An Empirically Derived Allocation to Emerging-Market Equities: Markowitz Optimisation and Black-Litterman Interest-Rate Scenarios for a World Portfolio, 2016 to 2026

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Abstract

This paper examines what share of emerging-market equities should be added to a world portfolio from the perspective of a euro-based investor. The analysis rests on the euro-denominated monthly returns of two accumulating index funds over ten years (August 2016 to August 2026): the iShares Core MSCI World UCITS ETF (IE00B4L5Y983) as the world portfolio and the iShares MSCI EM UCITS ETF (IE00B4L5YC18) as the emerging-market holding; the risk-free rate is set at 2 per cent. The paper introduces the asset class: the origin of the term and the classification schemes, the criteria for promotion to developed status, the largest emerging markets by economic weight and by market capitalisation, and their sensitivity to US interest rates, their public debt and their currency risks.

The Markowitz minimum-variance portfolio holds 37.9 per cent emerging markets (volatility 12.46 per cent, return 11.58 per cent p.a.). The tangency portfolio of the capital market line contains no emerging-market equities ex post (minus 2.5 per cent unconstrained), because the world fund earned 12.92 per cent p.a. at 13.25 per cent volatility, a Sharpe ratio of 0.82, whereas the emerging-market fund earned 9.40 per cent at 14.47 per cent volatility, a Sharpe ratio of only 0.51. The market portfolio with 11.8 per cent emerging markets falls short of the maximum Sharpe

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ratio by only 0.006. A Black-Litterman optimisation with empirically estimated interest-rate views yields an allocation of 25.7 per cent (range 22 to 29 per cent) if the US one-year rate falls by 1.5 percentage points and an allocation of zero if it rises by 1.5 percentage points. The allocation is therefore a rate-dependent corridor from zero to about 25 per cent around the market weight of twelve per cent.

Keywords: Emerging markets · Asset allocation · Portfolio optimisation · Black-Litterman · Capital market line · Interest-rate sensitivity · Currency risk.

JEL codes: E43, F31, G11, G12, G15.

Non-Technical Summary

Emerging markets generate more than half of world output at purchasing-power parities, yet they account for only about twelve per cent of global stock-market capitalisation. This gap is the starting point of a question that every investor with a world portfolio faces: how much emerging markets should there be? This paper answers it not with a rule of thumb but with the data of the past ten years and two established optimisation methods.[2]

We first introduce the asset class: who coined the term, how the World Bank, the International Monetary Fund and the index providers MSCI, FTSE Russell and S&P Dow Jones define emerging markets, which criteria a country must meet to be promoted to developed status, and which countries carry the greatest weight economically and on the stock market. We discuss the characteristics investors should know: the high sensitivity to US interest rates and to the dollar, the on average lower public debt compared with the industrial nations, and the currency risk, which cost more than a third of the value of some currencies over the period studied.

The core of the paper is the optimisation. Following Markowitz we draw the efficient frontier from the world fund and the emerging-market fund, determine the portfolio with the lowest volatility and the portfolio with the best ratio of excess return to risk, the tangency point of the capital market line. We then apply the Black-Litterman method, which takes the market weights as the starting point and adds reasoned expectations; we derive these from the measured reaction of both funds to the US one-year rate and work through a fall and a rise of 1.5 percentage points.

The result is a corridor rather than a number. An investor who wants only to minimise volatility holds about 38 per cent emerging markets; one who extrapolates the past ten years holds none; the market portfolio holds just under twelve per cent. If US rates fall by 1.5 percentage points, the justified allocation rises to about a quarter of the equity portfolio; if they rise by 1.5 percentage points, it falls to zero. For experienced investors we therefore recommend a range from zero to about 25 per cent around the neutral anchor of twelve per cent, managed in step with the US interest-rate cycle.

[2] The paper uses the Xetra closing prices of the two funds in euro; they include dividends net of withholding taxes, fund costs and currency movements and thus correspond to what a euro-based investor would actually have earned.

Contents

1 Introduction

Few investment decisions are answered as often with rules of thumb as the question of the share of emerging markets in a global equity portfolio.[3] Some investors follow the market weight, others round numbers between ten and thirty per cent, and many justify their choice with the growth advantage of emerging economies, although economic growth and equity returns are barely related across countries (Ritter 2005; Dimson, Marsh and Staunton 2026). At the same time the asset class is in motion as rarely before: Taiwan has replaced China as the heaviest index country, Greece will join the developed markets in 2027, and the monetary policy of the United States, which has moved emerging markets more than their own fundamentals for decades, stands at a turning point in the summer of 2026.

The theoretical foundation of any allocation decision is the portfolio theory of Markowitz (1952, 1959), which asks about the expected value and the variance of the portfolio as a whole. Tobin (1958) added the risk-free asset, and Sharpe (1964), Lintner (1965) and Mossin (1966) derived the Capital Asset Pricing Model, in which the tangency portfolio of the capital market line coincides in equilibrium with the capitalisation-weighted market portfolio. Implementation often founders on estimation error: Michaud (1989) spoke of the optimisation enigma, Best and Grauer (1991) and Chopra and Ziemba (1993) showed how small changes in expected returns produce extreme weights, and DeMiguel, Garlappi and Uppal (2009) found that naive equal weighting frequently beats optimised portfolios out of sample. Black and Litterman (1991, 1992) responded with a method that takes the equilibrium returns embedded in the market portfolio as the starting point and departs from them only where the investor holds reasoned views.

The literature on emerging-market equities began with Errunza and Losq (1985), Harvey (1995) and Bekaert and Harvey (1995, 2000), who documented higher volatility, lower correlation with the industrial countries and growing integration into the world capital market. The dependence on US financing conditions was first described systematically by Calvo, Leiderman and Reinhart (1993); Rey (2013), Bruno and Shin (2015) and Miranda-Agrippino and Rey (2020) condensed it into the concept of a global financial cycle, and Reinhart, Rogoff and Savastano (2003) explained why emerging markets are more prone to debt crises despite lower debt ratios. The contribution of this paper is to bring these insights together empirically for a euro-based investor: we use the euro prices actually obtainable for two large index funds, determine the efficient frontier, the minimum-variance, tangency and market portfolios, estimate the interest-rate

[3] The term emerging markets goes back to Antoine van Agtmael, who coined it in 1981 as a staff member of the International Finance Corporation in order to market an equity fund for developing countries (World Bank Group 2026).

sensitivity of both funds and carry it into Black-Litterman views for two interest-rate scenarios.

The paper is structured as follows.[4] Section 1, the present section, introduces the research question and surveys the prior literature. Section 2 clarifies the term, the definition and the classification of emerging markets and the criteria for promotion to developed-market status. Section 3 presents the largest emerging markets by economic weight and by market capitalisation. Section 4 examines growth and returns, interest-rate sensitivity, public debt, currency risk and diversification benefits. Section 5 describes the data and the methodology, Section 6 presents the Markowitz optimisation with the efficient frontier, the minimum-variance portfolio, the capital market line and the tangency portfolio, Section 7 the Black-Litterman optimisation under two interest-rate scenarios, and Section 8 summarises the results, states the recommendation and offers an outlook.

2 Emerging Markets: Term, Definition and Classification

2.1 Origin of the Term and Economic Delimitation

Until the 1980s one spoke of the Third World or of developing countries.[5] The expression emerging markets arose in 1981 at the International Finance Corporation, when its staff member Antoine van Agtmael was looking for a name for an equity fund investing in developing countries that suggested not poverty but progress (World Bank Group 2026). Van Agtmael (2007) later described how the marketing term became an asset class: economies on the way from low to high income, with functioning but not yet fully open capital markets. O'Neill (2001) attached to the acronym BRIC the expectation that Brazil, Russia, India and China would shape the world economy of the coming decades.

There is no binding economic definition. The International Monetary Fund distinguishes only between advanced economies and emerging market and developing economies, with the assignment based on income, export diversification and integration into the global financial system (IMF 2026a); it has counted Korea as advanced since 1997, and Taiwan likewise, whereas MSCI continues to classify both as emerging markets. The World Bank ranks all economies every 1 July by gross national income per capita (Atlas method) into four groups; for fiscal year 2027 the thresholds are 1,175, 4,635 and 14,375 US dollars, above which the group of 87 high-income economies begins, while 59 economies count as upper-middle income, 47 as lower-middle income and 25 as low income (World Bank 2026a). In July 2026 Vietnam, the Philippines, Sri Lanka, Jordan and Micronesia

[4] The terms emerging markets and emerging economies are used synonymously in this paper; they always refer to the 24 countries of the MSCI Emerging Markets Index in its composition of 31 July 2026.

