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# Typological Classification, Diagnostics, and Measurement of Flights-to-Quality

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**Typological Classification, Diagnostics, and Measurement of Flights-to-Quality**


# Abstract

*This paper proposes a total return-based framework to study flight-to-quality phenomenon of fixed-income securities. It consists of three elements: (i) the general definition of event; (ii) the typological classification of the phenomena to be able associate them with the phases of business cycle; (iii) automated technique to diagnose the time frames and to measure the impact of flight-to-quality on debt instruments. The proposed framework is applied to analyse capital movements from Emerging Markets public debt to the U.S. Treasuries and vice versa within the period 1998-2010. The results show that different phases of business cycles and GDP rates behaviours, including turning points, could be associated with flights-to-quality of different types and nature.*



**JEL codes***:* G11, G15.

**Key words**: flight-to-quality, financial crisis, emerging market debt, U.S. treasury bonds.

## 1. Introduction

The flight-to-quality phenomenon, when investments fly from risky to safe financial instruments, has been attracting a considerable scientific interest (Jones, 2012), He and Krishnamurthy, 2012; and Briere et al., 2012). Although varied research has been dedicated to these phenomena and their economic drivers, still there is a lack of a universal, generally accepted, definition of these episodes. Thus, the definitions of the flight-to-quality event used by diverse authors usually depend on the purpose of the respective research (Lei and Wang, 2012).

For example, Bernanke et al. (1996) and Alfaro et al. (2006) ascribed to flight-to-quality such situations when lower quality borrowers struggle to obtain finance. On the other hand, Goyenko and Ukhov (2009) and Naes et al. (2011), analysing the liquidity dynamics of diverse asset classes, define flight-to-quality events as an increase of investors' preferences for the most liquid securities. Alternatively, Baur and Lucey (2009) and Inci et al. (2011), examining the correlation between various markets, describe flight-to-quality as a period when the correlation between a chosen pair of markets decreases, while the performance of the riskier market drops. As our present paper evidences, these definitions are quite restrictive, as, for instance, in the case of emerging markets, flight-to-quality events can be observed while correlation between safe and risky assets performance holds and, in some cases with increasing prices of risky assets. Thus, additional research in this field remains highly desirable and the creation of a general framework for flight-to-quality analyses is needed.

This paper presents a total return-based framework for flight-to-quality studies focusing on fixed-income securities. Our methodology sheds light on the nature of this type of events and widens the set of approaches available to research these phenomena. First, the proposed definition of flight-to-quality phenomenon is based on the comparison of safe and risky assets performance, instead of analysing differential spreads (Blinder and Zandi, 2010) and/or short-run correlations (Bunda et al., 2010). Second, we propose a typological classification of flight-to-quality events, based on the interest rate dynamics and total returns behaviour of safe and risky securities. The type of flight-to-quality event depends on the interest rates of both asset baskets moving up, moving down, or one moving up while the other moves down. This typological classification envisages taking into consideration the economic conditions under which a flight-to-quality occurs. Third, the total return-based technique we apply allows identifying the time frames and the strength of the events. This technique improves the widely applied differential spread-based approaches (Fuerst et al., 2011), which are based on the spread between the yields of bonds, and thus represent a relative measure of the impact of flight-to-quality events, but provide no information about the separate dynamics of safe and risky assets. To the best of our knowledge, the vast majority of research in this field focus either on what happens within the flight-to-quality event, or on its influence on the economy and on the welfare of society (Caballero and Kurlat, 2008). We take the different approach of focusing also on what happens before the ignition of a flight-to-quality and after its termination. We compare the performance of risky and safe assets returns prior, within, and after the event. Our proposed total return-based framework is applied to the study of flights-to-quality out of risky sovereign emerging market bonds towards the safety of U.S. Treasury bonds over the period from January 1998 to December 2010.

The rest of the paper is organized as follows. Section two presents the proposed working definition of Flight-to Quality events and their subsequent typology. Section three describes the methodology for the *ex-post* diagnostics of flight-to-quality time frames and their impact on security values. The application for the case of flights between risky sovereign emerging market bonds and the safe U.S. Treasury bonds over the period from 1998 to 2010 and their typological classification are provided in section four. Conclusions are presented in the section five.

## 2. Definition and Typology of Flight-to-Quality

The first part of our framework is the flight-to-quality definition, which is based on the performance of assets measured in terms of total returns.

*Definition*: A flight-to-quality event is an investment migration from risky to safe assets leading to an underperformance of total returns of risky assets when compared to the total returns of safe assets.

The underperformance of risky assets is usually caused by a sudden drop in risk appetite and increase in risk aversion. Thus, a quantification of the investors´ appetite for safe and risky assets becomes potentially insightful for deepening the comprehension of flight-to-quality events.

The second component of our framework is the typological classification of the flight-to-quality events. A two-level classification is proposed, as summarized in Figure 1.

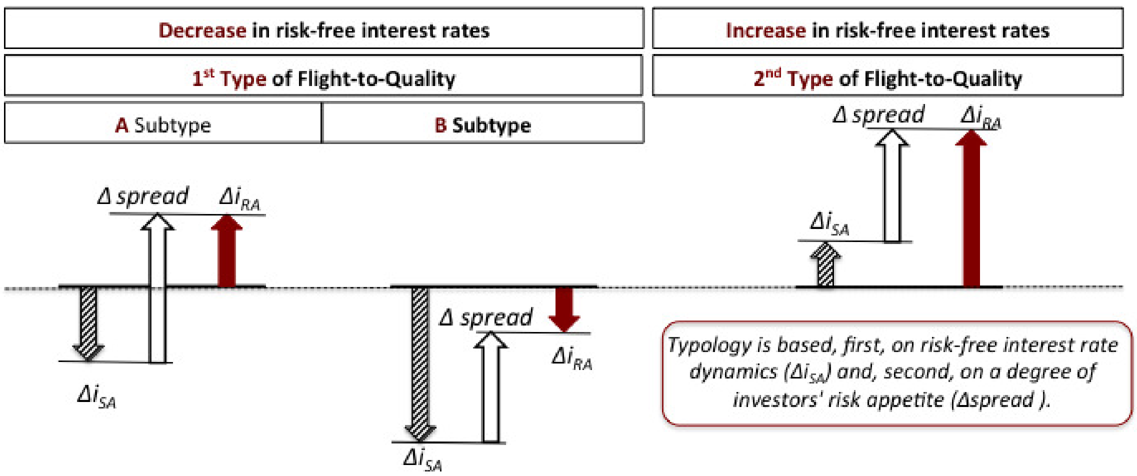


**Figure 1**: Summary of the Flight-to-Quality Typological Classification.

The types of events are defined according to the behaviour of two observable parameters: (*i*) the dynamics of the risk-free interest rate and (*ii*) the dynamics of the risk premium or spread of risky asset over safe securities. The type of flight-to-quality itself provides information on both parameters: the sign of the risk-free interest rate change (1$^{st}$ type versus 2$^{nd}$ type) and the relative strength of the risk aversion, where the spread is either superior or inferior to the change in the risk-free interest rate (1.A subtype versus 1.B subtype).

