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Methodology brief

Introducing the J.P. Morgan Emerging Markets Bond Index Global (EMBI Global)

- **The EMBI Global, which currently includes 27 countries, has been created in response to investor demand for a broader emerging markets debt benchmark**

- **The EMBI Global is a traditional, market-capitalization-weighted index; in addition, an index that limits the weights of larger countries – called the EMBI Global Constrained – will be produced**

- **J.P. Morgan Research will base its emerging markets model portfolio recommendations on the EMBI Global**

- **Daily historical index levels are available from December 31, 1993**
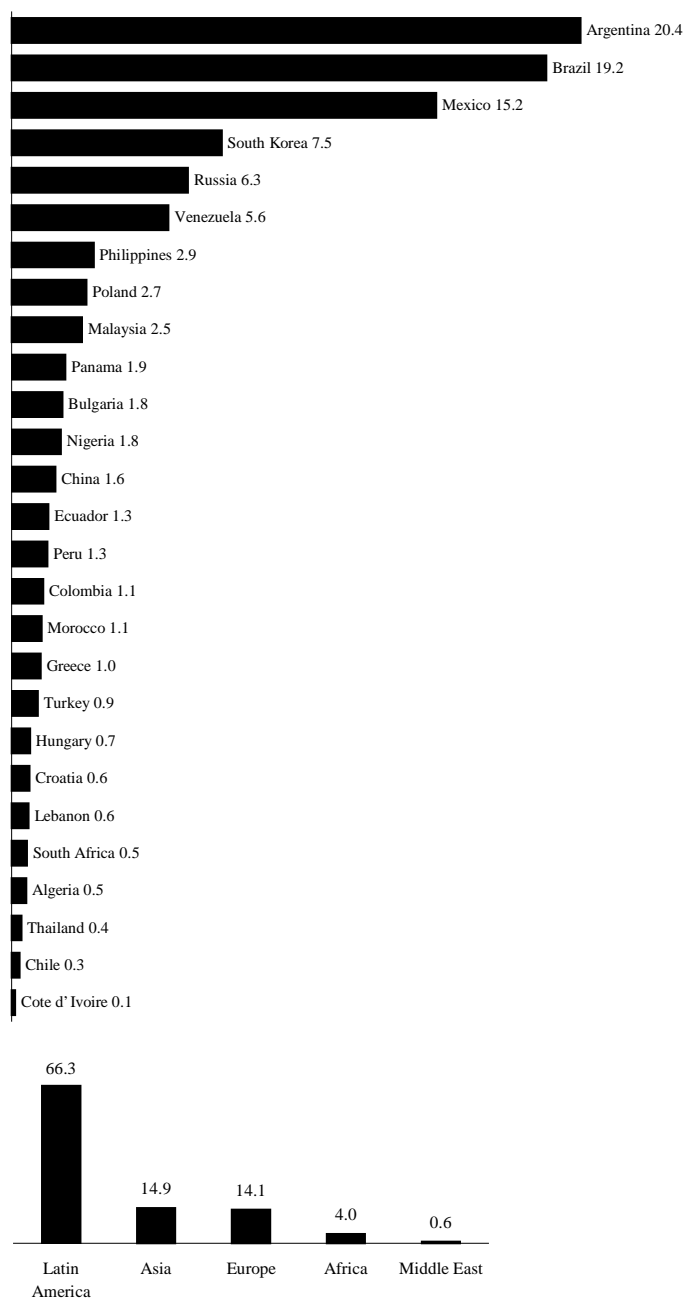
Overview

The J.P. Morgan Emerging Markets Bond Index Global (EMBI Global), which currently covers 27 emerging market countries, is our newest and most comprehensive emerging markets debt benchmark. Included in the EMBI Global are U.S.-dollar-denominated Brady bonds, Eurobonds, traded loans, and local market debt instruments issued by sovereign and quasi-sovereign entities. Exhibit 1 details the EMBI Global's country weights, as well as its regional weights, as of July 30, 1999.

The EMBI Global was created in response to investor demand for a benchmark that includes a broader array of countries. It expands upon the composition of its predecessor, the Emerging Markets Bond Index Plus (EMBI+), by using a different country selection process and admitting less liquid instruments.

Instead of selecting countries according to a sovereign-credit-rating level, as is done with the EMBI+, the EMBI Global defines emerging markets countries with a combination of World Bank-defined per capita income brackets and each country's debt-restructuring history. These two criteria allow the EMBI Global to include a

Exhibit 1

EMBI Global: Country and regional compositions

Market capitalization weights (%) as of July 30, 1999

Argentina 20.4
Brazil 19.2
Mexico 15.2
South Korea 7.5
Russia 6.3
Venezuela 5.6
Philippines 2.9
Poland 2.7
Malaysia 2.5
Panama 1.9
Bulgaria 1.8
Nigeria 1.8
China 1.6
Ecuador 1.3
Peru 1.3
Colombia 1.1
Morocco 1.1
Greece 1.0
Turkey 0.9
Hungary 0.7
Croatia 0.6
Lebanon 0.6
South Africa 0.5
Algeria 0.5
Thailand 0.4
Chile 0.3
Cote d' Ivoire 0.1

Latin America	Asia	Europe	Africa	Middle East
66.3	14.9	14.1	4.0	0.6

number of higher-rated countries that international investors have nevertheless considered part of the emerging markets universe.

The EMBI Global – like the EMBI[+] – will only consider for inclusion emerging markets issues denominated in U.S. dollars, with a minimum current face outstanding of US$500 million and at least 2½ years to maturity (at the time each is added to the index). However, the EMBI Global does not require that its "candidate instruments" satisfy the EMBI[+]'s series of additional liquidity tests (a minimum bid/ask price spread and a specific number of interdealer broker quotes). Instead, the EMBI Global only requires that easily accessible and verifiable daily prices, either from an interdealer broker or J.P. Morgan source, be available for the given instrument. The EMBI Global's use of these pricing criteria results in the inclusion of nearly twice as many issues as are in the EMBI[+].

Two differently weighted versions of this broader group of bonds are available. The flagship EMBI Global will use a traditional market-capitalization approach to determine the weight of each individual issue, as well as the resulting country index allocations. The EMBI Global – whose weights more accurately represent the market's supply of index issues – is geared toward active managers of large portfolios and any portfolio that, regardless of size, faces daily fluctuations in its balance of investable funds.

An alternative index, the EMBI Global Constrained, limits the weights of those index countries with larger debt stocks by only including a specified portion of these countries' eligible current face amounts of debt outstanding. The EMBI Global Constrained is geared toward managers who face limitations on the amount of portfolio exposure they can take to individual issuers. In addition, the EMBI Global Constrained – which assigns a larger weight to less liquid issues from countries with smaller debt stocks – may be a more appropriate

benchmark for managers of smaller, passively-managed portfolios that are not faced with fluctuations in their balances of investable funds. These investors should be better positioned to deal with the less liquid composition characteristics of the EMBI Global Constrained.

