To the problem of evaluation of market risk of global equity index portfolio in global capital markets

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Abstract – Thinking about the development of the unifying mathematical approach to solve the problem on the evaluation of market risk of the global equity index portfolio in the highly volatile global capital markets, the authors focus their attention to an increasing necessity of application of the dynamic assessment of the financial systems with the use of the continuous system representation models, which allows to make the accurate characterization of the Returns on Investments (ROI) of the diversified global equity index portfolio. In our view, the creation of the complex computer models to accurately characterize the financial system's operating modes results in ability by the investors to find the categorical behaviour properties of the financial system and to predict its dynamic properties precisely. In our opinion, in the periods of the challenging turbulent economic conditions in Bernanke (1995), the process of extraction of useful knowledge from the big streams of financial data from the various capital markets with the aim to make the virtuous investment decisions requires a deep understanding of the cognitive modeling techniques in application to the investment decision making as far as the global equity index portfolio is concerned. We analyzed the nature of the current financial and economic crises in the USA, presenting the views by the American business leaders, academicians and politicians, which were publicly expressed at The Economic Club of Washington in Washington, District Columbia in the USA. We highlighted the fact that it is important for the institutional and private investors to diversify their investments, and create the global equity index portfolio, aiming to increase the Return on Investment (ROI) and to accumulate the wealth in the course of the wealth management process at a global scale. Also, we considered the standard approach, which can be used to evaluate the market risk of a hypothetical global equity index portfolio with the Monte Carlo simulation technique, using the Student's t copula and the Extreme Value Theory (EVT) in Matlab (2012). We proposed a conceptual framework, based on the suggestion that the application of the dynamic analysis of the nonlinear interactions between of the global capital flows can significantly leverage the effective investment control strategies in the researched case of the global equity index portfolio.

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Introduction

The modern financial and economic theories have been created, using the foundational economic principles in *Menger (1871), von Böhm-Bawerk (1884, 1889, 1921), von Mises (1912, 1949), Hayek (1931, 1935, 1948, 1980, 2008), Hazlitt (1946), Rothbard (1962, 2004).*

We live in the time of big changes by the *globalization* in *Wolf (2005)*, when the modern financial and economic theories are constantly complemented by the new research discoveries, propositions, and findings in *Ledenyov D O, Ledenyov V O (2012a, b, c, d, 2013a, b, c, d).* The *globalization* has a considerable impact on the national financial systems, originating a strong necessity toward the new monetary policies introduction in *Mishkin (2007a, b).* As a result of the ongoing global changes by the *globalization*, the developed economies of the scale and scope experience the unresolved financial and economic problems in *Stiglitz (2002).* The most serious economic problems, which are similar to the problems at the time of the *Great Depression* in *Bernanke, Parkinson (1989)*, are observed in the *USA* during a recent decade in *Bernanke (2007a, b, c, d, 2008a, b, c, d, 2009a, b, c, d, 2010a, b c, d, 2011a, b, c, d).*

Let us comprehensively analyze the nature of the current financial and economic crises in the *USA*, presenting the views by the *American* business leaders, academicians and politicians, which were publicly expressed at *The Economic Club of Washington in Washington, District Columbia in the USA.*

Sperling (2011) described the beginning of the economic crisis in the *USA* in *2008*: "In *November* when *President-elect Obama* was taking over an economic policy, the *Blue Chip* forecast projected that the economy would contract in the fourth quarter of *2008* and the first quarter of *2009* at an annualized rate of *1.65* percent. In other words, they were projecting that our economy would be losing at a pace – growth at a pace to show we're contracting at near *2* percent. By *December* that projection for that six-month period had gone to *3 ¼* (percent). So what do we know now? What do we know now, now that we have better information? During that six-month period the economy contracted at an annualized rate of *7.8* percent, nearly *8* percent. Actually, in the fourth quarter of *2008* our economy was losing – was contracting, losing growth at a rate of *8.9* percent a year. It was the worst six-month period of growth since records of quarterly growth were first kept in *1947*. Other than the period of demobilization in *1946* after *World War II*, it was the worst six months on record since the heart of the *Great Depression*. And on the jobs front, our economy lost *2.3* million private-sector jobs in the first quarter of *2009*. We were losing jobs at a pace of nearly *800,000* a month in the first quarter of *2009* against – again, the worst record since the heart of the *Great Depression*."

Paulson (2009) recalls his memories on the important moments of his desperate attempts to take control over the chaotic events at the beginning of the economic crisis in the *USA*: "We had to stabilize the situation immediately. We knew that markets were exceptionally fragile and would be further threatened in *September* when we expected that a number of large financial institutions, including *Lehman Brothers*, would post disappointing earnings. *Chairman Bernanke*, *FHFA Director Lockhart*, and I met almost daily, over a *10*-day period, to work toward a comprehensive action plan. As I made clear at the time, we sought a temporary solution that would achieve three goals: *(1)* stabilize markets, *(2)* promote mortgage availability, and *(3)* protect the taxpayer."

Summers (2009): "If you look, you have to see a couple things. You have to see that there are still substantial downdrafts in our economy, that economies don't go from losing *600,000* jobs a month to a terribly happy path overnight. You have to see that there are still substantial strains in credit markets."

Marriott (2009) made a very emotional statement: "We need to get corporations out of the bunker, out and moving again around the country, and holding meetings and traveling. And that's going to come as the economy recovers and as corporate investment starts to take hold."

Bernanke, Bertaut, DeMarco, Kamin (2011) shortly describe the main causes of the economic crisis in the *USA*: "A broad array of domestic institutional factors—including problems with the originate-to distribute model for mortgage loans, deteriorating lending standards, deficiencies in risk management, conflicting incentives for the *GSEs*, and shortcomings of supervision and regulation - were the primary sources of the *U.S.* housing boom and bust and the associated financial crisis."

Schmidt (2011) explains that there are the two serious crises in the West: "The Western world is dealing with two fundamental crises. The first has to do with globalization. This interconnectedness that is happening naturally is not going to stop. The technology is going to continue; there's all sorts of reasons why we all want to be interconnected. The world is getting smaller, and in my view, a much more livable place. But the other thing that's happening is that, because of business innovation and so forth, the Western world has a jobless problem. I'm convinced that there is an answer. That answer is the hard answer, unfortunately: investing in education, especially a science and math education; creating models for innovation in your country; getting rid of roadblocks to creating new businesses – because that's ultimately where the jobs are created."

Immelt (2011) states: "A global financial crisis plunged us into the worst recession since the *Great Depression*. … It's a turbulent time. And I think when people lose confidence in their

future, they're prone to act on fears and not their hopes. And I think we've begun a great debate in boardrooms and state capitols and government, which is really a great debate for this country. It's how do we compete? How do we create new jobs? And how do we win in this new economic era?"