The typology we propose is a theoretical attempt to deepen the flight-to-quality understanding and to put the phenomenon in the context of the economic environment. In the majority of previous research only 1.A subtype events are identified and analysed. We argue the importance of correctly identifying the other types of flight-to-quality events, as they can provide possible warning signals of upcoming changes in the business cycle. The typology is used to interpret the results obtained from the application of the methodology we describe below.

## 3. Flight-to-Quality Diagnostics

The third element of our proposed framework is a total return-based automated technique to identify the occurrence of flight-to-quality events, measuring their impact and delimiting the start and end dates (time windows) of their occurrence. The general concept resides in the quantitative difference in the aggregate performance of risky and safe assets. The methodology is defined by the following four steps:

### ***First Step***

For each rolling anchor date (*AD*) of a chosen *n*-day long interval, a set of *n* different subjacent sub-intervals is considered; the anchor date is fixed, while the initial dates go from 1 to *n* days back into the past. Then, the *n* values of percentage returns of the risky asset total return index (further on referred to as risky assets index) and the respective *n* values of percentage returns of the safe asset total return index (further on referred to as safe assets index) are computed. Thus, the *n* different initial dates are employed in the consecutive return calculations using in each turn the same final date, or anchor date. This means that each time after the rolling anchor date (*AD*) is fixed, the algorithm goes by *1*-day steps into the past until the chosen *n*-day limit, i.e. the date *AD–n*, is reached. Thus, the first step can be represented by:

$$R^{Index}_{(AD-k,AD)} = \frac{Index_{(AD)}}{Index_{(AD-k)}} - 1 \tag{1}$$

where *Index* stands for safe (risky) assets index; $R^{Index}$ is the return of safe (risky) assets index; $AD$ is an anchor date consecutively assuming all the dates within the analyzed historical period; $k$ is a number of days within which the return of the safe (risky) assets index is calculated. Here $k \in [1, n]$ while $n$ could be thought as the largest analyzed flight-to-quality window.

***Second Step***

The $n$ differences between the returns of safe and risky assets indexes $(\Delta R_k)$ are to be computed by the following formula:

$$R_{k(AD)} = R^{S}_{(AD-k,AD)} - R^{R}_{(AD-k,AD)} \tag{2}$$

where $k \in [1, n]$ .

***Third Step***

The search for the maximum delta $\left(\Delta R^{MAX}_{(AD)}\right)$ for each anchor date ($AD$) is performed and the maximum value out of the $n$ values of the return differences between safe and risky assets indexes is identified. This could be written as follows:

$$\Delta R^{MAX}_{(AD)} = \mathrm{MAX}_{k=1,2,\dots,n}\left(\Delta R_{k(AD)}\right) \tag{3}$$

In parallel, the number of days $(k)$, which corresponds to $\Delta R^{MAX}_{(AD)}$, is stored as $N_{AD}$. It is worth noting that the length of the sub-interval $N_{AD}$ which maximizes the difference in returns for each anchor date, is not fixed and varies from one anchor date to the next, and so on. In the fourth step of the algorithm, this number $N_{AD}$ will be used for determining the initial dates of flight-to-quality events.

This procedure is repeated for all dates in the period under analysis, each date, in turn, being defined as an anchor date other. For each of the rolling anchor dates, the values of their respective $\Delta R^{MAX}_{(AD)}$ (maximized as a function of the parameter $k$ according to the above equation 3) are used to build the respective curve of maximum differences between safe and risky assets index returns. This curve is schematically represented in Figure 1.

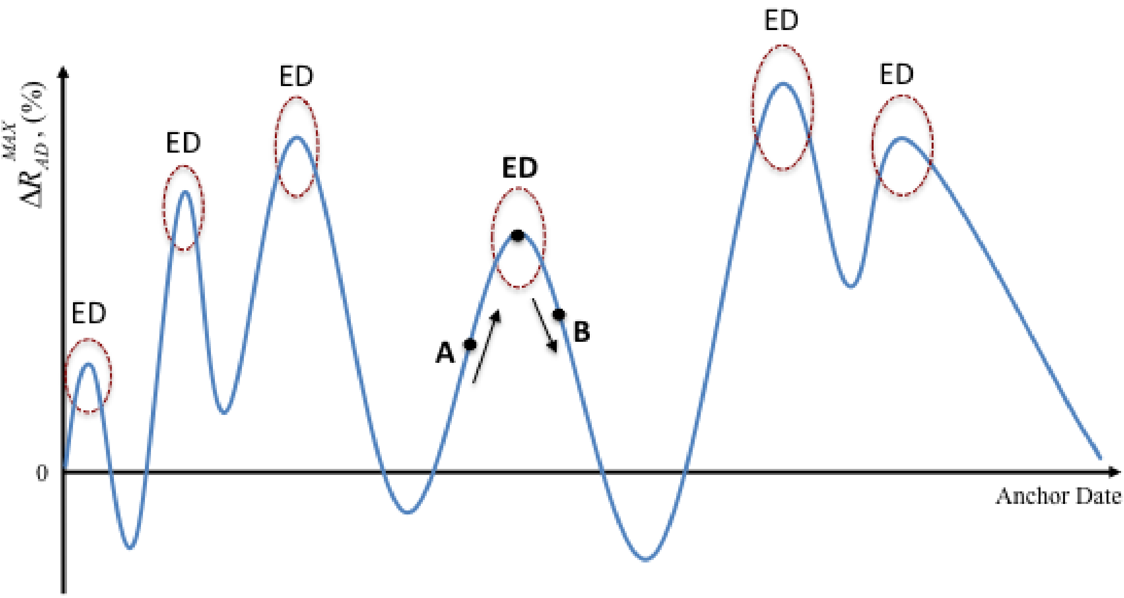


**Figure 1**: Maximum differences between safe and risky assets total returns in percentage of the initial indexes' values observed $N_{AD}$ days prior to the anchor date ($AD$).