Why create an expanded index?

Since the EMBI[+]'s introduction in July 1995, the population of emerging markets sovereign and quasi-sovereign issuers has significantly expanded. Though the issues from these countries have historically met the EMBI[+]'s minimum issue size requirement of US$500 million, they did not meet its stringent liquidity criteria and so were excluded.

The EMBI Global, which uses relaxed instrument selection criteria, incorporates coverage of this growing portion of the emerging markets debt universe. As shown in Exhibit 3, since their start dates both the EMBI Global and EMBI Global Constrained have exhibited risk and return characteristics similar to that of the EMBI[+]. However, it is important to note that the

Exhibit 3
Historical total return performance comparison
Based on monthly data, as of July 30, 1999

	EMBI Global	EMBI Global Constrained	EMBI+
1994	-18.35	-19.28	-18.93
1995	26.38	27.34	26.78
1996	35.23	37.75	39.30
1997	11.95	10.81	13.02
1998	-11.54	-8.11	-14.35
1999 YTD	8.17	6.66	8.28
Cumulative return	49.47	53.78	50.06
Average annual return	7.46	8.01	7.54
Return volatility	21.44	20.53	22.49

Exhibit 2
EMBI[+] vs. EMBI Global: Indices at a glance
July 30, 1999

	EMBI+	EMBI Global
Number of countries	16	27
Number of instruments	68	128
Market capitalization	US$127 billion	US$169 billion
Country admission requirements	Must be rated BBB-/Baa3 or lower by both S&P and Moody's	Classified as having low or middle per capita income by the World Bank, or Has restructured external or local debt in past 10 years, or Currently has restructured external or local debt outstanding
General instrument admission requirements	US$500 million minimum face amount oustanding, and At least 2 1/2 years until maturity (when added to index), and Must pass series of liquidity tests (a minimum bid/ask price and a specific number of interdealer broker quotes)	US$500 million minimum face amount oustanding, and At least 2 1/2 years until maturity (when added to index), and Daily price - either from an outside or J.P. Morgan source - must be available

EMBI Global's broader set of countries contains select, less volatile investment opportunities that, in the past, have provided temporary safe havens during market downturns.

Country and instrument selection process

We adhere to a strict set of rules for selecting countries and instruments for inclusion in the EMBI Global.

Defining the universe of eligible countries
Initially, two criteria determine whether a country is defined as an emerging market and, therefore, can be considered for inclusion in the EMBI Global.

First, a country must be classified as having a low or middle per capita income by the World Bank for at least one of the past three years, based on data lagged one year. Our current source for these classifications (presently, any country with a per capita income less than US$9,635) is the World Bank publication, *Global Development Finance.* Published annually, this report reflects per capita income brackets as of the previous year's close. Second, regardless of their World Bank-defined income level, countries that either have restructured their external or local debt during the past 10 years or currently have restructured external or local debt outstanding will also be considered for inclusion in the index.

Using these two criteria generates a universe of 150+ countries that can be considered for inclusion in the EMBI Global.

Instrument selection process
Once this universe of emerging markets countries has been defined, the eligible instruments from these countries must be selected. Instruments that satisfy all the following defined criteria will be eligible for inclusion in the EMBI Global:

1) Issuer type classification;
2) Currency denomination;
3) Current face amount outstanding;
4) Remaining time until maturity;
5) Settlement method;
6) Quantifiable source of cash flow return; and
7) Quoted price availability

Issuer type classification
The EMBI Global contains only those bonds issued by sovereign and quasi-sovereign entities from index-eligible countries. Issuers are classified as

quasi-sovereign if the sovereign has explicitly guaranteed the issuer or is its majority shareholder.

Currency denomination
From the list of sovereign and quasi-sovereign debt instruments from index-eligible countries, only those instruments denominated in U.S. dollars are considered for inclusion. Historically, the universe of emerging markets external debt has seen its most liquid issues denominated in U.S. dollars. At a future date, non-U.S. dollar debt, specifically euro-denominated issues, will be reconsidered for inclusion in the EMBI Global.

Current face amount outstanding
The list of U.S. dollar-denominated sovereign and quasi-sovereign issues from index-eligible countries is narrowed further by only considering issues with a current face amount outstanding of US$500 million or more.

If an issue's current face outstanding falls below this requirement – due to either a debt retirement by the sovereign or the amortization of principal – the issue will be removed from the index at the next month-end rebalancing date.

The reverse also holds true. Existing issues that, through reopenings, increase in size to satisfy our minimum current face outstanding requirement are then considered for inclusion in the EMBI Global.

Time until maturity
Of the issues with at least a current face amount outstanding of US$500 million, only those instruments with at least 2½ years until maturity are considered for inclusion. Once added, an instrument may remain in the EMBI Global until 12 months before it matures. On the month-end preceding this anniversary, the instrument is removed from the EMBI Global.

Settlement method
Instruments in the EMBI Global must be able to settle internationally (either through Euroclear or another institution domiciled outside the issuing country).

Quantifiable source of cash flow return
J.P. Morgan reserves the right to exclude from the composition of the EMBI Global any debt instrument that it considers to have a cash flow structure from which a verifiable daily return cannot be calculated.

Quoted price availability
The final requirement is that an issue's bid and offer prices be available on a daily and timely basis – either

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from an interdealer broker or J.P. Morgan. The lack of availability of such prices prevents the addition of a new issue to the index. In the case of the current EMBI Global issues, if reliable prices for an issue become unavailable during a month, it is removed from the index at its next month-end rebalancing date. Once an issue is removed, it will not be reconsidered for inclusion in the index during the next 12 months.

As shown in Exhibit 2, the EMBI Global contains a total of 27 countries – 11 more than the 16 currently in the EMBI[+]. In addition, the EMBI Global contains 128 instruments – 60 more than the EMBI[+]'s 68.

These country and instrument selection criteria generate a composition for the EMBI Global that is significantly different than that of the EMBI[+] (Exhibit 4).

Timing of the addition of new issues

A new issue that meets the EMBI Global's admission requirements is added to the index on the first month-end business date after its issuance, provided its issue date falls before the 15th of the month. A new issue whose issue date falls on or after the 15th of the month is added to the index on the last business day of the next month.

The only exception to this rule is a new issue that is released as part of a debt exchange program. For example, assume a country exchanges a portion of its outstanding Brady debt for a new issue after the 15th of the month. At the month-end rebalancing date immediately following this event, the amount of debt retired in this exchange would be removed from the EMBI Global, and the new issue would be added to the index (provided official exchange results are made available in a timely manner).