Zoellick (2012) prefers to make a clear statement: "Just to give you a sense of how the world has changed, in the past 5 years, two-thirds of global growth has come from developing countries."

Weymouth (2013) is full of frustration, when she describes the present state of the *US* economy: "Part of it is the economy. People are not hiring a lot. You're not going to have a big jobs section when people are not hiring. But a lot of it is just the world has changed, right? Pretty much the room-mate business is gone, the pet business is gone, yard sales are gone. So I don't know. I don't think that money is coming back."

Roberts (2013) describes the events shortly: "And one day housing stopped – *2008*, and all of a sudden our subscriber losses were bigger."

Faust (2013) expresses an opinion with some skepticism about the ability to fund the science and education programs by the federal government at the time of severe economic crisis in the *USA*: "Let me shift to another very important dimension of what we're facing, and that is the research challenge. We are outstanding institutions because we are research institutions that have, in partnership with the federal government, produced the kinds of discoveries that have changed people's lives and fueled the American economy since that partnership was established after *World War II*. What's happening to that partnership now and in the face of the federal deficit? How are we going to fund science and scientific discovery in the *United States* in the future, especially when we see competition from other parts of the world that are investing extremely heavily in their scientific and educational enterprises?"

Bloomberg (2012) highlights a well known fact that there are the short- and long- term economic and financial challenges, facing the *US* economy. These serious economic and financial problems, which need to be resolved with the purpose to overcome the economic downturn in the *US* economy, are listed below in *Bloomberg (2012)*:

1. *Short-term challenges facing the U.S. economy*:

"The *uncertainty* that is paralyzing businesses and hindering investment…. Right now thousands of pages of new conflicting and incomprehensible regulations are being written by government lawyers who have little appreciation for the way the markets work or the way businesses and banks operate. No one knows what the real impact will be on the

private sector, and that uncertainty is artificially depressing lending, investment, and hiring levels."

2. *Long-term challenge facing the U.S. economy*:

"We are facing a *structural economic crisis* that is much more dangerous to our future…. Globalization has moved many middle-class jobs overseas, where the industries of tomorrow are being created. Automation has rendered many middle-class jobs obsolete. Cost increases, especially for health care, college tuition, and tort law, have eaten away at real income. Higher education is improving outside the *United States* at a rate almost guaranteed to reduce our competitiveness. And relative productivity has decreased so much that it now often takes two middle-class breadwinners to make ends meet rather than one."

Bloomberg (2012) also proposes the following possible short- and long- term solutions, which, in his opinion, may help to improve the difficult situation, presently observed in the *US* economy:

1. *Short-term remedies for the U.S. economy*:

"In the short-term, that means eliminating the *uncertainty* that is paralyzing businesses by adopting a credible deficit reduction plan that balances new revenue with spending cuts."

2. *Long-term remedies for the U.S. economy*:

*"*And in the long term, it means helping cities and states do more to create pro-business economic environments that spur entrepreneurship. It means allowing business to tap into new markets by clearing away trade barriers. It means helping us build the modern infrastructure that will catalyze private investment. And it means attracting and developing high-skilled workers by fixing our broken immigration system and aligning our school system with today's economic realities."

Bloomberg (2012) finalizes his strategic vision on the future of the *US* economy by saying that, presently, there is a considerable number of *uncertainties* in the finances: "The financial industry attracts a lot of people who have created so many new things, nobody understands them all. But they have to know what the world is that they're going to be dealing with. And the *uncertainty of the regulations*, the *uncertainty of court decisions*, the *uncertainty on the tax law* is the biggest single impediment, I think, to growth."

Blankfein (2012) points out to a well known fact: "The fiscal cliff as a major uncertainty in the world is responsible for a real burden and a real diminution of value and wealth in the world, just because uncertainty makes everything worth less."

Zuckerman (2013) issues a kind of prescription for the *US* economy: "Get the economy growing at a much more rapid rate. We have to have a major infrastructure bank, a federal infrastructure bank. They would be large-scale projects. We can finance them today at record-low interest rates. And if you had them tolled, therefore, over time they would pay back. Put a nationwide electronic grid in the country, so that everybody could have access to it in a very easy way.

Change the rules on the importation or the allowance of people with degrees, advanced degrees, – *STEM* – science, technology, engineering, mathematics. We have a shortage of those people in the country today. Change the regulations that allow foreign companies to locate in the United States. What is the most difficult thing for them to do is to get through the regulatory hurdles.

And finally, reform the tax code. There are just a whole host of special tax write-offs that are available to particular industries and particular interest groups. Frankly, it corrupts the system; it diminishes the credibility of the system. I'd try and eliminate most of them and lower the tax rates. I think that would be very stimulative to the economy. And if we could do that in the next two weeks, that would also help."

Let us highlight a very notable fact that the invited speakers at *The Economic Club of Washington* see the present financial and economic events, trends and patterns in the *US* economy through the lenses of a subjective analysis prism, expressing the fragmented opinions as a result of the experienced multiple psychological shocks, enormous life pressures and totally destructive economic stresses during the recent years. Of course, we understand that the opinions by *The Economic Club of Washington* invited speakers cannot pretend to be objective, but all their statements reflect one important fact that there is a deep economic downturn in the *USA*.

Let us explain that, in the situation of the present financial and economic *uncertainties*, the *US Federal Reserve* and other *central banks* responded to the financial crisis with the introduction and implementation of the *Quantitative Easing (QE)* policies in a desperate attempt to avoid the economic stagnation, recession and crisis processes in the *USA* and other developed countries in *Bernanke (2012a, b, 2013)*, *Ledenyov D O, Ledenyov V O (2013d)*. "The central banks introduced a series of quantitative easing programs and decreased the long term interest rates to near zero with the aim to ease the credit conditions and provide the liquidity into the financial systems, responding to the *2007-2013* financial crisis in the *USA, UK, Western Europe, and Japan*," as explained in *Ledenyov D O, Ledenyov V O (2013d)*. *Barack H. Obama* provided the following comments on the *US Federal Reserve System* achievements under the governance by *Ben S. Bernanke* in *Aglionby (2013)*: "He (*Ben S. Bernanke*) has been an outstanding partner,

along with the *White House*, in helping us recover much stronger than, for example, our *European* partners, from what could have been an economic crisis of epic proportions." However, the authors think that the realization of the *financial engineering programs* cannot be considered as the only possible remedy to stimulate the *US* economy in the time of severe economic crisis. In our opinion, the *financial engineering programs* such as the *Quantitative Easing* (*QE)* have to be used to complement the necessary economic reforms, which must be implemented in the frames of new economic development strategy in the *USA*. Let us add that we found that the *QE* program implementation may stabilize or destabilize the *US* financial system, depending on the level of added liquidity in the *US* financial system over the selected time period, because of the turbulence appearance in the quantitative easing transmission channels and transactions network channels at the *QE* policy implementation by the *US Federal Reserve System* in *Ledenyov D O, Ledenyov V O (2013d)*.

