3) The same goes for the first half of semester's *Domestic Equity Portfolio Project* …

4) … at least **another 8%** of the overall course grade.

5) **BOTH portfolio projects will help raise your overall course score** -- exam(s) have a much lower average score.

6) But you need to put in your **OWN** time, effort **unassisted and observing stated Academic Conduct spelled out in this assignment document**, submitted on time …

7) … and it could be the difference between passing or failing this course.

Step #1 Select, declare, and notify me your 6-market selection in your International Portfolio

See this assignment's folder for Phases and due dates. You must *Internal Messages* instructor [via BlackBoard] with your choice of foreign stock markets in your portfolio. See instructions below:

Please note the following regarding this assignment:

- **PS: we are picking international stock markets; NOT individual foreign stocks from various countries.**
- **It uses U.S. as "Market 1", the Headquarters [HQ] of this International Portfolio**. Therefore, subsequent return calculations are priced in US$. The many Steps in this assignment will have references to "HQ" and U.S$ as the Reporting Currency "RC" …
- **… Advice:** once you complete and understood the process in this assignment, you can "reset" your assignment and use your (if non-U.S.) home country as the HQ -- results will be different even if you use the SAME Market allocation with US as the HQ -- *"foreign currency component"* relative to your chosen Home Country HQ is an important component of return in an International Portfolio.

All you need to do in **Step #1** (which is one of the two due dates for this assignment) is to choose "Market 2", "Market 3", "Market 4", and "Market 6" from the following list of international stock markets and then use their corresponding data in the "starting template & data" Excel file to construct your International Portfolio:

["Market 1"] **US [HQ] U.S.**

Then pick **5 more** stock markets from following to form your **6-market** International Portfolio:

AU	Australia	IN	India	ND	Netherlands
BZ	Brazil	ID	Indonesia	SG	Singapore
CA	Canada	IT	Italy	SP	Spain
CN	China	JP	Japan	SZ	Switzerland
FR	France	KR	Korea	TW	Taiwan
GM	Germany	MY	Malaysia	TH	Thailand
HK	Hong Kong	MX	Mexico	UK	U.K.

PS: **if you are interested in other international markets not listed above**, you are free to propose them. But they tend to pose the following problems:

- Insufficient data [FX, Index] dating back to at least year 2000.
- ETF and/or Mutual Fund was not available back in year 2000.

You will be building an International Portfolio from a set of **6-market** indexed funds meeting the following **requirements**:

a) Unlike our prior *Domestic Equity Portfolio Project*, we will NOT pick individual domestic (U.S) stocks (e.g. GE, IBM, JNJ, etc.); we will be selecting **6** international stock markets and their indexes, and their corresponding indexed funds:

1) **ALL students must include U.S** and …

(i) Please note that there is **more than one major stock market index** in the U.S. By selecting U.S, you will also need to select/use only **ONE** of these U.S. indexes in your portfolio: i.e. either Dow-30, or S&P500, or NASDAQ, or Russell, or Wilshire, etc. More on this in Step #3h.

(ii) Also, the project will need to use specifically the **S&P500** as the **overall benchmark** against your international portfolio …

(iii) … by the way, it is also OK to select the (benchmark) S&P500 as the U.S. component in your International Portfolio while using it to benchmark against your entire portfolio.

(iv) **Why** must you use U.S. as part of your International Equity Portfolio? Some reasons:

- It is the largest equity market in the world.
- The market is extremely broad, **deep, and liquid**.
- In terms of trading, it is **integrated** to other asset class markets [bonds, real estate, etc.].
- Priced in the U.S dollar, it is a **stable**, broadly-held international currency commonly used by international investors to **hedge** weaker, more volatile currencies if your home country is not the U.S. [e.g. Indonesia, Mexico, etc.].
- The transaction **costs** and fund management **expenses** are VERY low.
- It has convenient **access** to other foreign equities. For example, it is cheaper to buy dual-listed Singapore stocks or funds in the U.S. than it is to buy them in Singapore. This has to do with the much larger transaction volume in the U.S. than in Singapore. In the case of China, it turns out that there are much more product offerings [mutual funds, ETFs, leveraged equities] in the U.S. than in China.
- One **problem** about investing exclusively in U.S equities is that although it has a "decent" long-term annualized rate of return of about 6%~8%, there are higher (riskier) returns elsewhere (see China below; emerging markets; etc.). U.S equities therefore form a stable component of return while providing good coefficient of correlation with other countries in your portfolio BUT investors **should** invest outside of the U.S. market to chase **higher returns** as well as **diversify risk** in an **overall international portfolio context**.

2) … **although not compulsory, ALL students may/should include <u>China</u>**. Why?

- If you are from China, you should familiarize yourself with her fast-growing stock market. If you are not from China, see below …
- China is the second largest economy in the world; soon it will have the largest financial markets in the world.
- More importantly, she has a **higher economic growth rate** -- this tends to translate to a **higher return** albeit with more volatility in the equity market. PS: during the past two years, the economy and stock market return performance is NOT good; but in the longer-term outlook remains optimistic (we think/hope).
- Adding this component should significantly increase your portfolio returns especially when your holding period is more than ten years.
- As is the case in any portfolio construction, the challenge is to select **complementary** other-country components, through favorable coefficient of correlation, in **reducing the volatility in a portfolio context**.

3,4,5,6) If you picked China, then pick **another 4 "foreign" markets.** If you chose not to pick China, then pick **another 5 "foreign" markets;** (e.g. Australia, Germany, etc.) to complete your International Portfolio.

- PS: by adding other countries in your international portfolio, you can also reduce domestic as well as some of the country-specific **systematic risk** in your portfolio.

b) The countries in your portfolio must be **"well diversified"**, typically coming from different geography and structure of economy, i.e. you should not pick all your foreign countries in the same continent [all-Asia, all-Europe, etc.]. For example, [Korea, Singapore, Japan] or [France, Germany, Spain: all part of the Eurozone] would be bad combinations as their respective economies and financial markets are highly correlated.

PS: to save you time, steps (c) through (e), which has been grayed out and described below, are already done for you. Once you **proposed (*<u>Internal Messages</u>* me)** your selected foreign markets, I will provide you your **personalized "starting template & data" Excel file**. **You must start the entire project using this file; DO NOT recycle/use other files from a prior semester -- this would be a violation of Academic Conduct.**

c) The observed period.

- We need monthly historical data for at least the past 25 years, starting from **01/01/2000** …
- … till the **current month of this assignment**. PS: in this document ***CM*** and ***CY*** respectively refers to *current month* and *current year* of the **actual date of your assignment**. So, your last data point should be *current month*/01/*current year*, i.e. ***CM/01/CY***.
- We need to standardize the dates of these monthly data. For convenience, we will use the beginning of each month, whichever is the first non-holiday trading day of each month.
- Doing so will allow us to "date-synchronize" the data [stock indexes, fund prices, foreign exchange rates] across all countries.

d) For each selected stock market, do a quick check for the monthly **data availability** of the following:

i) **Exchange Rate** of each selected market against the U.S. Dollar.

ii) **Stock Market Index** which is "broad" enough to represent the performance of the overall stock market in that country. For example, the Bovespa for Brazil, Toronto Stock Exchange for Canada, the Shanghai Stock Exchange for China, the Tokyo Stock Exchange for Japan, the FTSE for UK, etc. These are indexed values, each priced in their respective local currency.

iii) **Country Exchange-Traded Funds (ETF) prices**. For example, EWZ for Brazil, EWA for Australia, EWJ for Japan, etc. These are all priced in U.S. Dollars regardless of whether you are a U.S. or a non-U.S investor. [Historical note: country ETFs were created in the U.S as "baskets" of respective foreign country stocks to track that country's stock market index. Its value is then priced and sold in U.S Dollars and "traded like a stock" during active market hours].

iv) **"Aligning the dates" for all the countries' data**. Most countries have their own unique public holidays which are not observed in other countries (e.g. Thanksgiving in U.S; Chinese Lunar New Year in most Asian countries; Independence Day or National Day; etc.). As a result, it is possible that the financial markets in one country will be closed on that day (no trading data available for that day) while it is open in another country. This situation will lead to "spotty" data across a particular date; you will need to "fill in the data" or pick the next day to ensure data is available across all your selected countries. *Question: Why is it necessary to do data alignment by dates? Answer: to do HPY Coefficient of Correlation studies among the markets.*

e) **Important:** before you start downloading the data and doing and calculations in the later part of this project, make sure you have the requisite monthly data for (i), (ii), (iii) and (iv). This **data availability condition must be satisfied concurrently**. Otherwise, we can't calculate periodic returns over a common observed period across these countries; nor can we calculate the coefficient of correlation [from one month to the next] among these selected countries.

f) Note that it is OK for more than one student to pick (aside from U.S. and China) the same ONE or TWO countries in their portfolio but not EXACTLY the same complete set of international markets. If you overlap in only 2, that is fine. And I will assume that students are **observing Academic Conduct policies by doing their own (individual) work** on their selected countries.

g) The **approval** of the choice of countries in your portfolio is **based on a first-come-first-serve basis**. So, *Internal Messages* [via BlackBoard] me as soon as possible …

- … also, the sooner you declare, the more choices you have on picking your preferred countries for your International Portfolio.
- I am trying to discourage students having portfolios with the same set of countries.

h) This Project is **NOT graded on portfolio performance** [who will have the highest return during the observed period]. It is the process of collecting, compiling, calculating, and reporting the required data and plots that your scores will be based upon. And in the process, it would be great if students are able to learn a bit more about their chosen countries with future interest to invest in them.

Phase 1 Step #1 Deliverables

- ✓ **[From Step #1a] Select and declare your 5 international stock markets [+ U.S.] International Portfolio.**
- ✓ ***Internal Messages* me [via BlackBoard] your portfolio's choice of markets** arranged in **alphabetical order**, e.g. "BZ, CN, GM, …" / "CN, FR, JP, …" / "AU, MX, UK, …" / etc.
- ✓ **See assignment folder for Phases and due dates.**
- ✓ **Late points will be assessed if you fail to meet this deadline**.
- ✓ **Once instructor received and approved your choice of markets, he will *Internal Messages* you your given personalized copy of the "starter template and data" Excel file :**

1. **IMPORTANT:** This is an individual project. DO NOT RECYCLE YOUR FRIEND'S PAST SEMESTER's PROJECT -- THEY ARE DIFFERENT -- do not look at them for project guidance and process; it is an **Academic Conduct violation.**
2. i.e. **DO YOUR OWN WORK from scratch from your given Excel; no help from others**. ALL THE GUIDANCE for your (this semester's) project is in this document and the Sample Deliverables posted in BlackBoard – **you must follow these instructions to the latter**. Not doing so would lead to point deductions in the project.
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8. **YOU DO NOT NEED TO DOWLOAD ANY DATA.** To save you time to work on your International Portfolio construction, the instructor have downloaded a set of **Foreign Exchange (FX)** currency data, **foreign stock market index** data, **foreign stock market index mutual funds** and **foreign market exchange-traded funds (ETF)** data. These data have been "cleaned up" and **date-synchronized** across all countries.
9. Not following all of the above instructions will lead to **ZERO score** in this individual project.
10. Any **violation** of Academic Conduct during this Project will lead to an automatic **failure** in this course.

Reminder:

- **For Phase 1, you only need to declare your selected stock markets, i.e. Step #1 by the due date …**
- … the sooner you declare, the more choices you have on picking your preferred markets for your International Portfolio: I am trying to discourage students from having a portfolio with the same set of countries [OK to have an overlap of up to three countries].
- Once approved [via my *Internal Messages* reply], you can proceed to the remaining steps in Phase 1.
- The entire project has **4 Phases**; each Phase will be time-released to keep pace with successive lectures. **The entire project may be submitted any time BEFORE due date**; see assignment folder for due date.

As the class declares their portfolios, I will update them periodically and re-post these declarations to BlackBoard.

Step #2A Global Investments: about the concept of *"home", HQ,* and Reporting Currency *RC*

<no deliverable in this step; just overall comments on this project and International Investment in general>

a) Once an individual investor, an institutional fund manager, or a company operates outside of the country from which she is physically located, she becomes a global investor or global company.

b) **Home, Domestic, Foreign may not be the same thing**. As the portfolio or company gets bigger and more extensive in its operation, this is not a straight-forward designation or concept. For example,

i) **Chiquita** Brands International, founded in **Boston** in 1870, became a **Swiss** producer and distributor of bananas and other produce. It was headquartered in Charlotte, North Carolina, **U.S**.

- Its bananas are grown in Central America and the Caribbean; its operating currencies are from those respective countries.
- In October 2014, it was acquired by Cutrale and Safra Group, **Brazil**.

ii) **Fyffes**, founded in **London** in 1888, is a **Japanese**-owned [Sumitomo Group] fruit and fresh produce company headquartered in Dublin, **Ireland**. PS: do you see any banana plantations in Ireland?

- Her fruits are sourced from the Canary Islands, Brazil, and Central America; so it involved various foreign operating currencies.
- PS: in 2014 March, it agreed to merge with Chiquita but terminated that transaction a year later.

iii) In the case of ***Portfolio Management***, the manager/institution might be domiciled [HQ] in **Singapore**, operates out of Zurich, **Switzerland**, its portfolio assets denominated in **Euros** and custodian-ed with Merrill Lynch Wealth Management in the **U.S.**, but chose to construct an emerging/developing market portfolio asset allocation in the **Brazilian**, **Chinese**, **Indian**, **Mexican**, **and Vietnamese financial markets**.

c) **The world is your oyster**. From the above multi-national situations, it become clear that the operating environment and arrangement can become complicated very quickly. Using the above example [iii], let us review the following relevant terms with regard to any multi-national entity or portfolio investments:

- **Domicile** — The national origin of the entity: Singapore.
- **HQ** — The declared operating headquarter: Switzerland.
  Significance: company registration, regulation.
- **Reporting Currency *RC*** — Portfolio valuation, performance of assets.
  Significance: financial reporting and taxation.
- **Local Currency *LC***, — Currency of the country.
- **Functional Currency *FC***, — Primary currency of the economic environment in which it operates.
- **Other Currency *OC*** — Transactions in another country other than *LC* and *FC*.

In *Portfolio Investment*, these three are typically the same. For example, if the manager purchased Chinese stocks, it is priced in Yuan. So, in Swiss terms, Yuan is the *LC*, *FC*, as well as the *OC*.

But if it is a **manufacturing company** it is very common for them to be different:

- Factory located in, wages paid in Indonesia: *LC* = Rupiahs.
- Raw material/parts imported from supplier subsidiary: *FC* = Yuan.
- Finished goods priced/sold to foreign markets: *OC* = Euro.

d) **<u>In this International Equity Portfolio Project</u>**, our situation are as follows:

- HQ = U.S — Our classroom environment in this project.
- RC = U.S — Overall International Portfolio risk-adjusted returns measured in US$.
- LC = FC = non-U.S — U.S + the your other selected foreign markets.
  Asset allocation traded/priced in respective foreign market currencies:
  - Stock market <u>indexes</u> always priced in the market's currencies.
  - <u>Mutual</u> funds data [from Fidelity and Vanguard] for that foreign market already priced in US$.
  - <u>Exchange-Traded</u> Funds data for that foreign market already priced in US$.

  Eventually, the HPYs of your chosen foreign markets are calculated in *RC*:
  - Performance comparison plots based on *RC* values.
  - Each risk-return calculated based on *RC* values.
  - Correls among the markets are also calculated based on *RC* value.

e) **Why U.S as RC?**

- As stated in Step #1, there is a long history of financial investment products availability -- part of this project has to do an empirical study of the relative performances of each of the selected stock markets around the world …
- … we really need at least fifteen years of data to see the ups-and-downs of the markets over more than one economic cycle.
- Just as important, we need sufficient years to get a reliable, long-run coefficient of correlation data among the stock markets -- this would give us a better idea of where to look for risk reduction in an international portfolio context …
- … and in the case of an international portfolio, we can certainly achieve higher returns with reduced risk [as measured by portfolio standard deviation] compared to a domestic portfolio, especially if an investor is from U.S. or Europe [take a look at the annual HPYs of their respective stock market indexes: SP500, DAX, CAX, FTSE, et al].

f) **How to do a non-U.S RC?**

- In this project, we want to start your International Portfolio with *RC* = US$ …
  - This is because of data availability -- the instructor have gone through the laborious task of collecting, cleaning, and "lining up" the data across all financial markets,
  - The investable markets data [mutual funds and ETFs] are already in US$.
  - This greatly simplifies the method on International Portfolio construction, calculations, and analysis behind it [dealing this this currency].
- … once you understood this process, you can take an **additional pre-step** to **convert** the given data **into your chosen *RC***, e.g. Euro, Yuan, Pound, etc.
- Then do the same steps as in this *International Portfolio Project* -- all your results would be denominated in this *non-US$ RC*.
- IMPORTANT: with the same Asset Allocation in a specific set of markets, your *US$-RC* results <u>will be different</u> from your *non-US$-RC* results. This is because it is denominated in another currency -- part of your International Portfolio returns will always be composed of the "currency gains/losses" with respect to your chosen *RC*, regardless of Dollar, Euro, or Yuan.
- The instructor will make further comments on this process when we visit the lecture topic on *"Global Performance Measure and Attribution"*.

Step #2B Download/collect the data set: exchange rates, benchmark funds, stock market funds

a) According to the dates or thereabouts (due to certain national holidays) in Step #1d (iv), …

b) … according to your declared international stock markets in Step #1a, …

c) … and according to Step #1d, collect these markets'
   i) Currency exchange rate against the $,
   ii) Stock market index,
   iii) Stock market ETF.

d) These beginning of the month data set should be arranged in row format. For example:

	U.S.		e.g. China			*… the other markets' data*
Date	S&P500	SPY	Yuan/$	Shanghai	FXI	
01/01/2000			*data*	*data*	*data*	
02/01/2000			*data*	*data*	*data*	
:			:	:	:	
:			:	:	:	
CM/01/*CY*			*data*	*data*	*data*	

PS: The illustrated data in this entire document may be different from your assignment data because of **actual date** you will be doing your assignment. It also depends on your choice of markets used in your assignment. Where ***CM*** refers to *current month* of the actual date of your assignment, and ***CY*** refers to the *current year* of the actual date of your assignment, you last monthly data point should be ***CM/01/CY***.

e) **Good news: I have downloaded and cleaned up all the above data. The Excel data file consists of data for 16 international stock markets** [from which you include U.S and also pick the other markets for your International Portfolio]**.**

Once you completed **Phase 1 Step #1a** with your proposed set of countries, you will be provided with **your instructor-provided personalized copy of your "starter template and data" Excel file.** This should save you a lot of time and effort not doing the data collection … then use it to complete all the remaining steps in the project.

f) Organization of your Excel and its Worksheets

- Do not rename your instructor-given personalized "starting template & data" Excel filename.
- Do not delete those existing worksheets and its red banner.
- Do not start from your own new Excel file and copy over those worksheets and data.
- **Use that existing "Deliverables" worksheet to consolidate** all your deliverable results and charts. It makes it easier for the instructor to grade them. See instructions in "**Step #18 The Entire Project's Deliverables**"
- Those worksheets should be **arranged as is** at the beginning of your Excel. You are **free to create additional worksheets to the right** to implement all the steps in the project. Some typical organization:
  - One worksheet for each Step of the Project,
  - One worksheet for each market,
  - One worksheet for each required Deliverable of the Project.
  - … or whichever way makes sense. It is up to you and it must be your own work.