Abscissa of each point of the curve illustrated in Figure 1 corresponds to the rolling anchor date ($AD$). In its turn, an ordinate is the maximum difference in returns of safe and risky assets indexes within $n$ sub-intervals of the n-day long window. The local maxima of the $\Delta R^{MAX}_{(AD)}$ curve, marked by dashed ovals in Figure 1, are the end dates ($ED$) of the flight-to-quality events. This can be comprehended as follows. Prior to a chosen local maximum date, corresponding to the flight-to-quality end date ($ED$ in bold) the flight-to-quality impact on the total returns difference is strengthening with time; see point $\boldsymbol{A}$ in Figure 1. On the other hand, posterior to the same chosen local maximum date ($ED$ in bold), the difference in the total returns along the time scale is decaying; see point $\boldsymbol{B}$ in Figure 1. That is the reason why the local maximums of the $\Delta R^{MAX}_{(AD)}$ curve are considered to determine the end dates ($ED$) for the preceding them flight-to-quality events. This is what one would expect to observe and what in fact is observed while searching for flight-to-quality end dates ($ED$).

***Fourth Step***

For the identified end dates ($ED$), the difference $\left(\Delta R^{MAX}_{(ID,ED)}\right)$ is maximized as a function of the initial date of flight-to-quality ($ID$), which can be obtained by the following equation:

$$\Delta R_{(AD)}^{MAX} = \text{MAX}_{k=1,2,\ldots,n}\left(R_{(ED-k,ED)}^{S} - R_{(ED-k,ED)}^{SR}\right) \quad (4)$$

where $ID = ED - k$.

Here the use of end date ($ED$) instead of anchor date ($AD$) means that only the end dates of flight-to-quality ($ED$), identified in the previous third step of the algorithm, are employed and not all the rolling anchor dates. Using the parameter $N_{AD}$, mentioned in the third step of the algorithm, which is the number of days of a flight-to-quality event, the initial date ($ID$) is expressed, as follows:

$$ID = ED - N_{ED} \quad (5)$$

Summarizing, the essence of the algorithm is: first, determining the end date ($ED$) of the flight-to-quality event, which corresponds to the local maximum of the safe and risky total return difference of the considered rolling periods; second, determining the initial date ($ID$), which corresponds to the maximum difference between safe and risky total returns for the identified flight-to-quality end date ($ED$). Finally, in the selection process of flight-to-quality-like events to be included in the sample, $\Delta R_{(ID,ED)}^{MAX}$ must exceed a pre-defined hurdle, or event impact parameter ($EIP$). The greater the value of this selection filter criterion, the more impactful are the flights-to-quality identified and the smaller is their number within the period under analysis.

## 4. Application

### *Data and imposed conditions*

The proposed flight-to-quality identification methodology described in section three is applied to detect the time windows of flights out of the emerging market fixed income securities described by the J.P. Morgan EMBI-Global index (further on referred as *EMBI*) to the U.S. Treasury debt issues represented by the *UST* total return index provided by the iBoxx Ltd (further on referred as *ITRROV*) in the period from January 1998 to December 2010.

The trial maximum duration of flight-to-quality events ($n$) is assumed to be 45 working days as the analyzed phenomena is typically a short-run event, very concentrated in time. For example, Mandelbrot and Hudson (2002) claim that sharp drops and rises in prices occur within very limited and narrowed periods of time. Additionally, the spread of the aggregated yield of emerging markets debts over aggregated yield of U.S. Treasury is examined. As a result, we find that the 45-day period is an appropriate time window for flight-to-quality events.

The $EIP$, or the hurdle difference between the *EMBI* and *ITRROV*, is defined as three different levels, 1%, 2% and 3%. Such limits imposed to the total returns differences are considered to characterize the notion of "*investment migration*" and allow for gradual analysis of the complex structure of flights-to-quality.

***Internal structure of flights-to-quality***

When analyzing flight-to-quality events, it is important to take into account that there are situations when the same initial date ($ID$) corresponds the different consecutive end dates ($ED_i$), as it is illustrated by the black arrows in Figure 2.

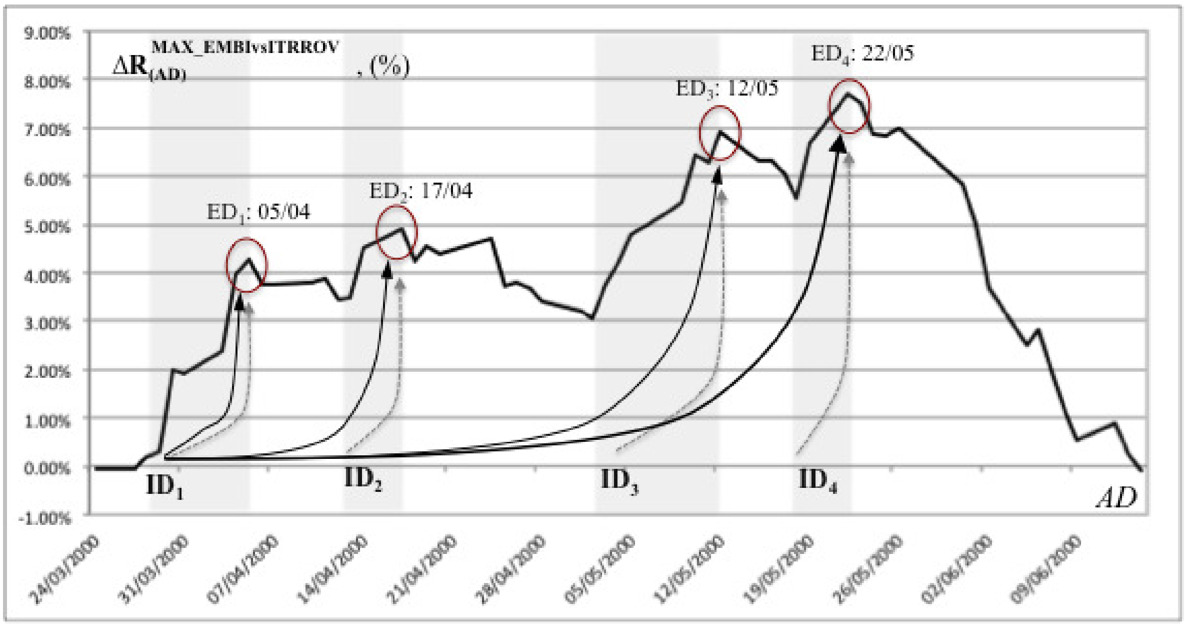

**Figure 2**: Decomposition of the aggregated flight-to-quality (27.03.2000 – 22.05.2000) into the series of four weaker flights-to-quality, indicated by the dashed arrows.