Going to the next point, let us analyse the influence by the financial crisis on the investments climate in the developed nations. We can confidently say that, at the present time, a limited number of big investors continue to keep a great confidence in the *US* economy.

In this connection, let us review the *Warren Buffett's* vision and thoughts, who exemplified the realization of *American dream* for many *American* investors and businessmen over the years. *Rubenstein (2012)* stated: "*Warren Buffett*, a rare modern man with the essential traits of our Founding Fathers: great wisdom, courage and leadership, and also great wealth."

Warren Buffett provides his general investment advice by making the following statements in *Buffett (2012)*: "The *American* economy has done wonderfully. I mean, if you take the *20th* century, the *Dow* started at *66*, and it ended at *11,400*. Now, think of that. How could anybody get a bad result on investing starting at *66* and go to *11,400*? But a lot of people do because they jump in at the wrong time, or they think they know this stock versus that stock. But the average person should just consistently buy equities, which to me are by far the most attractive investment choice around, and put it in and not think about it for *20* or *30* years; they'll do very well."

Warren Buffett comments on his investment strategy in *Buffett (2012)*: "I'm comfortable any place I understand the business well, and to some extent the rules that they operate in, and where I've got the right management. And so, we will buy a business, you know, in any one of *40* countries tomorrow if it's the right kind of business. But most businesses I hear about are in the *United States*. We're on the radar screen here to a greater extent than around the world."

Warren Buffett emotionally acknowledges that there are some serious financial and economic problems in the *USA*, trying to be optimistic about the future of his country in *Buffett*

(2012): "It's a cinch. We haven't lost the secret sauce. When I was born in *1930*, the *Dow* was *252* the day before…. It was going to go down to *42*.…Look at what has happened since that time….we went through a terrible war. We went through a terrible *Depression*. We went through *25* percent unemployment. We went through thousands of banks closing – six for one, you know. We're not smarter than the people in *1930*. We don't work harder than the people in *1930*. We've just got a system that works. It's been working, you know, since *1776*, and it will keep working."

In our opinion, the international economic integration due to the *globalization* quickly changes the *World*. As a result, the *Gross Domestic Products (GDPs)*, generated the *USA, UK, Western Europe, Japan* economies, continue to shrink sharply due to a number of different economic, financial and political factors in *Bloomberg (2012), Ledenyov D O, Ledenyov V O (2013d)*. However, the *GDPs* of the emerging *Brazil, Russia, India, China (BRIC)* economies increase exponentially in the time of *globalization* in *Wolf (2005)*. Therefore, in our opinion, it is important for the investors to diversify their investments and create the ***global equity index portfolio***, aiming to increase and accumulate the wealth due to the globally diversified investments during the *wealth management* process at a global scale.

Let us note that the authors have already investigated some research problems on the optimal allocation of assets in the investment portfolio with the application of the *modern portfolio management theory* and the *nonlinear dynamic chaos theory* in the investment, commercial and central banks in *Ledenyov D O, Ledenyov V O (2013a)*. In addition, some approaches to the risk management with the application of econophysics analysis in the central banks and financial institutions were discussed in *Ledenyov D O, Ledenyov V O (2012d)*.

Therefore, the authors will complement our early research findings in *Ledenyov D O, Ledenyov V O (2012d, 2013a)* by the research data on the influence by the effect of uncertainty on the investment in *Bernanke (1979)*. We will limit the scope of our research by the evaluation of the market risk of the *global equity index portfolio* in the global capital markets in the time of great uncertainties mainly.

As always, we will use the knowledge bases in the *econophysics* and *econometrics* to make the present research, accenting our research attention on the possible influences by the *nonlinearities* in the finances and economics in an analogy with the existing influences by the *nonlinearities* in the physics as well as the electrical and electronic engineering to a certain extent in *Ledenyov D O, Ledenyov V O (2012e)*.

We assume that, in the finances and economics, the *econometrics* methods are much better known to the readers, comparing to the *econophysics* methods. Moreover, it makes sense

to remind that the *econophysics* is frequently regarded as a new science in our time. However, we believe that the *econophysics* as a science was established by *Newton*, who had a profound influence on both the physics and the finances in the *United Kingdom* many years ago. In general, the application of the *econophysics* methods has a long history in the finances and economics, let us mention just one interesting fact that the *diffusion* process, which certainly relates to the physics, was comprehensively researched in application to the finances by *Ben Shalom Bernanke* more than *30* years ago in *Bernanke (1979)*.

Evaluation of market risk of a hypothetical global equity index portfolio

Let us begin the consideration of the investment related topics with the interesting statement by *Paul S. Otellini* in *Otellini (2009)*: "For any nation in the 21^{st} century, but particularly for the *United States*, supporting a true ***culture of investment*** is the key to long-term success." *Otellini (2009)* continues: "If we are committed to investing in ideas to *improve*—not just *maintain*—what we have and what we know, the *United States* will do more than just recover from this recession. We will emerge, once again, as a competitive, global powerhouse."

Therefore, we will consider a general approach, which can be used to evaluate the market risk of a hypothetical ***global equity index portfolio*** with a *Monte Carlo* simulation technique, using the *Student's t copula* and *Extreme Value Theory (EVT)*, is described below in *Matlab (2012)*. The *Matlab* models simulate the market risk of a hypothetical global equity index portfolio with a *Monte Carlo* simulation technique, using the *Student's t copula* and *Extreme Value Theory (EVT)* in *Glosten, Jagannathan, Runkle (1993), Embrechts , McNeil, Straumann (1999), Bouye, Durrleman, Nikeghbali, Riboulet, Roncalli (2000), McNeil, Frey (2000), Roncalli, Durrleman, Nikeghbali (2000), Nystrom, Skoglund (2002), Nystrom, Skoglund (2002), Zeevi, Mashal (2002)*. The process first extracts the filtered residuals from each return series with an asymmetric *GARCH* model, then constructs the sample marginal *Cumulative Distribution Function (CDF)* of each asset using a *Gaussian kernel* estimate for the interior and a *Generalized Pareto Distribution (GPD)* estimate for the upper and lower tails. A *Student's t copula* is then fit to the data and used to induce correlation between the simulated residuals of each asset. Finally, the simulation assesses the *Value-at-Risk (VaR)* of the hypothetical global equity portfolio over a one month horizon," as explained *in Matlab (2012)*. In Fig. 1, the plot illustrates the relative price movements of each index in *Matlab (2012)*. The initial level of each index has been normalized to unity to facilitate the comparison of relative performance, and no dividend adjustments are explicitly taken into account in *Matlab (2012)*.