End of Phase1

to be continued: more Steps will be released when we do more lectures …

<… don't panic; a few steps at a time and you have to keep up with the lectures, readings, and problem sets>

Step #3 Discussion: where should you invest?

This step does not require you to calculate or plot anything. It explains why we should invest globally and how we can do it via investable mutual funds and/or exchange-traded funds (ETFs).

a) Short answer, **"The World Is Your Oyster: don't limit your investments to your domestic market".** And for sure, the U.S is not the best/only market a diversified investor should invest in. PS: risks might also be higher in other markets.

b) In the case of **American domestic investors**, despite the size of the economy (nominal $22+ trillion, 2021) and the depth and breadth of its developed financial markets (very active, liquid, efficient, and transparent), they should still look beyond their borders. Reasons:
- Low GDP growth rate (2% ~ 3% during very good years) …
- … the rest of the world on average is much higher than this.
- Market saturation in certain sectors; growth-constrained …
- … extending market footprint, higher margins and earnings can be sought overseas.
- Currency issues, especially during prolonged periods of weak U.S$ relative to other foreign currencies.
- Further diversification possible.
- Even partial reduction in systematic risk for a domestic U.S. investor.

c) In the case of **Chinese domestic investors**, despite past and current phenomenal annual growth (6% ~ 12%) of her economy and financial markets, they should still look beyond their borders. Reasons:
- Choices of investments not as diverse as the financial markets are still being developed.
- Market risk might be too high.
- Market volatility might be unacceptable.
- Recent slowing economic growth. PS: 6+% is still a good rate.
- Unexpected government intervention in the market can create more market uncertainties.
- Periods of political risks and uncertainties.
- Currency issues, especially during periods of weak Yuan relative to other foreign currencies, and/or unexpected "Yuan devaluation and revaluation" by the Chinese central bank.
- Diversification benefits are available outside domestic market …
- … in fact, capital preservation via "flight to safety" outside of China has been a strong trend during the past two decades.

d) In the case of **domestic investors from the rest of the world (non-U.S, non-China)**, there are just as many reasons for them to look beyond their borders:
- Much smaller economy …
- … choices of domestic investments might be limited …
- … corresponding market liquidity might be an issue. ➔ PS: if you are from Singapore, Indonesia, Vietnam, Thailand et al, then even more/stronger reasons to venture beyond your borders.
- Market risk might be too high.
- Market volatility might be unacceptable.
- Domestic currency might be too weak and/or volatile. ➔ PS: if you are a Russian or a Turkish billionaire with assets in rubles and liras respectively, should you diversify your holdings?
- Lack of governmental, judicial, and infrastructure institutions to foster smooth succession and transfer of power from one government to the next. This can typically lead to inconsistent long-term economic planning and stifles the growth trajectory of the economy.
- Diversification benefits and capital preservation are certainly available outside their domestic market.
- PS: referring to any/most of the above reasons, e.g. if you are from Philippines or Venezuela, you might have good investor reasons to be nervous.

e) Two common ways to invest in a particular country are to purchase that country's broad (stock) market index either through a closed-end **mutual fund** or through and **exchange-traded fund (ETF)**.

f) So, as a first step in our *International Equity Portfolio Project*, let us examine what kinds of "pearls" we can find by comparing the historical returns of some **key U.S. stock index funds** against outside-of-U.S (commonly called "**ex-U.S funds**") and **global index funds**. These investable funds are priced in U.S. dollars:

- **DIA†** Called "Diamonds", this ETF tracks the U.S. **Dow-30** Index. Consists of 30 "blue chip" stocks, considered the most "solid" and long-running American companies representing the whole U.S. economy and industries.

- **SPY†** PS: not used in Step #4 but listed here. Called "Spiders", this ETF tracks the U.S. **S&P 500** Index, 500 American companies who are leaders (market cap, revenue, earnings) in their respective industries. In a later step, you will have a chance to use this as a **benchmark** against your constructed international portfolio. Instead we will use the broader **VTSMX** index which is representative of SPY below.

- **QQQ†** Called "Cubes", this ETF tracks the "top-100 U.S" high tech companies listed in the **NASDAQ** stock market.

† *In Yahoo! Finance website, the market index **search notation** for the Dow30 index is **^DJI**, the S&P500 is **^GSPC**, and the NASDAQ is **^IXIC**. In this project documentation, it is conveniently notated with the alternate, more **recognizable ^Dow30**, **^SP500** and **^QQQ** respectively.*

- **VIEIX** This is the "Vanguard **Extended Market** Index" mutual fund. It tracks the entire U.S-only midcap and smallcap stock market. This is the complement to S&P500.

- **IWM** This ETF tracks the U.S **Russell-2000** Index of small market capitalization companies.

- **VTSMX** This is the "Vanguard **U.S Total Stock Market** Index" mutual fund. It tracks the entire U.S.-only (domestic) stock market. It is the broadest U.S. index which covers all of the above. PS: VIEIX + SPY approximately equals the entire U.S stock market [this VTSMX].

- **VBMFX** This is the "Vanguard **U.S Total Bond**" mutual fund. It is made of practically risk-free U.S. Treasurys [67%] and good credit quality corporate bonds. This is the only non-equity fund. It is included as part of your survey to provide a "low" benchmark of returns against the other funds and your international portfolio. It also offers **extremely good coefficient of correlation** measure with the equity asset classes.

- **VGTSX** This is the "Vanguard **Total International Stock** Index" mutual fund. It tracks the rest of the world excluding the U.S (i.e. "ex-U.S"). As of 06/09/2025 the allocation:
  - Country-wise: 15% Japan, 10% UK, 9% China, 7% Canada, 6% France, 6% Switzerland, 5% Germany, 5% Taiwan, 6% India, 5% Australia, 3% Korea, 3% Netherlands, …, etc.
  - Region-wise: 40% Europe, 26% Emerging Markets, 25% Pacific, 7% CanMex, 0.5% ME.

  PS: VTSMX + VGTSX = entire world.

- **VHGEX** This is the "Vanguard **Global Equity** Mutual Fund". It tracks the entire world (including the U.S). As of 06/09/2025, the allocation:
  - Country-wise: **60% US**, 4.5% UK, 4.4% Netherlands, 4.0% China, 3.5% Japan, 4.0% France, 2.5% Taiwan, 2.2% Canada, 2.5% Korea, 2.3% Germany, 1.0% Denmark, 1.6% Switzerland, …, 1.1% Ireland, 0.9% Hong Kong, 0.6% India, 0.6% Italy, … 0.2% Israel.
  - Region-wise: 62% North America, 22% Europe, 8% Pacific, 8% Emerging Markets.

  The one fund for the whole world? Is this all you need? Maybe.

Additional **U.S. capitalization-based** mutual funds. It is useful to see how they performed against the above broader-based indexes:

- **VWNFX** This is the "Vanguard U.S **Large Cap <u>Value</u>** Index" mutual fund. PS:
  - Stocks can be classified as "growth", "value", or a "blend" of the latter two.
  - Also, all large cap value stocks are in S&P500 but not all S&P500 stocks are value stocks as S&P500 also contains other growth and blend stocks.
  - Why do we make these distinctions? Historically, as you will see once you compute and plot these funds, they each have different aggregate performance over long holding periods …
  - … so, one "style of investment" for portfolio Asset Allocation can be based on choosing between value, growth, or blend. In particular, this is a common practice used in market-timing and "asset rotation".

- **VISVX** This is the "Vanguard U.S **Small Cap <u>Value</u>** Index" mutual fund.

- **NAESX** This is the "Vanguard U.S **Small Cap <u>Blended</u>** Index" mutual fund, i.e. a mix of growth and value small cap stocks.

g) With the above investable funds, global investors should ask the following **questions**:

(i) Do **U.S-only** funds (DIA, SPY, QQQ, IWM, VTSMX et al) outperform the rest of the world?
- If the answer is "yes", then "stay home?" …
- … if the answer is "no", then "leave home" but "go where"?

(ii) Conversely, do the **rest-of-the-world** (ex-U.S) funds (VGTSX et al) outperform U.S? Investors would still be faced with the above yes-no answers.

(iii) In any case, in a more holistic approach, should you have a **mix** of U.S-only and non U.S? i.e. invest in global funds such as VHGEX?

h) For the **U.S-component of your *International Portfolio***, you will need to **select from ONE** of the above U.S index funds: **DIA, SPY, QQQ, IWM, or VTSMX**.
PS: even though we will use the S&P500 Index and its SPY fund as **benchmarks** against your portfolio, if you choose to, you can still include SPY as one of your portfolio component choices -- if you do so, the plots will have "one less line", for example:

- ✓ In Step #5, ^HQ and ^SP500 is the same line,
- ✓ In Step #7, ETF [HQ] and SPY [SP500] is the same line,
- ✓ In Step #16, HQ[US] and SP500 is the same line.

On the other hand, if you did not choose SPY as a component in your International Portfolio's component, for example DIA as in this documentation, then you will have "separate lines" in your plots – HQ [DIA] and SPY; ^HQ and ^SP500; ETF [HQ] and SPY [SP500]; HQ [US] and SP500; etc.

Step #4 Survey of investments around the world -- comparing performance of various U.S, non-U.S, and Global Funds: on the same chart calculate and plot the indexes of these funds

a) So, as a first step in our International Equity Portfolio Project, let us examine what kinds of "pearls" we can find by calculating, plotting and then **comparing the historical returns** of these key U.S. stock index funds against outside-of-U.S (commonly called "ex-U.S") and global index funds.

b) **Common-Base Indexes (CBI)** are defined and base-lined in a number of different ways. Since we will be plotting performances as a rate of return, our Baseline Index is defined as *"the HPY since beginning of observation date 1/1/2000".*

c) This will allow us to compare all our funds from this **common starting point and date**. Note that these index funds are already (traded) in U.S. Dollars, i.e. no foreign to domestic currency conversion.

- Define the first traded price of the fund at the beginning of the observation date as p(0).
- Let all subsequent monthly traded fund prices be p1, p2, p3, and so on. Generically these fund's traded prices are notated as *p(t)* for the tth monthly observation.
- Then the respective funds' index value at a particular time *t*, i.e. ix_t, can be calculated as:

$$ix_t = \frac{p_t}{p_0} \times 100$$

d) In effect, the fund index ix_t is really the Holding Period Return HPR_t [baselined at 100] for successively longer and longer holding periods (in months) since the beginning of the observation date.

e) The following is an Excel-like numerical example of calculating **VBMFX**'s CBI values:

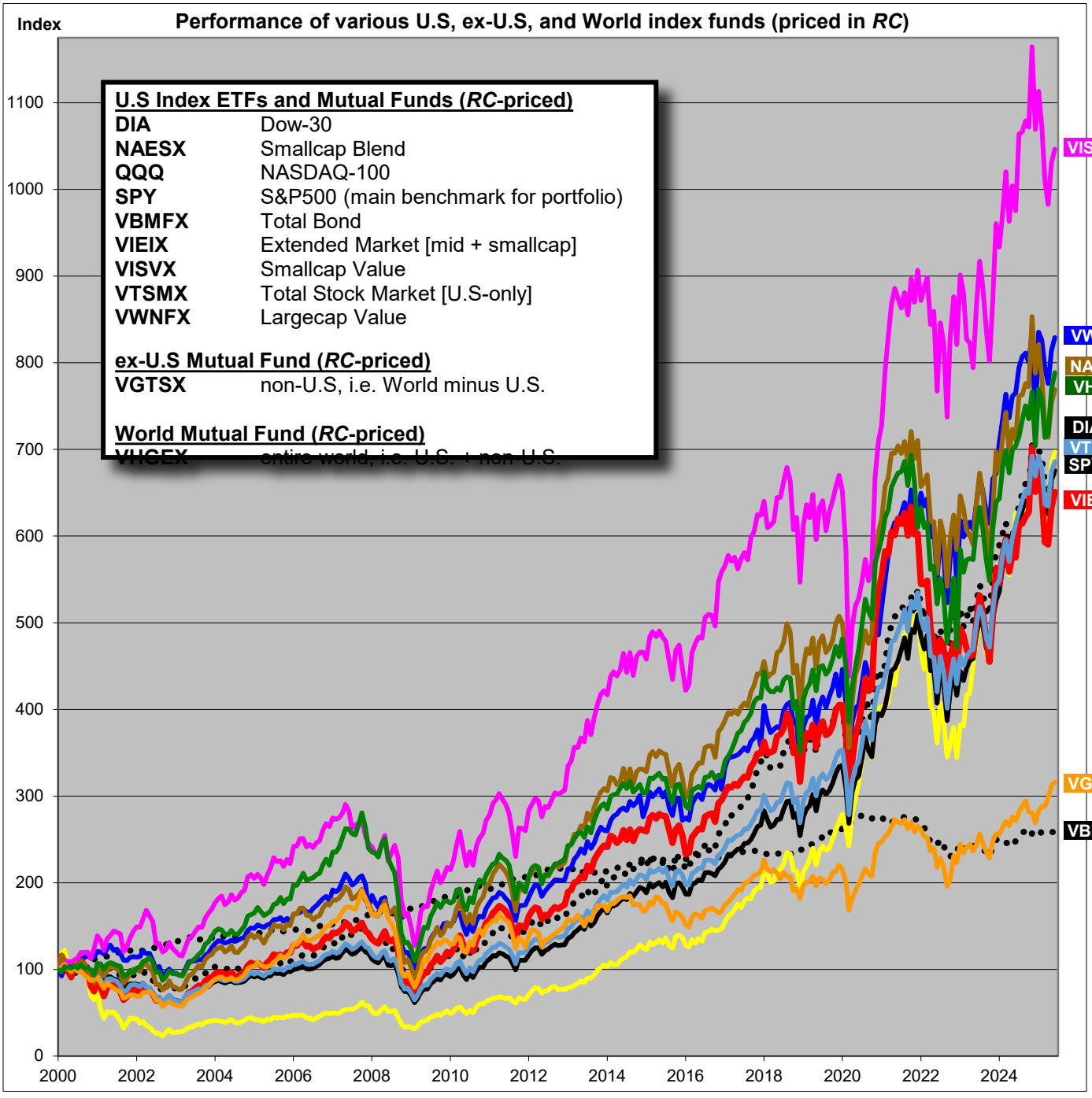
Column:	A	B	C	D	E
Row	Period t	Observed Date	[U.S.] **VBMFX** mutual fund	Calculated **VBMFX CBI**	Comments & instructions
1	0	01/01/2000	3.6900	**100.00**	Cell C1: this is p(0), the base value. Cell D1: the CBI starts at 100.00 at the beginning of observation period.
2	1	02/01/2000	3.7300	**101.08**	Cell D2: CBI = (C2/C1)*100 = 101.08.
3	2	03/01/2000	3.7800	**102.44**	Cell D3: CBI = (C3/C1)*100 = 102.44.
	:	:	:	:	For each period t, we take its stock price p(t) and always divide by p(0), the base value, not the previous observation's stock price. i.e. we are not calulating the change in in stock prices from one period to the next but the change from current period p(t) from the base value p(0).
	n-1	*prev month*	9.5300	**258.27**	Tips: A convenient way to calculate each CBI value is to use (Cn/$C$1) * 100, where Cn is the cell of the current row, and $C$1 is a way to lock on to the p(0) base value cell.
	n	*CM/01/CY*	9.5200	**257.99**	The final period.

PS: The illustrated data in this entire document may be different from your assignment data because of **actual date** you will be doing your assignment. It also depends on your choice of markets used in your assignment. Where ***CM*** refers to *current month* of the actual date of your assignment, and ***CY*** refers to the *current year* of the actual date of your assignment, your last monthly data point should be ***CM/01/CY***.

f) **Repeat** the above process for calculating each column of CBI values for the **DIA**, **SPY**, **NAESX**, **QQQ**, **VIEIX**, **VISVX**, **VTSMX**, **VWNFX, VGTSX**, and **VHGEX** funds.

e) Use your personalized Excel file's "**Deliverables**" **worksheet** to plot all your calculated funds' CBIs from (e) and (f) on the same chart in this worksheet. PS: for subsequent Steps and Phases, consolidate all the required (deliverable) charts and summary tables in this worksheet. The following is an example is this CBI plot:

[HQ = US, RC = USD, ETF = DIA] / Benchmark = SP500 [SPY]



e) How to read the CBI chart of these funds:

- At beginning of observation period, the index starts at 100.
- Stocks are priced individually in **absolute** dollar terms. By baselining it from 100, this allows us to plot stock performances **relative** to each other from a **common starting point** and also against the S&P500 and Dow30, which are our benchmarks.
- Upward trend indicates the stock price increase.
- An index of 245 at time t, for example, indicates that the fund has increased by 145% from its original value since the beginning of the observed period, i.e. $HPR_t = 2.45$ and $HPY_t = 145\%$.

f) Some observations. Over the **past 24 years** [PS: past performance does not guarantee future performance]:

- VBMFX, the **U.S. Total Bond fund**, is included to illustrate the "slow-and-steady" low returns [due to high credit quality] over this long holding period. We use it here as a ***low volatility*** benchmark to contrast the much larger "roller coaster rides" of the other stock index funds.

- The holding period yield (HPY) of **QQQ** [NASDAQ-100] is 0% till 10/01/2013. This is due to the dot-com Internet bubble during the 1990s. It peaked at around $96 [adjusted close] on 3/1/2000 and bottomed at around $18 [adjusted close] in 9/1/2002. Since breaking even on 11/1/2013, it has maintained a sharp, steady climb in-between small corrections to catch up with the other indexes. It has a 200% HPY since May 2020. In 2023, it climbed the steepest overtaking both ^SP500 and ^Dow30.

- Although only 30 stocks, the Dow-30 [**DIA**] outperformed S&P500 [**SPY**] in the **long run**.
  PS: The Dow-30 is a subset of S&P500, i.e. they are all components of the S&P500.

- Through VIEIX, a **combination of MidCap + Small Cap** typically outperformed Dow-30, but not the past 5 years.

- Through VWNFX, **LargeCap <u>Value</u>** stocks underperformed MidCap + SmallCap and the Dow30.