Exhibit 5 indicates the dates on which the EMBI Global's current countries were added and details the different instrument types contained in each country's composition.

Exhibit 4
EMBI[+] vs. EMBI Global: Country weights by region
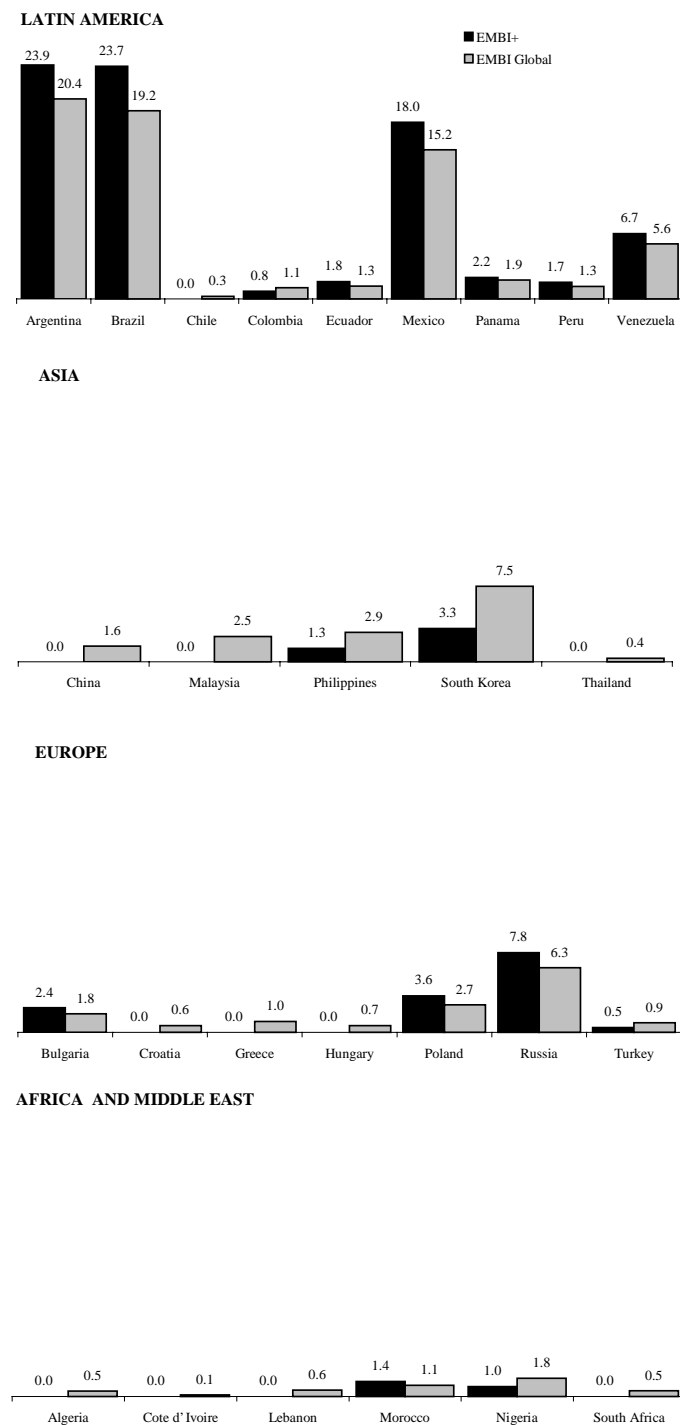*Market capitalization weights (%) as of July 30, 1999*

LATIN AMERICA

EMBI+
EMBI Global

	Argentina	Brazil	Chile	Colombia	Ecuador	Mexico	Panama	Peru	Venezuela
EMBI+	23.9	23.7	0.0	0.8	1.8	18.0	2.2	1.7	6.7
EMBI Global	20.4	19.2	0.3	1.1	1.3	15.2	1.9	1.3	5.6

ASIA

	China	Malaysia	Philippines	South Korea	Thailand
EMBI+	0.0	0.0	1.3	3.3	0.0
EMBI Global	1.6	2.5	2.9	7.5	0.4

EUROPE

	Bulgaria	Croatia	Greece	Hungary	Poland	Russia	Turkey
EMBI+	2.4	0.0	0.0	0.0	3.6	7.8	0.5
EMBI Global	1.8	0.6	1.0	0.7	2.7	6.3	0.9

AFRICA AND MIDDLE EAST

	Algeria	Cote d'Ivoire	Lebanon	Morocco	Nigeria	South Africa
EMBI+	0.0	0.0	0.0	1.4	1.0	0.0
EMBI Global	0.5	0.1	0.6	1.1	1.8	0.5

Exhibit 5
EMBI Global: Country addition dates and instrument-types by region
July 30, 1999

		Instrument types			
	Date of entry	**Eurobonds**	**Brady-style**	**Loans**	**Domestic**
Latin America					
Argentina	December 1993	√	√		√
Brazil	December 1993	√	√		
Chile	May 1999	√			
Colombia	February 1997	√			
Ecuador	December 1993		√		
Mexico	December 1993	√	√		
Panama	December 1993	√	√		
Peru	December 1993		√		
Venezuela	December 1993	√	√		
Asia					
China	March 1994	√			
Malaysia	October 1996	√			
Philippines	December 1993	√	√		
South Korea	December 1993	√			
Thailand	May 1997	√			
Europe					
Bulgaria	December 1993		√		
Croatia	August 1996		√		
Greece	January 1997	√			
Hungary	January 1999	√			
Poland	December 1993	√	√		
Russia	December 1993	√	√	√	
Turkey	June 1996	√			
Africa					
Algeria	March 1999			√	
Cote d' Ivoire	April 1998		√		
Morocco	December 1993			√	
Nigeria	December 1993		√	√	
South Africa	December 1994	√			
Middle East					
Lebanon	April 1998	√			

Index weighting methods

EMBI Global uses the traditional approach
The weight of each instrument in the EMBI Global – our flagship index – is determined by dividing the issue's market capitalization by the total market capitalization for all instruments in the index. The result represents the weight of the issue expressed as a percentage of the EMBI Global. Country weights for the EMBI Global are easily calculated by aggregating the weights of the instruments for each country. The market capitalization of each issue is calculated by multiplying its face amount outstanding by its bid-side settlement price. Face amounts outstanding for each issue are updated at each month-end in order to reflect market events – such as reopenings or buybacks – that have increased or decreased the issue's available supply.

EMBI Global Constrained uses a unique approach
Since the EMBI Global Constrained uses the same country and instrument selection process as the EMBI Global, the list of issues contained in both indices is always the same. The month-end addition and removal of index issues occur simultaneously for the EMBI Global and EMBI Global Constrained.