[5] The Emerging Markets Database of the International Finance Corporation supplied the first comparable price series from the 1980s onwards, on which the early studies of Harvey (1995) and Bekaert and Harvey (1995) rest.

moved up into the upper-middle-income group (World Bank 2026b). Table 1 compares the principal classification schemes.[6]

Table 1: Classification schemes for emerging markets compared

Institution	Criterion	Categories	Examples of divergent classifications
World Bank (2026a)	Gross national income per capita (Atlas method); thresholds FY2027: 1,175 / 4,635 / 14,375 USD	Low, lower-middle, upper-middle and high income (25 / 47 / 59 / 87 economies)	Korea, Taiwan, Chile, Poland, Saudi Arabia and Greece are high-income economies
IMF (2026a)	Income, export diversification, financial-market integration; no fixed rule	Advanced economies; emerging market and developing economies	Korea (since 1997), Taiwan, the Czech Republic and Israel count as advanced
MSCI (2026a)	Economic development, size and liquidity, market accessibility; annual review in June	Developed, Emerging, Frontier, Standalone	Korea and Taiwan remain Emerging; Greece Developed from May 2027
FTSE Russell (2025)	Quality of Markets, gross national income, market size	Developed, Advanced Emerging, Secondary Emerging, Frontier	Korea and Poland Developed; Greece Developed from September 2026; Vietnam Secondary Emerging from September 2026
S&P Dow Jones (2025)	Size and liquidity criteria, market accessibility, consultation of investors	Developed, Emerging, Frontier	Korea Developed; Greece Developed from September 2026; Iceland Emerging from September 2026

Sources: World Bank (2026a); IMF (2026a); MSCI (2026a, 2026b); FTSE Russell (2025); S&P Dow Jones Indices (2025); own compilation.

Such promotions are rarer than the growth rhetoric suggests: according to the World Development Report 2024, only 34 middle-income economies have made the leap into the high-income group since 1990, more than a third of them thanks to accession to the European Union or to newly discovered oil; the 108 middle-income economies are home to six billion people, and their growth typically slows at around ten per cent of US income per head (World Bank 2024).[7] The comparison in Table 1 shows that classification as an emerging market is not an economic fact but a convention that differs according to purpose. For investors the classification of the index providers is decisive, because it determines which index a country falls into and which capital flows it receives as a result.

[6] The World Bank's Atlas method smooths exchange-rate fluctuations through a three-year average of exchange rates, adjusted for the inflation differential against the major industrial countries (World Bank 2026a).

[7] The term middle-income trap goes back to Gill and Kharas (2007); it describes economies that can no longer compete on the wages of poor countries and cannot yet compete on the innovative capacity of rich ones.

2.2 Capital-Market Classification: MSCI, FTSE Russell and S&P Dow Jones

For investment practice the MSCI classification is the most important, because the largest emerging-market funds are based on MSCI indices, among them the fund examined here with 8.9 billion euro of assets.[8] MSCI assesses every market on three criteria: economic development, size and liquidity, and market accessibility for international institutional investors (MSCI 2026a). A country must meet all three criteria; the economic-development criterion is used only to delimit the developed markets, because the range of development levels within the emerging and frontier universes is too wide. Table 2 summarises the requirements of the framework published in June 2026.

Table 2: Requirements of the MSCI Market Classification Framework (June 2026)

Criterion	Frontier	Emerging	Developed
A Economic development	no requirement	no requirement	GNI per capita 25 % above the World Bank high-income threshold for three consecutive years
B Size and liquidity: number of companies meeting the Standard Index criteria	1	3	5
Company size (full market capitalisation)	USD 232 mn	USD 3,937 mn	USD 7,874 mn
Security size (float-adjusted market capitalisation)	USD 116 mn	USD 1,969 mn	USD 3,937 mn
Security liquidity (annualised traded value ratio, ATVR)	2.5 %	15 %	20 %
C Market accessibility: openness to foreign ownership	at least some	significant	very high
Ease of capital inflows and outflows	at least partial	significant	very high
Efficiency of the operational framework	modest	good and tested	very high
Availability of investment instruments	high	high	unrestricted
Stability of the institutional framework	modest	modest	very high

Source: MSCI (2026a). World Bank high-income threshold for 2024: USD 13,935 GNI per capita; size values applicable to the May 2026 index review.

Market accessibility is assessed in the annual Global Market Accessibility Review on 18 measures, among them restrictions on foreign ownership, liberalisation of the foreign-exchange market, investor registration, settlement, stock lending and short selling (MSCI

[8] The size and liquidity requirements correspond to the minimum requirements of the MSCI Global Standard Indexes and are updated quarterly; the values in Table 2 apply to the May 2026 index review (MSCI 2026a).

2026a).[9] Korea's promotion has been failing on these measures for years: MSCI (2026b) names the limited convertibility of the won, the rigid investor registration and the limited liquidity of the foreign-exchange market as unresolved points, although Korea has long been a developed market by income, size and liquidity and has been classified as such by FTSE Russell and S&P Dow Jones Indices since the late 2000s. Greece shows that classifications work in both directions: downgraded by MSCI in 2013, the country returns to the developed markets in May 2027; the June 2026 review also lifted Bulgaria to frontier status, placed Indonesia under review for a downgrade and warned Turkey about possible manipulation of the free float (MSCI 2026b); FTSE Russell (2025) and S&P Dow Jones Indices (2025) promote Greece as early as September 2026. An emerging-market index is thus not a static construct; every reclassification triggers capital flows that move the prices of the affected markets for months.

2.3 Promotion Criteria: From Developing Country to Industrial Nation

What must a country achieve to rise from developing country to industrial nation?[10] The answer has an economic, an institutional and a capital-market dimension. Economically, income per head is decisive: the World Bank threshold of 14,375 US dollars is the first hurdle; MSCI requires for developed-market status that income exceed this threshold by at least 25 per cent for three consecutive years, currently around 17,400 US dollars, and upgrades only when the change can be regarded as irreversible (MSCI 2026a). Institutionally, all schemes demand a stable legal order, protection of minority shareholders, reliable accounting, free movement of capital and a liquid foreign-exchange market. Bekaert, Harvey, Lundblad and Siegel (2011) showed that alongside the formal opening to foreign capital, non-regulatory characteristics also determine how far a market's valuations diverge from those of the industrial countries, with political country risk and the development of the stock market emerging as the robust factors; Bekaert, Harvey and Lundblad (2005) found that equity-market liberalisation raised real growth by about one percentage point per year.

On the capital-market dimension there must be enough large, liquid companies: for a developed market MSCI requires at least five companies with a capitalisation of more than 7.9 billion US dollars each and an annual trading volume of at least 20 per cent of the free float (MSCI 2026a). The three dimensions are rarely met at the same time: Korea and Taiwan have satisfied the economic and size criteria for many years but fail the requirements on the foreign-exchange market and investor access; Qatar and the United

[9] The Global Market Accessibility Review rates each measure ++ (no issues), + (minor improvements possible) or −/? (improvements needed); changes in these ratings trigger the annual consultations (MSCI 2026a).

[10] The World Bank adjusts the income thresholds annually for inflation; exchange-rate movements against the US dollar can therefore move a country above or below a threshold even without any real change (World Bank 2026b).

Arab Emirates were promoted from frontier to emerging status in 2014 and Kuwait in 2020, while Saudi Arabia moved from standalone status into the emerging-market index in 2019, in each case only once the market had opened to foreign investors and although their incomes exceed those of many industrial countries (MSCI 2026a). Promotion is therefore less an event than a process in which income, institutions and market infrastructure mature in succession; for investors it matters because upgrades trigger capital inflows and valuation adjustments.

3 The Largest Emerging Markets by Economic Weight and Market Capitalisation

3.1 Economic Weight

According to the World Economic Outlook of April 2026, world output reaches around 126.3 trillion US dollars in 2026; 73.8 trillion or 58.4 per cent falls to the advanced economies and 52.5 trillion or 41.6 per cent to the emerging market and developing economies, which at purchasing-power parities nevertheless account for 61.0 per cent of the world economy (IMF 2026a).[11] The 24 countries of the MSCI Emerging Markets Index together produce 44.2 trillion US dollars at market prices in 2026, or 35 per cent of world output, and 48.1 per cent at purchasing-power parities; real growth of the emerging market and developing economies is projected at 3.9 per cent for 2026, more than twice that of the advanced economies at 1.8 per cent. Table 3 shows the ten economically largest countries of the index.

[11] All figures in this section come from the database of the World Economic Outlook of April 2026 (IMF 2026a); values for 2026 are projections.

Table 3: The ten largest economies of the MSCI Emerging Markets Index, 2026

Country	GDP at market prices (USD bn)	GDP at PPP (USD bn)	Share of world economy at PPP (%)	Real growth 2026 (%)	Government debt 2026 (% of GDP)
China	20,852	44,295	19.9	4.4	106.9
India	4,153	18,902	8.5	6.5	83.4
Brazil	2,636	5,230	2.3	1.9	96.5
Mexico	2,121	3,581	1.6	1.6	62.7
Korea	1,931	3,542	1.6	1.9	54.4
Turkey	1,640	4,025	1.8	3.4	25.5
Indonesia	1,540	5,449	2.4	5.0	41.5
Saudi Arabia	1,389	2,895	1.3	3.1	32.1
Poland	1,134	2,164	1.0	3.3	65.7
Taiwan	977	2,275	1.0	5.2	27.6
Memo: United States	32,384	32,384	14.5	2.3	125.8
Memo: advanced economies	73,814		39.0	1.8	108.2
Memo: emerging market and developing economies	52,482		61.0	3.9	77.2

Source: IMF (2026a), World Economic Outlook April 2026; projections for 2026; PPP = purchasing-power parity; government debt as gross general government debt.