- Through NAESX, a **Blend of SmallCap** stocks, they outperformed the other major U.S stock indexes [Dow-30, S&P500, NASDAQ]. However, it is **extremely volatile** due to the growth/bust nature of some of the component stocks in this index.

- Over long holding periods, VISVX, a **SmallCap <u>Value</u>** Indexed fund, had phenomenal returns. However, its volatility is the highest of all the indexed funds.

- Since **VTSMX** tracks the **total U.S stock market**, it is somewhat the **broad average** of the performances of DIA, SPY, QQQ, and NAESX funds.

- **VGTSX**, which tracks the rest-of-the-world **non-U.S** stocks, "tends" to underperform most of the U.S-only index funds indicating that the U.S economy has been generally better (robust might be the better word) than the rest of the world. In particular, Europe and China has been looking "weak and problematic" [to be fair, all countries including the U.S., has their own problems], while the emerging markets are significantly impacted by concerns of "weaker Chinese demand, slowing global growth, weakening currency against the U.S. dollar".

- The **VHGEX** global fund [U.S + rest-of-the-world] outperformed the **complementary** pair of VTSMX and VGTSX funds, but it is also a very volatile fund.

- Ranked in this order from highest/lowest "**Beta**" -- VISVX, VWNFX, NAESX, VHGEX, DIA, VTSMX, SPY, QQQ, VIEIX, VGTSX, and VBMFX -- during a bull market, these funds **rise highest/lowest**. And during a bear market, these funds **drop steepest/shallowest**. One implication of this is that:
  - **Asset Allocation** (benefits of diversification),
  - **Fund Rotation** (picking outperformers),
  - In particular **sector rotation** (riding on economic/business cycles for certain industries),
  - Along with **market timing** (when to rotate),

  are the hallmark practices and investment decision-making/execution of a good fund manager.

- **Covid-19**. There is a "**sharp-V**" at the beginning of 2020 for ALL stocks and market indexes. The market peaked around February 18, 2020. ***The market dropped 30% in 30 days BUT*** has quickly recovered [for some stocks and sectors] most of those loses three months later and went on to exceed

the pre-Covid19 highs of the respective indexes. PS: subsequent "waves" of Covid infections (Delta, Omicron, etc.) also caused (down-up) see-saw volatility in the markets.

- **Ukraine (2022 Spring Break)**. The global community and financial markets just doesn't seem to get any good breaks:
  - After two years of COVID, 2020 and 2021, with available vaccinations, the waning of Delta and the emergence of the less lethal Omicron, it looked like the global economy has bottom-ed …
  - … with the beginning of the first two months of 2022 and "living with COVID", the financial markets rebounded somewhat -- see the right side of the small "V" of the plots.
  - IT DID NOT LAST LONG -- the week before Spring at the end of February:
    + **Russian troops** (nearly 200K) **entered Ukraine**,
    + **Economic and financial sanctions on Russia,**
    + **Curbs on Russian oil imports** put further strain on the global supply of oil.
    + **COVID BA2 variant** emerges in East Asia and Europe -- infections rates were exceedingly high in Hong Kong, etc.
  - The financial markets started multiple weeks of declines and dropped about 16% by late Spring [3/20/2022] -- a little inverted "V" with a down trend).
  - We entered the back half of 2022 [Q3 and Q4] as the year of "***persistent Inflation and energy shortage***".

- **2022 Summer**. It rebounded about 6% from that multi-wee decline and has been trading sideways since early Summer [06/07/2022] -- **volatility and uncertainty in the financial markets will continue in the near term** … probably pending oil shortage situation as well as easing of inflation pressure -- yes, quite a bit of uncertainty in the near term.

- **2022 Q3, Q4**. We entered the back half of 2022 as the year of "***persistent Inflation and energy shortage***".

- **2023**. The beginning of this year did not look good due to continued Inflation persistence and signs of weaker economic data. But by the end of this year, the market rallied and defied these expectations; pushed higher by Artificial Intelligence and an actual more robust than expected U.S. economy.

- **2024**. NASDAQ, SP500, and Dow30 has reached all-time highs. Now what? Are there further momentum to push the market even higher?
  - **Artificial Intelligence**. The AI "revolution" [or over-hype?] picked up a lot of momentum in 2024. It can carry the stock market for several future quarters but eventually, actual performance (earnings report) of these AI companies must justify the stock market valuation -- if not, the market should correct downwards.

- **2025**. It will be an interesting year – new U.S. administration, foreign policy and tariff imposition is causing a lot of market uncertainty and volatility – start of a weaker economy and market correction in U.S? → the European equity market is looking relatively more attractive than the U.S?

g) Going further back, the following are 10-year annualized decade returns [1930 ~ 2009] of S&P500, the U.S total stock market, and some capitalization-based indexes:

	30~39	40~49	50~59	60~69	70~79	80~89	90~99	00~09	1930 ~2013
S&P500	-0.1%	9.2%	19.4%	7.8%	5.9%	17.5%	18.2%	-0.9%	9.7%
Total Market	-0.2%	9.6%	18.2%	8.3%	6.1%	16.7%	18.0%	-0.3%	9.7%
Large-Cap Value	-5.7%	12.7%	18.4%	9.4%	12.9%	20.6%	16.8%	4.1%	11.2%
Small-Cap Blend	2.3%	14.9%	19.2%	13.0%	9.2%	16.8%	15.5%	9.0%	12.7%
Small-Cap Value	-2.6%	19.8%	19.6%	14.4%	14.4%	20.1%	16.2%	12.8%	14.4%

Some investment lessons can be drawn from 80 years of [U.S] market history:

1) 10-year holding period is based on the famous maxim from Warren Buffet, "don't buy something unless you would be willing to hold on to it if the market shuts down for 10 years". Also, a 10-year period tends to cover an entire economic cycle.

2) When measured in such 10-year increments, the **market was up most of the time**: 28 were positive, and only 4 were negative.

3) The market can have **many successful decades in a row**, i.e. prolonged bull runs. Most investors remember that the 1990s produced very high returns for equities, but this this table showed even better returns in the 1980s.
4) **Leading and lagging asset classes sometimes change places**. This makes it hard to pick just one and be confident it will always be on top:
    - In the 1960s, small-cap and small-cap value stocks clearly led the way. They did the same from 2000 through 2009.
    - However, the 1970s were led by large-cap value and small-cap value. In 1950s, 1980s, and the 1990s, every asset class in this table produced double-digit returns; and the 1940s came close.

5) The **most consistent high-performance winner was small-cap value stocks**:
    - Except for the 1930s, this asset class produced decade-long gains that were over 12.5% …
    - …in only one decade, the 1930s, did this group had a negative return. And if you adjust it for inflation, that group's returns were actually positive: up 1.4%.
    - Warning: it is however very volatile; you need to have a very long holding period on it.

6) The first 10 years of this century has been regarded as a "**lost decade**" for stock investors, largely because of large-cap growth stocks and a couple of serious bear markets. But in that decade, a portfolio that was divided equally among these four asset classes wound up being a moneymaker, with an average gain of 6.7%.

7) With regard to the **total stock market index**, this index is too broad (entire market). Although it is well diversified, it sometimes suffers from **low returns** (even underperforms S&P500 half the time). This is because not all stocks in the market are great performers:

    i) Nearly half of the small-cap stocks in this index are growth stocks, representing an asset class that historically had underperformed the S&P500, not outperformed it.
    ii) And there is only 3% of small-cap value stocks in this index. This is the component that typically outperforms S&P500.

8) On the other hand, S&P500 is a collection of 500 of the largest companies by market capitalization. These companies don't get this big by accident; they had created market-perceived value through revenues, earnings, future growth prospects over time.

9) Over the last 80 years, **"beating the market" has been very easy if you regard the S&P500 Index as the market**.

10) The adage that **investors get paid to take risks** seems to be working just fine:

    - ✓ Large-cap value stocks are riskier than S&P500, and they returned more.
    - ✓ Small-cap growth stocks are riskier than large-cap value stocks, and they returned even more.
    - ✓ Small-cap value stocks are the riskiest among these asset classes, and they had the highest long-term return. Including this component in your portfolio can significantly boost your portfolio returns.

11) More than 90% of your ultimate investment return depends of **Asset Allocation**.

12) Because of (10) and (4), it is impossible to know which assets class will do the best next week, next month, next year, or even the next decade. But there is magic in combining all four of these in one portfolio. Over 84 years from 1930 through 2013, this group of four **boosted annual returns from 9.7% to 12.0%**. If you think that is not a big deal, think compounding effect of Time Value of Money (TVM): a **$1,000** investment in 1930,

at **9.7%**, grew to **$2.4 million** …
… while at **12.0%**, grew to **$13.6 million**.

These [U.S] investment lessons can be **applied to non-U.S markets** in the following ways :

- In particular, the **Chinese markets** is at its infancy …
  - … with gradual market reforms and liberalization, you are sowing seeds that will benefit from a similar return pattern many decades later.
  - The **challenge** remains screening for good small-cap and large-cap value stocks …
  - … at the moment, there are a lot of inefficient/failing publicly-traded companies and in most industries, they have yet to go through the consolidation phase to weed out the weak competitors.
  - In particular, since 2020, there seems to seem "tighter" government regulation and oversight of the high-tech and Internet companies …
  - … this, coupled with the need to get a better handle on bitcoins and virtual currencies, has caused some uncertainties and market correction to certain stock in the market.
- So, your portfolio must be committed to **extremely long holding periods in "auto-pilot mode"** [ideal for investing for retirement] while seeking further diversification in the U.S., European, and Emerging markets.

h) PS: even though the various U.S stock market indexes (as a whole) did not outperform the rest-of-the-world index funds, **your portfolio should still consist of some U.S stocks or funds**:

- ✓ There are quite a lot of individual U.S stocks which are **phenomenal performers** (e.g. high-tech, biotech, energy, financials, consumer discretionary, etc.) above the broad U.S stock indexes. So, individual stock-picking, if done correctly, could enhance your portfolio returns.
- ✓ There are also quite a few stocks which pay out consistent/increasing quarterly dividends with **attractive dividend yields (better than money market rates and T-bill yields)**. These stocks can provide **income** and be part of the **defensive** stocks in your portfolio.

i) **Conclusion: you should invest globally**, i.e. domestic, U.S, China, and rest-of-the-world …
… which is how your *International Portfolio Project* is structured:

- U.S. ,
- + probably China, much riskier (volatility) and need a longer horizon,
- + a few other countries.
- ***= in its totality, i.e. "overall portfolio context", it is possible to achieve higher-than-US returns by taking on a little bit more diversified risk.***

End of Phase2

to be continued: more Steps will be released when we do more lectures …
<… don't panic; a few steps at a time and you have to keep up with the lectures, readings, and problem sets>

Step #5 Stock market index as a proxy of a country's economy: on the same chart, in addition to the S&P500 benchmark index, calculate, plot and compare your chosen foreign stock market indexes (in local currency)

a) In most sizeable economies where there is a developed stock market, there is typically a constructed (country) stock market index. Its purpose is to capture the collective performance of a set of domestic stocks. The stocks that are included in this index are typically leaders in their respective industry sector. By doing so, **a country's stock market index is an indicator of the country's economic health**: when the country's overall economy performs well, these stocks tend to perform well.

In the case of the U.S., due to the size of her economy and the breadth and depth of her financial markets (more than one stock market: NYSE, NASDAQ, AMEX, PHLX, PCX), as stated earlier in Step #3, there are actually more than one important stock market indexes: Dow-30, S&P500, NASDAQ, Russell-2000, Wilshire-5000, etc. In other countries, there is typically one stock market with its associated index:

• China	Shanghai Stock Exchange Composite Index	^SSEC
• France	CAC-40 [Paris]	^FCHI
• Germany	DAX-30 [Frankfurt]	^GDAXI
• Japan	Nikkei 225 Index [Osaka]	^N225
• etc.		

Note: these country stock market indexes are constructed in their respective **local currencies** and are **not investible**.

b) So, let us examine and compare the historical performance of the U.S stock market (S&P500 as the benchmark index) to that of our chosen foreign stock markets. This will give us a better idea of the relative performance of these countries' stock market indexes and where we should invest.

c) In a similar fashion as Step #4, we will calculate **Common-Base Indexes (CBI)** for each of the country stock market indexes.

- Define the first stock index at the beginning of the observation period (i.e. t0) as *idx0*.
- Let all subsequent monthly stock market index values be *idx1*, *idx2*, *idx3*, and so on. Generically these stock indexes are notated as idx(t) for t^{th} monthly observation.
- Then a particular country's stock market index CBI value at a particular time *t*, i.e. idx_t, can be calculated as:

$$idx_t = \frac{idx_t}{idx_0} \times 100$$

- In effect, the stock market index's CBI value at idx_t is really the Holding Period Return HPR_t [baselined at 100] for successively longer and longer holding periods (in months) since the beginning of the observation date.
- Column C and D is an Excel-like numerical example of calculating **S&P500's** CBI values:

Column:	A	B	C	D	E
Row	Period t	Observed Date	**^SP500** stock market index	Calculated **^SP500 CBI**	Comments & instructions
1	0	01/01/2000	1,394.46	**100.00**	Cell C1: this is idx(0), the base value. Cell D1: the CBI starts at 100.00 at the beginning of observation period.
2	1	02/01/2000	1,366.42	**97.99**	Cell D2: CBI = (C2/C1)*100 = 97.99.
3	2	03/01/2000	1,498.58	**107.47**	Cell D3: CBI = (C3/C1)*100 = 107.47.
	:	:	:	:	For each period t, we take its stock index value idx(t) and always divide by idx(0), the base value, not the previous observation's stock price. i.e. we are not calulating the change in in stock prices from one period to the next but the change from current period idx(t) from the base value idx(0).
	n-1	*prev month*	5,911.69	**423.94**	Tips: A convenient way to calculate each CBI value is to use (Cn/$C$1) * 100, where Cn is the cell of the current row, and $C$1 is a way to lock on to the idx(0) base value cell.
	n	*CM/01/CY*	6,000.36	**430.30**	The final period.

PS: The illustrated data in this entire document may be different from your assignment data because of **actual date** you will be doing your assignment. It also depends on your choice of markets used in your assignment. Where ***CM*** refers to *current month* of the actual date of your assignment, and ***CY*** refers to the *current year* of the actual date of your assignment, your last monthly data point should be ***CM/01/CY***.

d) **Repeat** the above process for calculating each column of CBI values for ^DJI and for each of your selected "foreign markets"; use the respective chosen foreign stock market index data to calculate their respective CBI values for each period.

*PS: In Yahoo! Finance website, the market index **search notation** for the Dow30 index is **^DJI**, the S&P500 is **^GSPC**, and the NASDAQ is **^IXIC**. In this project documentation, it is conveniently notated with the alternate, more **recognizable ^Dow30**, **^SP500** and **^QQQ** respectively.*

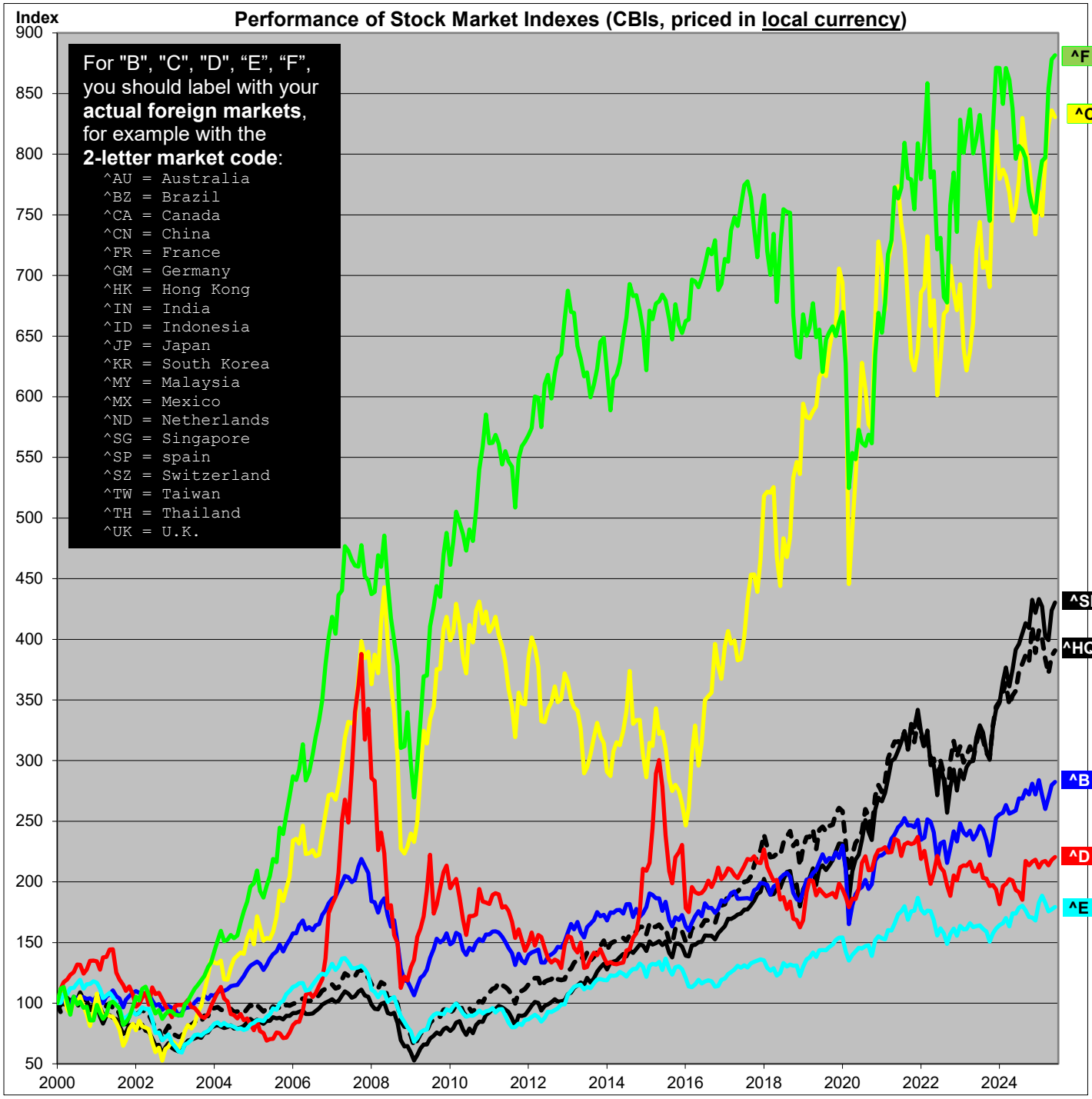
e) Since each chosen country's stock market index values are in their respective domestic currency, the calculated **stock market index CBI values will also be in their respective local currency**. i.e. they are yet to be adjusted to total (U.S.) dollar Reporting Currency (RC) returns; see next Step.

f) Then plot all your calculated chosen Country Stock Market Index CBI on the same chart.