Such aggregated flight-to-quality could be decomposed into a set of weaker flights-to-quality. Thus, for each identified end date ($ED_i$), with the exception for $ED_1$, an intermediate initial date ($ID_i$) lying between $ED_{i-1}$ and $ED_i$ should be determined. Consequently, the identified aggregated flight-to-quality can be alternatively analyzed as if it was composed of four weaker flights-to-quality, as represented in Table 1.

| ID | ED | Δ | Aggregated |
|---|---|---|---|
| 27/03/2000 | 05/04/2000 | 4.27% | ^ |
| 12/04/2000 | 17/04/2000 | 1.48% | ^ |
| 02/05/2000 | 12/05/2000 | 3.97% | ^ |
| 18/05/2000 | 22/05/2000 | 2.28% | **7.71%** |

**Table 1**: Decomposed flight-to-quality (27.03.2000 – 22.05.2000).

In Table 1, Δ stands for a strength of flight-to-quality being the difference between *ITRROV* and *EMBI* returns in percentage in respect to the initial date ($ID_i$) indexes' values. The shadowed cells represent the earliest initial date ($ID_1$) and the latest end date ($ED_4$) corresponding to the highest maximum difference in the returns of the *ITRROV* and *EMBI* $\left(\Delta R_{(ED)}^{MAX\_EMBI\_vs\_ITRROV}\right)$.

***Results***

Our proposed methodology results in an identification of the initial and the end dates of 133 flight-to-quality events with the difference in the *ITRROV* and *EMBI* total returns over 1%, 74 events with the difference in the *ITRROV* and *EMBI* total returns over 2%, and 50 events with the difference in the *ITRROV* and *EMBI* total returns higher than 3%.

Our results are represented on an annually basis in Tables 2-14, where shadowing indicates the initial ($ID$) and final ($ED$) dates of the aggregated flights-to-quality, as well as their aggregate strengths and the sets of minor events identified within the aggregated time intervals.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 23/03/1998 | 03/04/1998 | 0.75% | -2.04% | | | 2.79% | 2.79% |
| 2 | 14/04/1998 | 27/04/1998 | -0.66% | -1.80% | | | | 1.14% |
| 3 | 01/05/1998 | 18/05/1998 | 0.29% | -3.48% | ^ | 3.77% | 3.77% | 3.77% |
| 4 | 21/05/1998 | 27/05/1998 | 0.59% | -1.75% | ^ | | 2.34% | 2.34% |
| 5 | 05/06/1998 | 15/06/1998 | 1.14% | -3.14% | ^ | 4.28% | 4.28% | 4.28% |
| 6 | 17/06/1998 | 26/06/1998 | 0.64% | -3.91% | ^ | 4.55% | 4.55% | 4.55% |
| 7 | 01/07/1998 | 06/07/1998 | 0.33% | -1.61% | **9.40%** | | | 1.94% |
| 8 | 20/07/1998 | 27/07/1998 | 0.15% | -3.40% | ^ | 3.55% | 3.55% | 3.55% |
| 9 | 31/07/1998 | 12/08/1998 | 0.85% | -10.89% | ^ | 11.74% | 11.74% | 11.74% |
| 10 | 14/08/1998 | 27/08/1998 | 1.33% | -22.92% | ^ | 24.25% | 24.25% | 24.25% |
| 11 | 02/09/1998 | 10/09/1998 | 1.62% | -8.24% | **36.45%** | 9.86% | 9.86% | 9.86% |
| 12 | 28/09/1998 | 05/10/1998 | 2.42% | -4.20% | | 6.62% | 6.62% | 6.62% |
| 13 | 22/10/1998 | 29/10/1998 | 0.74% | -2.70% | | 3.44% | 3.44% | 3.44% |
| 14 | 06/11/1998 | 12/11/1998 | 0.94% | -2.38% | | 3.32% | 3.32% | 3.32% |
| 15 | 23/11/1998 | 14/12/1998 | 1.51% | -6.37% | | 7.88% | 7.88% | 7.88% |

**Table 2**: Identified flight-to-quality events and their impacts in 1998.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 06/01/1999 | 14/01/1999 | 0.42% | -12.18% | | 12.60% | 12.60% | 12.60% |
| 2 | 20/01/1999 | 25/01/1999 | 0.56% | -4.48% | | 5.04% | 5.04% | 5.04% |
| 3 | 04/02/1999 | 08/02/1999 | -0.08% | -1.58% | | | | 1.50% |
| 4 | 16/02/1999 | 03/03/1999 | -1.26% | -3.97% | | | 2.71% | 2.71% |
| 5 | 07/05/1999 | 24/05/1999 | 0.22% | -7.46% | | 7.68% | 7.68% | 7.68% |
| 6 | 22/06/1999 | 28/06/1999 | 0.00% | -1.75% | ^ | | | 1.75% |
| 7 | 06/07/1999 | 12/07/1999 | 0.79% | -2.67% | **4.00%** | 3.46% | 3.46% | 3.46% |
| 8 | 30/07/1999 | 05/08/1999 | 0.27% | -2.05% | | | 2.32% | 2.32% |
| 9 | 17/08/1999 | 20/08/1999 | 0.09% | -1.18% | | | | 1.27% |
| 10 | 10/09/1999 | 24/09/1999 | 0.89% | -0.38% | | | | 1.27% |
| 11 | 08/10/1999 | 15/10/1999 | -0.13% | -1.39% | | | | 1.26% |
| 12 | 26/11/1999 | 01/12/1999 | -0.30% | -1.35% | | | | 1.05% |