Where the EMBI Global and EMBI Global Constrained differ is in the portions of each issue's current face amount outstanding used in their respective calculations of market capitalizations. While the EMBI Global uses the total current face amount outstanding of each issue, the EMBI Global Constrained uses only a certain portion of the current face amount outstandings for instruments from countries with larger debt stocks. In effect, the EMBI Global Constrained limits (or *constrains*) the current face amount allocations of the bonds in the EMBI Global.

A similar effect could have been achieved by imposing a maximum index weight for each country (for example, 20%), but such a cap creates difficulties for benchmarked investors. An investor trying to remain neutral to a weight-capped benchmark would need to constantly rebalance his or her portfolio (and incur the resulting transaction costs) as daily price fluctuations pushed the portfolio's country weights above or below the benchmark's fixed weights.

Adjusting the admissible current face amount allocations – rather than setting a specific weight cap – still allows the EMBI Global Constrained to limit a country's weight, while maintaining the reinvestment process characteristic of traditional market-capitalization-weighted indices. This is desirable since, barring composition changes, a portfolio that replicates the index's bond allocations naturally rebalances itself as asset prices drift. In addition, the EMBI Global Constrained's country weights are kept within a desirable range without the need to perform forced rebalancings if a country's weight drifts above a preset capped weight.

How the EMBI Global Constrained works
The EMBI Global Constrained's bond allocation calculation process starts with each EMBI Global country's current face amount outstanding of debt. The following inclusion schedule is applied to these amounts to determine the constrained amounts eligible for inclusion in the EMBI Global Constrained.

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From each country's total EMBI Global eligible debt stock, the EMBI Global Constrained includes:

1) 100% of the first US$5 billion of the eligible debt stock;

2) 75% of the eligible debt stock that exceeds US$5 billion but does not exceed US$10 billion;

3) 50% of the eligible debt stock that exceeds US$10 billion but does not exceed US$15 billion;

4) 25% of the eligible debt stock that exceeds US$15 billion but does not exceed US$25 billion;

5) 10% of the eligible debt stock that exceeds US$25 billion but does not exceed US$35 billion; and

6) 0% of the eligible debt stock that exceeds US$35 billion.

For example, country A in the EMBI Global has US$50 billion of debt, broken down into five separate bond issues. Applying the constraining steps described above to this total eligible debt stock results in the following:

	Current face amount		Percent eligible		Result
Amount that is ≤ US$5 billion	$5.00	x	100%	=	$5.00
Amount that is > US$5 billion, but ≤ US$10 billion	5.00	x	75%	=	3.75
Amount that is > US$10 billion, but ≤ US$15 billion	5.00	x	50%	=	2.50
Amount that is > US$15 billion, but ≤ US$25 billion	10.00	x	25%	=	2.50
Amount that is > US$25 billion, but ≤ US$35 billion	10.00	x	10%	=	1.00
Amount that is > US$35 billion	15.00	x	0%	=	0.00
Total eligible debt stock:	$50.00		Constrained amount:		$14.75
Percentage of total debt stock eligible for inclusion:					29.50%

As shown in the table above, the EMBI Global Constrained would only include US$14.75 billion of country A's US$50 billion EMBI Global allocation. In effect, only 29.5% (US$14.75 billion divided by US$50 billion) of country A's EMBI Global allocation is eligible for inclusion in the EMBI Global Constrained.

The next step in the constraining process is to determine what portion of each of country A's five bonds should be included in the EMBI Global Constrained. Applying country A's inclusion percentage of 29.5% to the current face allocation of each bond results in the following instrument allocations:

Instrument #	Instrument current face amount		Percentage eligible		Resulting constrained face amount
1	$5.00	x	29.50%	=	$1.48
2	15.00	x	29.50%	=	4.43
3	25.00	x	29.50%	=	7.38
4	3.00	x	29.50%	=	0.89
5	2.00	x	29.50%	=	0.59
Total eligible debt stock:	$50.00		Constrained amount:		$14.75

In the next table, this same process is applied to country B, which has only US$3 billion of eligible debt stock, broken down into five separate bond issues, in the EMBI Global. The results are the following:

	Current face amount		Percent eligible		Result
Amount that is ≤ US$5 billion	$3.00	x	100%	=	$3.00
Amount that is > US$5 billion, but ≤ US$10 billion	0.00	x	75%	=	0.00
Amount that is > US$10 billion, but ≤ US$15 billion	0.00	x	50%	=	0.00
Amount that is > US$15 billion, but ≤ US$25 billion	0.00	x	25%	=	0.00
Amount that is > US$25 billion, but ≤ US$35 billion	0.00	x	10%	=	0.00
Amount that is > US$35 billion	0.00	x	0%	=	0.00
Total eligible debt stock:	$3.00		Constrained amount:		$3.00
Percentage of total debt stock eligible for inclusion:					100.00%

As shown in the table above, the EMBI Global Constrained would include the full US$3 billion of the country B's eligible debt. Since country B has such a small current face amount outstanding of eligible debt, 100% of country B's total EMBI Global instrument allocations would also be eligible for inclusion in the EMBI Global Constrained.

Determining instrument and country weights
Once these instrument allocations are derived for each country, the current settlement price for each instrument is applied to its EMBI Global Constrained's allocation to calculate the market capitalization of each issue in the index. The weight of each instrument in the EMBI Global Constrained is then determined by dividing its market capitalization by the total market capitalization for all of the EMBI Global Constrained's instrument allocations. The result represents the weight of each issue expressed as a percentage of the EMBI Global Constrained. By allocating their portfolios according to these exact instrument weights, and accounting for coupon reinvestments and index instrument allocation changes, investors can replicate the performance of the EMBI Global Constrained. Country weights for the index are easily calculated by aggregating the weights of the instruments for all countries.

Causes of EMBI Global Constrained rebalancings
Since EMBI Global Constrained instrument allocations are linked to the total current face amount of debt stock contained in the EMBI Global, any event that affects this amount also triggers a recalculation of the EMBI Global Constrained's instrument allocations.

Among the events that would trigger this recalculation are the following:

1) The addition of an instruments to the EMBI Global;
2) The deletion of an instrument from the EMBI Global;

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3) An increase in the current face outstanding of an index instrument due to a reopening or the capitalization of a coupon as principal; and

4) A decrease in the current face outstanding due to a buyback or the amortization of principal.

Adjustments to the EMBI Global Constrained's instrument allocations resulting from the above events will only be performed on the month-end rebalancing dates.

Impact of this process on country weights
While the EMBI Global and EMBI Global Constrained both always contain the same list of debt instruments, the EMBI Global Constrained's instrument allocation constraining process generates instrument and country weights that are different than those of the EMBI Global.