- ✓ *PS: instead of ^B, ^C, ^D, etc. you should label yours with the actual 2-letter country code, e.g. ^BZ, ^CN, ^GM, etc.*
- ✓ *Reminder: when plotting the Country Stock Market Index, the FX, and the Country Fund CBI charts [Steps #5 thru #7], you should adopt the stated **"Color-coding Conventions for alphabetically-ordered Market Plots"** in page 2. Not doing so will lead to point deductions.*

The following is an example:

[HQ = US, ^HQ = ^Dow30] / Benchmark = ^SP500



g) How to read this Country Stock Market CBI chart:

- Note: If you choose to invest in S&P500 in U.S (HQ), then ^HQ and ^SP500 are one same line. See also Step #8.
- Our common-base index (CBI) for all country stock market starts at 100.
- By baselining it from 100, this allows us to plot from a **common starting point** and date to compare other country stock market indexes against the S&P500 and Dow30, which are our benchmarks.
- Upward trend indicates an increase in the value of the country stock market index.
- An index of 350 at time t, for example, indicates that the particular index has increased by 250% since the beginning of the observed period, i.e. HPY_t = 250% and HPR_t = 3.50.

Step #6 Foreign currency (FX) is the second component of your return: on the same chart, plot each of the foreign currency's index against the U.S. $

a) When a domestic investor invests in a foreign equity, it is typically priced in that country's foreign currency. Hence, in addition to the rate of return of the foreign stock (denominated in foreign currency), **the second component of the return of this foreign equity is the increase/decrease in the value of this foreign currency (FX) relative to the investor's reporting currency *RC***, i.e. **FX gains/losses**. In this regard, the reporting currency denominated rate of return of a foreign investment can be **decreased/negated** by FX losses. Conversely, an FX gain can lead to an **enhanced** return of that foreign investment.

b) Let the foreign currency's (*fc*) common-base index (CBI) be defined as "the U.S. $-price of this currency starting at 100". PS: reminder, in this project, *HQ* = US and *RC* = USD.

- Define the first exchange rate at the beginning of the observation period (at time t0) as *e0*.
- Let all subsequent monthly exchange rates be *e1*, *e2*, *e3*, and so on. Generically these exchange rates are notated as e_t for tth observation.
- Then the foreign currency's CBI value against the $ at a particular time *t*, notated as ix_t, can be calculate as:

  If exchange rate is quoted as $/*fc* (e.g. $/£), use this: $$£\ ix_t = \frac{e_t}{e_0} \times 100$$

  If exchange rate is quoted as *fc*/$ (e.g. Yuan/$), use this: $$Yuan\ ix_t = \frac{e_0}{e_t} \times 100$$

  Thus the foreign currency CBI calculation is dependent on whether *fc* is in the numerator or the denominator of the exchange rate quotation versus the $.

- PS: since all foreign currency CBI values are priced relative to the U.S dollar, you do not need to calculate the US$ index. This is always a "flat line" of 100 for all periods.

Column:	A	B	C	D	E
Row	Period t	Observed Date	**FX** $/£	Calculated **£ CBI**	Comments & instructions
1	0	01/01/2000	1.6270	**100.00**	Cell C1: this is e(0), the base exchange rate. Cell D1: the CBI starts at 100.00 at the beginning of observation period.
2	1	02/01/2000	1.6150	**99.26**	Cell D2: CBI = (C2/C1)*100 = 99.26.
3	2	03/01/2000	1.5849	**97.41**	Cell D3: CBI = (C3/C1)*100 = 97.41.
	:	:	:	:	If the $ is in the numerator in the exchange rate, in this case it is [$/£], we take this exchange rate and always divide by e0, not the previous observation's exchange rate (i.e. we are not calculating the change in FX from one period to the next but the current FX from the baseline e0). PS: if the $ is in the denominator in the exchange rate [e.g. Yuan/$], then we always take e0 and divide by each row's exchange rate.
	n-1	*prev month*	1.3273	**81.58**	Tips: A convenient way to calculate each CBI value is to use (Cn/$C$1) * 100, where Cn is the cell of the current row, and $C$1 is a way to lock on to the e(0) base value cell.
	n	*CM/01/CY*	1.3460	**82.73**	The final period.

- **Repeat** the above process for each of your selected "foreign stock markets" using the respective exchange rate data and the appropriate formula to calculate their foreign currency CBI values. PS: if more than one of your chosen foreign (EU) stock market uses the same common €uro currency [e.g. France, Germany, Italy], then you will have fewer FX CBIs and its plots.

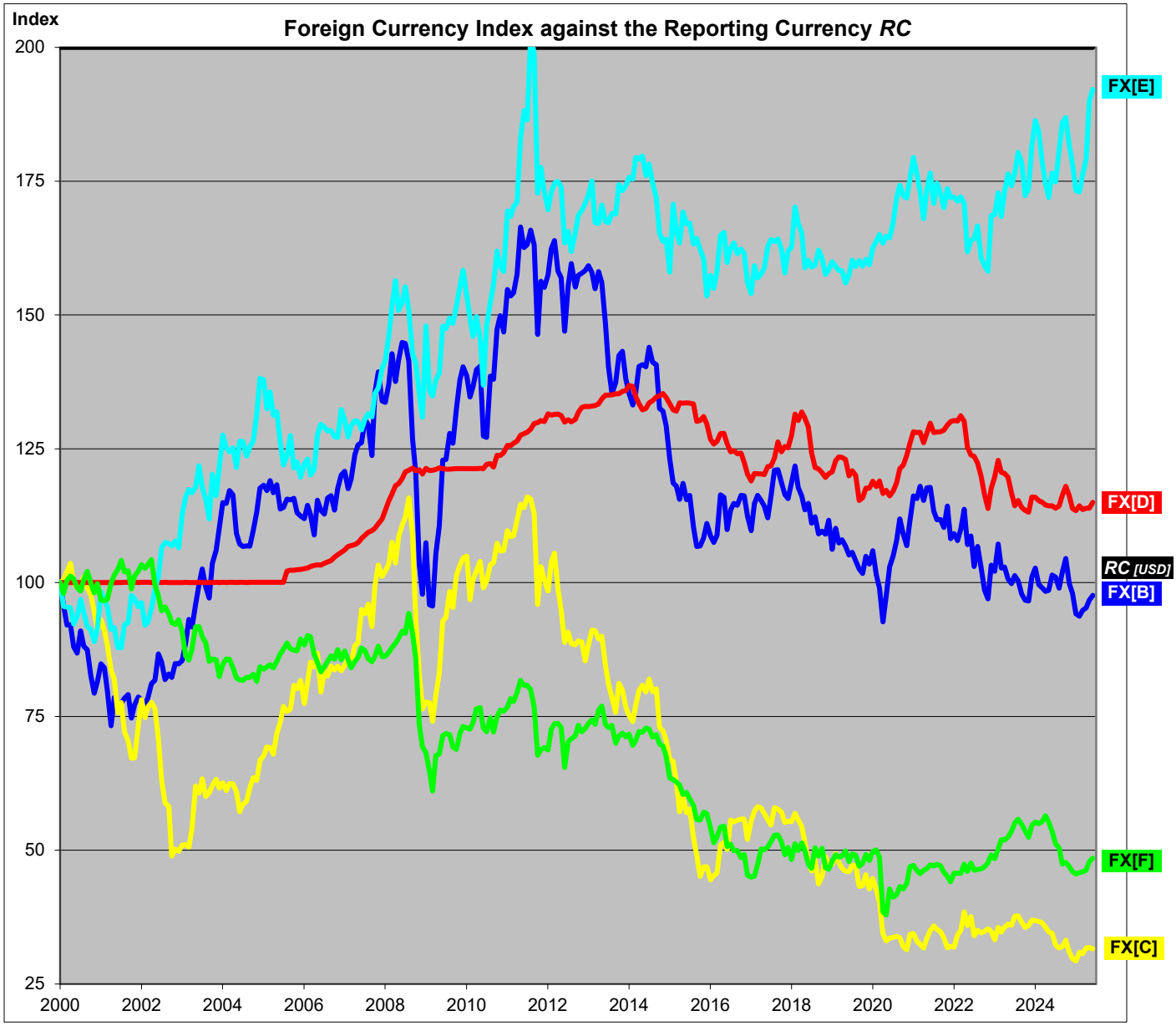
- PS: since all foreign currency CBI values are priced relative to the U.S dollar, you do not need to calculate the US$ index. This is always a "flat line" of 0 for all periods.

c) Then plot all your calculated *fc* currency CBIs on the same chart.

- ✓ *PS: instead of FX[B], FX[C], FX[D], etc., you should label yours with the actual 2-letter country code, e.g. FX[BZ], FX[CN], FX[GM], etc.*
- ✓ *Reminder: when plotting the Country Stock Market Index, the FX, and the Country Fund CBI charts [Steps #5 thru #7], you should adopt the stated **"Color-coding Conventions for alphabetically-ordered Market Plots"** in page 1. Not doing so will lead to point deductions.*

The following is an example:

[HQ = US, RC = USD]



d) How to read this Currency Index chart:

- Our common-base index (CBI) for all currencies starts at 100…
- … this allows us to compare currencies from a common starting point and date.
- A "flatline" probably indicates that the currency was pegged during that period.
- Upward trend indicates the foreign currency strengthening against the U.S. $ …
- … for example, CBI of 250 indicates that particular currency has increased by 150% against the $ since the beginning of the observed period, i.e. and HPY_t = 150% and HPR_t = 2.50.

Step #7 Investing in foreign markets via U.S. $-denominated country funds: on the same chart calculate and plot all your chosen Country Fund Indexes

a) As stated in Step #5, all **stock market indexes are not investable**. They are just indexes constructed from the prices of a set of its domestic stocks for the purpose of indicating the performance of that country's stock market. Over time, a number of large American fund management companies (Fidelity; Vanguard; PIMCO; BlackRock, etc.) had created **foreign country (non-U.S) funds priced in U.S. Dollars which tracks the respective foreign country's stock market index**. Some of these funds are even available for retail in other countries [typically at a costlier price (due to lower transaction volume)].

b) So, let us examine and compare the historical performance of the U.S stock market (SPY) and that of our chosen foreign country funds.

c) In a similar manner as Steps #4 and #5, we will calculate **Common-Base Indexes (CBI)** for each of your chosen country funds.

- Define the first traded price of the country fund at the beginning of the observation period (i.e. t0) as *fund0*.
- Let all subsequent monthly traded fund prices be *fund1*, *fund2*, *fund3*, and so on. Generically these country fund's traded prices are notated as $fund_t$ for t^{th} observation.
- Then the country fund's CBI values at a particular time t, i.e. CBI_t, can be calculate as:

$$CBI_t = \frac{fund_t}{fund_0} \times 100$$

- The following Column B and C is an Excel-like numerical example of this process:

Column:		A	B	C	D	E
Row	1	Period t	Observed Date	Country Fund EWZ **ETF**	Calculated Brazil **CBI**	Comments & instructions
	1	0	01/01/2000	7.74	**100.00**	Cell C1: this is fund(0), the starting base value. Cell D1: CBI starts at 100.00 at beginning of observation period.
	2	1	02/01/2000	8.34	**107.76**	Cell D2: Index = (C2/C1)*100 = 107.76.
	3	2	03/01/2000	8.41	**108.74**	Cell D3: Index = (C3/C1)*100 = 108.74.
		:	:	:	:	For each period t, we take its fund price fund(t) and always divide by fund(0), the base value, not the previous observation's fund price. i.e. we are not calulating the change in fund prices from one period to the next but the change from current period fund(t) from the base value fund(0).
		n-1	*prev month*	27.21	**351.74**	Tips: A convenient way to calculate each CBI value is to use (Cn/$C$1) * 100, where Cn is the cell of the current row, and $C$1 is a way to lock on to the fund(0) base value cell.
		n	*CM/01/CY*	27.72	**358.34**	The final period.

c) **Repeat** the above process for each of your selected foreign country funds as well as the U.S benchmark SPY; use the respective country fund price data to calculate their respective country fund CBI values for each period. Note: in this document, the US-selected fund is DIA, which is the ETF[HQ] of the following plot.

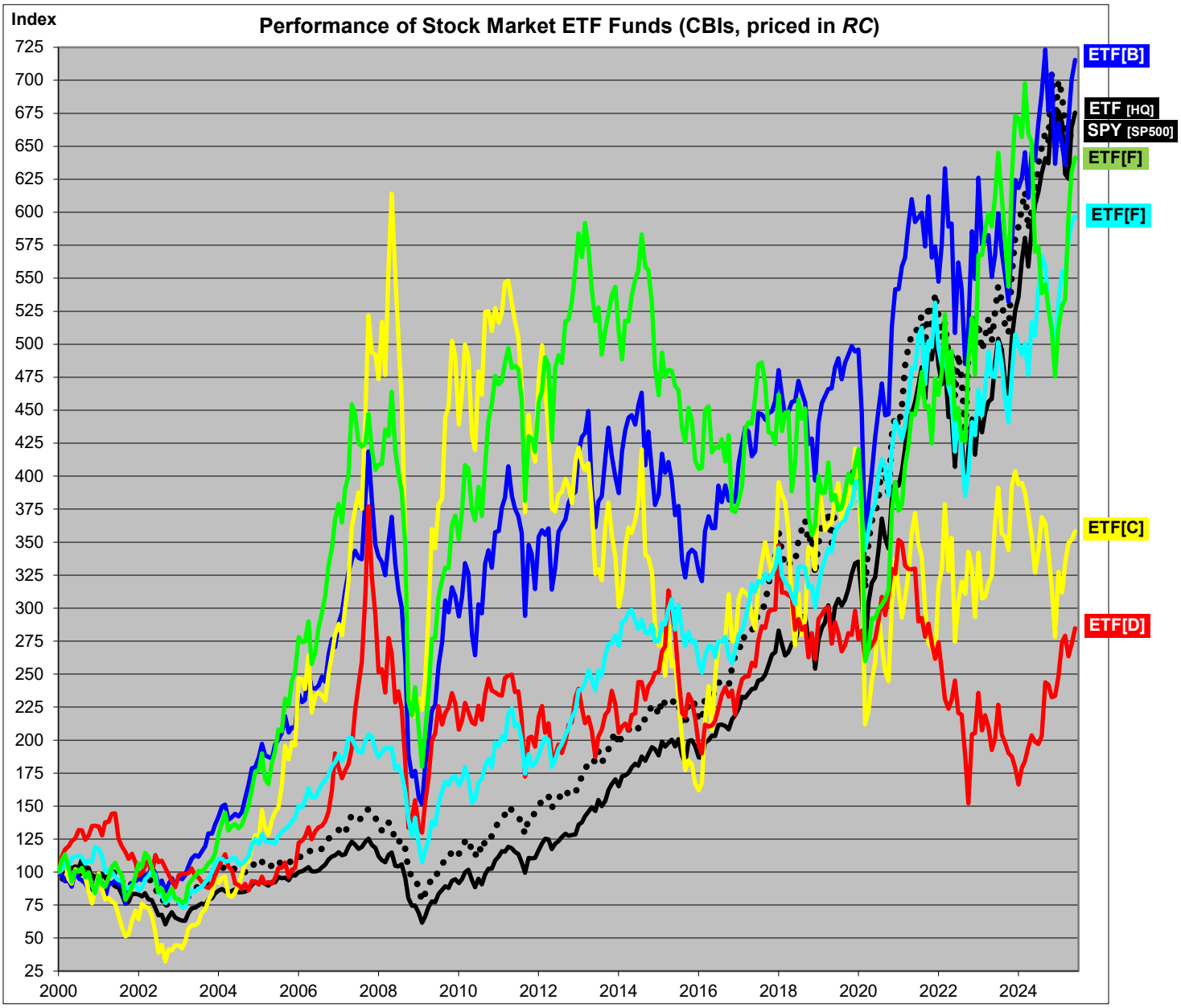
d) Then plot all your calculated Country Funds' CBIs PLUS the benchmark SPY fund's CBI (calculated) in Step #4 on the same chart.

- ✓ *PS: instead of the following ETF[B], ETF[C], ETF[D], you should label yours with you actual 2-letter country code, e.g. BZ[EWZ], CN[FXI], GM[EWG], etc.*

✓ *Reminder: when plotting the Country Stock Market Index, the FX, and the Country Fund CBI charts [Steps #5 thru #7], you should adopt the stated* ***"Color-coding Conventions for alphabetically-ordered Market Plots"*** *in page 1. Not doing so will lead to point deductions.*

The following is an example:

[HQ = US, RC = USD, ETF = DIA] / Benchmark = SP500 [SPY]



e) How to read the CBI chart of these funds:

- Our common-base index (CBI) for all funds starts at 100 on …
- … this allows us to compare funds from a common starting point and date.
- Upward trend indicates an increase in the value (price) of the fund …
- … for example, an index of 450 indicates that particular fund has increased by 350% since the beginning of the observed period, i.e. or HPY_t = 350% and HPR_t = 4.50.

End of Phase3
to be continued: more Steps will be released when we do more lectures …
<… don't panic; a few steps at a time and you have to keep up with the lectures, readings, and problem sets>

Step #8 Declare your International Equity Portfolio Weights

- From Phase1, you had already declared U.S + the other markets as component markets in your International Equity Portfolio.

- Using this set of markets, you will be actually constructing **TWO** International Equity Portfolios:

  (1) An International Equity Portfolio made up of Foreign **Country Stock Market Indexes**. We assume that these stock market indexes are local currency-weighted and priced in their respective foreign currency. As you will see in the next step, calculating the total $-return involves a %return on these indexes and their corresponding appreciation or depreciation in their respective currencies relative to the U.S. Dollar. Note: this is your "theoretical" International Equity Portfolio; it is an **impracticable, unattainable, uninvestable portfolio** for an individual investor to build due to the following reasons:
    - May not have access to some of the components of the foreign stock market index.
    - May not have access to cost-effective foreign currencies (to purchase foreign stocks).
    - Foreign stock market index may be constructed from hundreds/thousands of stocks …
    - …insufficient funds/resources to replicate that foreign stock market index.

  (2) An International Equity Portfolio made up of Foreign **Country ETFs**. Since ETFs are already priced in $s, the $-return is a straightforward calculation. Note: this is your **practical**, **investable International Equity Portfolio**. Your country components in this portfolio is made up of country funds; these funds are created by fund retailers (Fidelity, Vanguard, Black Rock, etc.) and readily available to individual investors via the purchase of the countries' respective ETFs or mutual funds. In a later part, we will address the issue if the country ETF is a good proxy of that country's stock market index, whether the performance of the country ETF "closely mirrors" its country stock index, i.e. how correlated are they? If not, then investors risk "buying the wrong product (country ETF) intending to get the performance (exposure) of that country's stock market".