**Table 3**: Identified flight-to-quality events and their impacts in 1999.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 03/01/2000 | 12/01/2000 | -0.18% | -1.63% | ^ | | | 1.45% |
| 2 | 24/01/2000 | 31/01/2000 | 0.36% | -1.34% | **2.47%** | | | 1.70% |
| 3 | 15/02/2000 | 22/02/2000 | 1.02% | -0.40% | | | | 1.42% |
| 4 | 10/03/2000 | 15/03/2000 | 0.65% | -0.70% | | | | 1.35% |
| 5 | 27/03/2000 | 05/04/2000 | 1.57% | -2.70% | ^ | 4.27% | 4.27% | 4.27% |
| 6 | 12/04/2000 | 17/04/2000 | -0.12% | -1.60% | ^ | | | 1.48% |
| 7 | 02/05/2000 | 12/05/2000 | -0.91% | -4.88% | ^ | 3.97% | 3.97% | 3.97% |
| 8 | 18/05/2000 | 22/05/2000 | 0.62% | -1.66% | **7.71%** | | 2.28% | 2.28% |
| 9 | 11/08/2000 | 21/08/2000 | 0.19% | -0.99% | | | | 1.18% |
| 10 | 06/09/2000 | 18/09/2000 | -0.55% | -3.27% | ^ | | 2.72% | 2.72% |
| 11 | 04/10/2000 | 26/10/2000 | 1.55% | -4.31% | **6.82%** | 5.86% | 5.86% | 5.86% |
| 12 | 02/11/2000 | 08/11/2000 | -0.42% | -2.79% | | | 2.37% | 2.37% |
| 13 | 21/11/2000 | 30/11/2000 | 1.18% | -1.17% | | | 2.35% | 2.35% |

**Table 4**: Identified flight-to-quality events and their impacts in 2000.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 29/01/2001 | 07/02/2001 | 0.91% | -0.24% | | | | 1.15% |
| 2 | 15/02/2001 | 28/02/2001 | 1.62% | -1.56% | ^ | 3.18% | 3.18% | 3.18% |
| 3 | 09/03/2001 | 23/03/2001 | 0.87% | -4.33% | ^ | 5.20% | 5.20% | 5.20% |
| 4 | 28/03/2001 | 03/04/2001 | 0.33% | -1.02% | ^ | | | 1.35% |
| 5 | 10/04/2001 | 23/04/2001 | -0.20% | -5.79% | **7.60%** | 5.59% | 5.59% | 5.59% |
| 6 | 24/05/2001 | 01/06/2001 | 0.86% | -0.74% | | | | 1.60% |
| 7 | 08/06/2001 | 18/06/2001 | 0.76% | -1.85% | ^ | | 2.61% | 2.61% |
| 8 | 26/06/2001 | 12/07/2001 | 0.09% | -9.78% | **11.32%** | 9.87% | 9.87% | 9.87% |
| 9 | 23/07/2001 | 01/08/2001 | 0.42% | -3.23% | | 3.65% | 3.65% | 3.65% |
| 10 | 09/08/2001 | 14/08/2001 | 0.30% | -0.71% | | | | 1.01% |
| 11 | 16/08/2001 | 21/08/2001 | 0.29% | -3.11% | | 3.40% | 3.40% | 3.40% |
| 12 | 04/09/2001 | 14/09/2001 | 2.37% | -3.92% | ^ | 6.29% | 6.29% | 6.29% |
| 13 | 19/09/2001 | 05/10/2001 | 1.41% | -3.35% | ^ | 4.76% | 4.76% | 4.76% |
| 14 | 22/10/2001 | 02/11/2001 | 1.68% | -4.53% | **10.72%** | 6.21% | 6.21% | 6.21% |
| 15 | 15/11/2001 | 19/11/2001 | 0.03% | -1.25% | | | | 1.28% |
| 16 | 26/11/2001 | 30/11/2001 | 1.15% | -2.26% | | 3.41% | 3.41% | 3.41% |
| 17 | 14/12/2001 | 24/12/2001 | 0.44% | -1.01% | | | | 1.45% |

**Table 5**: Identified flight-to-quality events and their impacts in 2001.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 04/01/2002 | 15/01/2002 | 1.96% | -0.32% | | | 2.28% | 2.28% |
| 2 | 24/01/2002 | 04/02/2002 | 0.95% | -0.71% | | | | 1.66% |
| 3 | 12/04/2002 | 10/05/2002 | 0.89% | -2.16% | | 3.05% | 3.05% | 3.05% |
| 4 | 16/05/2002 | 06/06/2002 | 1.14% | -2.80% | ^ | 3.94% | 3.94% | 3.94% |
| 5 | 10/06/2002 | 21/06/2002 | 1.51% | -4.89% | **10.55%** | 6.40% | 6.40% | 6.40% |
| 6 | 28/06/2002 | 30/07/2002 | 1.68% | -5.34% | | 7.02% | 7.02% | 7.02% |
| 7 | 08/08/2002 | 13/08/2002 | 1.31% | -2.80% | | 4.11% | 4.11% | 4.11% |
| 8 | 30/08/2002 | 23/09/2002 | 2.25% | -2.31% | | 4.56% | 4.56% | 4.56% |
| 9 | 25/09/2002 | 30/09/2002 | 0.81% | -1.06% | | | | 1.87% |
| 10 | 04/10/2002 | 09/10/2002 | 0.54% | -1.34% | | | | 1.88% |
| 11 | 02/12/2002 | 05/12/2002 | 0.57% | -0.86% | | | | 1.43% |
| 12 | 23/12/2002 | 30/12/2002 | 1.06% | 0.04% | | | | 1.02% |

**Table 6**: Identified flight-to-quality events and their impacts in 2002.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 13/01/2003 | 24/01/2003 | 1.25% | -1.26% | | | 2.51% | 2.51% |
| 2 | 13/05/2003 | 20/05/2003 | 1.41% | -1.61% | | 3.02% | 3.02% | 3.02% |
| 3 | 17/06/2003 | 23/06/2003 | -0.22% | -2.21% | ^ | | | 1.99% |
| 4 | 25/06/2003 | 07/07/2003 | -1.38% | -3.07% | **3.13%** | | | 1.69% |
| 5 | 21/07/2003 | 06/08/2003 | -0.74% | -3.73% | | | 2.99% | 2.99% |
| 6 | 19/09/2003 | 30/09/2003 | 1.33% | 0.17% | | | | 1.16% |
| 7 | 16/10/2003 | 28/10/2003 | 1.51% | -0.71% | | | 2.22% | 2.22% |