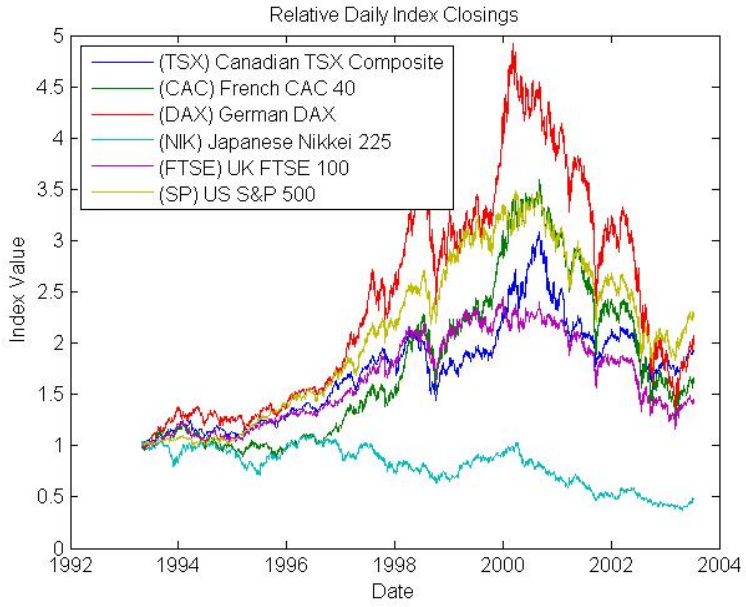

Fig. 1. *Relative daily index closings (after Matlab (2012)).*

Let us convert the closing level of each index to daily logarithmic returns (sometimes called geometric, or continuously compounded, returns) in *Matlab (2012)*. Since the first step in the overall modeling approach involves a repeated application of *GARCH* filtration and *Extreme Value Theory* to characterize the distribution of each individual equity index return series, it is helpful to examine the details for a particular country in *Matlab (2012)*.