- The portfolio weights for both portfolios should be identical, and the total percentage allocation of all the countries should add up to 100%. For example:

Markets	**U.S.**	**MarketB**	**MarketC**	**MarketD**	**MarketE**	**MarketF**
Stock Index Portfolio	†	**^B**	**^C**	**^D**	**^E**	**^F**
ETF Portfolio	‡	**ETF[B]**	**ETF[C]**	**ETF[D]**	**ETF[E]**	**ETF[F]**
Portfolio Weights	20%	15%	15%	15%	15%	20%
TOTAL	**= 100%**					

	S&P500	Dow30	NSDAQ	Russ2K	UStotMkt
† Choose from one of the U.S. stock indexes:	^GSPC,	^DJI,	^IXIC,	^RUT,	^W5000.
‡ Use index funds from the same column as chosen †:	SPY,	DIA,	QQQ,	IWM,	VTSMX.

Note: In U.S, if you choose S&P500 (the main benchmark), then some of the plots will be one instead of two lines.

PS: In Yahoo! Finance website, the market index **search notation** for the Dow30 index is **^DJI**, the S&P500 is **^GSPC**, and the NASDAQ is **^IXIC**. In this project documentation, it is conveniently notated with the alternate, more **recognizable ^Dow30**, **^SP500** and **^QQQ** respectively. And replace the above B, C, D, E, (F if required) with you selected markets, for example B is BZ, C is CN, D is GM, E is JP, (F if required, is UK).

Note: portfolio weights do not have to be evenly distributed across each market. For simplicity, I am using nearly equal weighting for each market above. But you want to make sure your Excel's weight cells are "variable" cells that drive the re-calculation of the portfolio's weighted returns.

Step #9 Construct the Country ETF Portfolio and calculate various data

a) For each country, calculate the **periodic (monthly) Holding Period Yields (HPYs)** of its ETF.

- Define the first ETF price at the beginning of the observation period as *etf0*.
- Let all subsequent ETF prices be *etf1*, *etf2*, *etf3*, and so on. Generically these ETF values are notated as etf_t for t[th] observation.
- Then the ETF's HPY during period (month) *t*, i.e. HPY_t, can be calculate as:

$$HPY_t = \frac{etf_t}{etf_{t-1}} - 1$$

where *t* is a specific period (month) and *t-1* is its previous period.

- The following is an Excel-like numerical example of this process for Brazil ETF's HPYs:

Column:	A	B	C	D	E
Row	Period t	Observed Date	[Brazil] Adj Close EWZ **ETF**	**Calculated monthly HPY**	Comments & instructions
1	0	01/01/2000	7.74	**-**	Cell C1: this is etf(0) beginning value. Cell D1: start of observation date, no HPY yet.
2	1	02/01/2000	8.34	**7.76%**	Cell D2: HPY1 = (C2/C1) - 1 = 7.76%. This is the HPY during period 1.
3	2	03/01/2000	8.41	**0.91%**	Cell D3: HPY2 = (C3/C2) - 1 = 0.91%. This is the HPY during period 2.
	:	:	:	:	For each period t, we are just calculating the HPY_t of this period, i.e. the percentage change from p_{t-1} to p_t.
	n-1	*prev month*	27.21		Once you have set up the Excel formula to calculate the periodic HPY in cell D2, just drag this cell all the way down to the last period to calculate the rest of the periodic HPYs.
	n	*CM/01/CY*	27.72	**1.87%**	The final period.

- Repeat the above process for each of your chosen Market ETFs.
- You will also need to calculate monthly HPYs of SPY, VBMFX, VTSMX, VHGEX, VGTSX for Step #15.

b) Calculate the **periodic (monthly) HPYs of your weighted Market ETF Portfolio**.

- From (a), you have calculated the periodic monthly HPYs of each Market ETF.
- Let each $HPY[\$ETF]_{it}$ denote the periodic HPY for Market ETF *i* during period *t*.
- Then the periodic (monthly) HPY of yourMarket ETF Portfolio, $HPY[ETFportfolio]_t$, can be calculated as the weighted average return of all the market components in it:

$$HPY[ETFportfolio]_t = w_{1t} \times HPY[\$ETF]_{1t} + w_{2t} \times HPY[\$ETF]_{2t} + \ldots + w_{nt} \times HPY[\$ETF]_{nt}$$

- The following is an Excel-like numerical example of this process:

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
	Weight: Country:	**20% U.S.**	**15% MktB**	**15% MktC**	**15% MktD**	**15% MktE**	**20% MktF**	**6-MktETF Portfolio**	**Bnchmrk U.S. ETF**
	Date	**%Δ$ETF**	**%Δ$ETF**	**%Δ$ETF**	**%Δ$ETF**	**%Δ$ETF**	**%Δ$ETF**	**%Δ$ETF**	**SPY**
0	01/02/2000	-	-	-	-	-	-	-	-
1	**02/01/2000**	**-7.19%**	**-2.94%**	**7.76%**	**11.70%**	**1.32%**	**9.23%**	**3.08%**	**-1.52%**
2	03/01/2000	7.89%	-4.24%	0.91%	5.00%	7.36%	3.87%	3.70%	9.41%
3	04/01/2000	-1.57%	0.63%	-12.81%	2.01%	-4.03%	-9.49%	-4.34%	-3.27%
:	:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:	:
n	*CM/01/CY*	1.38%	2.17%	1.87%	4.54%	0.83%	1.78%	2.05%	1.65%

For example, in cell H-1, during this period 1:

$$HPY[ETFportfolio]_1 = w_{U.S} \times HPY[\$ETF]_{U.S} + w_{MktB} \times HPY[\$ETF]_{MktB} + w_{MktC} \times HPY[\$ETF]_{MktC} + + w_{MktD} \times HPY[\$ETF]_{MktD} + w_{MktE} \times HPY[\$ETF]_{MktE} + w_{MktF} \times HPY[\$ETF]_{MktF}$$

$$= 20\%(-7.19\%) + 15\%(-2.94\%) + 15\%(7.76\%) + 15\%(11.70\%) + 15\%(1.32\%) + 20\%(9.23\%)$$

$$= \mathbf{3.08\%}$$

i) Repeat this process for each of the periods (i.e. rows of data).

ii) Note: you also need to set up and compute Column I. This is the periodic (monthly) HPYs of your benchmark portfolio using the S&P500 ETF "**SPY**". In a later Step #14, you will be required to calculate coefficient of correlation data between each Market ETFs and this U.S. ETF (SPY) Benchmark.

c) Calculate the **portfolio sample standard deviation of your Market ETF Portfolio**.

- From the table in previous step (b), the Excel formula for calculating the sample standard deviation is simply *STDEV(H1:Hn).*
- To be conservative, use STDEV, which calculates the sample standard deviation, as oppose to STDEVP which calculates the population standard deviation.

d) From previous (b) step's Column *H*, you have calculated the periodic (monthly) weighted HPYs of your Market ETF Portfolio. Now, use each of these HPYs to **calculate your Market ETF Portfolio's Common-base Index (CBI)**. In the final Step #15, you will need these values to plot and compare the performance of your portfolio against some of the U.S, ex-U.S, and global funds.

Let $HPY[ETFportfolio]_t$ be the periodic (monthly) weighted HPY of your Country ETF Portfolio [Column *H*] for period *t*. Then your Country ETF Portfolio's CBI value [Column *J*] for corresponding period *t* is:

$$CBI[ETFportfolio]_t = [(\text{previous period's CBI value} \div 100) \times (1 + \text{current period's ETF Portfolio HPY})] \times 100$$

$$= [(CBI_{t-1} \div 100) \times (1 + HPY[ETFportfolio]_t)] \times 100$$

where t and (t – 1) represents current and previous periods.
See Column *K* below for instructions on how to calculate the CBI values in Column *J*:

	A	*B*	…	*G*	*H*	*I*	*J*	*K*
	Weight: Country:	**20% U.S.**	…	**20% Mkt F**	**6-MktETF Portfolio**	**Bnchmrk U.S. ETF**	**ETF Portfolio**	**Comments**
	Date	**%Δ$ETF**	…	**%Δ$ETF**	**%Δ$ETF**	**SPY**	**CBI**	**Instructions for Column *J***
0	01/01/2000	-	…	-	-	-	**100.00**	CBI starts at 100 beginning date.
1	02/01/2000	-7.19%	…	9.23%	**3.08%**	-1.52%	**103.08**	= [(100.00/100) * (1+3.08%)] * 100
2	03/01/2000	7.89%	…	3.87%	**3.70%**	9.41%	**106.90**	= [(103.08/100) * (1+3.70%)] * 100
3	04/01/2000	-1.57%	…	-9.49%	**-4.34%**	-3.27%	**102.26**	= [(106.90/100) * (1+-4.34%)] * 100
:	:	:	:	:	:	:	:	once you set up the formula for
:	:	:	:	:	:	:	:	cell J-1, just drag this cell all the …
n	*CM/01/CY*	5.83%	…	1.78%	**2.05%**	1.65%	**701.07**	… way to the last period to replicate.

e) Calculate the **Holding Period $-Yield ($HPY) of your Country ETF Portfolio**. Continuing from the above, take the final period's CBI to do this calculation:

$$\$HPY \text{ (Country ETF Portfolio)} = [CBI(\text{final period}) - 100.00] \div 100$$

$$= [701.07 - 100.00] \div 100$$

$$= \mathbf{601.07\%}$$

f) For each of your selected market ETF fund, calculate the **Holding Period Yield ($HPY)** of its ETF. Although you can use the above steps (d) and (e), an easier way is to do the following:

- Define the first and last ETF value during the observation period as etf(0) and etf(last).
- Then the HPY of a particular Country ETF can be calculate as:

$$\$HPY = \frac{etf(last) - etf(0)}{etf(0)}$$

For example, using table (a)'s Brazil ETF data,

$$\$HPY_{Brazil} = (\$27.7200 - \$7.7400) \div \$7.7400 = \mathbf{258.1395\%}$$

- Repeat this process for your other selected Country ETF fund.

g) For each market, calculate the **average** of the periodic (monthly) HPYs of its ETF. This is notated as "Mth Avg".

- For example, continuing with MktB's ETF from table in step (b), the Excel formula for calculating the average is *AVERAGE(C1:Cn).*
- Repeat this process for each of your Market ETFs as well as SPY, VBMFX, VTSMX, VHGEX, VGTSX.

h) For each country, calculate the **sample standard deviation** of the periodic (monthly) rate of return of its ETF. This is notated as "Mth σ".

- For example, continuing with CountryB's Country ETF from table in step (b), the Excel formula for calculating the sample standard deviation is *STDEV(C1:Cn).*
- To be conservative, use STDEV, which calculates the sample standard deviation, as oppose to STDEVP which calculates the population standard deviation.
- Repeat this process for each of your Market ETFs as well as SPY, VBMFX, VTSMX, VHGEX, VGTSX.

i) Calculate the Sharpe Ratio of each Market ETF's during this Holding Period.

- The **Sharpe Ratio** is defined as "the excess return above risk-free rate (RFR), per unit of risk":

$$Sharpe\ Ratio = \frac{Mthly\ Avg\ - Mthly\ RFR}{\text{Mthly } \sigma}$$

As of 06/09/2025, the risk-free rate is about **4.500%** (10-year T-Bill Rate annualized); its **monthly rate** is approximately **0.3750%** (i.e. divide by 12).

For example, continuing with MktB's ETF from steps (g) and (h), MktB's Sharpe Ratio can be calculated as:

$$SharpeRatio_{CountryB} = (0.8568\% - 0.3750\%) \div 6.4270\% = \mathbf{0.0750}$$

i.e. 0.0750% risk-adjusted return per unit (1%) of risk.

j) Calculate the **coefficient of correlation** between each pair of Market ETF's %Δ$ETF.

- For example, from table in step (b), using Excel, the coefficient of correlation (ρ) between MktB and MktC is *CORREL(C1:Cn, D1:Dn)*

k) Calculate the **coefficient of correlation** between each Country ETF's %Δ$ETF and the U.S. Benchmark ETF (SPY).

- For example, from table in step (d), using Excel, the coefficient of correlation (ρ) between CountryB and SPY is *CORREL(C1:Cn, I1:In)*

Step #10 Summarize and Compile all Calculated Data of the Market ETF Portfolio

- We've done quite a bit of calculations from the previous steps. It is time to summarize these results into a compact readable table.

- The following is just one possible format; however, you do not have to follow this format:

6-Mkt ETF Portfolio Returns and Statistics [HQ = US, RC = USD]

	A	B	C	D	E	F	G	H	I
1		Market ETFs						6-Mkt ETF	Bnchmrk
2	AA	20%	15%	15%	15%	15%	20%	Portfolio	US SPY
3	HPY[USD]	576.53%	615.44%	258.34%	184.85%	496.91%	541.50%	601.07%	575.61%
4	Mth Avg	0.72%	0.86%	0.94%	0.61%	0.70%	0.87%	0.79%	0.73%
5	Mth σ	4.29%	6.43%	10.10%	7.39%	4.72%	7.09%	5.33%	4.46%
6	Sharpe	0.0806	0.0750	0.0558	0.0324	0.0687	0.0701	0.0769	0.0792
7	Mth RFR	0.38%	0.38%	0.38%	0.38%	0.38%	0.38%	0.3750%	0.3750%
8	Correl	US[DIA]	B[ETF]	C[ETF]	D[ETF]	E[ETF]	F[ETF]	0.82	
9	US[DIA]		0.71	0.57	0.39	0.74	0.68		0.95
10	B[ETF]			0.69	0.54	0.73	0.72		0.76
11	C[ETF]				0.46	0.55	0.66		0.63
12	D[ETF]					0.45	0.43		0.43
13	E[ETF]						0.65		0.77
14	F[ETF]								0.71
15								ρ(Mkt, US SP500)	

PS: you should replace the above "B[ETF]", "C[ETF]", "D[ETF]", etc. with your actual 2-letter country code, arranged alphabetically, for example, "BZ[ETF]", CN[ETF], GM[ETF], etc.

- How to read the above table of compiled data:

Columns B~G, Rows 3~6	Each of the Market ETF's risk-return characteristics.
Columns C~G, Rows 9~13	Coefficient of correlation (ρ) among pairs of Market ETFs.
Column I, Rows 3~6	Risk-return characteristics of the U.S. Benchmark Portfolio (SPY).
Column H, Rows 3~6	Risk-return characteristics of your Market ETF Portfolio according to the declared portfolio weights B2~F2. This should easily beat the U.S. Benchmark Portfolio; **strong reason to diversify your portfolio with international equities**.
Column I, Rows 9~14	Coefficient of correlation between each Market ETF and the U.S. Benchmark Portfolio (SPY).
Cell HI~8	Coefficient of correlation between the benchmark U.S. market S&P500 ETF (SPY) and your International ETF portfolio.

Step #11 Construct the Stock Market Index Portfolio and calculate various data

This is **very similar** to the previous step of constructing the Market ETF Portfolio. However, there is **one exception**: the individual Stock Market Indexes are in **local currency**. Therefore in order to get the periodic rate of **US$**-return of each Stock Market Index, you need to adjust it for appreciation or depreciation of the respective local currencies:

$$\text{US\$-return} = (1 + \text{StockMarketIndexReturn})(1 + \%\Delta FX) - 1$$

This step is explained in detail in the following segment (a).

a) For each market, calculate the **periodic (monthly) US$-rate of return** of its stock market index.

- Define the first index value during the beginning of the observation date as *idx0*.
- Let all subsequent stock index values be *idx1*, *idx2*, *idx3*, and so on. Generically these stock index values are notated as idx_t for t^{th} observation.

i) Calculate the periodic (monthly) index HPYs (local currency) during each period *t*:

$$HPY[Idx]_t = \frac{idx_t}{idx_{t-1}} - 1$$

See cell B-1 below.

ii) Calculate the appreciation or depreciation of the foreign currencies during each period t:

If the foreign currency is in the numerator, use this: $\%\Delta FX_t = \frac{e_{t-1}}{e_t} - 1$

e.g. Yuan/$

If the foreign currency is in the denominator, use this: $\%\Delta FX_t = \frac{e_t}{e_{t-1}} - 1$

e.g. $/£

where *t* and (*t*-1) is the data from the current and previous period respectively. See cell C-1.

iii) Using above (i) and (ii), we are now ready to calculate the periodic (monthly) US$-denominated HPYs of its stock market index:

$$\text{HPY\$Idx}_t = (1 + \text{HPY[Idx]}_t) \times (1 + \%\Delta FX_t) - 1$$

- The following is an Excel-like numerical example of this process:

	A	B	C	D	E
		Market E			
t	Observed Date	**(i) HPY[Idx]**	**(ii) %ΔFX**	**(iii) HPY$Idx**	Comments
0	01/01/2000	-	-	-	Start of holding period, no % returns yet.
1	02/01/2000	0.22%	-4.43%	**-4.21%**	(i) is in local currency; (ii) is in $
n-1	: : *prev month*	: : :	: : :		
n	*CM/01/CY*	0.41%	1.86%	2.28%	… the final period.

For example, in cell D-1, during period (month) 1, Market F's

$$\text{HPY\$Idx}_1 = (1 + 0.22\%) \times (1 + -4.43\%) - 1 = \textbf{-4.21\%}$$

Do this for each of the periods (months) for Market E.

- **Repeat** the above process for the other Market Indexes for each of the periods.

b) Calculate the **periodic (monthly) HPYs** of your weighted Market Index Portfolio.

$$HPY\$IdxPortfolio_t = w_{1t} \times HPY\$Idx_{1t} + \cdots + w_{nt} \times HPY\$Idx_{nt}$$

- The following is an Excel-like numerical example of this process:

	A	B	C	D	E	F	G	H	I
	Weight:	**20%**	**15%**	**15%**	**15%**	**15%**	**20%**	**6-Market Idx Portf**	**Bnchmrk U.S Index**
	Country:	**U.S**	**MktB**	**MktC**	**MktD**	**MktE**	**MktF**	HPY$Idx	**^SP500**
	Date	HPY$Idx	HPY$Idx	HPY$Idx	HPY$Idx	HPY$Idx	HPY$Idx		
0	01/01/2000	-	-	-	-	-	-	-	-
1	02/01/2000	-7.42%	-2.96%	8.36%	11.73%	-4.21%	9.61%	**2.38%**	-2.01%
:	:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:	:
n	*CM//01/YY*	1.17%	1.91%	-1.47%	2.14%	2.27%	1.65%	1.29%	1.50%

For example, in cell H-1, during this period 1 (month):

$$\begin{aligned} HPY\$IdxPortfolio_1 &= w_{U.S} \times HPY\$Idx_{U.S} + w_{MktB} \times HPY\$Idx_{MktB} + w_{MktC} \times HPY\$Idx_{MktC} \\ &\quad + w_{MktD} \times HPY\$Idx_{MktD} + w_{MktE} \times HPY\$Idx_{MktE} + w_{MktF} \times HPY\$Idx_{MktF} \\ &= 20\%(-7.42\%) + 15\%(-2.96\%) + 15\%(8.36\%) + 15\%(11.73\%) + 15\%(-4.21\%) + 20\%(9.61\%) \\ &= \mathbf{2.38\%} \end{aligned}$$

i) Repeat this process for each of the periods (i.e. rows of data).

ii) Note: you also need to set up and compute Column I. This is the periodic (monthly) HPYs of your benchmark portfolio using the ^S&P500 Stock Index. In a later Step #14, you will be required to calculate coefficient of correlation data between Country Indexes and this U.S. Benchmark Index.

c) Calculate the **portfolio sample standard deviation of your Market Index Portfolio**.