**Table 7**: Identified flight-to-quality events and their impacts in 2003.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 08/01/2004 | 06/02/2004 | 1.05% | -1.96% | | 3.01% | 3.01% | 3.01% |
| 2 | 12/02/2004 | 19/02/2004 | 0.24% | -0.87% | | | | 1.11% |
| 3 | 13/04/2004 | 21/04/2004 | -0.53% | -2.35% | ^ | | | 1.82% |
| 4 | 23/04/2004 | 10/05/2004 | -1.37% | -7.92% | **7.59%** | 6.55% | 6.55% | 6.55% |
| 5 | 07/06/2004 | 14/06/2004 | -0.57% | -1.72% | | | | 1.15% |
| 6 | 12/10/2004 | 25/10/2004 | 0.75% | -0.78% | | | | 1.53% |

**Table 8**: Identified flight-to-quality events and their impacts in 2004.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 29/12/2004 | 18/01/2005 | 0.81% | -0.57% | | | | 1.38% |
| 2 | 08/03/2005 | 15/04/2005 | 0.87% | -3.23% | | 4.10% | 4.10% | 4.10% |
| 3 | 03/10/2005 | 14/10/2005 | -0.34% | -2.85% | | | 2.51% | 2.51% |

**Table 9**: Identified flight-to-quality events and their impacts in 2005.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 27/02/2006 | 10/04/2006 | -1.14% | -2.94% | | | | 1.80% |
| 2 | 03/05/2006 | 24/05/2006 | 0.73% | -2.22% | ^ | | 2.95% | 2.95% |
| 3 | 01/06/2006 | 13/06/2006 | 0.85% | -0.20% | ^ | | | 1.05% |
| 4 | 16/06/2006 | 27/06/2006 | -0.24% | -1.71% | **3.65%** | | | 1.47% |
| 5 | 05/09/2006 | 22/09/2006 | 1.11% | -0.24% | | | | 1.35% |

**Table 10**: Identified flight-to-quality events and their impacts in 2006.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 22/02/2007 | 05/03/2007 | 1.21% | -0.18% | | | | 1.39% |
| 2 | 23/05/2007 | 13/06/2007 | -1.17% | -2.70% | ^ | | | 1.53% |
| 3 | 18/06/2007 | 29/06/2007 | 0.77% | -0.49% | ^ | | | 1.26% |
| 4 | 06/07/2007 | 26/07/2007 | 2.25% | -1.57% | **5.08%** | 3.82% | 3.82% | 3.82% |
| 5 | 08/08/2007 | 16/08/2007 | 1.47% | -2.26% | | 3.73% | 3.73% | 3.73% |
| 6 | 04/09/2007 | 10/09/2007 | 1.31% | 0.23% | | | | 1.08% |
| 7 | 15/10/2007 | 24/10/2007 | 1.87% | 0.59% | | | | 1.28% |
| 8 | 31/10/2007 | 12/11/2007 | 1.50% | -0.75% | ^ | | 2.25% | 2.25% |
| 9 | 14/11/2007 | 26/11/2007 | 2.29% | -0.78% | **4.97%** | 3.07% | 3.07% | 3.07% |
| 10 | 14/12/2007 | 20/12/2007 | 1.20% | 0.18% | | | | 1.02% |

**Table 11**: Identified flight-to-quality events and their impacts in 2007.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 26/12/2007 | 04/01/2008 | 2.35% | 0.48% | ^ | | | 1.87% |
| 2 | 10/01/2008 | 23/01/2008 | 2.48% | 0.02% | ^ | | 2.46% | 2.46% |
| 3 | 30/01/2008 | 11/02/2008 | 0.90% | -0.88% | ^ | | | 1.78% |
| 4 | 26/02/2008 | 03/03/2008 | 1.72% | 0.19% | **4.33%** | | | 1.53% |
| 5 | 05/03/2008 | 17/03/2008 | 2.04% | -0.70% | | | 2.74% | 2.74% |
| 6 | 13/06/2008 | 15/07/2008 | 2.73% | -1.21% | | 3.94% | 3.94% | 3.94% |
| 7 | 23/07/2008 | 18/08/2008 | 2.15% | 0.85% | | | | 1.30% |
| 8 | 29/08/2008 | 17/09/2008 | 2.53% | -5.71% | ^ | 8.24% | 8.24% | 8.24% |
| 9 | 22/09/2008 | 10/10/2008 | 0.77% | -16.22% | ^ | 16.99% | 16.99% | 16.99% |
| 10 | 14/10/2008 | 24/10/2008 | 1.43% | -15.82% | **30.53%** | 17.25% | 17.25% | 17.25% |
| 11 | 04/11/2008 | 20/11/2008 | 3.49% | -6.23% | | 9.72% | 9.72% | 9.72% |

**Table 12**: Identified flight-to-quality events and their impacts in 2008.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 06/01/2009 | 15/01/2009 | 1.41% | -1.32% | | | 2.73% | 2.73% |
| 2 | 09/02/2009 | 17/02/2009 | 1.59% | -1.94% | | 3.53% | 3.53% | 3.53% |
| 3 | 26/02/2009 | 06/03/2009 | 0.90% | -1.39% | | | 2.29% | 2.29% |
| 4 | 08/05/2009 | 13/05/2009 | 1.03% | -0.80% | | | | 1.83% |
| 5 | 12/06/2009 | 23/06/2009 | 1.27% | -1.61% | ^ | | 2.88% | 2.88% |
| 6 | 01/07/2009 | 08/07/2009 | 1.27% | -0.38% | **2.96%** | | | 1.65% |
| 7 | 07/08/2009 | 17/08/2009 | 1.75% | -0.45% | ^ | | 2.20% | 2.20% |
| 8 | 21/08/2009 | 02/09/2009 | 1.50% | 0.26% | **2.38%** | | | 1.24% |
| 9 | 16/09/2009 | 28/09/2009 | 0.91% | -0.26% | | | | 1.17% |
| 10 | 14/10/2009 | 28/10/2009 | 0.20% | -2.45% | | | 2.65% | 2.65% |
| 11 | 18/11/2009 | 30/11/2009 | 0.98% | -0.49% | | | | 1.47% |