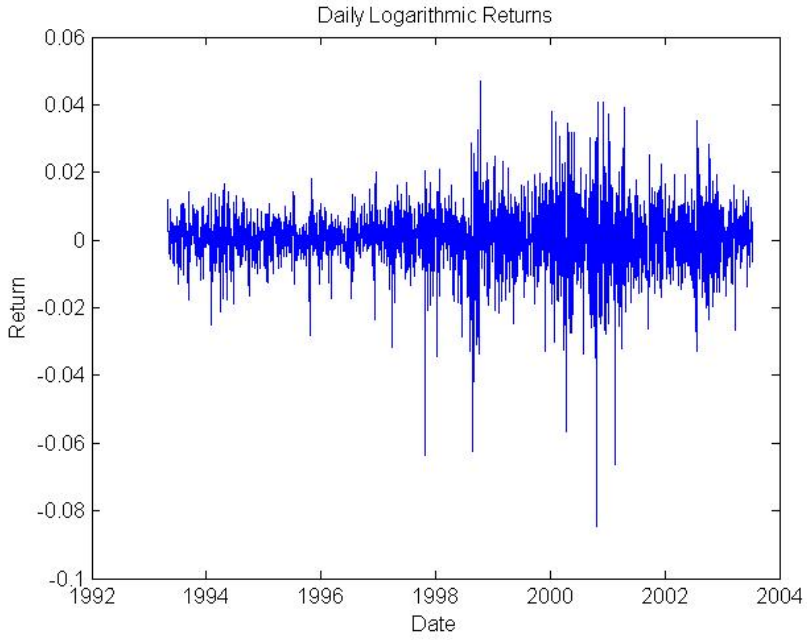

Fig. 2. *Daily logarithmic returns in Canada (after Matlab (2012)).*

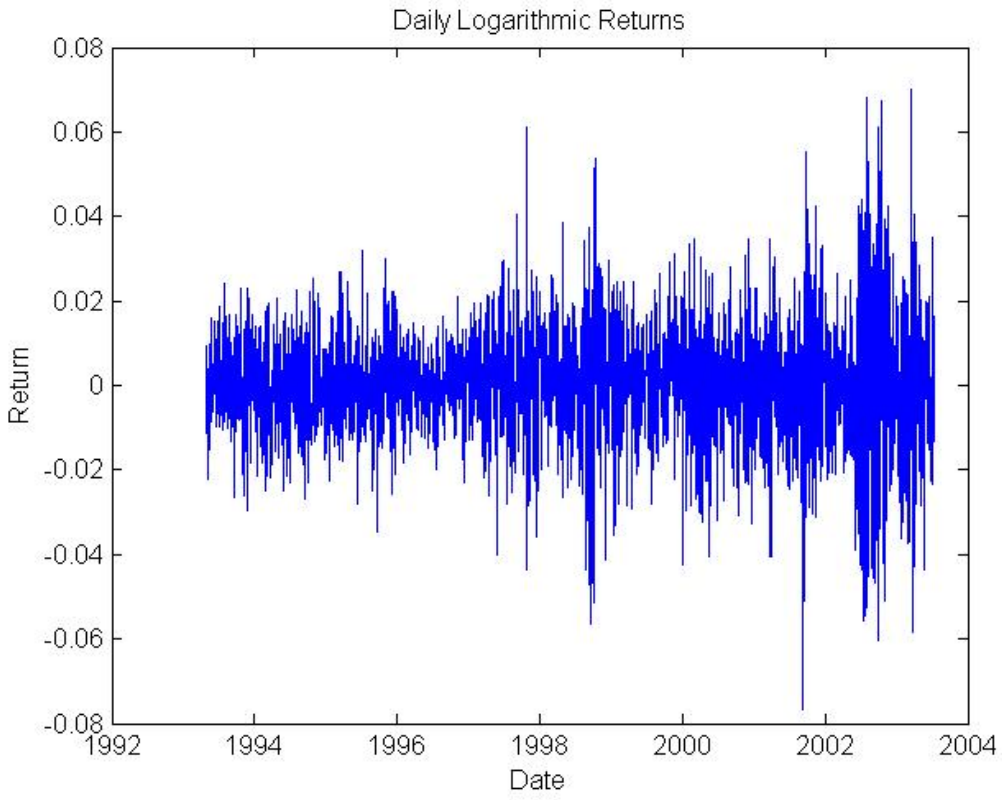

Fig. 3. *Daily logarithmic returns in France (after Matlab (2012)).*

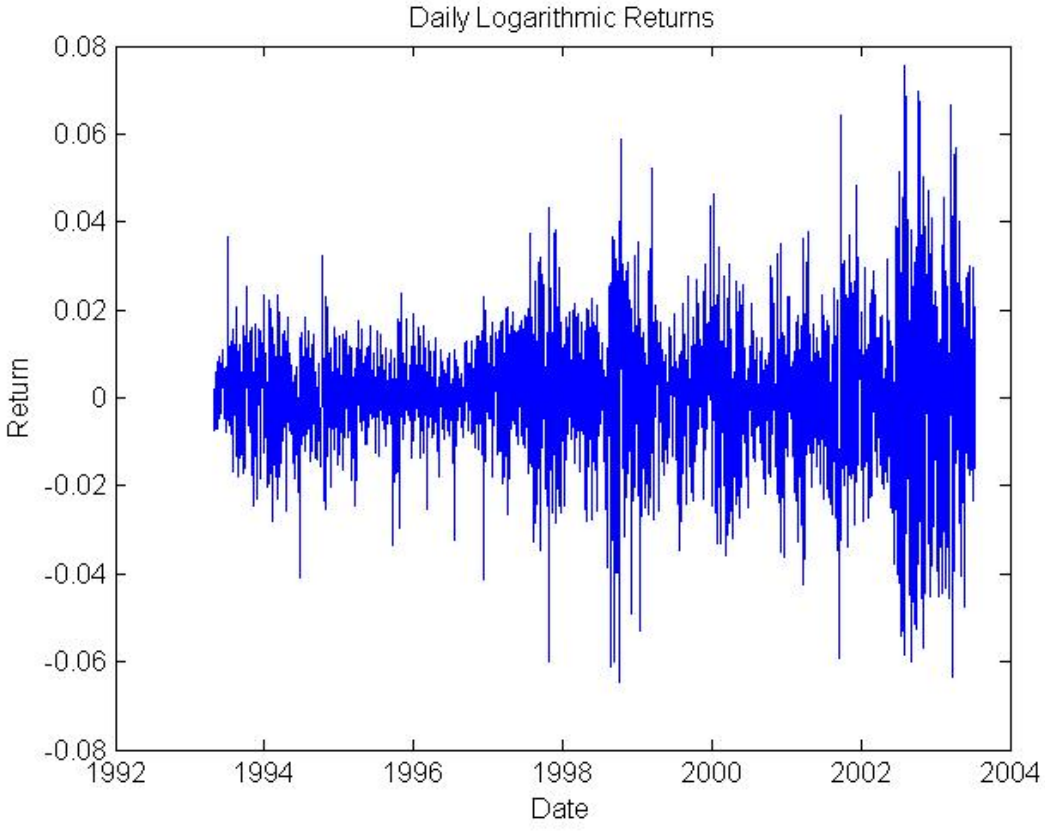

Fig. 4. *Daily logarithmic returns in Germany (after Matlab (2012)).*

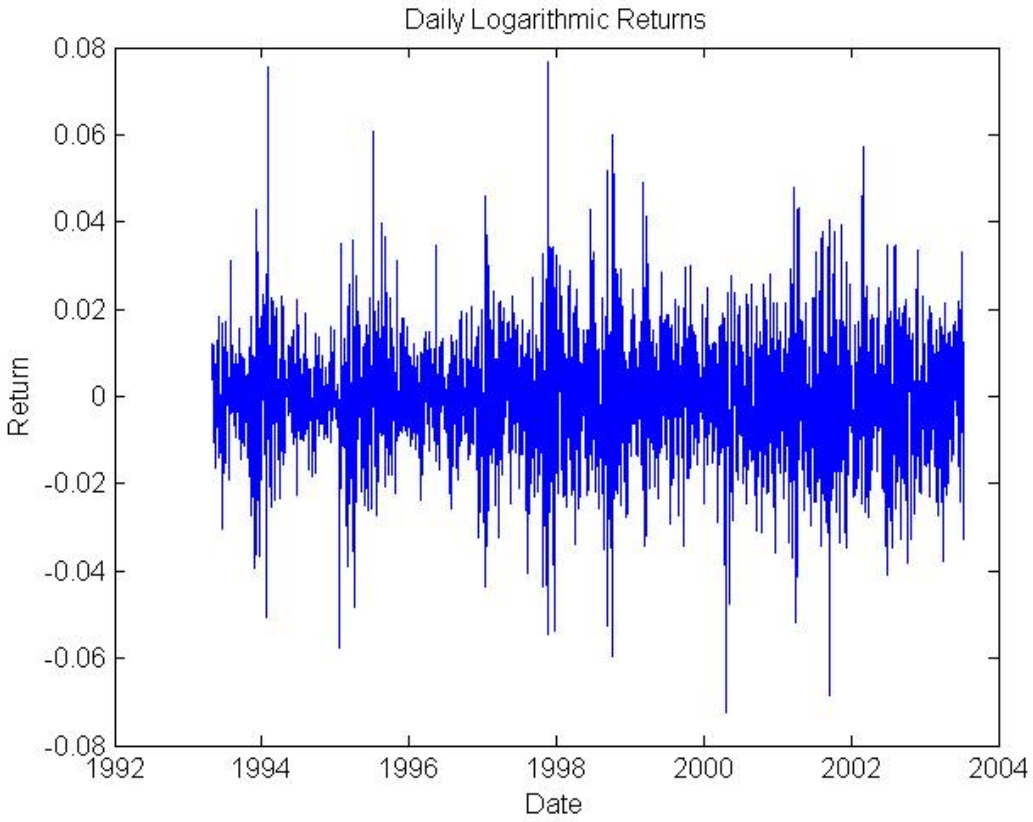

Fig. 5. *Daily logarithmic returns in Japan (after Matlab (2012)).*

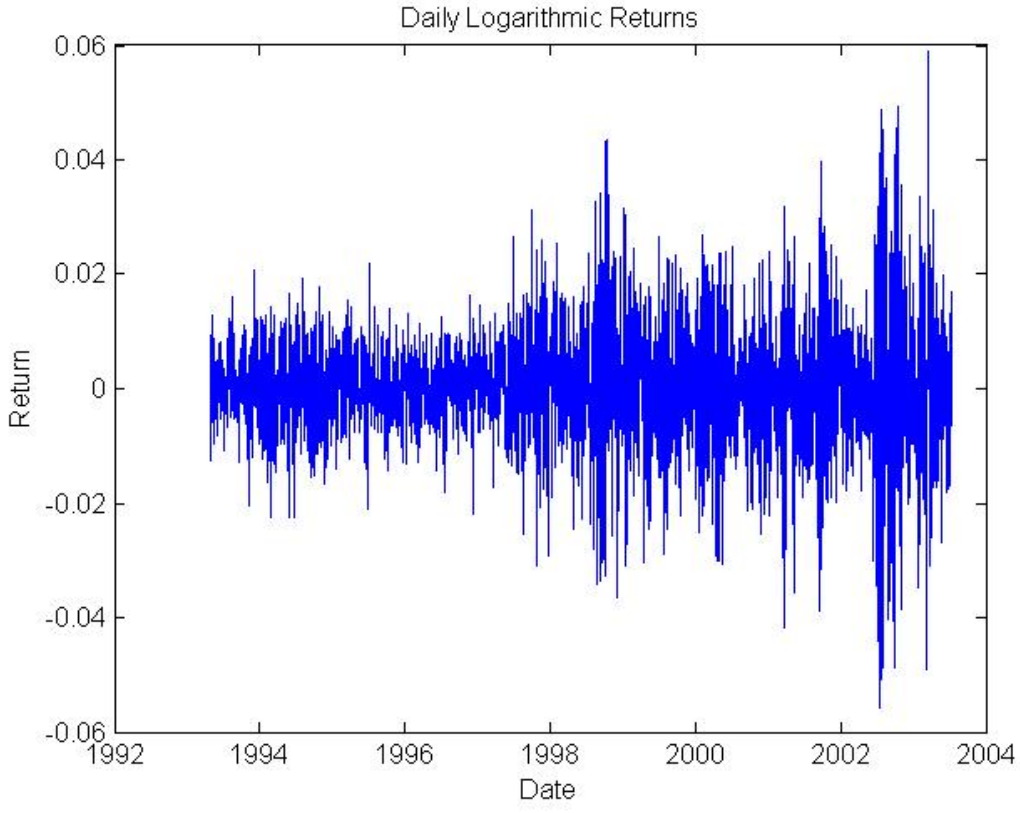

Fig. 6. *Daily logarithmic returns in U.K. (after Matlab (2012)).*

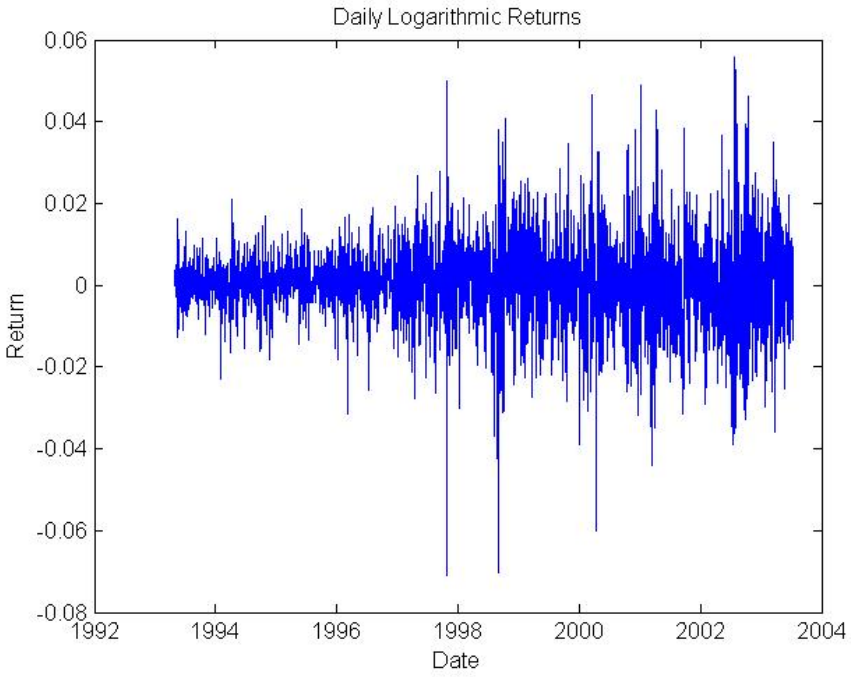

Fig. 7. *Daily logarithmic returns in U.S.A. (after Matlab (2012)).*

Let us filter the returns for each index. Modeling the tails of a distribution with a *GPD* requires the observations to be approximately independent and identically distributed (i. i. d.). However, most financial return series exhibit some degree of autocorrelation and, more