

4 Financial volatility and economic growth

1. Introduction

Over the course of the past few decades monetary policy has been the political instrument of choice for public authorities of developed economies to reactivate growth of their economies, and indirectly of the world economy, in periods of weakness such as the one we are currently experiencing and guaranteeing stability around full employment or potential growth. However, **there is a generalised and growing fear in the financial markets that what we shall refer to as the hypothesis of the “new monetary conflict between full employment and financial stability” may become true.**

This hypothesis asserts that **in the current context (strongly conditioned to the sequels of the financial and debt crises experienced by the developed economies in the period 2007-2011), monetary policy at developed countries has lost efficacy in stabilizing domestic (and global) economic growth around its potential or full-employment level without destabilizing financial markets sooner or later (compromising in this way the short-term stabilization of economic growth reached).**

This fear partly can explain the generalised downward revision of economic growth forecasts for 2016 and the following years by financial agents and analysts in response to the unexpected increase in financial volatility since mid-2015, after a long period of stability at low levels.

This article explores statistically the possible occurrence, in line with the aforementioned hypothesis¹⁸, of a structural change in the dynamics of global financial volatility and in its relation with world economic growth from 2012 (i.e. in the period subsequent to the recent financial and debt crisis of the developed economies) relative to its characteristics prior to 2007 (i.e. in the pre-crisis period).¹⁹

2. What justifies the change in the relationship between volatility and growth?

The aforementioned thesis of a reduction in the efficacy of developed countries' monetary policy (due to the increase of its destabilising effects over the financial markets) has been theoretically and empirically justified in several research and opinion articles by Lawrence Summers²⁰ in recent years²¹. The key to this reduction would be the current conjunction of the following two conditions:

- (i) a strong misalignment between the observed level of the interest rate and that (hypothetically lower²²) level required to sustain full employment, and
- (ii) the impossibility of diminishing short-term interest rate lower enough to correct such misalignment given its proximity to zero (and the consequent need for recurring to unconventional monetary policy instruments for stabilising growth around its full employment value).

On the other hand, an additional fear that this loss of efficacy could compromise not only the economic growth of developed economies but also the world's finds its justification in the presence of restrictions on

18: In any case, the results of this article are enough for corroborating or refuting such hypothesis, which only serve the purpose of motivating our exercise.

19: The term “financial volatility” refers to the volatility of prices of and returns on the equities, bonds and currencies most commonly traded on the financial markets. In this case, we will use as the indicator of financial volatility the VIX index, which is an implied measure of the volatility of the Standard & Poor's 500 stock exchange index, since this is an indicator highly correlated with the most widely used measures of global financial volatility (such as the global volatility index developed by BBVA Research) but for which there is greater availability of data. For world economic growth we will use a converted-to-monthly version of the world GDP produced by the BBVA-GAIN model from quarterly world GDP data and monthly economic indicators such as IPIs and PMIs.

20: Professor at Harvard University and ex-secretary of the U.S Treasury.

21: See for example “Reflections on the ‘new secular stagnation hypothesis’”, a chapter in the book:

http://voxeu.org/sites/default/files/Vox_secular_stagnation.pdf.

22: As a consequence of the sizable reduction in wealth experienced by the population segments with higher propensity to consume during the recent financial crisis and by the aging of population (and the associated high saving rates).

the possibility that an increase of emerging economies growth could be able to counter an eventual stagnation of the developed economies. Between these restrictions stand:

- (i) the exhaustion China's development model during last decade and its transition to lower levels of average growth (consistent with the correction of the current over-investment situation and its population aging), and
- (ii) the narrow margin for expansive monetary and fiscal policies in the emerging economies given the drop in commodity prices and the high levels of debt, specially by firms.

3. Correlation between financial volatility and economic growth

Figure 4.1 shows the negative correlation between the trend in world economic growth and that in world financial volatility, while Table 4.1 quantifies this correlation, in terms of both the contemporaneous values of these variables (-44%) and the lagged or advanced values of one against the other.

Table 4.1 suggests that the VIX anticipates world economic growth, which is confirmed by the result of statistical tests showing that current movements in the VIX help to predict future fluctuations in world economic growth but that the converse does not occur²³.