**Table 13**: Identified flight-to-quality events and their impacts in 2009.

| N | ID | ED | ITRROV | EMBI | Event Impact Parameter | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Aggregated | over 3% | over 2% | over 1% |
| 1 | 11/01/2010 | 05/02/2010 | 1.65% | -1.57% | | 3.22% | 3.22% | 3.22% |
| 2 | 15/04/2010 | 07/05/2010 | 2.12% | -3.35% | ^ | 5.47% | 5.47% | 5.47% |
| 3 | 13/05/2010 | 25/05/2010 | 1.66% | -2.57% | **6.78%** | 4.23% | 4.23% | 4.23% |
| 4 | 03/06/2010 | 08/06/2010 | 0.99% | -0.90% | | | | 1.89% |
| 5 | 21/06/2010 | 29/06/2010 | 1.32% | -0.12% | | | | 1.44% |
| 6 | 09/08/2010 | 16/08/2010 | 1.20% | 0.11% | | | | 1.09% |
| 7 | 23/08/2010 | 31/08/2010 | 0.61% | -1.25% | | | | 1.86% |
| 8 | 14/10/2010 | 19/10/2010 | 0.20% | -0.84% | | | | 1.04% |
| 9 | 05/11/2010 | 16/11/2010 | -1.26% | -3.26% | ^ | | 2.00% | 2.00% |
| 10 | 19/11/2010 | 30/11/2010 | 0.43% | -1.46% | **3.25%** | | | 1.89% |
| 11 | 14/12/2010 | 17/12/2010 | 0.53% | -1.13% | | | | 1.66% |

**Table 14**: Identified flight-to-quality events and their impacts in 2010.

Tables 2 to 14 contain the initial ($ID$) and final dates ($ED$) of the flight-to-quality occurrences, the performance of $ITRROV$ and $EMBI$ as well as the differential total return between the *ITRROV* and *EMBI* indexes from the beginning to the end of the subjacent phenomenon compared to the event impact parameter (*EIP*) limit conditions in order to demonstrate that the selection of flight-to-quality is dependent on the minimal strength of the events to be selected for specific analyses.

***Economic interpretation of flights-to-quality over 1998-2010***

All 133 identified flights-to-quality are classified in accordance with the proposed Typology. 100 events out of 133 are ascribed to the 1.A subtype; 11 episodes are of 1.B subtype; and 22 cases belong to the 2$^{nd}$ type of flight-to-quality. The relationship between the occurrences of the 1.A subtype, 1.B subtype, the 2$^{nd}$ type of flight-to-quality and the economic growth rates is graphically analyzed. The U.S. and the World annual *GDP* growth rates, according to the World Bank data, are considered for this study.

The higher frequency of 1.A subtype events coincides with the decreasing slope of *GDP* growth rate. They predominantly happen over the periods of economic slowdown and contraction (see Figure 3). Within the analyzed period, those phases could be associated with 1998 (Russian bond default and other emerging market distresses), the first half of 2000 (Dotcom crash), 2001 – 2002 (September 11 attack and war on terror, Brazil presidential election uncertainty), and the second quarter of 2007 – 2010 (U.S. subprime mortgage crisis ignition resulting into the global financial crisis).

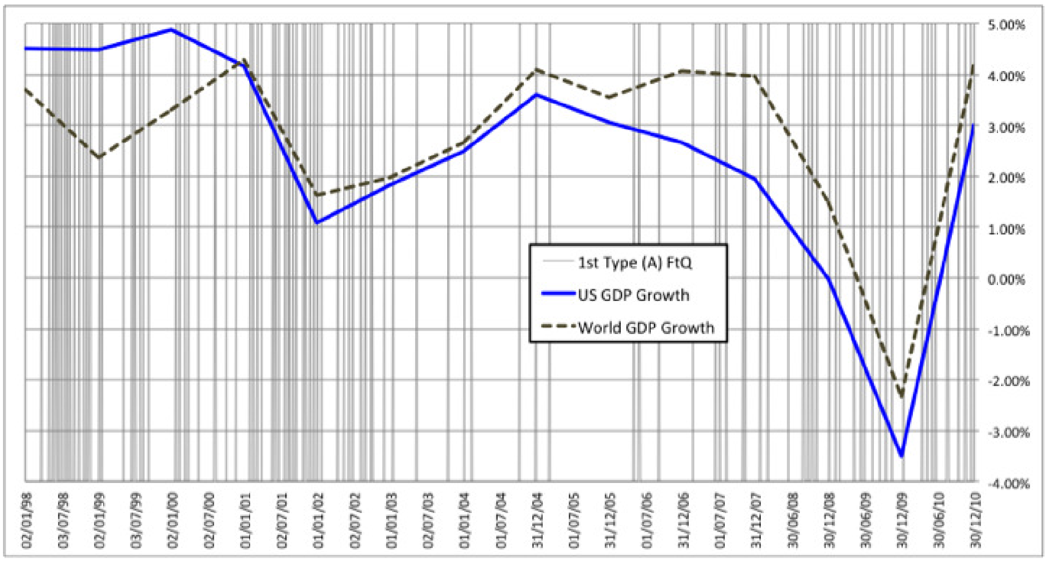


**Figure 3**: Occurrences of the flights-to-quality of the 1st Type, Subtype A, along with the U.S. and the World annual GDP growth rates over 1998 – 2010.

The flights-to-quality of 1.B subtype are observed prior to the turning points of *GDP* rate dynamics (see Figure 4). Their major concentration coincides with the turning point when the accentuated slowdown of the GDP growth rate curves begins, especially so in case of the World *GDP* (2007 - 2008). Thus, 1.B subtype events could eventually alarm of upcoming changes from an economic growth to a slowdown and *visa versa*. It is worth noting that diagnostics and analyses of the flight-to-quality, obeying to characteristics of 1.B. subtype, are addressed for the first time.