importantly, heteroskedasticity. For example, the sample autocorrelation function *(ACF)* of the returns associated with the selected index reveal some mild serial correlation in *Matlab (2012)*.

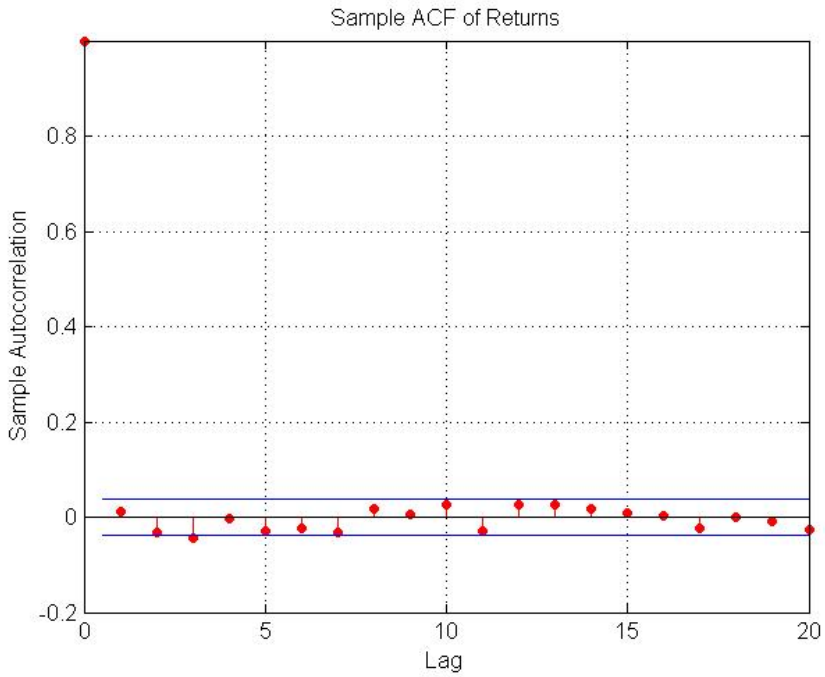

Fig. 8. *Sample of autocorrelation function (ACF) of returns (after Matlab (2012)).*

However, the sample *ACF* of the squared returns illustrates the degree of persistence in variance, and implies that *GARCH* modeling may significantly condition the data used in the subsequent tail estimation process in *Matlab (2012)*.

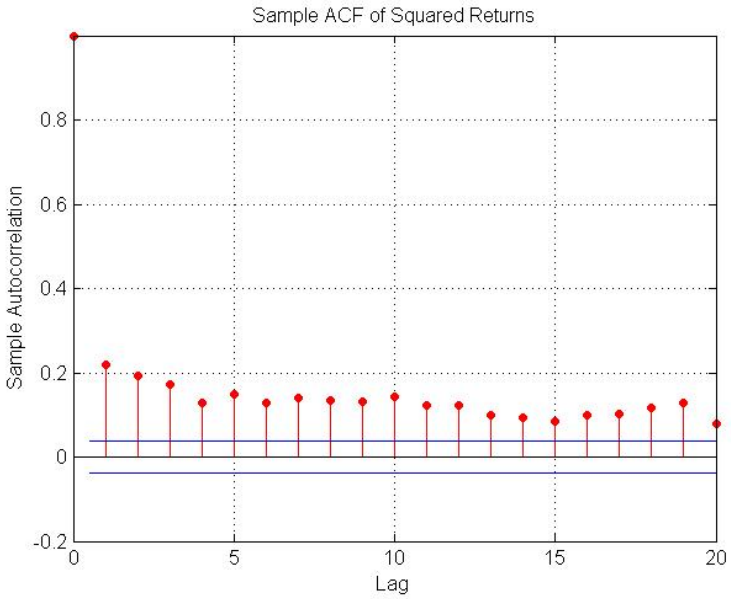

Fig. 9. *Sample of autocorrelation function (ACF) of squared returns (after Matlab (2012)).*

For the selected index, compare the model residuals and the corresponding conditional standard deviations filtered from the raw returns. The lower graph clearly illustrates the variation in volatility (heteroskedasticity) present in the filtered residuals in *Matlab (2012)*.