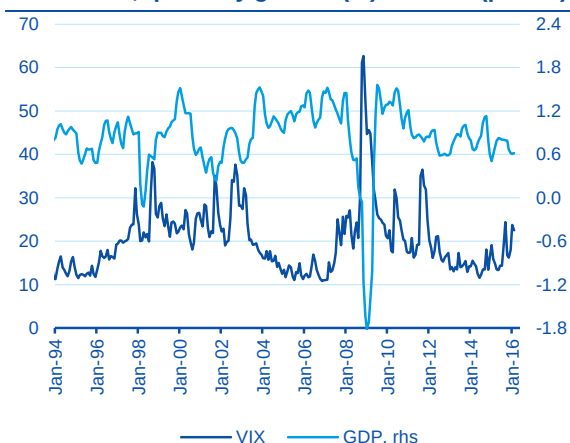
These statistical results regarding the correlation between the VIX and world economic growth are what usually lead financial agents and analysts to revise their growth forecasts downwards when they see unexpected changes in volatility.

The *hypothesis of the new monetary conflict between full-employment and financial stability* described in the previous section suggests that we should find major structural changes in this pattern of correlations when comparing the pre- and post-crisis periods. Table 4.1 shows that the evidence confirms this assumption: **the correlation in the post-crisis period (after 2012) is nearly double that corresponding to the pre-crisis period (before 2007)**.

However, **the correlation between any pair of macro-financial variables is a deceptive guide in trying to quantify the causal impact of one variable on the other**. This is due to the impossibility of discounting in advance the existence of bidirectional causality between the variables (in other words the possibility that variations in the first are capable of affecting the second and that variations in the second are also capable of affecting the first). **Unravelling these causal impacts on the basis of correlations requires recourse to theoretical knowledge of the relation between the two variables being studied, incorporating it into an econometric model that expresses that relation**, as we do in the remainder of this article.

23: We carried out the traditional Granger causality test, finding that the VIX "causes" in Granger's sense, world economic growth, but not vice versa.

Figure 4.1

World GDP, quarterly growth (%) and VIX (points)

Source: BBVA Research and CBOE

Table 4.1

Correlations. Units of time: months

	VIX		
	1997-2016*	1997-2007	2012-2016*
GDP(t-3)	-31%	-11%	21%
GDP(t)	-44%	-17%	-26%
GDP(t+3)	-39%	-22%	-40%

Source: BBVA Research and CBOE

4. From correlation to causality (or anticipation)

Scientific literature studying the causal relation between financial volatility and economic growth, whether theoretical or empirical, is relatively limited and recent, due to the complexity (high non-linearity) of the models required by such studies. Nonetheless, thanks to the digital revolution, which has brought substantial improvements in computing capacity and the efficiency of statistical data analysis, great advances have been made in this area in the past few years²⁴.

In the light of these advances, there is a broad consensus that variations in financial volatility are attributable to unexpected changes in the flow, nature and/or processing of information received by financial agents able to alter their degree of uncertainty regarding future trends of prices of and returns on the listed financial instruments (shares, bonds, currencies, derivatives, etc.) forming the object of their transactions on the financial markets.

From this point of view **it is to be expected that changes in the pace of global economic growth may trigger fluctuations in global financial volatility, but also that changes in financial volatility (not caused by previous changes in economic growth) should cause changes in the pace of economic growth.** The econometric exercise in the following section seeks to unravel these effects quantitatively, although we will first briefly explain the possible channels through which, in accordance with our current theoretical understanding, these two causal effects can be transmitted.

Effect of growth on volatility

New data on economic activity, including both the official GDP data and the more frequent data on indicators that serve to anticipate the quarterly GDP data before their official publication, constitute one of the pieces of information to which financial agents and analysts attach most importance in the process of revising their financial forecasts.

24: We would highlight the following contributions (which will form the basis of the theoretical considerations of the remainder of this article): (i) "Risk Matters: the real effects of volatility shocks", article by Juan Rubio-Ramírez (permanent academic collaborator with BBVA Research), Jesús Fernández-Villaverde et al., published in 2011 in American Economic Review vol.101, no. 6 (pp. 2530-61) and (ii) "The impact of uncertainty shocks", article by Nicholas Bloom, published in 2009 in Econometrica Vol.77, No. 3 (pp. 623-385).

It is therefore to be expected that the publication of unexpected data on any of these variables will have the substantial potential to alter financial agents' uncertainty about the future trend of economic growth and, through the transactions carried out in reaction, to change the levels of financial volatility observed.

More specifically, **the publication of information showing or anticipating unexpectedly low economic growth data for one or more of the world's economies may lead in certain circumstances to an increase in financial agents' uncertainty about the future growth of these economies and of the world economy. It may also involve increased uncertainty about key variables for determining and forecasting future trends in prices of listed financial instruments**, such as future revenues, current and capital expenditure and financial solvency of companies and households. For example, many analysts *partly* attribute the increase in financial volatility (and the fall in the price of oil) since mid-2015 to an effect of this type caused by the disappointing data on the growth of China's economy in the past few quarters²⁵.