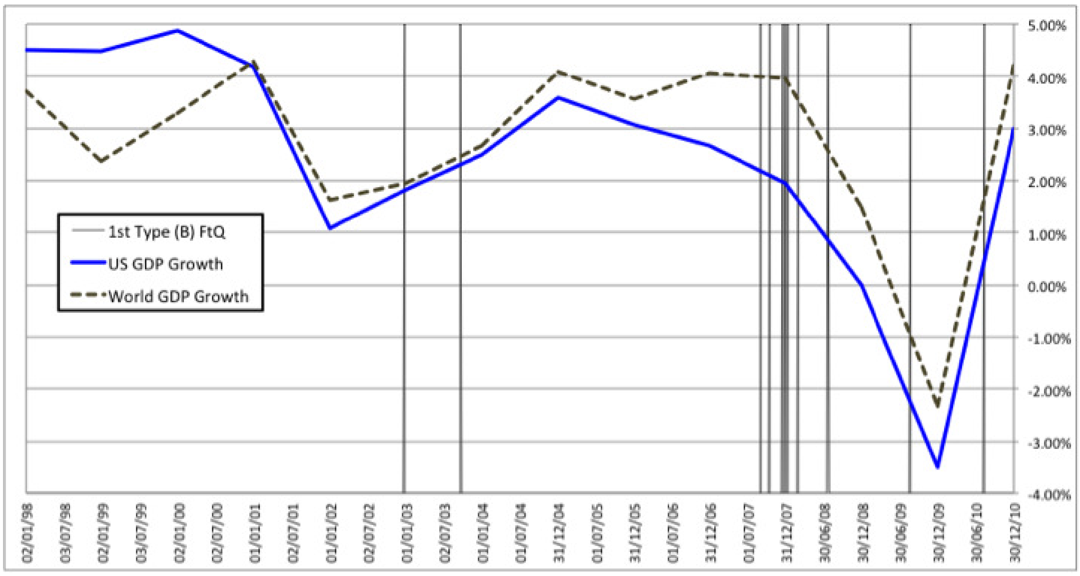


**Figure 4**: Occurrences of the flights-to-quality of the 1st Type, Subtype B, along with the U.S. and the World annual GDP growth rates over 1998 – 2010.

The major concentrations of the 2nd type of identified flights-to-quality coincide with the increase in *GDP* growth rate (see Figure 5). Events of the 2nd type mostly happen over the periods of an accelerated growth and economic expansion. Generally, within the analysed period these phases could be associated with 1999 and 2000 (Technological boom); 2002 – 2007 (global economic expansion and emerging markets growth), and the last quarter of 2010 (partial recovery from the global financial crisis).

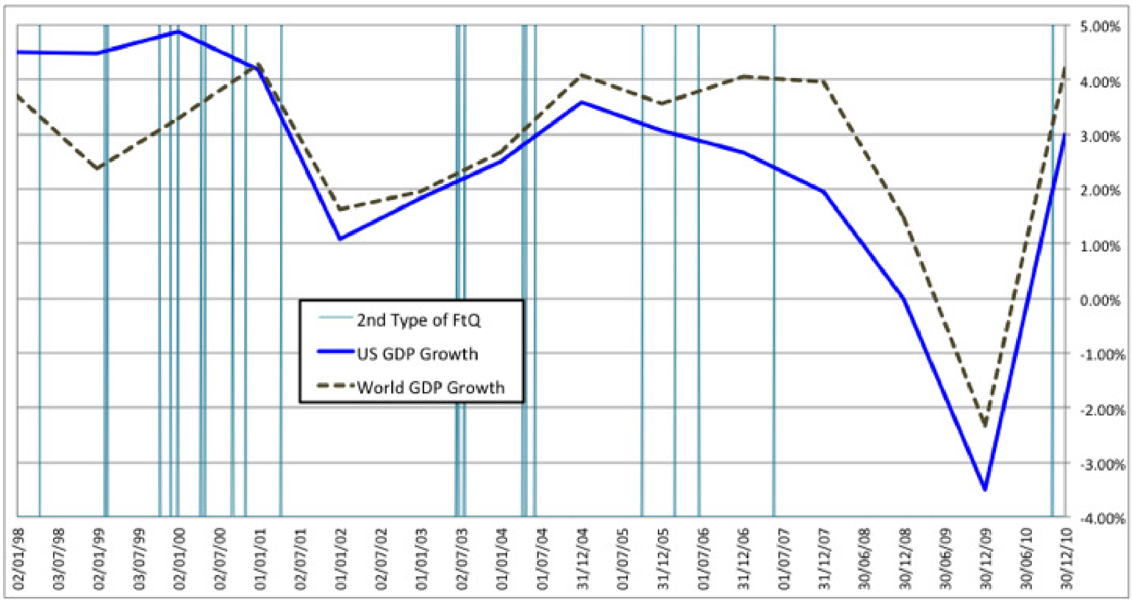


**Figure 5**: Occurrences of the flights-to-quality of the 2nd Type along with the U.S. and the World annual GDP growth rates over 1998 – 2010.

## 5. Conclusions

This study proposes a total return-based framework to analyse flight-to-quality events. This framework is based on three components.

The first component is the general definition of flight-to-quality event, based on the comparative behaviour of safe and risky assets total returns. The definition is applicable to diverse asset classes and it is not restricted only to the fixed-income origination-destination pairs of securities, mutually affected during flight-to-quality episodes. Thus, the performed elaboration of general definition of flight-to-quality in terms of the total returns instead of the differential spread, for instance, is a relevant contribution to the literature, as there is an absence of the universal definition of the phenomenon while many researches have been dedicated to the study these phenomena.

The second component is the development of a typological classification of flights-to-quality. In accordance with the proposed typology, two types of flight-to-quality are distinguished. The first type, which is the most common for deteriorating economic conditions, crisis phases, and also turning points, leads to a decrease of the risk-free interest rate. On the other hand, the second type, which is rather rare, is accompanied by a decrease in the safe asset performance due to the expansion of the overall economic activity. The 1st type flight-to-quality events are then segregated into the two subtypes. The 1.A. subtype phenomena, with decaying total returns of the risky assets, are the most frequent episodes under a slowdown of the economy. The important insight of this research is the attribution of the 1.B. subtype phenomena, characterized by the increase in total returns of both safe and risky assets, to the initial worries of investors in respect to the future changes in the course of the economy. Therefore, these events can be interpreted as indicators of upcoming turning points in general, and in particular as warnings of an approaching slowdown in economic activity.

The third component of the framework is related to the automated identification algorithm. The objective of the proposed diagnostics methodology is to detect the time windows and the strength of the occurred flights-to-quality within the considered historical period. The proposed methodology represents an important progress as it gives a new insight into the analysis of circumstances under which flights-to-quality occur, allowing automatic detection of the initial and final dates of the studied episodes.

The total return-based framework is applied to the analyses of investment flights out of emerging market securities towards U.S. Treasury bonds within 1998-2010. 133 flight-to-quality events are identified, measured, and classified. All the diagnosed flights-to-quality are put in the context of the economic environment depending on their types. This study suggests the validity of the economic interpretation ascribed to the two types and two subtypes of flight-to-quality. Our research also indicates that such a framework can be a useful tool for future flight-to-quality studies.

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