China, at 20.9 trillion US dollars, is by far the largest economy of the index and, at 19.9 per cent of the world economy at purchasing-power parities, larger than the United States at 14.5 per cent; India follows at a distance but grows fastest at 6.5 per cent.[12] Brazil, Mexico and Turkey carry more economic weight than Korea and Taiwan, whereas on the stock market the reverse holds; Korea, Taiwan, Poland and Saudi Arabia have long been high-income economies under the World Bank classification, and their membership of the index rests solely on capital-market criteria. The negative growth rates of Qatar and Kuwait stem from the war in the Middle East that broke out on 28 February 2026, largely closed the Strait of Hormuz until the ceasefire of 7 April and damaged Qatar's liquefied-gas facilities (IMF 2026b).

3.2 Market Capitalisation and Index Weights

The stock market weights differently from the economy.[13] On 31 July 2026 the MSCI Emerging Markets Index comprised 1,178 companies from 24 countries with a float-adjusted market capitalisation of 11.95 trillion US dollars; the MSCI World comprised

[12] At purchasing-power parities Indonesia, Brazil and Turkey are also larger than Korea; the order in Table 3 follows gross domestic product at market prices, which is more relevant for market capitalisation in dollars.

[13] The float adjustment counts only shares actually available for trading; holdings of the state, of founding families or of strategic investors are deducted, which weighs particularly heavily in emerging markets.

1,282 companies from 23 countries and 89.53 trillion, and the MSCI ACWI, which unites both universes, 101.48 trillion US dollars (MSCI 2026c, 2026d, 2026e). The share of emerging markets in the global index is thus 11.78 per cent, against 35 per cent of world output. This gap has three causes: many companies are unlisted or in state and family ownership, so that only the free float counts; valuations are lower; and the index rules capture only companies accessible to foreign investors. Table 4 shows the country weights and the largest constituents.

Table 4: Country weights and largest constituents of the MSCI Emerging Markets Index, 31 July 2026

Country	Weight in index (%)	Share of output of the 24 index countries (%)	Largest constituents (index weight in %)
Taiwan	26.6	2.2	Taiwan Semiconductor Manufacturing 15.5; MediaTek 1.3; Delta Electronics 0.8; Hon Hai 0.8
China	21.4	47.1	Tencent 3.1; Alibaba 2.1; China Construction Bank 0.8
Korea	20.3	4.4	Samsung Electronics 7.2 (preference shares 0.9); SK Hynix 5.6
India	11.7	9.4	Reliance Industries, HDFC Bank, ICICI Bank (each below 1 %)
Brazil	4.2	6.0	Petrobras, Vale, Itaú Unibanco
Other 19 countries	15.9	30.9	including Saudi Arabia, South Africa, Mexico, Indonesia, Thailand, Poland
Ten largest constituents combined	38.1		Information technology 40.8 % of the index; financials 20.0 %

Sources: MSCI (2026c); IMF (2026a) for output in 2026; own calculation. For India and Brazil the largest constituents are named without weights because they are not among the ten largest index constituents.

Taiwan provides 2.2 per cent of the output of the index countries but 26.6 per cent of the index; China provides 47.1 per cent of the output but only 21.4 per cent of the index.[14] A single company, Taiwan Semiconductor Manufacturing, weighs more at 15.5 per cent than India; together with Samsung Electronics and SK Hynix the three semiconductor makers account at 28 per cent for more than a quarter of the index, and the information-technology sector reaches 40.8 per cent against 28.9 per cent in the MSCI World (MSCI 2026c, 2026d). This composition is young: in 2016 the largest constituent weighed three to four per cent, and in 2021 China's weight approached the 40 per cent mark before the regulatory clampdown on the technology groups, the property crisis and geopolitical estrangement halved the share within five years (Callan 2026). Whoever adds emerging markets today buys above all the semiconductor value chain of East Asia; the correlations and volatilities

[14] The output shares in Table 4 refer to nominal gross domestic product in 2026 of the 24 index countries (IMF 2026a); at purchasing-power parities the shares of China and India would be higher still.

estimated in Sections 6 and 7 describe an index that changed itself during the period under review.

4 What Investors Should Know About Emerging Markets

4.1 Growth, Valuation and Returns

The most common justification for an emerging-market allocation is that higher economic growth brings higher equity returns.[15] The evidence argues otherwise. Ritter (2005) found across 16 countries and the whole of the twentieth century a negative correlation between real growth per head and real equity returns, because growth accrues above all to employees and to the founders of new companies, while existing shareholders are diluted through capital increases and new issues. Dimson, Marsh and Staunton (2026) confirm this in their database of 35 markets spanning 126 years: from 1900 to 2025 emerging markets returned 6.9 per cent per year and developed markets 8.5 per cent; only since 1960 have emerging markets led with 10.9 per cent against 9.6 per cent for developed markets. The shortfall over the full period stems to a considerable extent from the market closures in Russia in 1917 and China in 1949, which remind investors that emerging markets can not only fluctuate but also disappear.

The recent past is ambiguous too. Since the start of official index calculation at the end of 2000 the MSCI Emerging Markets Index has beaten the MSCI World with 9.06 per cent per year in US dollars against 7.45 per cent, owing to the commodity and China boom of 2001 to 2007; over the ten years to July 2026 it lags well behind the MSCI World with 9.19 against 12.73 per cent, at higher volatility of 17.44 against 14.86 per cent and a Sharpe ratio of 0.45 against 0.72 (MSCI 2026e). The other side of the coin is the cheaper valuation: on 31 July 2026 the index traded at 10.4 times expected earnings, the MSCI World at 18.8 times; the price-to-book ratio was 2.45 against 4.13 and the dividend yield 2.03 against 1.53 per cent (MSCI 2026c, 2026d). The year 2025 and the first months of 2026 reversed the ranking: the emerging-market index gained 33.6 per cent in US dollars in 2025 against 21.1 per cent for the MSCI World and a further 20.0 against 10.3 per cent to the end of July 2026 (MSCI 2026e), carried by the semiconductor makers of Taiwan and Korea and by the weaker dollar. The ten-year sample therefore contains a long phase of underperformance and a short catch-up.

[15] Goetzmann and Jorion (1999) showed that return estimates for emerging markets are biased upwards when only markets are considered that survived and re-entered the databases.

4.2 Interest-Rate Sensitivity Towards the United States

Few characteristics of emerging markets are better documented than their dependence on financing conditions in the United States.[16] Calvo, Leiderman and Reinhart (1993) showed for the capital inflows to Latin America in the early 1990s that external factors, above all low US interest rates, explained more than the reforms of the recipient countries, and Fratzscher (2012) confirmed the dominance of such push factors during the crisis, whereas country-specific pull factors gained the upper hand in the recovery of 2009 and 2010. Rey (2013) formulated from this the thesis of a global financial cycle driven by US monetary policy that leaves emerging markets only the choice of imposing capital controls or importing the interest rates of the Federal Reserve; Miranda-Agrippino and Rey (2020) documented it with a single global factor that explains a large part of the fluctuations of risky assets worldwide. Bruno and Shin (2015) described the mechanism: loose US monetary policy weakens the dollar, improves the balance sheets of dollar-indebted borrowers and raises the risk appetite of the lending banks; a tightening reverses the process.

The taper tantrum of May 2013, when the announcement of a reduction in bond purchases sent the currencies and stock markets of emerging economies tumbling, has become the textbook case: Eichengreen and Gupta (2015) found that the countries that had previously received the largest capital inflows suffered most, and Chari, Dilts Stedman and Lundblad (2021) showed that unconventional monetary policy first lifts emerging-market returns mainly through valuation gains rather than physical flows, whereas in the unwinding phase outflows and risk premia dominate and their effect there is an order of magnitude larger.[17] Kalemli-Özcan (2019) explained why emerging markets react more strongly than industrial countries: their risk premia move with US monetary policy, so that a rate increase in Washington raises not only risk-free rates there but also risk spreads; Hofmann and Park (2020) demonstrated that the trade-weighted dollar has itself become a risk factor for emerging markets.

[16] The Federal Reserve held the policy rate on 29 July 2026 in the range of 3.50 to 3.75 per cent; three members of the Federal Open Market Committee voted for an increase of 25 basis points (Federal Reserve 2026b).

[17] The taper tantrum denotes the market reaction to the announcement by the then Federal Reserve chairman Ben Bernanke on 22 May 2013 that bond purchases would be reduced; the yield on ten-year US Treasuries rose by about one percentage point within four months.