Countries with large current face amounts outstanding of index-eligible debt will have their EMBI Global Constrained instrument allocations and, thus, index market capitalization weights reduced – relative to the EMBI Global – by the above-described allocation-constraining process. Conversely, countries with relatively small current face amounts outstanding of total eligible debt will have a larger market capitalization weight in the EMBI Global Constrained than in the EMBI Global, since their instrument allocations will not be reduced as much by this process. Exhibit 6 compares the EMBI Global Constrained's regional weights to those of the EMBI+ and EMBI Global. A comparison of the country weights for these three indices appears in Exhibit 7.

Exhibit 6
EMBI Global Constrained: Comparison of index regional weights to those of other indices
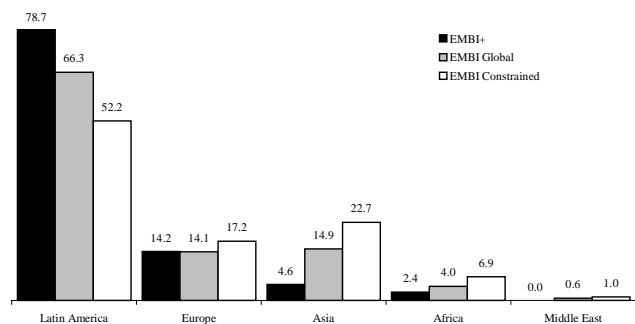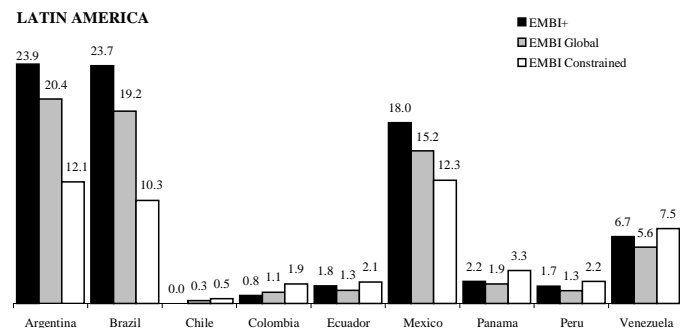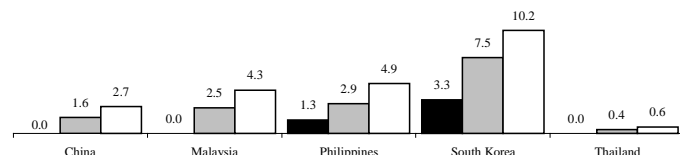*Market capitalization weights (%) as of July 30, 1999*

Exhibit 7
EMBI Global Constrained: Comparison of index country weights by region to those of other indices
Market capitalization weights (%) as of July 30, 1999
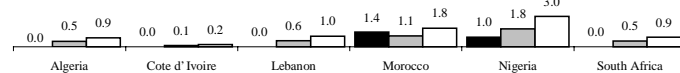
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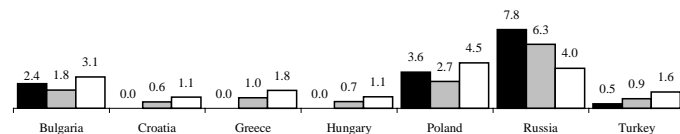
Daily production of the EMBI Global

The EMBI Global is produced every business day of the year. Business days are based on the U.S. bond market calendar set by the Emerging Markets Traders Association (EMTA).

Pricing on regular business days
The instrument prices used in the official closing calculation of the EMBI Global are captured as of 3:00 p.m. EST. The preferred source for these prices are interdealer broker screens. For index instruments not available on these screens, price quotes by J.P. Morgan traders are collected as close as possible to 3:00 p.m. EST. These J.P. Morgan trader prices will continue being used until reliable interdealer broker screen prices become available. If alternate nonbroker pricing becomes available, it will be evaluated for its quality and considered for use in the calculation of the EMBI Global's results.

Early closes
When the U.S. bond market closes early, typically before market holidays or when EMTA recommends an early close, prices of EMBI Global instruments are captured at the latest possible time to reflect an active closing market.

Where to find the EMBI Global

Daily EMBI Global results can be found in the following places:

- **MorganMarkets (morganmarkets.com):** Contains downloadable files of daily country and instrument returns, statistics, and compositions, as well as data series of historical index levels and sovereign spreads;

- **Reuters:** Page EMBI01 offers a directory of results for all J.P. Morgan emerging markets bond indices;

- **Bloomberg:** Page JPMX will soon offer EMBI Global results; and

- J.P. Morgan's monthly *Emerging Markets Bond Index Monitor* contains index returns, statistics, and composition updates for all of our emerging markets indices.

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Appendix: Instrument and index total return calculations

The following description of our methodology for calculating returns (total, price, and interest returns) is divided into two broad sections. Section I describes single-instrument returns. Section II describes index total returns.

The total return calculation for a single instrument is a means of representing the economic benefit of holding the specific security. In its simplest form, it is based on the "cash in/cash out" notion – i.e., what is paid for the security at the initial purchase versus what is received at its sale. Of course, most fixed income securities pay some form of coupon along the way, and some pay amortizations. For the calculation of individual instrument total returns, this cash is reinvested in the instrument when received. However, when the instrument is part of a portfolio whose allocations are based on market capitalization (in the case of the EMBI Global or the EMBI Global Constrained), the use of this market capitalization weighting scheme in effect causes this cash to be proportionately reinvested in the other instruments that make up the portfolio.

The means of calculating the total return on a basket containing various instruments is an extension of the single-instrument total return framework. To hold a "passive" portfolio, one would buy the instruments in the same proportions in which they comprise the EMBI Global or EMBI Global Constrained. In the case of the EMBI Global, each proportional amount is a function of both the amount of the instrument outstanding (based on publicly available information) and its settlement price. These two factors, when multiplied together, equal the asset's market capitalization. The EMBI Global Constrained uses a similar approach, with one exception: For each country with a larger debt stock, a smaller amount of each of its instrument face amounts outstanding is added to the portfolio.