- From the table in previous step (b), the Excel formula for calculating the sample standard deviation is simply *STDEV(H1:Hn).*

- To be conservative, use STDEV, which calculates the sample standard deviation, as oppose to STDEVP which calculates the population standard deviation.

d) From previous (b) step's Column *H*, you have calculated the periodic (monthly) weighted rate of return of your Country Index Portfolio. Now, use each of these periodic returns to **calculate your Market Index Portfolio's Common-base Index (CBI)**. This step is identical to that done in Step #9(d) [Market ETF Portfolio]:

$$\begin{aligned} \textit{Index Portfolio } CBI_t &= [(\text{previous period's CBI value} \div 100) \times (1 + \text{current period's HPY\$IdxPortfolio})] \times 100 \\ &= [(CBI_{t-1} \div 100) \times (1 + HPY\$IdxPortfolio_t)] \times 100 \end{aligned}$$

where t and (t – 1) represents current and previous periods.

See Column *K* below for instructions on how to calculate the CBI values in Column *J*:

	A	B	…	G	H	I	J	K
	Weight: Country:	**20% U.S.**	…	**20% MktF**	**6-Mkt Idx Portf**	**Bnchmrk U.S Index**	**Index Portfolio**	**Comments**
	Date	**HPY$Idx**	…	**HPY$Idx**	**HPY$Idx**	**^SP500**	**CBI**	**Instructions for Column *J***
0	01/01/2000	-	…	-	-	-	**100.00**	CBI starts at 100 beginning date.
1	02/01/2000	-7.42%	…	9.61%	**2.38%**	-2.01%	**102.38**	= [(100.00/100) * (1+2.38%)] * 100
2	03/01/2000	7.84%	…	3.96%	**3.96%**	9.67%	**106.43**	= [(102.38/100) * (1+3.96%)] * 100
3	04/01/2000	-1.72%	…	-10.44%	**-4.08%**	-3.08%	**102.08**	= [(106.43/100) * (1+-4.08%)] * 100
:	:	:	:	:	:	:	:	once you set up the formula for
:	:	:	:	:	:	:	:	cell J-1, just drag this cell all the
n	*CM/01/CY*	1.17%	…	1.65%	**1.29%**	1.50%	**434.86**	way to the last period to replicate.

e) Calculate the **Holding Period $-Yield ($HPY) of your Market Index Portfolio**. Continuing from the above, take the final period's CBI to do this calculation:

$HPY (Market Idx Portfolio) = [CBI(final period) – 100.00] ÷ 100
= [434.86 – 100.00] ÷ 100
= 3.3486 × 100
= **334.86%**

f) For each of your selected market, calculate the **Holding Period Yield ($HPY)** of its Market Stock Market Index. Although you can use the above steps (d) and (e), an easier way is to do the following:

- Define the first and last Stock Market Index value during the observation period as idx(0) and idx(last). Note that this is in their respective local currency.

i) Calculate the HPY of that particular Stock Market Index (in local currency):

$$HPY = \frac{Idx(last) - Idx(0)}{Idx(0)}$$

ii) Calculate the appreciation or depreciation of the foreign currencies during observation period:

If the foreign currency is in the numerator, use this: $\%\Delta FX = \frac{e(0)}{e(last)} - 1$

e.g. Yuan/$

If the foreign currency is in the denominator, use this: $\%\Delta FX = \frac{e(last)}{e(0)} - 1$

e.g. $/£

where *e(0)* and *e(last)* refers to the FX at the beginning and at the end of the holding period.

iii) Using above (i) and (ii), we are now ready to calculate the HPY $-rate of return of its stock market index:

$$\$HPY = (1 + HPY) \times (1 + \%\Delta FX) - 1$$

- Repeat this process for each of your selected Stock Market Index.

g) For each market, calculate the **average** of the periodic (monthly) rate of return of its Stock Market Index. This is notated as "Mth Avg".

- For example, continuing with Market B's stock market index from table (b), the Excel formula for calculating the sample standard deviation is *AVERAGE(C1:Cn)*

- Repeat this process for each of your selected stock market index.

h) For each market, calculate the **sample standard deviation** of the periodic (monthly) rate of return of its stock market index. This is notated as "Mth σ".

- For example, continuing with Market B's stock market index from table (b), the Excel formula for calculating the sample standard deviation is *STDEV(C1:Cn)*
- To be conservative, use STDEV, which calculates the sample standard deviation, as oppose to STDEVP which calculates the population standard deviation.
- Repeat this process for each of your select Stock Market Index.

i) Calculate the Sharpe Ratio of each Stock Market Index during this Holding Period.

$$Sharpe\ Ratio = \frac{Mthly\ Avg\ - Mthly\ RFR}{\text{Mthly } \sigma}$$

j) Calculate the **coefficient of correlation** between each pair of Stock Market Index's HPY$Idx.

- For example, from table in step (b), using Excel, the coefficient of correlation (ρ) between Market B and C is *CORREL(C1:Cn, D1:Dn)*

k) Calculate the **coefficient of correlation** between each Stock Market Index's HPY$Idx and the U.S. Benchmark Index (^SP500).

- For example, from table in step (b), using Excel, the coefficient of correlation (ρ) between Market B and ^SP500 is *CORREL(C1:Cn, I1:In).*

Step #12 Summarize and Compile all Calculated Data of the Stock Market Index Portfolio

This table is identical to that of the Market ETF Portfolio: instead of using Market ETFs, here we are using Stock Market Indexes to build our International Equity Portfolio.

- We've done quite a bit of calculations from the previous steps. It is time to summarize these results into a compact readable table.

- The following is just one possible format; however, you do not have to follow this format:

6-Mkt Index Portfolio Returns and Statistics [HQ = US, RC = USD]

	A	B	C	D	E	F	G	H	I
1		Stock Market Indexes						6-	Bnchmrk
2	Weight:	20%	15%	15%	15%	15%	20%	Market	U.S.
3	HPY%Δidx	290.87%	182.36%	730.50%	120.54%	79.36%	781.63%	Index	Index
4	HPY%ΔFX	0.00%	-2.38%	-68.44%	15.01%	92.10%	-51.51%	Portfolio	^SP500
5	$HPY	290.87%	175.64%	162.14%	153.65%	244.55%	327.47%	334.86%	330.30%
6	Mth Avg	0.54%	0.48%	0.69%	0.56%	0.52%	0.67%	0.58%	0.58%
7	Mth σ	4.29%	5.43%	8.54%	7.11%	4.79%	6.26%	4.40%	4.40%
8	Sharpe	0.0385	0.0202	0.0369	0.0259	0.0307	0.0477	0.0469	0.0460
9	Mth RFR	0.38%	0.38%	0.38%	0.38%	0.38%	0.38%	0.3750%	0.3750%
10	Correl	US^Dow30	^MktB	^MktC	^MktD	^MktE	^MktF	0.75	
11	US^Dow30		0.52	0.48	0.27	0.59	0.49		0.95
12	^MktB			0.61	0.29	0.65	0.58		0.55
13	^MktC				0.25	0.48	0.63		0.50
14	^MktD					0.24	0.18		0.28
15	^MktE						0.48		0.59
16	^MktF								0.53
17									ρ(Mkt, US^SP500)

PS: you should replace the above "^MktB", "^MktC", "^MktD", etc. with your actual 2-letter country code, arranged alphabetically, for example, "^BZ", ^CN, ^GM, etc.

- How to read the above table of compiled data:

Columns B~G, Rows 3~8	Each of the Stock Market Index's risk-return characteristics.
Columns C~G, Rows 11~15	Coefficient of correlation (ρ) among pairs of Stock Market Indexes.
Column I, Rows 5~8	Risk-return characteristics of the U.S. Benchmark Index (^SP500).
Column H, Rows 5~8	Risk-return characteristics of your Stock Market Index Portfolio according to the declared portfolio weights B~G-2. This should easily beat the U.S. Benchmark Index; **strong reason to diversify your portfolio with International equities**.
Column I, Rows 11~16	Coefficient of correlation between each foreign Stock Market Index and the U.S. Benchmark Index.
Cell HI~10	Coefficient of correlation between the U.S Benchmark Index and your International Market Index portfolio.

Cell D5

The $-denominated HPY (Holding Period Yield) of this Market C. This return is made up of two components of return:

1) The HPY of this market's stock market index (local currency).
2) The currency appreciation or depreciation of this market's currency relative to the US$ during the holding period.

Thus $HPY = [(1 + HPY%Δidx) × (1+ HPY%ΔFX)] – 1.

For example, [(1 + 730.50%) × (1+ -68.44%)] – 1 = 175.64%.

Cells for the other markets' $HPY are defined and calculated in a similar fashion.

Step #13 Summarize Market-by-Market Performance Comparison: Index vs. ETF

- This is the final summary (1of3 table) of our entire project.

- The following is just one possible format; however, you do not have to follow this format:

	A	B	C	D	E	F	G	H	I	J	K
1	[RC =USD] Market-by-Market Performance Comparison: Index vs. ETF								Correl		
2	AA	Market	Idx/ETF	HPY[USD]	Mth Avg	Mth σ	Sharpe	Mth RFR	SP500	Market	Market
3	20%	U.S.	^Dow30	290.87%	0.54%	4.29%	0.0385	0.3750%	0.95	1.00	U.S.
4			DIA	576.53%	0.72%	4.29%	0.0806	0.3750%	0.95		
5	15%	MktB	^B	175.64%	0.48%	5.43%	0.0202	0.3750%	0.55	0.62	MktB
6			ETF[B]	615.44%	0.86%	6.43%	0.0750	0.3750%	0.75		
7	20%	MktC	^C	162.14%	0.69%	8.54%	0.0369	0.3750%	0.50	0.78	MktC
8			ETF[C]	258.34%	0.94%	10.10%	0.0558	0.3750%	0.63		
9	15%	MktD	^D	153.65%	0.56%	7.11%	0.0259	0.3750%	0.28	0.64	MktD
10			ETF[D]	184.85%	0.61%	7.39%	0.0324	0.3750%	0.42		
11	15%	MktE	^E	244.55%	0.52%	4.79%	0.0307	0.3750%	0.59	0.58	MktE
12			ETF[E]	496.91%	0.70%	4.72%	0.0687	0.3750%	0.75		
13	15%	MktF	^F	327.47%	0.67%	6.26%	0.0477	0.3750%	0.53	0.77	MktF
14			ETF[F]	541.50%	0.87%	7.09%	0.0701	0.3750%	0.69		

PS: you should replace the above "B", "C", "D", etc. with your actual 2-letter country code, arranged alphabetically, for example, "BZ", "CN", "GM", etc.

- How to read the above table of compiled data: most of the rows and columns are self-explanatory:

Column D~G, Row 3	Risk-return characteristics of the <u>un-investable</u> Stock Market <u>Index</u>.
Column D~G, Row 4	Risk-return characteristics of the corresponding <u>investable</u> Market ETF <u>fund</u>. Same for each pair of rows for each of the foreign markets B, C, D, E, etc.
Column I, Row3,5,7,9,11,13	The **coefficient of correlation (ρ)** between the <u>un-investable</u> U.S Benchmark <u>Index</u> **^SP500** and each of the respective <u>un-investable</u> Market <u>Index</u>. For example ^SP500 with ^B, ^SP500 with ^C, ^SP500 with ^D, ^SP500 with ^E, ^SP500 with ^F, etc.
Column I, Row4,6,8,10,12,14	The **coefficient of correlation (ρ)** between the <u>investable</u> U.S Benchmark ETF **SPY** <u>fund</u> and each of the respective <u>investable</u> Market ETF <u>fund</u>. For example EPY with ETF[B], SPY with ETF[C], SPY with ETF[D], SPY with ETF[E], SPY with ETF[F], etc.
Column J, Rows 3~4	The coefficient of correlation (ρ) between each of the <u>un-investable</u> Stock Market <u>Index</u> and its corresponding <u>investable</u> Market ETF <u>fund</u>. Same for each pair of rows for each of the foreign market B, C, D, E, F, etc.
	PS: for some of these foreign markets, the coefficient of correlation between a particular foreign **un-investable** market's stock market <u>index</u> and its corresponding **investable** market ETF <u>fund</u> is **not very high** -- what this means is **beware**: *"buying this foreign market ETF fund is not that same as intending for it to track/follow the performance of that stock market/economy".*

Step #14 Summarize Portfolio Performance Comparison: Country Index Portfolio vs. Country ETF Portfolio vs. U.S. Benchmarks

- This is the final summary (2of3 table) of our entire project.
- The HPY[USD], Mth Avg, Mth σ, Sharpe, Mth RFR are Risk-Return performance data calculated and summarized from Step #10 and Step #12.
- The following is just one possible format; however, you do not have to follow this format:

	A	B	C	D	E	F	G	H	I	J	K	
1	[RC = USD] Perf Comparison: Mkt Index Port vs. Mkt ETF Portfolio vs. U.S. Bnchmrk								Correl			
2				HPY[USD]	Mth Avg	Mth σ	Sharpe	Mth RFR	ETF Portf	^SP500	SPY	
3	Yours:		Market Idx Portf	334.86%	0.58%	4.40%	0.0469	0.3750%	0.83	0.75	0.75	Idx Portf
4			Market ETF Portf	601.07%	0.79%	5.33%	0.0769	0.3750%		0.82	0.82	ETF Portf
5	US		^SP500 Market Idx	330.30%	0.58%	4.40%	0.0460	0.3750%			0.99	^SP500
6	Bnchmrk		SPY Market ETF	575.61%	0.73%	4.46%	0.0792	0.3750%				

- With regard to above columns I, J, K:
  - "Market Idx Portf" is the monthly HPYs of the multi-stock Market Index Portfolio from Step #11b (ii), Column H.
  - "ETF Portf" is the monthly HPYs of the multi-stock ETF Portfolio from Step #9b (ii), Column H.
  - "^SP500" is the monthly HPYs of S&P500 Index ^SPY from Step #11b, Column I.
  - "SPY" is the monthly HPYs of the SP500 ETF SPY from Step #9b (ii), Column I.
  - The above staggered matrix, is the Coefficient of Correlation among these HPYs.
    - ✓ Correl (ETF Portf, SPY) is already calculated and summarized in Step #10.
    - ✓ Correl (Idx Portf, ^SP500) ia already calculated and summarized in Step #10.
    - ➢ You will need to calculate the remaining Correls in the above matrix.

Step #15 Summarize Risk-Return statistics and Coefficient of Correlation between the monthly HPYs of VBMFX (U.S. Total Bond) and select U.S. index funds, your Market ETFs, your ETF Portfolio, and some global funds

- This is the final summary (3of3 table) of our entire project. You may set up table as below:

funds:	VBMFX TotBond	DIA US	SPY SP500	VTSMX UStotMkt	Mkt B B[ETF]	Mkt C C[ETF]	Mkt D D[ETF]	Mkt E E[ETF]	Mkt F F[ETF]	Your ETF Portfolio	VHGEX Global	VGTSX ex-US
HPY[USD]	144.36%	576.53%	575.61%	585.98%	615.44%	258.34%	184.85%	496.91%	541.50%	601.07%	688.59%	216.22%
Mth Avg:	0.31%	0.72%	0.73%	0.74%	0.86%	0.94%	0.61%	0.70%	0.87%	0.79%	0.82%	0.50%
Mth σ:	1.22%	4.29%	4.46%	4.59%	6.43%	10.10%	7.39%	4.72%	7.09%	5.33%	5.25%	4.90%
Correls with VBMFX:	-	0.08	0.12	0.12	0.25	0.11	0.16	0.26	0.16	0.20	0.21	0.21
		U.S. Index funds correls below 0!			Foreign funds correls close to or even below 0!							

PS: **TotBond** U.S. Total **Bond fund** has **GREAT** correls with **ANY equity fund** -- whether U.S., foreign, or global funds.

- The above *HPY[USD]* row of calculated numbers come from Step #10 (your selected Market ETFs) as well as Step #9 [a] (SPY, VBMFX, VTSMX, VHGEX, VGTSX).
- The above *Mth Avg* and *Mth σ* row of calculated numbers come from Step #9 [g] and [h] -- your selected Market ETFs as well as SPY, VBMFX, VTSMX, VHGEX, VGTSX.
- The above *Correls with VBMFX* row, highlighted in black, requires the following work:
  - Calculate the Coefficient of Correlation between VBMFX and your selected US (HQ) ETF, e.g. DIA.
  - PS: use Excel's CORREL function on the column of VBMFX HPYs and the column of DIA HPYs.
  - Then do the same for the Correls of VBMFX with your other selected Market ETFs: B[ETF], … , F[ETF].
  - Also calculate the Correls of VBMFX with SPY, VTSMX, VHGEX, VGTSX, and Your ETF Portfolio.