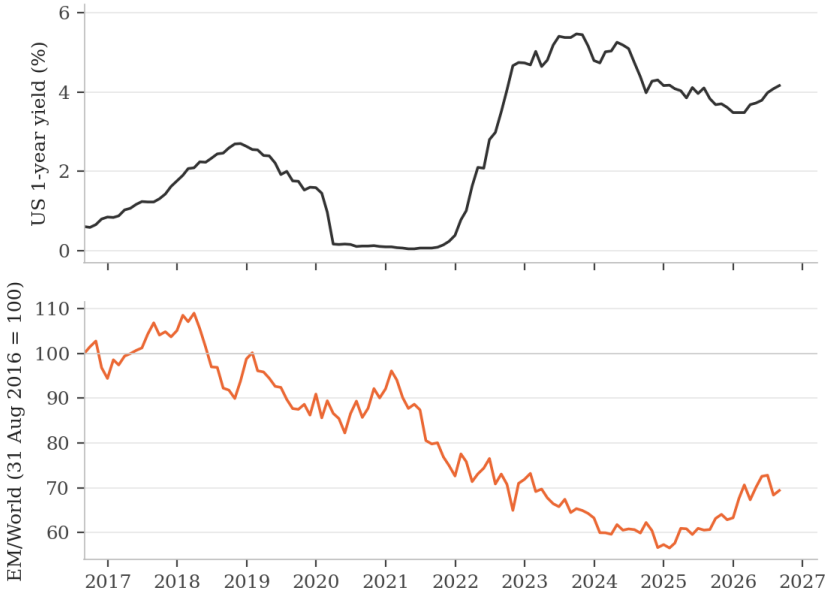

Figure 1: Yield on one-year US Treasuries and relative performance of the emerging-market fund against the world fund in euro, August 2016 to August 2026. Sources: FRED (DGS1); Yahoo Finance (Xetra closing prices EUNM and EUNL); own calculation. The relative performance is the ratio of the two price indices, normalised to 100 on 31 August 2016.

Figure 1 shows the relationship for the period under review.[18] The yield on one-year US Treasuries rose from 0.61 per cent in August 2016 to 2.7 per cent at the end of 2018, fell in the pandemic to 0.05 per cent in April 2021, peaked at 5.46 per cent in September 2023 and stood at 4.16 per cent in August 2026. The relative performance of the emerging-market fund was its mirror image: it peaked in the spring of 2018, fell to a low during the rate increases of 2022 and 2023 and recovered only when the Federal Reserve began cutting rates in September 2024 and the dollar weakened; over the whole period the emerging-market fund lost about 30 per cent against the world fund. Our estimate in Section 7.1 quantifies the sensitivity: an increase in the one-year rate by one percentage point over twelve months went along with a fall in the return of the emerging-market fund of 4.1 percentage points, against 2.6 percentage points for the world fund. In the summer of 2026 the relationship works in both directions: after six cuts since September 2024 the Federal Reserve has left the policy rate at 3.50 to 3.75 per cent, but inflation stood at 3.7 per cent in June 2026, well above target, three members of the Federal Open Market Committee voted for an increase (Federal Reserve 2026b), and at the end of August the one-year rate stood about half a percentage point above the midpoint of the policy range. A fall or rise of 1.5 percentage points, as assumed in the scenarios of Section 7, would correspond to a

[18] The rate series is the yield on one-year US Treasuries at constant maturity (FRED series DGS1) at month-end; the fund prices are Xetra closing prices at month-end in euro.

rate of about 2.7 or 5.7 per cent respectively and thus lies within the range of the period under review.

4.3 Public Debt: Lower Ratios, Lower Debt Tolerance

A frequently overlooked advantage of emerging markets is their on average lower public debt.[19] According to the World Economic Outlook, gross general government debt in 2026 reaches 108.2 per cent of output in the advanced economies and 77.2 per cent in the emerging market and developing economies; the United States stands at 125.8 per cent (IMF 2026a). As Table 3 shows, Korea, Indonesia, Saudi Arabia, Taiwan and Turkey have ratios between 25 and 55 per cent, far below most industrial countries. The exceptions prove the rule: China has expanded its ratio since the pandemic to 106.9 per cent, Brazil stands at 96.5 and India at 83.4 per cent; Greece, which leaves the index in 2027, is the most indebted index country at 136.9 per cent.

The lower ratio is no carte blanche, however. Reinhart, Rogoff and Savastano (2003) used the term debt intolerance to explain why emerging markets have run into payment difficulties at ratios of 30 to 40 per cent that industrial countries carry at 100 per cent: a history of defaults and high inflation lowers the threshold at which creditors lose confidence. Eichengreen, Hausmann and Panizza (2005) called the inability to borrow abroad in one's own currency original sin, because it turns every devaluation into a higher real debt burden; Du and Schreger (2016) documented that local-currency bond markets have since mitigated this original sin. The lower debt gives many emerging markets fiscal room that the industrial countries have lost, but it does not protect against capital flight when US rates rise and the dollar appreciates (Reinhart and Rogoff 2009).

4.4 Currency Risk

A euro-based investor who buys an emerging-market fund acquires a bundle of local-currency share prices, the exchange rates of these currencies against the dollar and the exchange rate of the dollar against the euro.[20] Table 5 shows how much the currencies of the largest index countries moved over the ten years to August 2026: the Brazilian real lost 37.8 per cent against the dollar, the Indian rupee 29.8 per cent and the Korean won 19.1 per cent; the yuan and the Taiwan dollar held their value, and the Mexican peso gained. Against the euro, which appreciated by 4.1 per cent against the dollar, the losses were somewhat larger still; the Federal Reserve's dollar index against emerging-market currencies rose by 7.9 per cent (Federal Reserve 2026a).

[19] Kose, Nagle, Ohnsorge and Sugawara (2021) describe the fourth debt wave of the emerging market and developing economies, under way since 2010, as the largest, fastest and broadest of the past fifty years.

[20] For comparison: the Japanese yen lost 35.4 per cent against the dollar over the same period and the Swiss franc gained 21.6 per cent; currency risk is not peculiar to emerging markets, but there it is larger on average and less often compensated by interest-rate advantages.

Table 5: Exchange-rate changes of selected emerging-market currencies, 31 August 2016 to 31 August 2026

Currency	Units per USD, August 2016	Units per USD, August 2026	Change against USD (%)	Change against EUR (%)
Chinese yuan	6.678	6.726	−0.7	−4.6
Indian rupee	66.94	95.38	−29.8	−32.6
Korean won	1,115.98	1,379.41	−19.1	−22.3
Taiwan dollar	31.74	31.61	+0.4	−3.5
Brazilian real	3.247	5.217	−37.8	−40.2
Mexican peso	18.849	17.043	+10.6	+6.3
South African rand	14.698	16.132	−8.9	−12.4
Thai baht	34.62	33.11	+4.6	+0.5
Malaysian ringgit	4.048	4.021	+0.7	−3.3
Memo: euro (USD per EUR)	1.1146	1.1598	+4.1	

Source: Federal Reserve (2026a), H.10 series via FRED (DEXCHUS, DEXINUS, DEXKOUS, DEXTAUS, DEXBZUS, DEXMXUS, DEXSFUS, DEXTHUS, DEXMAUS, DEXUSEU); last quotation of the respective month; own calculation. Negative values denote a depreciation of the emerging-market currency.

The currency element matters for two reasons.[21] First, it is not neutral: the monthly excess return of the emerging-market fund over the world fund responds with a coefficient of 0.62 to changes in the euro-dollar rate (t-value 5.1); a dollar weaker by one per cent went along with a relative emerging-market return higher by 0.6 percentage points. The dollar is thus, as Hofmann and Park (2020) argue, not merely a unit of conversion but a risk factor in its own right. Second, the currency risk of emerging markets can hardly be hedged, because the interest differential against the euro is incurred as hedging cost and liquid forward markets do not exist for many currencies. Perold and Schulman (1988) had called currency hedging a free lunch; Campbell, Serfaty-de Medeiros and Viceira (2010) showed that this does not hold for the dollar, because it appreciates in crises and unhedged dollar assets dampen equity risk for European investors. This explains a surprising observation in our data: in euro the volatility of the world fund was 13.25 per cent, whereas the index in dollars fluctuated by 14.86 per cent (MSCI 2026e); the dollar appreciated against the euro in the loss months and cushioned the losses of the euro-based investor, while emerging-market currencies depreciated against the dollar in the same phases. The optimisation in Section 6 rests on euro returns and therefore describes the risk that a euro-based investor actually bears.

4.5 Correlation, Concentration and Diversification Benefits

The classic reason for international diversification is the imperfect correlation of markets, which Solnik (1974) described as the source of a diversification gain that lowers risk without

[21] The estimate rests on 120 monthly observations; standard errors follow Newey and West (1987) with three lags. Details are documented in the worksheet Zinsregression of the Excel file.

sacrificing return.[22] Harvey (1995) found for the emerging markets of the early 1990s correlations with the world market often below 0.3. Integration has since reduced this advantage: Bekaert and Harvey (2000) showed that market opening raises correlation, Christoffersen, Errunza, Jacobs and Langlois (2012) found the increase to be concentrated in the developed markets, while emerging markets continued to offer a noticeable diversification gain, and Longin and Solnik (2001) demonstrated that correlation rises precisely in downturns, when investors need diversification most; Ang and Bekaert (2002) cast this regime change into a model with a crisis regime of high correlation and high volatility.