I. Single-instrument return

The total return on a performing instrument is measured from one trade day to the next using the following generalized equation:

$$(1) \qquad tr_t = \frac{ESV_{s(t)} + C_{v(t)} + AM_{v(t)}}{ESV_{s(t-1)}} \times \frac{FX_{i,t}}{FX_{i,t-1}} - 1$$

This equation captures the three main components of a fixed income asset's value: price, cash flow (coupon and/or amortization) and currency. These components are represented by:

$ESV_{s(t)}$ Effective settlement value; primarily a function of the effective settlement price but also of the ex-coupon and ex-amortization rules [see equation (2) below]

$C_{v(t)}$ If applicable, the coupon payment to which a holder on trade date t is entitled on value date v(t); determined by the instrument structure, ex-coupon conventions, and holiday calendar

$AM_{v(t)}$ If applicable, the amortization to which a holder on trade date t is entitled on value date v(t); determined by the instrument structure, ex-amortization conventions, and holiday calendar

$FX_{i,t}$ Foreign currency exchange rate for currency i measured in U.S. dollars per unit of foreign currency. Since the EMBI Global and EMBI Global Constrained currently contain only U.S. dollar-denominated instruments, currency does not contribute to the indices' daily returns. However, should non-U.S. dollar-denominated issues be added to these indices on a future date, our return calculation will appropriately incorporate day-to-day currency rate fluctuations.

t   Trade date; all index instruments trade on a New York holiday calendar

v(t)   Value date for trade date t; date used to calculate accrued interest, which usually, but not always, coincides with the settlement date

s(t)   Settlement date for trade date t; date on which cash transaction occurs

The effective settlement value can be calculated as follows:

$$(2) \qquad ESV_{s(t)} = ESP_{s(t)} + xc_{v(t)} + xam_{v(t)}$$

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where:

$ESP_{s(t)}$ Effective settlement price, which is the price paid for a bond that is traded on trade date t and settled on settlement day s(t). The settlement date is determined by the settlement convention of the bond and holiday calendar for the settlement convention; in short, the *amount of money*, including accrued interest, etc., owed at the settlement date.

$xc_{v(t)}$ Ex-coupon placeholder; in some markets, market convention designates a date that begins an "ex-period," ending on the coupon payment date, during which a seller of the bond is entitled to keep the upcoming coupon. This ex-period is usually 30 days. In effect, the coupon is stripped from the bond, such that the current buyer is no longer buying the rights to the coupon, and therefore the ESP paid by the buyer should be reduced by the amount of the foregone coupon. For the total return, however, it is imperative to maintain the continuity of the traded asset – i.e., the bond should be "reconstituted" to its cum-payment before the ex-structure. To do this, we account for the value this coupon represents to the seller via an ex-coupon placeholder. Intuitively, the placeholder is an amount representing the value of the next coupon discounted to the settlement date of the transaction and is calculated as:

$$xc_{v(t)} = \frac{C}{(1+L_t)^{\frac{d_{s,t}}{360}}}$$

C Coupon amount to be paid at the end of the ex-period

L_t One-month Libor, used as the cash rate for the discounting

$d_{s,t}$ Number of days from settlement to the next coupon

$xam_{v(t)}$ Ex-amortization placeholder; this concept is completely analogous to the ex-coupon placeholder and is calculated in the same way:

$$xam_{v(t)} = \frac{AM}{(1+L_t)^{\frac{d_{s,t}}{360}}}$$

The ex-coupon and ex-amortization placeholders are carried in both the numerator and the denominator of the

total return formula and effectively cease to exist when the ex-period elapses.

Although this equation is sufficient for the generalized concept of total return, complexities stem from the determination of the effective settlement price and the treatment of interim cash flows. Therefore, below we describe the differences between instrument types, then show how these differences are incorporated into the generalized equation.

Effective settlement prices, ESPs(t)
Effective settlement price is the instrument's settlement "price" - i.e., the amount of money owed at settlement. ESP calculations translate the quoted price into this settlement price, taking into account appropriate quotation conventions and settlement practices.

The quotation and settlement of foreign-currency bonds in the emerging markets currently follow guidelines set by three different groups. Brady bonds and Eurobonds follow standard international settlement, set by the International Securities Markets Association (ISMA). Argentine domestic bonds follow CNV (the local securities regulator, analogous to the U.S. SEC) guidelines. Price quoting conventions are overseen, but not set by, the Emerging Markets Traders Association (EMTA); EMTA members also agree upon trading and settlement practices for loans.

As a result, there currently are three settlement practices used for instruments in the EMBI Global: standard international settlement, Argentina local settlement, and loan settlement. The standard international settlement period was seven calendar days through June 1, 1995, and became three business days on June 7, 1995. Argentine domestic settlement is three business days. Loan settlement follows an EMTA prescribed "batch settlement" process, whereby trades executed during specified time periods all settle on single pre-determined settlement dates.

Two types of price-quoting distinctions apply: the clean versus dirty pricing convention and the current versus original face pricing convention.

Clean vs. dirty quote conventions
The clean-dirty distinction refers to whether an instrument's quoted price is inclusive of accrued interest or not. Since the effective settlement price refers to all money paid at settlement, if a bond is quoted clean, the accrued interest through the value date owed at settlement must be added to the instrument's price.

Current face vs. original face value quote conventions
The current face-original face value distinction applies to amortizing and capitalizing bonds; it refers to whether a bond's quoted price is for a current face amount of 100 or for the original face value of the bond, which may reflect the fact that the instrument has amortized to an amount less than 100 or has capitalized to an amount greater than 100. Since effective settlement price refers to the money actually paid at settlement, which is based on the current outstanding face value of the bond, an adjustment is made to the bond's quoted price on a current-face basis to adjust it to an original-face basis. Exhibit 8 shows the pricing conventions of instruments in the EMBI Global.

Exhibit 8
Price quoting conventions for EMBI Global instruments

	Current Face	**Original face**
Clean (without accrued interest)	Bradys, Euros, Moroccan Tranche A	
Dirty (with accrued interest)	Russian Principal Notes and IANs	Argentine local market, Nigerian P- Notes

For example, a bond that is trading at par but has just amortized 10% would trade at a price of 100 on a current-face basis, but at a price of 90 on an original-face basis. Also, a bond that is trading at par and has just capitalized 10% would trade at 100 on a current-face basis and 110 on an original-face basis.

The adjustment from a current-face to an original-face basis is achieved by using a "balance" scalar, $B_{v(t)}$, which keeps track of the remaining balance of a bond after capitalizations and amortizations. For bonds that have amortized from par, the balance scalar will be between 0 and 1, starting at 1 at issue and decreasing to 0 at the final amortization (maturity) of the bond. For bonds that capitalize, the number rises starting at 1, as determined by the capitalization rates of the bond. This balance scalar strictly follows the quoting conventions of a bond and is not necessarily related to the balance of outstanding bonds as tracked by an issuer.

For example, in the case of bonds that trade with an ex-period for amortizations, the "ex-balance" follows the same convention. If the bond goes ex-amortization 30 days before the coupon, on that date the seller retains the right to the coupon; therefore, the effective settlement price is lowered (jumps down) by the amount of the amortization, since the buyer is no longer entitled to it. For a bond trading on a current-face basis, this

adjustment at settlement is made via the $B_{v(t)}$ scalar. This scalar is an important variable because it adjusts other variables affecting the effective settlement price. Accrued interest, for example, is normally computed on a cash basis (i.e., coupon rate x day count), ignoring the current balance of the bond. Here, again, the scalar is used to adjust the accrued interest for the balance on the bond.