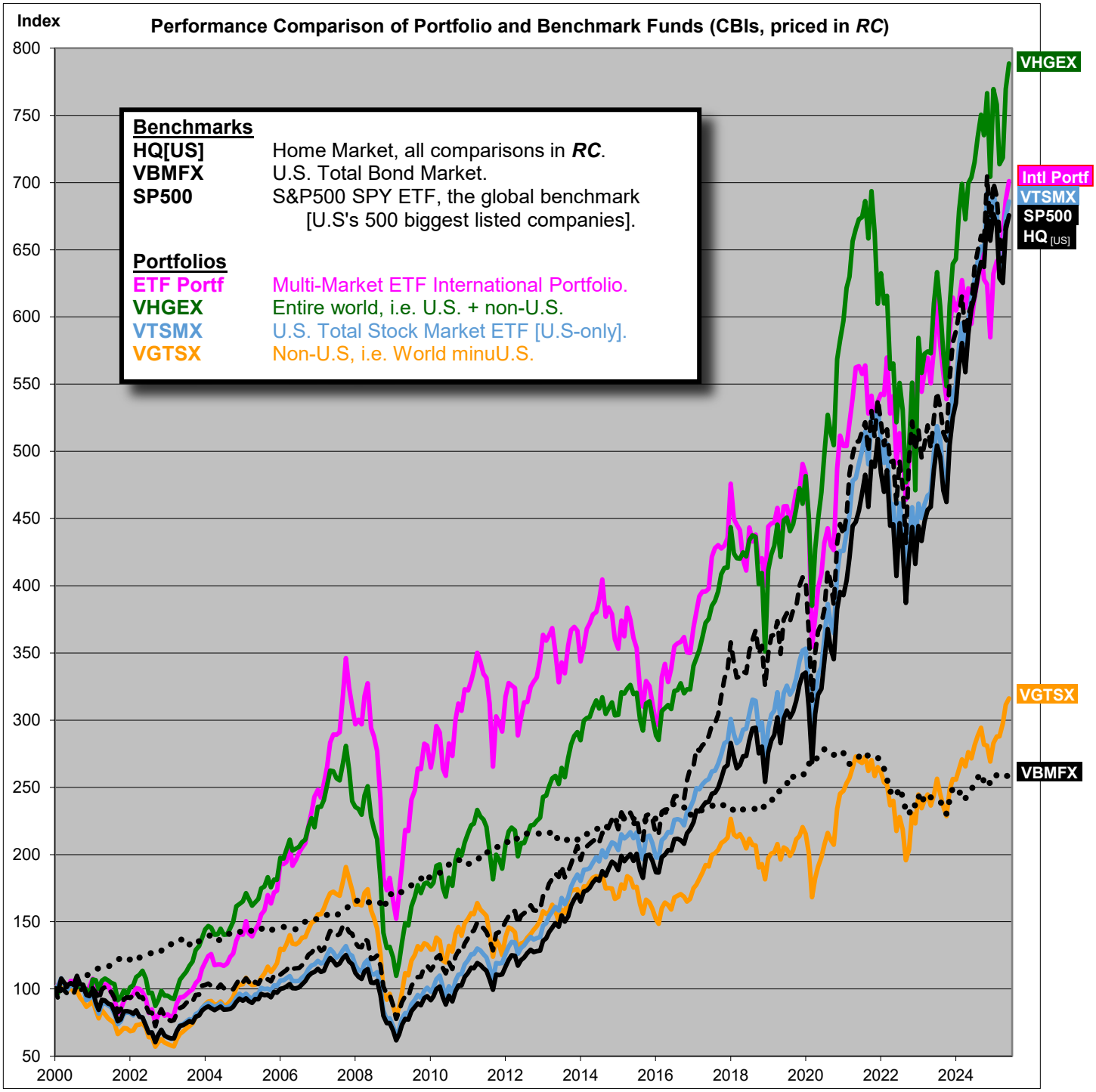
Step #16 How did your ETF Portolio performed relative to various U.S, ex-U.S, and global funds? Plot their CBIs.

- From all the previous Steps' calculation of various Common-base Indexes (CBI), assemble their calculated data:

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
		Common-Base Indexes [base = 100]						
	Date	[U.S.] Your HQ ETF **DIA**	[U.S.] Total Bond **VBMFX**	[U.S.] Benchmark **SPY**	[U.S] Total Market **VTSMX**	[ex-U.S] World - US **VGTSX**	[global] World + U.S **VHGEX**	**Your 5-Market ETF Portf**
0	01/01/2000	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1	02/01/2000	92.81	101.20	98.48	102.54	102.83	96.74	103.08
2	03/01/2000	100.13	102.60	107.75	107.98	106.11	103.40	106.90
:	:	:	:	:	:	:	:	:
n	*CM/01/CY*	676.53	258.32	675.61	685.98	316.22	788.59	701.07

- Then plot all the above CBIs on a single chart:

[HQ = US, RC = USD, ETF = DIA] / Benchmark = SP500 [SPY]



- Ranking of performances:

VHGEX	Entire world, i.e. U.S. + non-U.S [weighted by country market capitalization].
Intl Portf	Our Multi-market ETF International Portfolio (includes 20% from U.S's Dow30).
VTSMX	U.S. Total Stock Market [U.S-only]; offered by Vanguard ETFs.
SPY	S&P500 ETF, the benchmark (U.S's 500 biggest listed companies).
HQ [ETF]	Our U.S-based portfolio operation, using Dow30 ETF as a domestic AA.
VGTSX	**non-U.S, i.e. World minus U.S**; offered by Vanguard mutual funds *[barely beats the U.S. bond fund!!!].*
VBMFX	U.S. total Bond Market (60% U.S Treasurys, remaining good quality Corporates).

- See next section for some main conclusions and remarks about International Portfolio investment.

Step #17 Our Conclusions

Regardless of where we are from as a domestic investor and whichever set of foreign stock markets we chose in our International Equity Portfolio, we should all have the following general conclusions:

1) **U.S. stock market seems an unavoidable Asset Allocation in an International Portfolio.** This is because her performance is a lot better than of the ex-US [World minus U.S., see VGTSX]. **HOWEVER:**
   - ✓ **DO NOT invest in only-U.S market** -- long-run annual HPY is only 6+% …
   - ✓ … see how VHGEX performed.
   - ✓ If investors have sufficient tolerance for risk, especially with a longer investment horizon, they should consider emerging markets as part of their Asset Allocation.

2) **International Equity should be part of our diversified portfolio**:
   - ✓ There are opportunities for higher returns …
   - ✓ … and risk reduction benefits (lower coefficient of correlation with U.S. equities).

2) Since foreign stock market indexes are not investable, **using Country ETFs** could be a quick way, a low cost, and a **convenient access** to foreign equities for individual investors.

   However, we need to **check that the coefficient of correlation** between (un-investable) Stock Market Index and the (investable) Market ETF are "close" to each other (i.e. the market ETF **"tracks"** its stock market index). This is because the latter uses a much smaller set of stocks to replicate its respective stock market index.

   As a result:
   - ➢ The Market ETF may be over- or under-weighted with a particular set of foreign stock(s).
   - ➢ The Market ETF may be more volatile than its respective Stock Market Index, i.e. fewer stocks used to track the market index, leading to lesser nonsystematic risk reduction.
   - ➢ Thus, the Market ETF's periodic returns may not be able to closely track that of the respective Stock Market Index.

3) **Bonds is a (very) different asset class from equities**; these two major asset classes tend to have **low coefficient of correlation** (as you saw in your calculated results, near 0.00). **Further benefits to risk diversification** of the portfolio can be gained (at the expense of lower portfolio returns -- quality bond fund HPY tends to be lower, e.g. **VBMFX** Total Bond fund).

4) Also, one should be aware of the **trading volume**, **liquidity**, and **expense ratios** of some of these thinly-traded Stock Market ETFs.

5) These conclusions are some learning outcomes and issues to think about when you do your own **retirement planning**. Remember, ***"time is still on your side"*** -- with at least a 30-year investment horizon, even an "auto-pilot" retirement portfolio can amount to a lot of money -- hopefully that amount is sufficient for your twilight years.

May you live long and prosper.

~ *San Chee, ME, FRM*
AD717 Course Developer
Senior Lecturer, Financial Management Programs
Academic Coordinator, MET International Programs
Department of Administrative Sciences
Metropolitan College
BOSTON UNIVERSITY

Step #18 The Entire Project's Deliverables

a) **Did you comply with all the instructions in Pages 2,3,4?**

b) **DO NOT rename your given personalized** "starting template & data" Excel file which I had Internal E-mailed you after you had responded to Phase1 Step #1. Submit your Excel as named; see (f) below.

c) On your given personalized Excel file, there should be a **Worksheet titled "Deliverables"**. DO NOT create a new one, DO NOT copy over another one from somewhere else [i.e. not doing your own work]. **Use that existing "Deliverables" worksheet to consolidate** all your results and charts. It makes it easier for the instructor to grade them. This worksheet should contain the following plots and summary tables:

- ✓ Step #4's Survey of investments around the world (plot of various index funds).
- ✓ Step #5's Plot of Performance of Stock Market Indexes (CBIs, priced in local currency).
- ✓ Step #6's Plot of Foreign Currency Index against the Reporting Currency (RC).
- ✓ Step #7's Performance of Stock Market ETF Funds (CBIs, priced in *RC*).
- ✓ Step #10's Table Summary of Market ETF Portfolio Returns and Statistics.
- ✓ Step #12's Table Summary of Stock Market Index Portfolio Returns and Statistics.
- ✓ Step #13's Table Summary of Market-by-Market Performance Comparison: Index vs. ETF.
- ✓ Step #14's Table Summary of Portfolio Performance Comparison: Stock Market Index Portfolio vs. Market ETF Portfolio vs. U.S. Benchmarks.
- ✓ Step #15's Correlation of Coefficient measures between VBMFX U.S Total Bond fund and select U.S Index funds, your selected Market ETFs, your ETF Portfolio, and select global funds.
- ✓ Step #16's Plot of Performance Comparison your Market ETF Portfolio vs. various Benchmark and global funds (priced in *RC*).

Where convenient, you can combine some of the above deliverables, for example, the statistics, the $HPYs, the Sharpe Ratios, etc. And it does not have to be arranged in sequence to the Steps.

d) **IMPORTANT:** You must arrange/make one or more (but not all) of the above Steps fit conveniently in the physical (printable) pages. Your pages can either be in portrait or landscape format.

- ➢ i.e. you should size these Deliverables such that when you use Excel's Print Preview, it should show one or more of the above deliverables in its totality and not span/overlap the page view. **[see sample Deliverables; it is OK to follow this sequence and layout]**

e) Then **print the "Deliverables" worksheet in PDF format and name the PDF file IntlPortf-*yourname*.PDF**. You do this by doing a File > Print and then selecting "Adobe PDF" from the Printer pull-down menu. View this generated PDF output file to make sure your arranged deliverables meet the requirements in (c) and (d).

- ➢ ***yourname*** is the designated short name I used in your personalized Excel filename, e.g. IntlPortf-*SmithK*.pdf; IntlPortf-*XuSR*pdf; IntlPortf-*MullerG*.pdf; IntlPortf-ZjouZR.pdf; etc.

f) **DO NOT paper-print** and submit your project deliverables.

g) In our course **BlackBoard**, click on left-hand-side menu *Submit Portfolio Projects Here*. You **submit TWO files**:

1) Click on "**Submit International Portfolio Project Excel File**" to submit your IntlPortf-*yourname* **Excel** file.
2) Click on "**Submit International Portfolio Project PDF File**" to submit your IntlPortf-*yourname* **PDF** file.

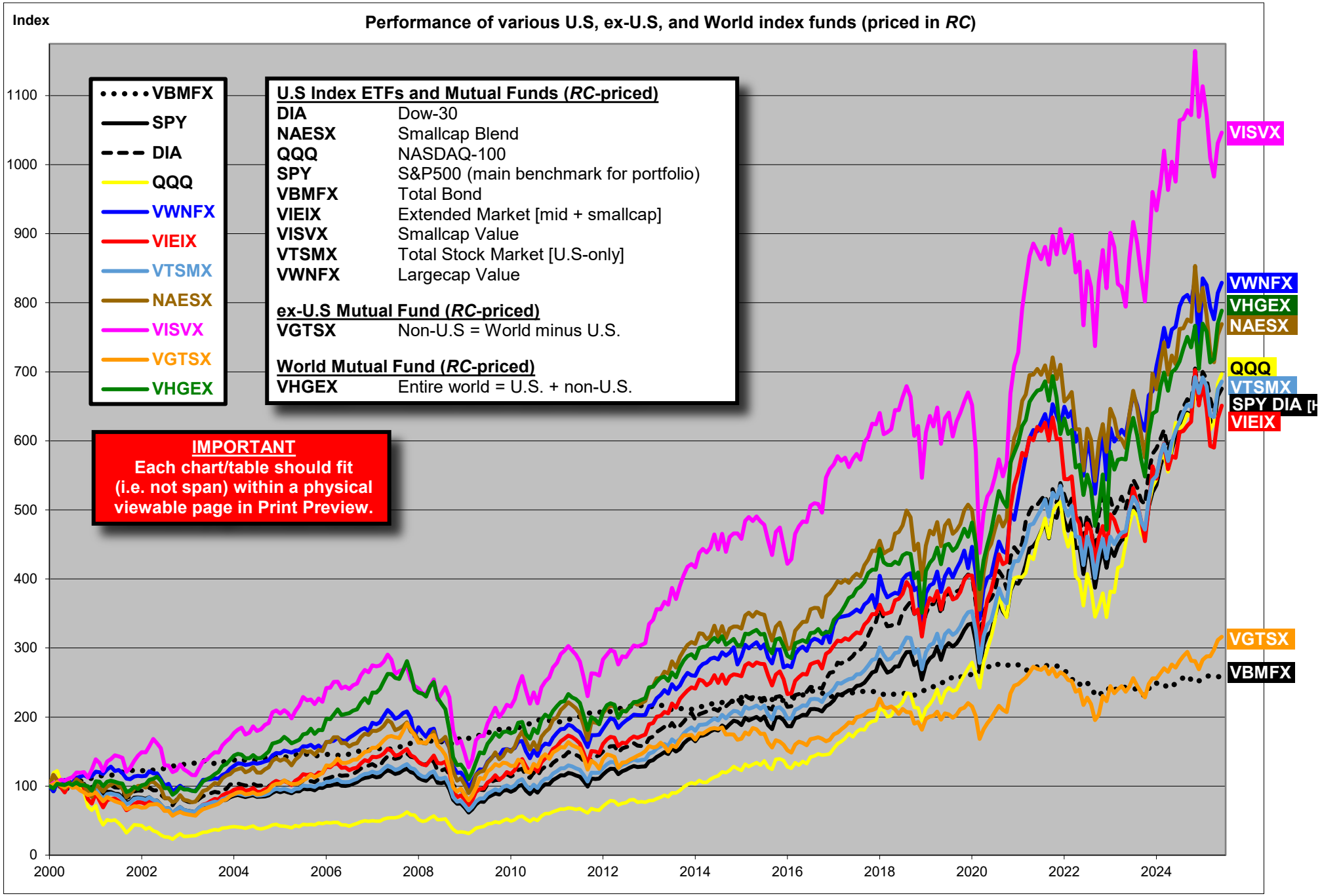
- ➢ PS: click on the "Browse My Computer" to locate/attach your file from your PC. Then click "Submit".

h) PS: if you do not follow the above deliverables instructions [worksheet; PDFs; file-naming convention; Internal E-mail] precisely, you will lose some points.

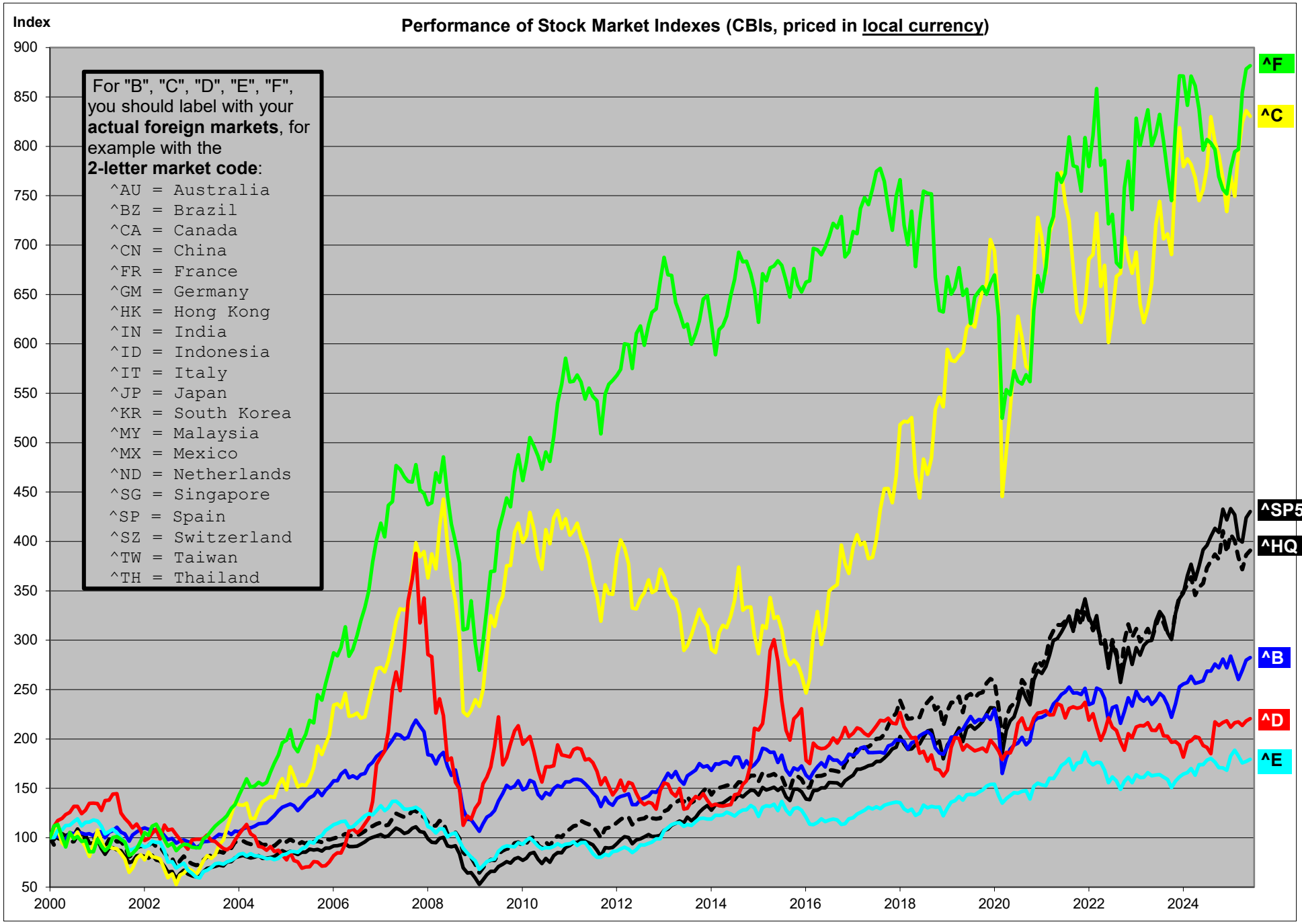
ENTIRE Individual International Equity Portfolio Project due any time one the week BEFORE our Exam