Our data fit this picture. The correlation of the monthly euro returns of the two funds was 0.64 over ten years; over rolling 36-month windows it ranged between 0.43 in April 2023 and 0.79 in April 2020, when the pandemic hit both markets simultaneously. A correlation of 0.64 is high enough to limit the diversification gain but low enough not to make it vanish: as Section 6 shows, an allocation of 38 per cent to emerging markets lowers the volatility of the world portfolio from 13.25 to 12.46 per cent, although the emerging-market fund on its own fluctuates more. What remains to be borne in mind is the concentration described in Section 3.2: whoever adds emerging markets today adds to a considerable extent the semiconductor risk of East Asia, which is more closely tied to the technology weight of the MSCI World than the commodity and banking stocks of ten years ago.

5 Data and Methodology

5.1 Data

We use the Xetra closing prices of two index funds in euro.[23] The world portfolio is represented by the iShares Core MSCI World UCITS ETF USD (Acc), ISIN IE00B4L5Y983, ticker EUNL, which with 127.9 billion euro of assets and ongoing charges of 0.20 per cent is the largest exchange-traded fund in Europe; the emerging markets are represented by the iShares MSCI EM UCITS ETF USD (Acc), ISIN IE00B4L5YC18, ticker EUNM, which manages 8.9 billion euro and costs 0.18 per cent (iShares 2026). Both funds replicate physically, were launched on 25 September 2009, are domiciled in Ireland, accumulate their income and are denominated in US dollars; their euro prices therefore include dividends net of withholding taxes, fund costs and the currency movement against the euro, and measure exactly what a euro-based investor without currency hedging would have earned. The period under review comprises the 121 month-end prices from 31 August

[22] Goetzmann, Li and Rouwenhorst (2005) showed over 150 years that the correlation of world equity markets rises in phases of globalisation and falls in phases of retreat; the diversification benefit is therefore itself cyclical.

[23] The price series come from Yahoo Finance (Xetra closing prices) and were checked against the price series of justETF; the mean deviation is below 0.1 per cent. All data are documented in the accompanying Excel file.

2016 to 31 August 2026, hence 120 monthly returns; the world fund rose from 38.67 to 128.21 euro, the emerging-market fund from 24.36 to 56.06 euro (Figure 2).

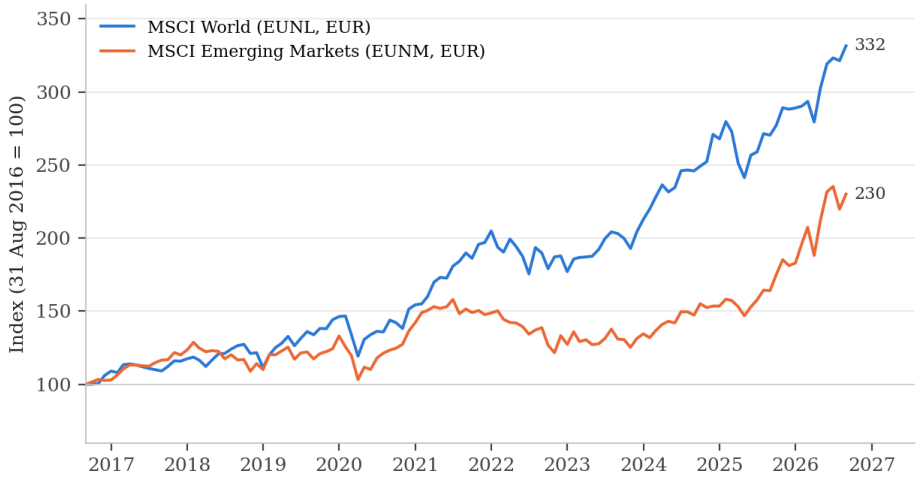

Figure 2: Performance of the world fund (EUNL) and the emerging-market fund (EUNM) in euro, 31 August 2016 = 100. Source: Yahoo Finance (Xetra closing prices at month-end); own calculation. Both funds accumulate; the prices include dividends net of withholding taxes and fund costs.

As the interest-rate series we use the yield on one-year US Treasuries at constant maturity from the FRED database, supplemented by the effective federal funds rate and the euro-dollar rate (Federal Reserve 2026a); the one-year rate is better suited than the policy rate itself, because it contains expectations about monetary policy over the coming twelve months and moves continuously.[24] The risk-free rate is set at 2.0 per cent per year in euro as specified, just below the deposit rate of the European Central Bank of 2.25 per cent in July 2026 (ECB 2026). We weight the market portfolio with the float-adjusted capitalisations of 31 July 2026: 88.22 per cent MSCI World and 11.78 per cent MSCI Emerging Markets (MSCI 2026c, 2026e). Table 6 summarises the descriptive statistics: the world fund earned an arithmetic average return of 12.92 per cent per year at a volatility of 13.25 per cent, the emerging-market fund 9.40 per cent at 14.47 per cent, and the Sharpe ratios are 0.82 and 0.51. In the calendar years the emerging-market fund led only four times: in 2017 with 19.9 against 7.7 per cent, in 2020, in 2025 with 19.2 against 7.9 per cent and to August 2026 with 25.8 against 14.7 per cent; in 2021 it lagged furthest with 4.7 against 32.7 per cent.

[24] The calendar-year returns of both funds as well as skewness, kurtosis and maximum drawdowns are laid down with formulas in the worksheet Statistik of the accompanying Excel file.

Table 6: Descriptive statistics of the monthly euro returns, September 2016 to August 2026

Statistic	MSCI World (EUNL)	MSCI Emerging Markets (EUNM)
Price 31 August 2016 / 31 August 2026 (EUR)	38.67 / 128.21	24.36 / 56.06
Total return over ten years (%)	231.6	130.1
Geometric return p.a. (%)	12.73	8.69
Arithmetic return p.a. (%)	12.92	9.40
Volatility p.a. (%)	13.25	14.47
Sharpe ratio (risk-free rate 2 %)	0.82	0.51
Best month (%)	+10.3 (July 2022)	+12.8 (April 2026)
Worst month (%)	−10.8 (March 2020)	−13.6 (March 2020)
Maximum drawdown (%)	−18.8 (March 2020)	−23.0 (October 2022)
Skewness / excess kurtosis	−0.38 / 0.67	−0.23 / 0.91
Correlation of monthly returns	0.64	
Observations	120	120

Source: Yahoo Finance (Xetra closing prices); own calculation. The arithmetic mean is annualised with the factor 12, the volatility with the factor $\sqrt{12}$.

5.2 Markowitz Optimisation, Capital Market Line and Market Portfolio

Markowitz (1952) describes a portfolio solely by the expected value and the variance of its return.[25] For two assets with expected returns μ_W and μ_EM, volatilities σ_W and σ_EM and correlation ρ, an emerging-market share w yields the portfolio return $\mu\_P = (1-w)\cdot\mu\_W + w\cdot\mu\_EM$ and the portfolio variance $\sigma\_P^2 = (1-w)^2\cdot\sigma\_W^2 + w^2\cdot\sigma\_EM^2 + 2\cdot w\cdot(1-w)\cdot\rho\cdot\sigma\_W\cdot\sigma\_EM$. Plotting volatility against return for all w produces the efficient frontier, whose leftmost point is the minimum-variance portfolio with weight $w\_MVP = (\sigma\_W^2 - \rho\cdot\sigma\_W\cdot\sigma\_EM) / (\sigma\_W^2 + \sigma\_EM^2 - 2\cdot\rho\cdot\sigma\_W\cdot\sigma\_EM)$; all portfolios above it are efficient, because no other portfolio offers a higher return at the same volatility. As expected values we use the annualised arithmetic means of the monthly returns, as variances and covariance the annualised sample moments (Markowitz 1959; Elton, Gruber, Brown and Goetzmann 2014).

Tobin (1958) extended the model by a risk-free asset with rate r_f. All combinations of the risk-free asset and a risky portfolio lie on a straight line through the point $(0, r\_f)$; the steepest of these lines touches the efficient frontier at the tangency portfolio and is called the capital market line. Its slope $(\mu\_T - r\_f) / \sigma\_T$ is the Sharpe ratio of the tangency portfolio (Sharpe 1994); because no steeper line reaches the efficient frontier, the tangency portfolio maximises the Sharpe ratio of all risky portfolios, and its weight vector is proportional to $\Sigma^{-1}\cdot(\mu - r\_f)$ with covariance matrix Σ. From this follows the separation theorem: every investor holds the same risky portfolio and chooses only the share invested

[25] The arithmetic mean is the unbiased estimator of the expected one-period return; the geometric return lies below it because of volatility (approximation: geometric $\approx$ arithmetic $- \sigma^2/2$).

risk-free or borrowed at r_f. Sharpe (1964), Lintner (1965) and Mossin (1966) inferred the market equilibrium: if all investors hold the same tangency portfolio, it must contain all risky assets at their market-value weights. Roll (1977) objected that the true market portfolio is unobservable; we use the capitalisation weights of the MSCI ACWI as its proxy.