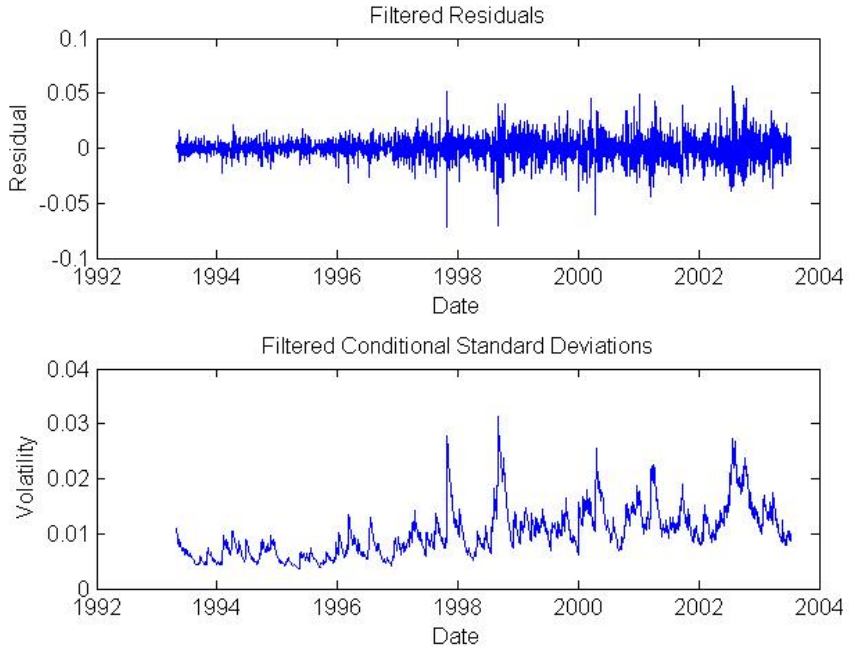

Fig. 10. *1) Filtered residual; and 2) Filtered conditional standard deviations (after Matlab (2012)).*

Having filtered the model residuals from each return series, let us standardize the residuals by the corresponding conditional standard deviation. These standardized residuals represent the underlying zero-mean, unit-variance, i. i. d. series upon which the *EVT* estimation of the sample *CDF* tails is based in *Matlab (2012)*. Thus let us examine the *ACFs* of the standardized residuals and squared standardized residuals. Comparing the *ACFs* of the standardized residuals to the corresponding *ACFs* of the raw returns reveals that the standardized residuals are now approximately i. i. d., thereby far more amenable to subsequent tail estimation in *Matlab (2012)*.

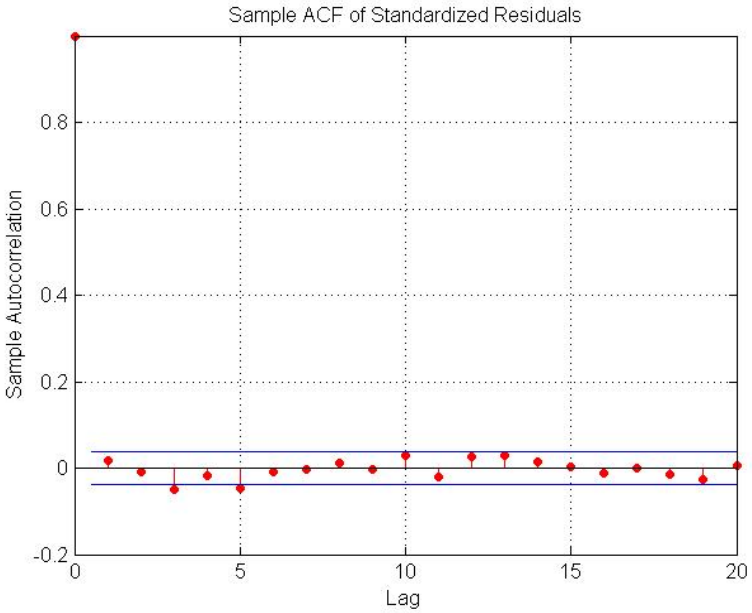

Fig. 11. *Sample ACF of Standardized Residuals (after Matlab (2012)).*

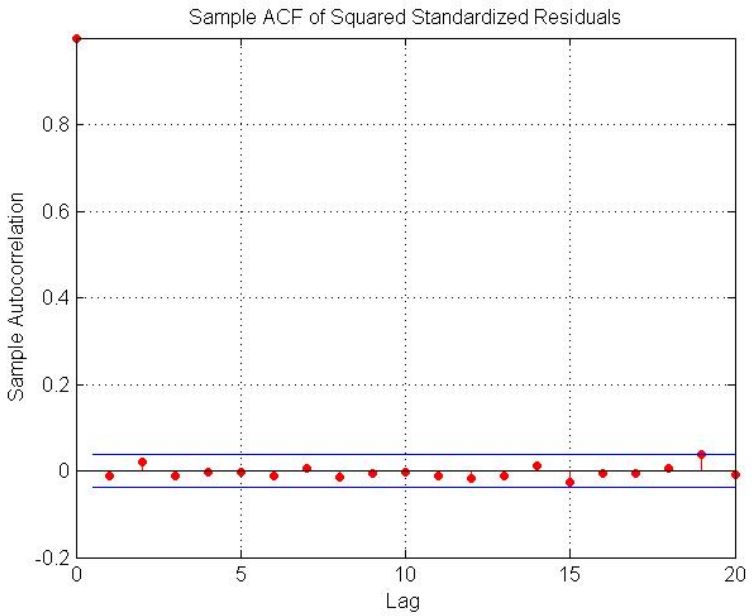

Fig. 12. *Sample ACF of Squared Standardized Residuals (after Matlab (2012)).*

Let us estimate the semi-parametric *CDFS*. Given the standardized, i. i. d. residuals from the previous step, estimate the empirical *CDF* of each index with a *Gaussian kernel*. This smoothes the *CDF* estimates, eliminating the staircase pattern of unsmoothed sample *CDFs*. Although non-parametric kernel *CDF* estimates are well suited for the interior of the distribution where most of the data is found, they tend to perform poorly when applied to the upper and lower tails. To better estimate the tails of the distribution, apply *EVT* to those residuals that fall in each tail in *Matlab (2012)*.