See the following pages for a sample an Excel WorkSheet deliverables …

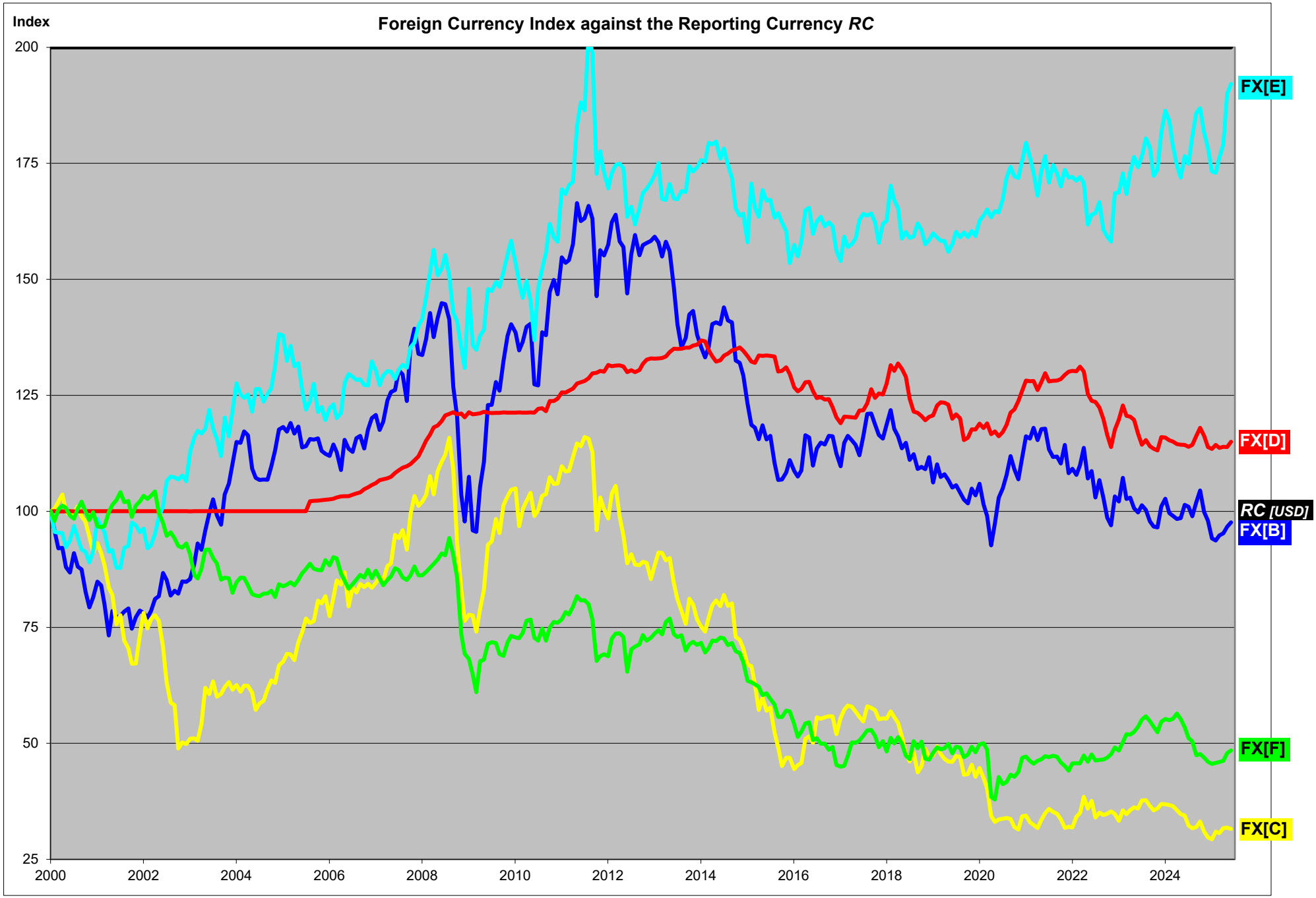
Step #4 | **[HQ = US, RC = USD, ETF = DIA] / Benchmark = SP500 [SPY]** | **Index Baseline = 100**



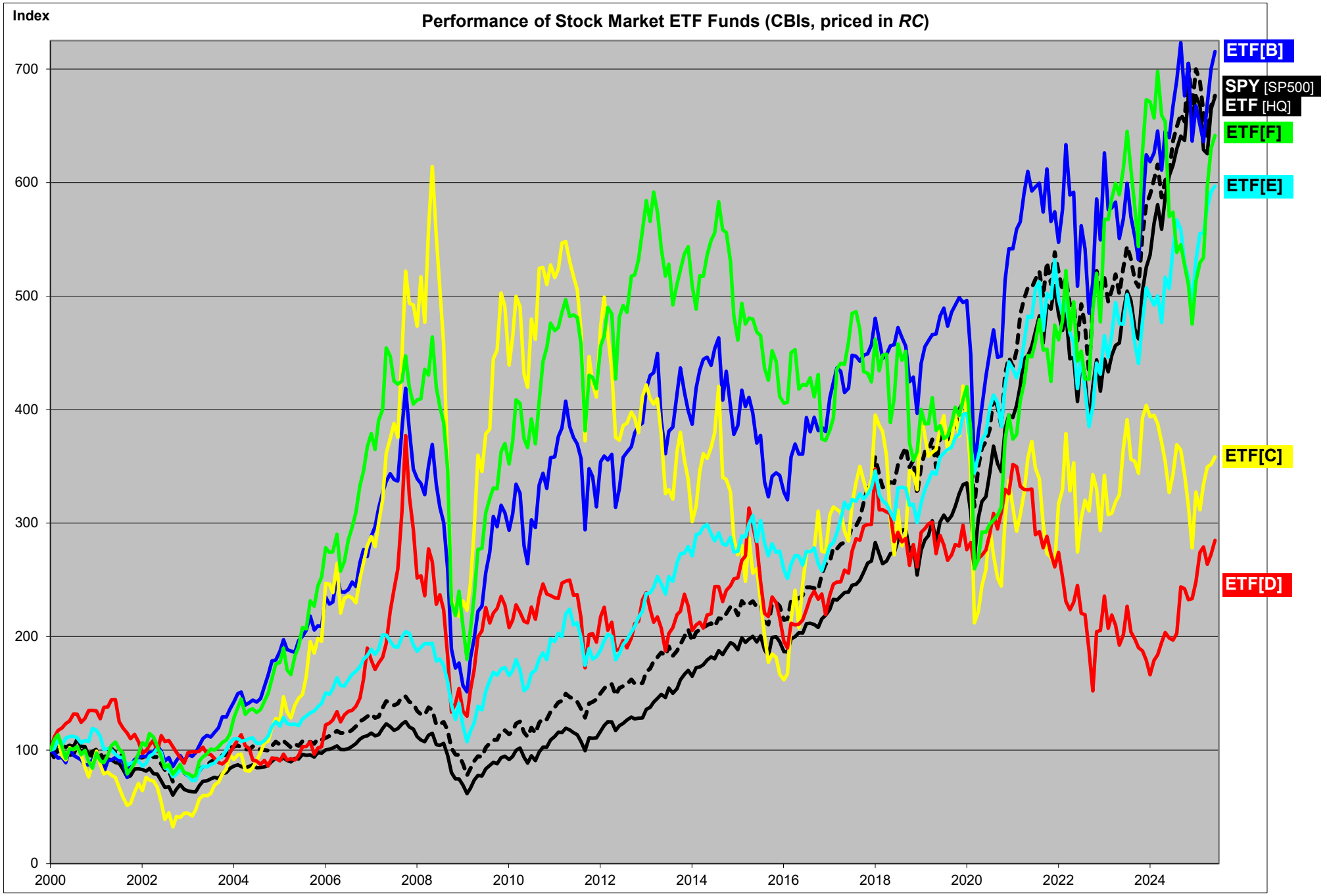
Step #5 | **[HQ = US, ^HQ = ^Dow30] / Benchmark = ^SP500** | **Index Baseline = 100**



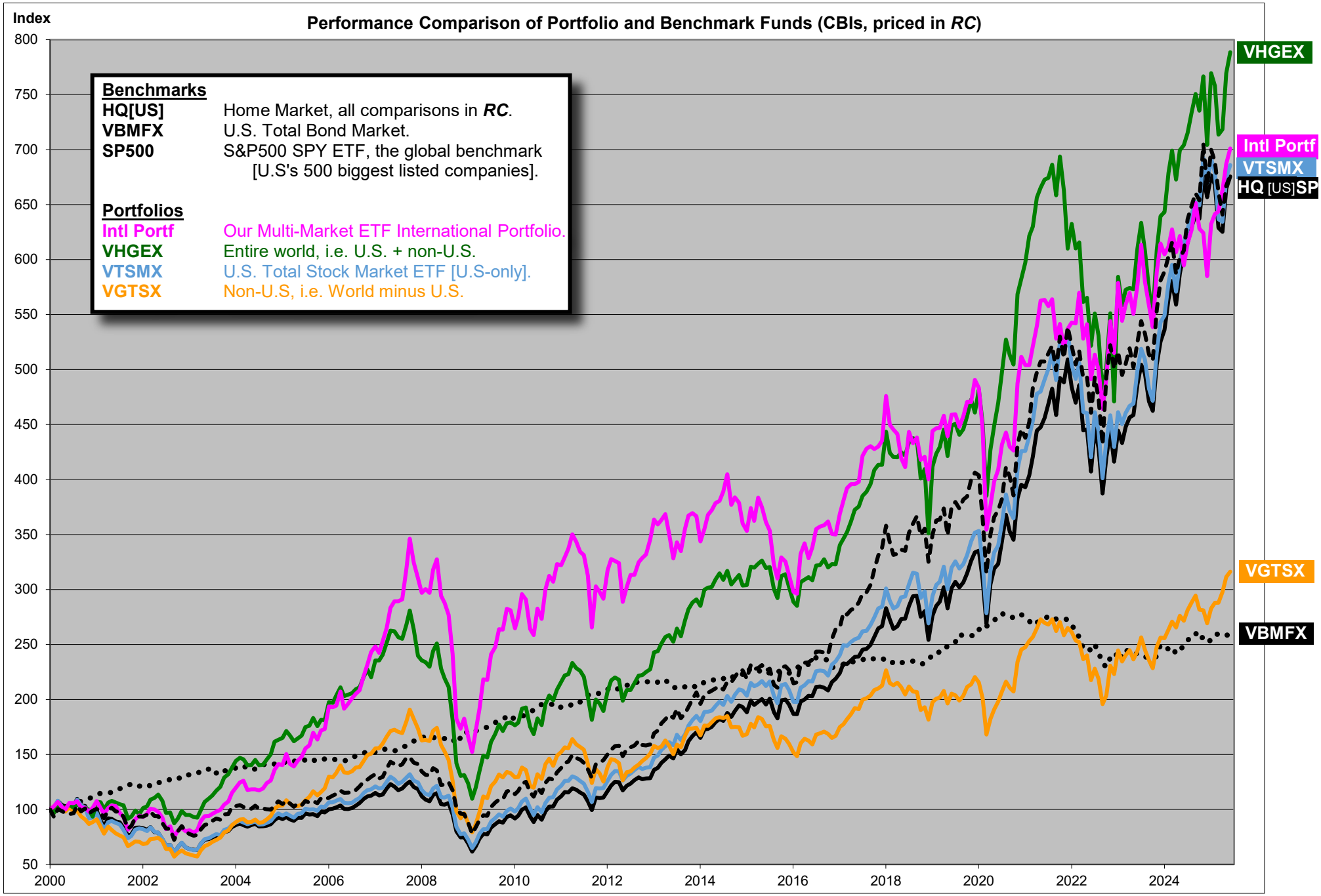
Step #6 **[HQ = US, RC = USD]** **Index Baseline = 100**



Step #7 | **[HQ = US, RC = USD, ETF = DIA] / Benchmark = SP500 [SPY]** | **Index Baseline = 100**



Step #16 | **[HQ = US, RC = USD, ETF = DIA] / Benchmark = SP500 [SPY]** | **Index Baseline = 100**



6-Mkt ETF Portfolio Returns and Statistics [HQ = US, RC = USD] — **Step #10**

	A	B	C	D	E	F	G	H	I	J
1		Market ETFs						6-Mkt ETF	Bnchmrk	
2	AA	20%	15%	15%	15%	15%	20%	Portfolio	US SPY	
3	HPY[USD]	576.53%	615.44%	258.34%	184.85%	496.91%	541.50%	601.07%	575.61%	
4	Mth Avg	0.72%	0.86%	0.94%	0.61%	0.70%	0.87%	0.79%	0.73%	
5	Mth σ	4.29%	6.43%	10.10%	7.39%	4.72%	7.09%	5.33%	4.46%	
6	Sharpe	0.0806	0.0750	0.0558	0.0324	0.0687	0.0701	0.0769	0.0792	
7	Mth RFR	0.3750%	0.3750%	0.3750%	0.3750%	0.3750%	0.3750%	0.3750%	0.3750%	
8	Correl	US[DIA]	B[ETF]	C[ETF]	D[ETF]	E[ETF]	F[ETF]	0.82		
9	US[DIA]		0.71	0.56	0.38	0.73	0.66		0.95	US[DIA]
10	B[ETF]			0.69	0.53	0.73	0.71		0.75	B[ETF]
11	C[ETF]				0.45	0.55	0.66		0.63	C[ETF]
12	D[ETF]					0.44	0.42		0.42	D[ETF]
13	E[ETF]						0.64		0.75	E[ETF]
14	F[ETF]								0.69	F[ETF]
15									ρ(Mkt, US SP500)	

6-Mkt Index Portfolio Returns and Statistics [HQ = US, RC = USD] — **Step #12**

	A	B	C	D	E	F	G	H	I	J
1		Stock Market Indexes						6-	Bnchmrk	
2	AA	20%	15%	15%	15%	15%	20%	Market	U.S.	
3	%Δidx[DC]	290.87%	182.36%	730.50%	120.54%	79.36%	781.63%	Index	Index	
4	%ΔFX[USD]	0.00%	-2.38%	-68.44%	15.01%	92.10%	-51.51%	Portfolio	^SP500	
5	HPY[USD]	290.87%	175.64%	162.14%	153.65%	244.55%	327.47%	334.86%	330.30%	
6	Mth Avg	0.54%	0.48%	0.69%	0.56%	0.52%	0.67%	0.58%	0.58%	
7	Mth σ	4.29%	5.43%	8.54%	7.11%	4.79%	6.26%	4.40%	4.40%	
8	Sharpe	0.0385	0.0202	0.0369	0.0259	0.0307	0.0477	0.0469	0.0460	
9	Mth RFR	0.3750%	0.3750%	0.3750%	0.3750%	0.3750%	0.3750%	0.3750%	0.3750%	
10	Correl	US^Dow30	^MktB	^MktC	^MktD	^MktE	^MktF	0.75		
11	US^Dow30		0.52	0.48	0.27	0.59	0.49		0.95	US^Dow30
12	^MktB			0.61	0.29	0.65	0.58		0.55	^MktB
13	^MktC				0.25	0.48	0.63		0.50	^MktC
14	^MktD					0.24	0.18		0.28	^MktD
15	^MktE						0.48		0.59	^MktE
16	^MktF								0.53	^MktF
17									ρ(Mkt, US^SP500)	

Step #13

	A	B	C	D	E	F	G	H	I	J	K
1	[RC = USD] Market-by-Market Performance Comparison: Index vs. ETF								Correl		
2	AA	Market	Idx/ETF	HPY[USD]	Mth Avg	Mth σ	Sharpe	Mth RFR	SP500	Market	Market
3	20%	U.S.	^Dow30	290.87%	0.54%	4.29%	0.0385	0.3750%	0.95	1.00	U.S.
4			DIA	576.53%	0.72%	4.29%	0.0806	0.3750%	0.95		
5	15%	MktB	^B	175.64%	0.48%	5.43%	0.0202	0.3750%	0.55	0.62	MktB
6			ETF[B]	615.44%	0.86%	6.43%	0.0750	0.3750%	0.75		
7	15%	MktC	^C	162.14%	0.69%	8.54%	0.0369	0.3750%	0.50	0.78	MktC
8			ETF[C]	258.34%	0.94%	10.10%	0.0558	0.3750%	0.63		
9	15%	MktD	^D	153.65%	0.56%	7.11%	0.0259	0.3750%	0.28	0.64	MktD
10			ETF[D]	184.85%	0.61%	7.39%	0.0324	0.3750%	0.42		
11	15%	MktE	^E	244.55%	0.52%	4.79%	0.0307	0.3750%	0.59	0.58	MktE
12			ETF[E]	496.91%	0.70%	4.72%	0.0687	0.3750%	0.75		
13	20%	MktF	^F	327.47%	0.67%	6.26%	0.0477	0.3750%	0.53	0.77	MktF
14			ETF[F]	541.50%	0.87%	7.09%	0.0701	0.3750%	0.69		

Step #14

	A	B	C	D	E	F	G	H	I	J	K	
1	[RC = USD] Perf Comparison: Mkt Index Portf vs. ETF Portf vs. US Bnchmrk								Correl			
2				HPY[USD]	Mth Avg	Mth σ	Sharpe	Mth RFR	ETF Portf	^SP500	SPY	
3	Yours:	Market Idx Portf		334.86%	0.58%	4.40%	0.0469	0.3750%	0.83	0.75	0.75	Idx Portf
4		Market ETF Portf		601.07%	0.79%	5.33%	0.0769	0.3750%		0.82	0.82	ETF Portf
5	US	^SP500 Market Idx		330.30%	0.58%	4.40%	0.0460	0.3750%			0.99	^SP500
6	Bnchmrk	SPY Market ETF		575.61%	0.73%	4.46%	0.0792	0.3750%				

Risk-Return statistics and Coefficient of Correlation between the monthly HPYs of VBMFX (U.S. Total Bond) and select U.S. index funds, your Market ETFs, your ETF Portfolio, and global funds:

Step #15

		VBMFX	DIA	SPY	VTSMX	B[ETF]	C[ETF]	D[ETF]	E[ETF]	F[ETF]	Your ETF Portfolio	VHGEX Global	VGTSX ex-US
	funds:	TotBond	US	SP500	UStotMkt								
	HPY[USD]:	158.32%	576.53%	575.61%	585.98%	615.44%	258.34%	184.85%	496.91%	541.50%	601.07%	688.59%	216.22%
	Mth Avg:	0.32%	0.72%	0.73%	0.74%	0.86%	0.94%	0.61%	0.70%	0.87%	0.79%	0.82%	0.50%
	Mth σ:	1.23%	4.29%	4.46%	4.59%	6.43%	10.10%	7.39%	4.72%	7.09%	5.33%	5.25%	4.90%
Correls with	VBMFX:	-	0.08	0.12	0.12	0.25	0.11	0.16	0.26	0.16	0.20	0.21	0.21

U.S Index funds correls near 0!

Foreign funds correls close to or even 0!

PS: **TotBond** U.S. Total **Bond fund** has **GREAT correls with ANY equity fund** -- whether U.S., foreign, or global funds.