5.3 Black-Litterman Optimisation

The method of Black and Litterman (1991, 1992) reverses the Markowitz optimisation.[26] Instead of estimating expected returns, it takes the observable market weights w_M and asks which excess returns π an investor with risk aversion δ would have to expect for exactly these weights to be optimal; the answer is $\pi = \delta \cdot \Sigma \cdot w_M$ with $\delta = (\mu_M - r_f) / \sigma_M^2$ (He and Litterman 1999; Idzorek 2007). To these equilibrium returns the investor adds views: a vector Q of expected returns, a matrix P that selects the assets concerned, and a matrix Ω that describes the uncertainty of the views. The combined expectation is $\mu_{BL} = [(\tau\Sigma)^{-1} + P'\Omega^{-1}P]^{-1} \cdot [(\tau\Sigma)^{-1}\pi + P'\Omega^{-1}Q]$, where the scalar τ measures the uncertainty of the equilibrium returns and is set in the literature between 0.025 and 0.10 (Walters 2014). The optimal weights follow from $w^* = (\delta\Sigma)^{-1} \cdot \mu_{BL}$; their ratio determines the allocation share, their sum the share of risky assets. Without views the investor obtains the market portfolio; with views he departs from it only as far as they are reliable.

We formulate two absolute views, one per fund, and derive them from a regression of the twelve-month returns of both funds on the twelve-month change in the US one-year rate. The view for an interest-rate scenario is $Q = \pi + \beta \cdot \Delta r$, that is equilibrium return plus estimated interest-rate effect, where β is the regression coefficient and Δr the assumed rate change of minus or plus 1.5 percentage points. We set the uncertainty of the view equal to the statistical uncertainty of the estimate: Ω is the diagonal matrix of the squared products of standard error and rate change. In this way the reliability of the views is not asserted but measured; for comparison we compute the variant of He and Litterman (1999) with Ω proportional to $\tau \cdot P\Sigma P'$ and vary τ between 0.025 and 0.10.

6 Results of the Markowitz Optimisation

6.1 Efficient Frontier and Minimum-Variance Portfolio

Figure 3 shows the efficient frontier formed by the two funds.[27] It starts at the pure emerging-market portfolio with 14.47 per cent volatility and 9.40 per cent return, bends to the left, reaches its lowest-risk point at the minimum-variance portfolio and rises to the

[26] Meucci (2010) shows that the method can be read as a Bayesian updating of a prior distribution with views of limited reliability; without views the posterior and the equilibrium coincide.

[27] At a correlation of 0.3, as Harvey (1995) found for the early 1990s, the minimum-variance weight of emerging markets at today's volatilities would be about 44 per cent; at a correlation of 0.9 it would fall to about 7 per cent.

pure world portfolio with 13.25 per cent volatility and 12.92 per cent return. The minimum-variance portfolio lies at an emerging-market share of 37.9 per cent; it has a volatility of 12.46 per cent, an expected return of 11.58 per cent and a Sharpe ratio of 0.77. Remarkably, adding the more volatile fund lowers risk: against the pure world portfolio volatility falls by 0.79 percentage points, because the covariance of 0.0122 is smaller than the variance of the world fund of 0.0175 and the correlation of 0.64 permits a diversification gain at similar individual volatilities.

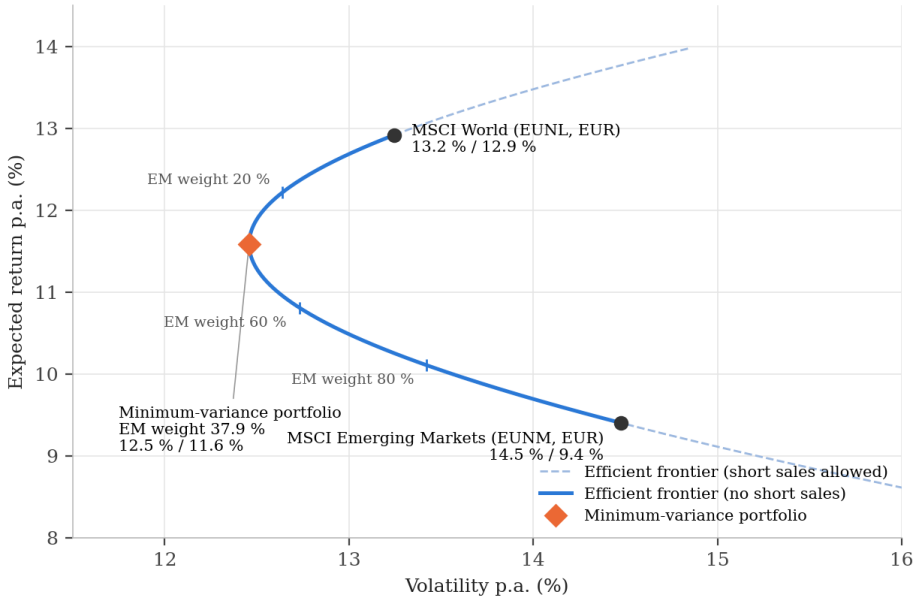

Figure 3: Efficient frontier of world fund and emerging-market fund with the minimum-variance portfolio, monthly returns in euro, September 2016 to August 2026. Source: own calculation. The dashed extension shows portfolios with short sales (emerging-market share below zero or above 100 per cent). Figures: volatility / expected return p.a.

Table 7 quantifies the efficient frontier in steps of ten percentage points.[28] Between zero and 40 per cent emerging-market share volatility falls while return declines by about 0.35 percentage points per ten percentage points of allocation; beyond 40 per cent risk and forgone return rise together, and these portfolios are inefficient. The Sharpe ratio falls monotonically along the whole frontier from 0.824 to 0.512. An investor who wants only to minimise volatility therefore holds 38 per cent emerging markets; an investor who wants to maximise return per unit of risk holds, as the following section shows, none ex post.

[28] The points of the efficient frontier are laid down in the Excel file (worksheet Efficient_Frontier) in steps of one percentage point, including the portfolios with short sales and the capital market line.

Table 7: Efficient frontier, minimum-variance portfolio, tangency portfolio and market portfolio

Emerging-market share (%)	World share (%)	Expected return p.a. (%)	Volatility p.a. (%)	Sharpe ratio
0 (pure world portfolio)	100.0	12.92	13.25	0.824
10	90.0	12.57	12.89	0.820
20	80.0	12.21	12.64	0.808
30	70.0	11.86	12.49	0.789
40	60.0	11.51	12.46	0.763
50	50.0	11.16	12.54	0.731
60	40.0	10.81	12.73	0.692
70	30.0	10.46	13.03	0.649
80	20.0	10.11	13.42	0.604
90	10.0	9.76	13.91	0.558
100 (pure emerging-market portfolio)	0.0	9.40	14.47	0.512
Minimum-variance portfolio: 37.9	62.1	11.58	12.46	0.769
Tangency portfolio (unconstrained): −2.5	102.5	13.00	13.35	0.824
Tangency portfolio (no short sales): 0.0	100.0	12.92	13.25	0.824
Market portfolio (MSCI ACWI): 11.8	88.2	12.50	12.84	0.818

Source: own calculation based on the monthly returns in euro; risk-free rate 2 per cent p.a. The Sharpe ratio is (return − 2 %) / volatility.

6.2 Capital Market Line, Tangency Portfolio and Market Portfolio

Figure 4 adds the risk-free asset to the efficient frontier.[29] The capital market line starts at the riskless point with 2 per cent return and touches the efficient frontier at the tangency portfolio. This lies at an emerging-market share of minus 2.5 per cent: an investor permitted to sell short would sell the emerging-market fund short to the extent of 2.5 per cent of the portfolio and place the proceeds additionally in the world fund; it earns 13.00 per cent return at 13.35 per cent volatility and a Sharpe ratio of 0.824. Without short sales the optimum lies at the boundary, at the pure world portfolio with a Sharpe ratio of likewise 0.824. The ex post efficient portfolio of the past ten years thus contains no emerging markets, because the emerging-market fund did not reward its higher volatility with a higher return: its Sharpe ratio of 0.51 lies so far below that of the world fund that even the diversification gain from the correlation of 0.64 does not lift it into the tangency portfolio.

[29] Whether an asset enters the tangency portfolio depends on the ratio of its Sharpe ratio to the Sharpe ratio of the existing portfolio multiplied by the correlation: an allocation pays if $SR\_EM > \rho \cdot SR\_W$, here $0.51 > 0.64 \cdot 0.82 = 0.52$, which is narrowly missed (Elton, Gruber, Brown and Goetzmann 2014).