Specifically, let us find upper and lower thresholds such that *10%* of the residuals is reserved for each tail. Then fit the amount by which those extreme residuals in each tail fall beyond the associated threshold to a parametric *GPD* by maximum likelihood in *Matlab (2012)*.

Given the exceedances in each tail, let us optimize the negative log-likelihood function to estimate the tail index (*zeta*) and scale (*beta*) parameters of the *GPD* in *Matlab (2012)*.

The following code segment creates objects of type |*paretotails*|, one such object for each index return series. These *paretotails* objects encapsulate the estimates of the parametric *GP* lower tail, the non-parametric kernel-smoothed interior, and the parametric *GP* upper tail to construct a composite semi-parametric *CDF* for each index in *Matlab (2012)*.

The resulting piecewise distribution object allows interpolation within the interior of the *CDF* and extrapolation (function evaluation) in each tail. Extrapolation is very desirable, allowing estimation of quantiles outside the historical record, and is invaluable for risk management applications in *Matlab (2012)*.

Moreover, *Pareto tail* objects also provide methods to evaluate the *CDF* and *inverse CDF* (quantile function), and to query the cumulative probabilities and quantiles of the boundaries between each segment of the piecewise distribution in *Matlab (2012)*.

Also, let us notice that the collections of *Pareto tail* objects are stored in cell arrays, high-level *MATLAB(R)* data containers designed to store disparate data types in *Matlab (2012)*.

Having estimated the three distinct regions of the composite semi-parametric empirical *CDF*, let us graphically concatenate and display the result. Again, note that the lower and upper tail regions, displayed in red and blue, respectively, are suitable for extrapolation, while the kernel-smoothed interior, in black, is suitable for interpolation in *Matlab (2012)*.

The progra calls the *CDF* and inverse *CDF* methods of the *Pareto tails* object of interest with data other than that upon which the fit is based. Specifically, the referenced methods have access to the fitted state, and are now invoked to select and analyze specific regions of the probability curve, acting as a powerful data filtering mechanism in *Matlab (2012)*.

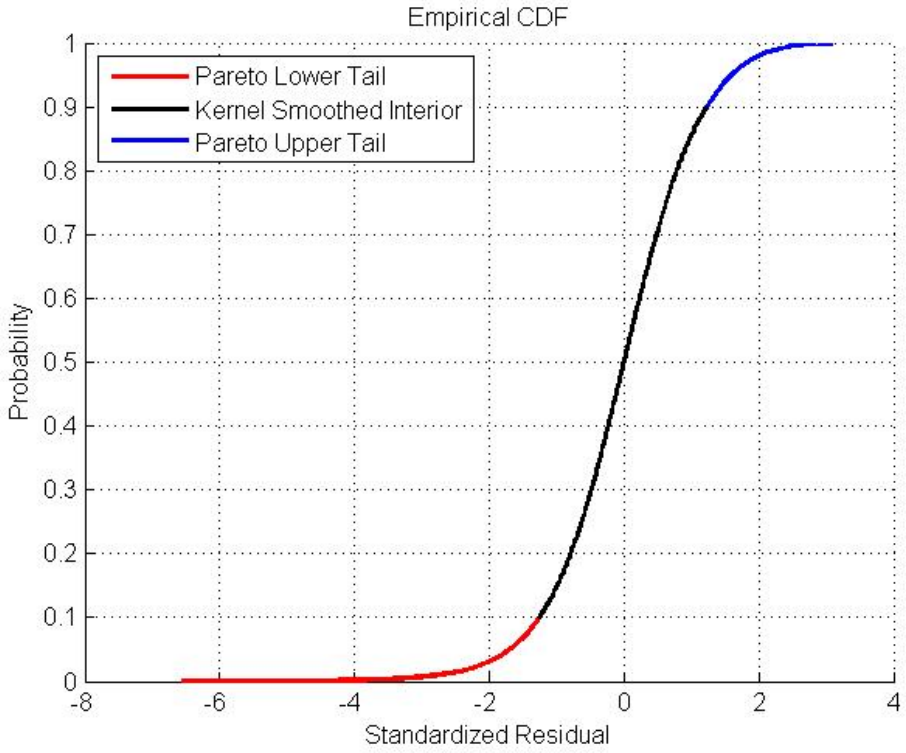

Fig. 13. *Empirical CDF (after Matlab (2012)).*

We propose a conceptual framework, based on our suggestion that the application of the dynamic analysis of the nonlinear interactions between of the global capital flows can significantly leverage the effective investment control strategies in the researched case of the *global equity index portfolio*. Going from the proposed conceptual framework, we developed the innovative software program in *Matlab*, which takes to the account the nonlinear dynamic phenomena, originated by the global capital flows in the global capital markets, during the computing of the *ROI* of the *global equity index portfolio* in *Ledenyov D O, Ledenyov V O (2013e), Shiryaev (1998a, b), Hull (2012a, b)*. We applied the advanced software program to optimize a number of the *global equity index portfolios* successfully in *Ledenyov D O, Ledenyov V O (2013e)*.

Conclusion

Let us conclude by saying that, thinking about the development of the unifying mathematical approach to solve the problem on the evaluation of market risk of the *global equity index portfolio* in the highly volatile global capital markets, the authors drew attention to an increasing necessity of application of the dynamic assessment of the financial systems with the

use of the continuous system representation models, which allows to make the accurate characterization of the *Returns on Investments (ROI)* of the diversified *global equity index portfolio*. In our view, the creation of the complex computer models to accurately characterize the financial system's operating modes results in ability by the investors to find the categorical behaviour properties of the financial system and to predict its dynamic properties precisely. In our opinion, in the periods of challenging turbulent economic conditions in *Bernanke (1995)*, the process of extraction of useful knowledge from the big streams of financial data from the various capital markets with the aim to make the virtuous investment decisions requires a deep understanding of the cognitive modeling techniques in application to the investment decision making as far as the *global equity index portfolio* is concerned. We analyzed the nature of the current financial and economic crises in the *USA*, presenting the views by the *American* business leaders, academicians and politicians, which were publicly expressed at *The Economic Club of Washington in Washington, District Columbia in the USA*. We highlighted the fact that it is important for the investors to diversify their investments and create the ***global equity index portfolio***, aiming to increase the *Return on Investment (ROI)* and to accumulate the wealth as a result of the *wealth management* process at a global scale. Also, we considered the standard approach, which can be used to evaluate the market risk of a hypothetical *global equity index portfolio* with a *Monte Carlo* simulation technique, using the *Student's t copula* and *Extreme Value Theory (EVT)* as described in *Matlab (2012)*. We proposed a conceptual framework that the application of the dynamic analysis of the nonlinear interactions between of the global capital flows can significantly leverage the effective investment control strategies in the considered case of the *global equity index portfolio*.

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