Because the balance scalar is determined independently (i.e., it is based solely on the cash flow structure and quoting conventions for the bond), it can be used to scale all other variables. The remainder of this description assumes that all non-price variables have been appropriately adjusted and, therefore, defined on an original-face basis.

With these concepts in mind, we can generalize the equation for the effective settlement price of performing instruments as follows:

$$(3) \quad \begin{aligned} ESP_{s(t)} &= bp_t^Q \times \left\{ if\ CO = 1, B_{v(t)}, if\ CO = 0, 1 \right\} \\ &+ CO \times AC_{v(t)} \times bp_t^Q + CD \times AI_{v(t)} \end{aligned}$$

where:

bp_t^Q Bid price of a bond according to the quoting conventions of the bond's market; total return is calculated on the bid side so as to represent the "cash out" value of the bond on a given day

CO   Current face/original face value indicator:
1 = Bond quoted on a current-face basis (i.e., needs scaling if applicable); and
0 = Bond quoted on an original-face value basis

$B_{v(t)}$ Face balance scalar used to adjust for principal balance due, as determined by the cash-flow structure, and settlement and ex-balance conventions

$AC_{v(t)}$ Accrued capitalization; for bonds that capitalize *and* are quoted on a current-face basis, an adjustment is made at settlement for the portion of the next capitalization that is not included in the quoted price. Since capitalization is a payment for principal (unlike accrued interest, which is a payment for interest), the accrued capitalization, AC, is multiplied by the quoted price; AC is determined analogously to accrued interest (i.e., capitalization rate x day count convention)

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CD   Clean/dirty indicator:
      1 = Bond quoted on a clean basis; and
      0 = Bond quoted on a dirty basis

$AI_{v(t)}$ Current period's coupon rate x day count convention; this is calculated up to, but excluding, the value date, v(t). Although conventions covering accrued interest calculations can be generalized, exceptions do apply.

Settlement and interest calculations
EMBI Global calculations take into account accrued interest conventions, settlement conventions, and ex-coupon/ ex-amortization conventions of each security and market.

Day-count basis
In general, the day-count basis will depend on whether a bond has a fixed or floating rate. For fixed-rate bonds, it is usually 30/360, and for floating-rate bonds, it is usually either actual/360 or Treasury actual/actual. Exceptions exist, which apply to certain Brady bonds.

Coupon payment
Depending upon the specific debt instrument, coupons can be scheduled monthly, quarterly, semiannually, or annually. How the coupon end-of-period and pay dates are set vary from bond to bond. Several conventions apply to situations in which the end of a coupon's period falls on a weekend or holiday, as defined by EMTA. These conventions are detailed in Exhibit 9.

Exhibit 9
End-of-period conventions
If a scheduled end-of-period (EOP) date falls on a weekend or holiday, the end of period:

EOP/Pay 1	Remains on that date, and the actual pay date is moved to the next business day.
EOP/Pay 2	And the actual pay date are moved to the next business day.
EOP/Pay 3	And the actual pay date are moved to the next business day, unless that pushes them to the next calendar month, in which case they are moved to the preceding business day.
EOP/Pay 4	And the actual pay date are moved to the next business day, and all subsequent ends of periods are benchmarked from that day.
EOP/Pay 5	All hybrid cases of 1 – 4.

Coupon accrual
Generally, interest accrues from the previous coupon date (inclusive) to the settlement date (exclusive). If a

bond trades ex-coupon, negative accrued interest will accrue from the ex-date to the coupon date.

Cash reinvestment
Since coupon income and amortization payments on performing instruments are reasonably certain, reinvestment is done on the date on which the value date for the trade captures the next cash payment. This allows the investor to affect the reinvestment trade such that, when the trade settles, the cash payment is available.

Price and interest return
Price return is the component of total return that follows just the price movement. Intuitively speaking, it is the original-face, clean-priced bond's return, Pt(o,c). This bond's return is calculated using variables already defined:

$$(4) \quad P_t^{O,C} = bp_t^Q \times \left\{ \text{if } CO = 1, B_{v(t)}, \text{if } CO = 0,1 \right\} + CO \times AC_{v(t)} \times bp_t^Q$$
$$+ xam_{v(t)} - \left\{ \text{if } CD = 0, AI_{V(t)}, \text{if } CD = 1,0 \right\}$$

Price return, adjusted for currency, then is:

$$(5) \quad Pr_t = \frac{P_t^{O,C} + AM_{v(t)}}{P_{t-1}^{O,C}} \times \frac{FX_{i,t}}{FX_{i,t-1}} - 1$$

Finally, interest return is simply a residual of total return and price return:

$$(6) \quad 1 + ir_t = \frac{tr_t + 1}{Pr_t + 1}$$

Treatment of non-performing instruments
In the event of an unexpected delay of or default on a payment, the specific cash flow would not be recognized until the payment is actually received. The calculation of an individual non-performing instrument's return and the resulting index return would follow the settlement-cash flow entitlement convention set by either EMTA or a similar market trade group.

Currently, two instruments in the EMBI Global are classified as non-performing assets, the Russian Principal Notes and Interest Arrears Notes (IANs). At the time of non-payment, EMTA recommended that market participants begin quoting prices for these instruments with all accrued and unpaid interest for free. In effect, prices for these instruments – which had previously been quoted on a clean, current-face basis are now quoted on a dirty current face basis. Using the total return calculation detailed in Equation 1, we see

that the daily total returns for these instruments equal the daily percentage price changes in these quoted prices. Any cash flow-related return has been eliminated due to the payment default.

A default will not force the removal of the affected instrument from the EMBI Global. As long as the affected instrument continues to satisfy our inclusion criteria, it will not be removed from the index.

Impact of debt restructuring on index composition
If a non-performing asset in the EMBI Global is rescheduled, we expect that the index's holdings would be valued according to the market's expectations of the assets (either new bonds or cash) that a creditor would receive in the restructuring process. Our best model for this process is the one used to value the EMBI[+]'s (as well as the EMBI Global's) non-performing loan positions as they were converted to performing bonds through the Brady restructuring era of the late 1980s and 1990s.

From the time preceding the announcement of the terms of the Brady exchange until the issuance of new performing Brady bonds, daily valuations of our index's holdings of non-performing instruments were performed using one of three verifiable sources:

1) Executable market prices for the given instrument assuming direct settlement;
2) Executable market prices for the given instrument assuming settlement on a participation basis; or
3) When-and-if-issued market prices for the new performing bonds and a discount value of cash expected to be received in the debt restructuring, creating a hybrid value for the instrument.

Given that none of the EMBI Global's currently non-performing instruments have entered into a restructuring process, we are able to price the index's positions using daily executable market prices assuming direct settlement. For a more detailed example of how the valuation process was done for past index holdings of non-performing loans pending a Brady restructuring, see *Emerging Markets Bond Index Plus (EMBI+): Methodology,* July 12, 1995, pages 5 – 8.