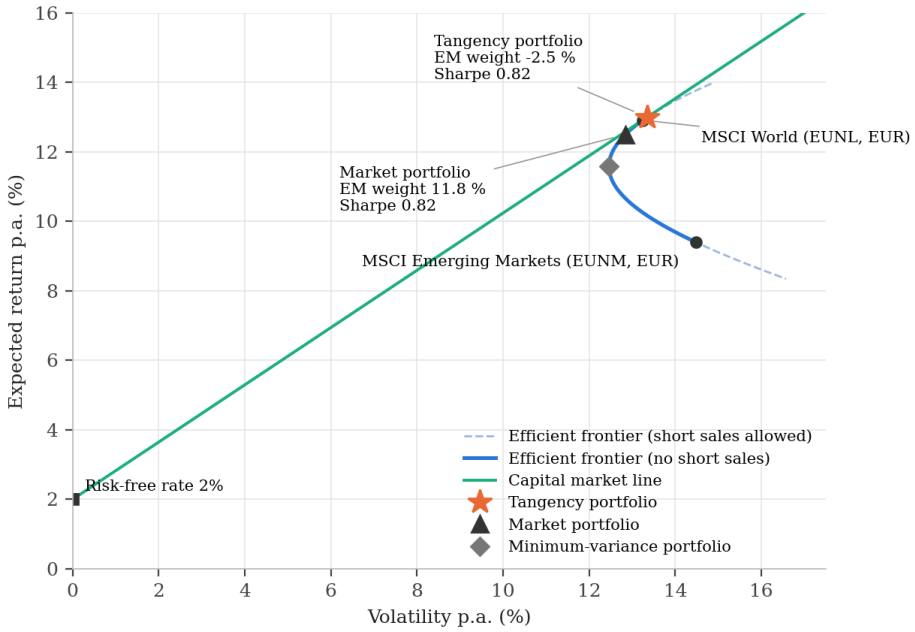

Figure 4: Capital market line, tangency portfolio, market portfolio and minimum-variance portfolio at a risk-free rate of 2 per cent. Source: own calculation. The slope of the capital market line equals the Sharpe ratio of the tangency portfolio of 0.824; the market portfolio is weighted 88.2 per cent world and 11.8 per cent emerging markets.

The significance of the tangency portfolio goes beyond the chart.[30] First, it maximises the slope of the capital market line and hence the Sharpe ratio, the ratio of excess return over the risk-free rate to risk: every point on the capital market line offers, at a given volatility, the highest return attainable with the two funds and the risk-free asset. Second, it follows from Tobin's (1958) separation theorem that the composition of the risky portfolio does not depend on risk appetite: a cautious investor holds part of the wealth risk-free and the rest in the tangency portfolio, a risk-seeking investor borrows and holds more than the wealth in it; both move along the same line. Third, under the assumptions of the Capital Asset Pricing Model of Sharpe (1964), Lintner (1965) and Mossin (1966) the tangency portfolio is identical with the market portfolio, which contains all available risky assets in market-value-weighted form: if all investors have homogeneous expectations, can borrow and lend at the risk-free rate and hold the same tangency portfolio, its weights must correspond to the relative market values, because in equilibrium every asset must be held. The market portfolio is thus the theoretical anchor of every allocation decision, and the capitalisation weights of the MSCI ACWI with 11.8 per cent emerging markets are its empirical approximation.

How far is this market portfolio from the empirical tangency portfolio?[31] Less far than the difference in weights suggests: it earns 12.50 per cent return at 12.84 per cent volatility

[30] The separation theorem presupposes that investors can both lend and borrow at the risk-free rate; Black (1972) showed that without this assumption a zero-beta portfolio takes the place of the risk-free asset.

[31] The standard error of the annual return is $\sigma/\sqrt{T}$ with $\sigma = 14.47$ per cent and $T = 10$ years; Merton (1980) showed that this error cannot be reduced by more frequent observations within the period.

and a Sharpe ratio of 0.818 against 0.824; on the capital market line a return of 12.58 per cent would have been attainable at its volatility, so the efficiency loss is eight basis points per year. This small distance is the real lesson of the section: the efficient frontier runs so flat in the neighbourhood of the tangency portfolio that allocations between zero and about 20 per cent are almost equivalent, whereas the estimation uncertainty of expected returns, which Michaud (1989) and Chopra and Ziemba (1993) described as the Achilles heel of optimisation, is many times larger: the standard error of the estimated annual return of the emerging-market fund is about 4.6 percentage points with 120 monthly observations (Merton 1980), so that the return difference of 3.5 percentage points between the two funds cannot be distinguished from zero statistically. That is why the following section turns to the Black-Litterman method, which takes not the uncertain historical return but the equilibrium as its starting point.

7 Black-Litterman Optimisation Under Two Interest-Rate Scenarios

7.1 Equilibrium Returns and Empirically Estimated Interest-Rate Views

From the market portfolio with 88.22 per cent world and 11.78 per cent emerging markets follows an implied risk aversion of $\delta = 6.37$, because the market portfolio earned an excess return of 10.50 per cent at a variance of 0.0165.[32] The equilibrium excess returns are $\pi\_W = 10.78$ and $\pi\_EM = 8.43$ per cent, that is 12.78 and 10.43 per cent expected return in total. In equilibrium the emerging-market fund receives a lower expectation than the world fund although it is more volatile, because its beta against the market portfolio of 0.80 lies below that of the world fund of 1.03: part of its risk is not systematic and is not rewarded in equilibrium. Its historical return of 9.40 per cent lies one percentage point below the equilibrium return, that of the world fund slightly above; the equilibrium smooths the differences that drove the optimisation in Section 6 to its corner solution.

We derive the views from the interest-rate regression summarised in Table 8.[33] Over twelve months an increase in the yield on one-year US Treasuries by one percentage point went along with a return of the emerging-market fund lower by 4.07 percentage points and a return of the world fund lower by 2.58 percentage points; the t-values of 2.26 and 1.72 rest on Newey-West standard errors because of the overlapping observations, and the difference between the two funds of 1.49 percentage points has a t-value of 1.84. On a

[32] The risk aversion of 6.37 exceeds the customary values of 2.5 (He and Litterman 1999) to 3.07 (Idzorek 2007) because the realised market premium of the decade was unusually high at 10.5 per cent; δ is irrelevant for the relative weights and affects only the share of risky assets.

[33] The twelve-month windows overlap by eleven months, so the 109 observations are not independent; the Newey and West (1987) standard errors account for this autocorrelation.

monthly basis the relationship for the individual funds cannot be distinguished from zero, because rate changes within a month mainly reflect surprises that hit prices and rates simultaneously; the relative return nevertheless responds here too, with minus 2.27 percentage points per percentage point. For the scenarios of minus and plus 1.5 percentage points the interest-rate effects are plus or minus 6.11 percentage points for the emerging-market fund and 3.87 percentage points for the world fund.

Table 8: Interest-rate sensitivity of the two funds to the yield on one-year US Treasuries

Dependent variable (return in %)	Horizon	Coefficient per percentage point of rate change	Standard error (HAC)	t-value	R^2	Observations
World fund (EUNL)	12 months	−2.58	1.50	−1.72	0.12	109
Emerging-market fund (EUNM)	12 months	−4.07	1.81	−2.26	0.18	109
Difference EM − World	12 months	−1.49	0.81	−1.84	0.04	109
World fund (EUNL)	1 month	+1.72	2.90	0.59	0.01	120
Emerging-market fund (EUNM)	1 month	−0.55	3.24	−0.17	0.00	120
Difference EM − World	1 month	−2.27	1.33	−1.70	0.02	120

Source: own calculation. Regression of the fund return in euro over the respective horizon on the change in the yield on one-year US Treasuries (FRED, DGS1) over the same horizon; overlapping twelve-month windows; Newey-West standard errors with 14 and 3 lags respectively.

The views are, for the scenario of falling rates, Q_W = 14.65 and Q_EM = 14.54 per cent excess return, and for the scenario of rising rates Q_W = 6.91 and Q_EM = 2.32 per cent. Their uncertainty according to the standard errors is 2.25 percentage points for the world fund and 2.71 percentage points for the emerging-market fund, that is Ω entries of 0.00051 and 0.00073, whereas the uncertainty of the equilibrium returns at $\tau = 0.05$ is 0.00088 and 0.00105. The views are therefore somewhat more reliable than the equilibrium: the combined expectations travel 80 per cent of the way from equilibrium to view for the world fund and 65 per cent for the emerging-market fund (at $\tau = 0.025$: 64 and 50 per cent; at $\tau = 0.10$: 91 and 78 per cent).

7.2 Results of the Two Scenarios

Table 9 summarises the results, and Figure 5 sets them against the Markowitz results.[34] Without a view the investor obtains the market portfolio with 11.8 per cent emerging markets. If the US one-year rate falls by 1.5 percentage points, the combined excess-return expectations rise to 13.89 per cent for the world fund and 12.41 per cent for the emerging-market fund; the optimal weights are 100.1 per cent world and 34.6 per cent emerging

[34] An investor who does not want to borrow holds, in the scenario of falling rates, a fully invested equity portfolio with 25.7 per cent emerging markets; the statement about the allocation share does not depend on leverage.

markets, 134.7 per cent in total, meaning that an investor with unchanged risk aversion would borrow because both assets become more attractive. Within the equity portfolio the allocation is 25.7 per cent, more than twice the market weight; the sensitivity analysis gives 22.2 per cent at $\tau = 0.025$, 29.1 per cent at $\tau = 0.10$ and 24.3 per cent under the Ω specification of He and Litterman (1999).