II. Index total return

To compute a daily index value, we need to know the following:

1) The list of instruments to be included and their amounts outstanding;
2) The daily total return of each instrument; and
3) The weight of each instrument as of the prior business day's close.

The first factor, the list of instruments and amounts outstanding, comprises parameters that are exogenous to the other factors and, therefore, changes to it should not result in changes in value of the index. These "rebalancing" events are done to the index on the last business day of each month, such that the index's next month's composition reflects the new instrument balance. When a rebalancing event occurs, it is as if the investor sells the entire portfolio at the day's closing bid-side prices, and then immediately reinvests the proceeds in the new portfolio in proportion to the new market values based on the same closing bid-side prices. This results in a shift in the relative weights but not a change in the overall portfolio value.

It is worth noting what is meant by the amount outstanding of an instrument. Recall that amortizations and capitalizations, where applicable, result in changes to the amount outstanding. These changes are "passive," however, and are already captured in the effective settlement price via the balance scalar. Therefore, the figure used in determining market value is the original amount outstanding, plus or minus any "active" changes to the amount outstanding resulting from reopenings or buybacks (which we will refer to as N, the "number of bonds"). Since this is an original-face-value concept, it is consistent with all our other variables, also defined in terms of original face value.

The total return on day t, TR_t is the arithmetically weighted average of each instrument's return from the period t-1 to t. The weights are market-capitalization weights from the prior business day, t-1:

$$(7) \quad TR_t = \sum_{i \in L(t')} m_{i,t',t-1} \times tr_{i,t}$$

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In this equation, the "ith" bond's dirty market-capitalization weight on day t-1 is defined by:

$$m_{i,t',t-1} = \frac{N_{i,t'} \times ESV_{i,s(t-1)}}{\sum\limits_{i \in L(t')} N_{i,t'} \times ESV_{i,s(t-1)}}$$

where::

$$\sum_{i \in L(t')} m_{i,t',t-1} = 1$$

and:

L(t')   Instrument list on day t'

t'   Last rebalancing day

$N_{i,t'}$ Number of bonds (see above); usually equal to the amount outstanding, except for capitalizing or amortizing bonds

Each term in the summation in Equation 7 measures the percentage contribution of an instrument to the change in the index portfolio's value between day t-1 and day t.

Since each instrument's weight is updated daily, it is possible to see how cash reinvestment is done. Because the effective settlement price of an instrument drops concurrently with its cash payment (the accrued interest, balance scalar, quoted price, or cash-promised variable drops, depending on the type of instrument), the instrument's market-capitalization weight drops, raising the relative importance of the other instruments within the portfolio. This achieves cross-index reinvestment. Since the scheduled cash flow causes the instrument's market capitalization and weight as a percentage of the index to drop, a simultaneous increase in the weight of the other instruments in the index occurs. As a result of this shift in instrument weights, from a mathematical perspective cross-index investment of the cash flow is achieved.

Once the aggregate daily total return of the EMBI Global is known, it is then applied to the index's prior day closing level to arrive at the current day's closing value:

$$(8) \quad I_t = I_{t-1} \times (1 + TR_t)$$

I_{t-1} The closing cumulative total return index level for the EMBI Global as of the prior business day (where December 31, 1993 = 100)

Price and interest return
All of the variables needed to calculate index price returns are defined above, except for one. This remaining variable represents the clean market capitalization, which is computed in an analogous way to the dirty market capitalization, but uses the clean-price concepts described earlier for bonds and loans, instead of the effective settlement price. Therefore, portfolio price return is the weighted average – in which the weights are clean – of the price returns of the constituent instruments. Interest return calculations continue to be based on the same formula.

Calculation of the EMBI Global Constrained
The EMBI Global Constrained's daily index value is derived using the same total return calculation as the EMBI Global. Where the difference arises between the two indices is in the underlying bond allocations. Unlike the EMBI Global, which uses the total debt stock outstanding per index issue, the EMBI Global Constrained limits the allocations of index bonds issued by those countries with larger debt stocks outstanding.

Similar to the EMBI Global's traditional market-capitalization weighted return, the EMBI Global Constrained's total return on day t, $(TR_{FC,t})$, is the arithmetically weighted average of each instrument's return from the period t-1 to t.

$$(9) \quad TR_{FC,t} = \sum_{i \in L(t')} m_{FC,i,t',t-1} \times tr_{i,t}$$

However, unlike the EMBI Global, the EMBI Global Constrained uses a set of instrument weights (m_{FC}) derived from the market capitalization of a set of instruments whose face amount outstanding allocations are constrained by a defined algorithm:

$$m_{FC,i,t',t-1} = \frac{N^{fc}_{i,t'} \times ESV_{i,s(t-1)}}{\sum\limits_{i \in L(t')} N^{fc}_{i,t'} \times ESV_{i,s(t-1)}}$$

where:

$$\sum_{i \in L(t')} m_{FC,i,t',t-1} = 1$$

and:

L(t')   Instrument list on day t'

t'   Last rebalancing day

$N^{fc}_{i,t'}$ Equals $N_{i,t'}$ x $FC_{i,t}$

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$FC_{i,t}$ The face-constrained factor applied to the current face amount outstanding of each country's eligible debt stock. This factor equals C_{FC}/C_{sum}.

and:

$$C_{sum} = \sum_{i \in L(t')} N_{i,t'} \times B_{V(t)},$$

C_{sum} equals the sum of the current face amounts outstanding for all instruments belonging to a given EMBI Global country at time t', while C_{FC} represents the portion of that country's current face amount outstanding of debt eligible for inclusion in the EMBI Global Constrained.

C_{FC} is derived by applying an the following inclusion schedule to the C_{sum} of each country:

1) 100% of the first US$5 billion of C_{sum}
2) 75% of C_{sum} that exceeds US$5 billion but does not exceed US$10 billion;
3) 50% of C_{sum} that exceeds US$10 billion but does not exceed US$15 billion;
4) 25% of C_{sum} that exceeds US$15 billion but does not exceed US$25 billion;
5) 10% of C_{sum} that exceeds US$25 billion but does not exceed US$35 billion; and
6) 0% of C_{sum} that exceeds US$35 billion.

Once the aggregate daily total return of the EMBI Global Constrained is known, it is then applied to the index's prior day closing level to arrive at the current day's closing value:

$$(10) \quad I_{FC,t} = I_{FC,t-1} \times \left(1 + TR_{FC,t}\right)$$

where:

$I_{FC,\,t-1}$ The closing cumulative total return index level for the EMBI Global Constrained as of the prior business day (where December 31, 1993 = 100)