Table 9: Black-Litterman results for the two interest-rate scenarios ($\tau = 0.05$, Ω from the regression standard errors)

Quantity	Base case without view	US rate −1.5 percentage points	US rate +1.5 percentage points
Equilibrium excess return π world / EM (%)	10.78 / 8.43	10.78 / 8.43	10.78 / 8.43
View Q world / EM (% excess return)	–	14.65 / 14.54	6.91 / 2.32
Combined excess return μ_BL world / EM (%)	10.78 / 8.43	13.89 / 12.41	7.67 / 4.46
Optimal weight world (% of wealth)	88.2	100.1	76.3
Optimal weight EM (% of wealth)	11.8	34.6	−11.1
Sum of risky assets (%)	100.0	134.7	65.3
EM share of the equity portfolio, unconstrained (%)	11.8	25.7	−16.9
EM share of the equity portfolio, no short sales (%)	11.8	25.7	0.0
Expected return of the equity portfolio (%)	12.50	15.51	10.22
Volatility of the equity portfolio (%)	12.84	12.54	14.06
Range of the share for $\tau = 0.025$ to 0.10 (%)	11.8	22.2 to 29.1	−6.4 to −28.9 (0.0)
Share with $\Omega = \mathrm{diag}(\tau P \Sigma P')$ after He and Litterman (%)	11.8	24.3	−11.6 (0.0)

Source: own calculation; all computational steps can be followed with matrix formulas in the worksheet Black_Litterman of the accompanying Excel file. Values in brackets: share without short sales.

If the US one-year rate rises by 1.5 percentage points, the picture reverses.[35] The combined expectations fall to 7.67 per cent for the world fund and 4.46 per cent for the emerging-market fund, the optimal weights to 76.3 per cent world and minus 11.1 per cent emerging markets; the investor would place a third of the wealth risk-free and sell the emerging-market fund short. Without short sales the share is zero, and this holds for all values of τ examined and for both Ω specifications. The asymmetry follows from the structure of the problem: falling rates lift the expectation for the emerging-market fund above that of the world fund because of its greater rate sensitivity; rising rates push it below the threshold at which the correlation of 0.64 no longer justifies an allocation, namely where the Sharpe

[35] The sum of risky assets of 65.3 per cent means that a third of the wealth would be placed at the risk-free rate; the allocation share always refers to the risky part of the portfolio.

ratio of the emerging-market fund falls short of the product of correlation and Sharpe ratio of the world fund.

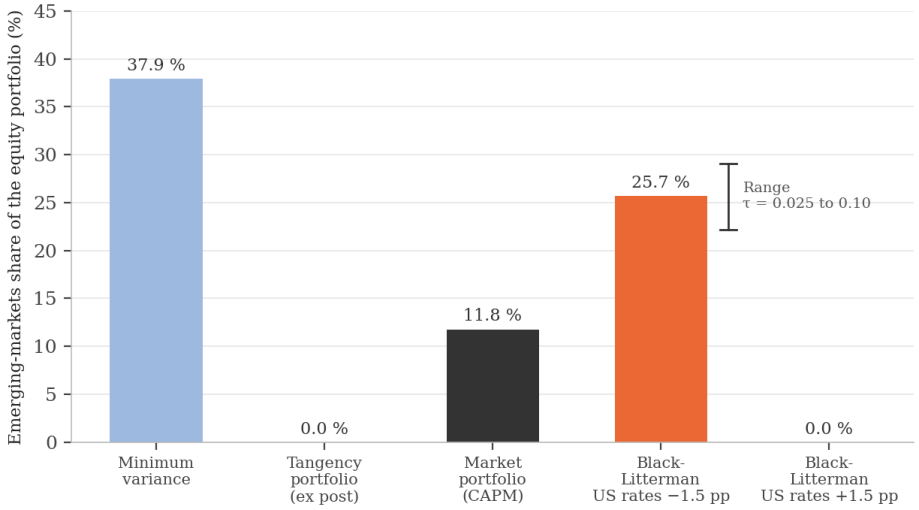

Figure 5: Emerging-market share of the equity portfolio by optimisation method and interest-rate scenario. Source: own calculation. Markowitz results ex post (monthly returns in euro, September 2016 to August 2026); Black-Litterman with $\tau = 0.05$ and Ω from the regression standard errors; in the scenario of rising rates the unconstrained share is −16.9 per cent, zero without short sales.

Figure 5 condenses the results.[36] The five bars answer the same question under different assumptions: the minimum-variance portfolio asks only about risk and answers 37.9 per cent; the tangency portfolio asks about the return per unit of risk realised ex post and answers zero; the market portfolio asks about equilibrium and answers 11.8 per cent; the Black-Litterman method asks about equilibrium under a reasoned interest-rate view and answers 25.7 per cent with falling and zero with rising rates. The spread is not a weakness of the methods but the measure of the uncertainty that attaches to the allocation decision; the Black-Litterman results tie this uncertainty to an observable variable, the US interest rate, and thereby supply a rule that can be applied over time.

7.3 Limitations of the Analysis

The results are subject to several limitations.[37] First, a sample of ten years describes only one interest-rate cycle; the estimated sensitivities could differ in other cycles, the more so as the relationship, as Section 4.4 has shown, works to a considerable extent through the dollar. Second, the optimisation rests on two assets; investors who hold bonds, commodities or property must determine the share within their overall portfolio. Third, both methods

[36] The unconstrained Black-Litterman weights are proportional to $\Sigma^{-1}\mu\_BL$; the allocation share is their ratio and therefore independent of the risk aversion δ, which determines only the leverage.

[37] Jagannathan and Ma (2003) show that short-sale constraints act like a shrinkage of the covariance estimate and improve out-of-sample results; the shares without short sales are therefore not only closer to practice but also statistically more robust.

assume that expected value and variance describe the return distribution adequately; the negative skewness of both funds and the increase in correlation in downturns described by Longin and Solnik (2001) suggest that the actual loss risk is somewhat higher than volatility indicates. Fourth, τ and Ω are judgement calls, even though we derive Ω from the data; the sensitivity analysis shows, however, that the range in the scenario of falling rates lies at 22 to 29 per cent and that the conclusion of the other scenario is unchanged. Fifth, all results apply to a euro-based investor without currency hedging, and transaction costs and taxes are disregarded; since the scenarios assume rate changes over twelve months, annual adjustments suffice. Finally, the classification itself is in flux: Greece's exit in 2027, a possible promotion of Korea and the shifts in weight between China, Taiwan and India will keep changing the index.

8 Conclusion and Outlook

What share of emerging-market equities belongs in a world portfolio?[38] The answer of this paper is: a rate-dependent corridor around the market weight. Over the ten years from August 2016 to August 2026 the world fund earned 12.92 per cent per year in euro at 13.25 per cent volatility, the emerging-market fund 9.40 per cent at 14.47 per cent, and the correlation was 0.64. The minimum-variance portfolio lies at 37.9 per cent emerging markets; the tangency portfolio of the capital market line contains none ex post, because their Sharpe ratio of 0.51 lies below the product of correlation and Sharpe ratio of the world fund; the market portfolio with 11.8 per cent emerging markets falls short of the maximum Sharpe ratio by only 0.006. The Black-Litterman optimisation with empirically estimated interest-rate views raises the share to 25.7 per cent (range 22 to 29 per cent) if the US one-year rate falls by 1.5 percentage points and lowers it to zero if it rises by 1.5 percentage points.

Three recommendations follow for experienced investors. First, the market weight of about twelve per cent should be the neutral anchor from which deviations must be justified; investors without a view on rates and the dollar stay there and lose only eight basis points of annual return against the ex post optimal portfolio. Second, a range from zero to about 25 per cent is appropriate, positioned according to the US interest-rate cycle and the dollar: falling US rates and a weaker dollar justify shares of a quarter of the equity portfolio, rising rates and a firm dollar an underweight down to complete abstention. Third, investors should justify the allocation not with the growth advantage of emerging economies, which does not show up in returns, but with the diversification gain, the valuation and the interest-rate view; and they should know that with today's index they buy above all the semiconductor value chain of East Asia and a dollar risk.

[38] The figures refer to the two funds examined, in euro; for a dollar-based investor or for currency-hedged share classes volatilities and correlations differ, but the ranking of the methods does not.

The outlook calls for vigilance in both directions.[39] In the summer of 2026 the US one-year rate stands above the midpoint of the policy range, three members of the Federal Open Market Committee have voted for a rate increase, and inflation has risen after the energy-price shock of the Middle East war, which argues for bringing the share back towards the lower end of the corridor. At the same time the valuation of emerging markets remains cheap at 10.4 times expected earnings, and an end to the US rate increases would, by our estimates, lift the share back towards a quarter. It remains open whether regime models in the manner of Ang and Bekaert (2002) determine the share over time better than the linear interest-rate view. Until then the rule holds: the right emerging-market share is not a number but a rule.

[39] The one-year rate and the policy range of 3.50 to 3.75 per cent refer to 31 August 2026; the one-year yield stood at 4.16 per cent (Federal Reserve 2026a, 2026b).

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