Financial volatility's "anticipation" of growth

Despite their great importance, **data on indicators of economic activity are only a small portion of the information processed by financial agents and analysts when revising their forecasts**, including those of economic activity.

Therefore **it is to be expected that only a small fraction of the fluctuations in financial volatility will be explicable by the effect of fluctuations in economic growth** (in fact, the results of our statistical exercise suggest that it is a negligible fraction). The rest would be explained by other **"uncertainty shocks"** which would cover all unexpected data or news, excluding data on economic activity, which also alter financial agents' uncertainty about the future path of the prices of the main financial instruments.

Among these alternative uncertainty shocks we would highlight the following categories:

1. Other data or news items that also alter uncertainty about future economic growth, such as: unexpected announcements of changes in monetary and fiscal policies (such as the US Federal Reserve's announcement of "tapering" in 2014), unexpected announcements of reforms or significant laws, announcements of possible natural disasters, etc.
2. Data or news items that alter uncertainty about the risk of default or bankruptcy on the part of counterparties (issuers of bonds, shares and other listed financial instruments with an appreciable weight in the average financial investor's portfolio), such as the unexpected announcement of the failure of a systemic financial institution (like Lehman Brothers in 2008).

Note that both categories of uncertainty shocks are capable not only of affecting short-term financial volatility but also of causing alterations in short- and long-term economic growth, by altering real investment decisions (for example postponing investments until the environment becomes less uncertain) or household saving decisions (precautionary saving).

The above explanation obliges us to reformulate, in precise terms, the question about the impact of financial volatility on economic growth. **There are no good theoretical grounds for expecting fluctuations in financial volatility *per se* to cause (*sensu stricto*) alterations to economic growth, but there are good grounds for thinking that several of the alternative uncertainty shocks (those other than unexpected data on economic activity) which are capable of altering levels of financial volatility are also capable of altering future economic growth.** In this last case, if the effect on financial volatility precedes the effect on economic growth, then unexpected changes in financial volatility must constitute an advance indicator of unexpected changes in future economic growth.

25: However there are other very important factors behind this increase in financial volatility, such as the change of system for setting the exchange rate of the China's currency and the new features in the regulation of its stock markets.

In other words, given our current degree of theoretical understanding, it seems highly questionable to assert that alterations in financial volatility can, *per se*, cause alterations in economic growth. However, **since financial volatility usually responds if not instantaneously then in any case more quickly than economic activity to the kind of alternative uncertainty shocks described previously, it is indeed to be expected that changes in financial volatility should foreshadow changes in economic growth when these kinds of shocks occur.**

However, hereinafter we shall refer to the “effect” of financial volatility on growth to refer to this adumbration of changes in future economic growth by current variations in financial volatility. We must not forget that we are dealing with the causal effect of alternative uncertainty shocks (other than unexpected data on economic activity), firstly on financial volatility and then on economic growth.

5. Quantifying the “effect” of volatility on growth

We now go on to summarise the results of our econometric exercise²⁶ aimed at:

1. Unravelling the fraction of the correlation between financial volatility and economic growth due to the causal impact of growth on volatility, thus enabling us to isolate the remaining fraction which reflects changes in growth anticipated by volatility (given their common origin in uncertainty shocks).
2. Determining whether the “effect” of financial volatility on economic growth (or more precisely whether the effect of the uncertainty shocks on both variables) is different in the post-crisis period (after 2011) from what it was in the pre-crisis period (before 2007), as suggested by the *hypothesis of the new monetary conflict between full-employment and financial stability*.

A first result of the exercise to highlight is the negligible role played by economic activity shocks (i.e. unexpected data on economic growth) in explaining variations in levels of financial volatility. Therefore, it is the alternative uncertainty shocks that explain the fluctuations in financial volatility and its ability to anticipate fluctuations in world economic growth (precisely those caused, with a bigger lag, by those very shocks).

Figure 4.2 compares the effect of a typical or average alternative uncertainty shock on financial volatility (in logarithms) in the pre- and post-crisis periods. We see that the magnitude of the average shock (given by the variation in the logarithm of the VIX in the initial period) is similar in both periods, but that now the effect quickly fades (in just six months) whereas in the past it was very persistent (more than two thirds of the initial effect still persisted after six months).

Figure 4.4 compares the effect of a transitory increase in the VIX²⁷ (caused by alternative uncertainty shocks) on world economic growth in the pre- and post-crisis periods, while Figure 4.5 makes the comparison for the case of a permanent increase in the VIX²⁸. We see clearly that **at present an equivalent increase (in percentage terms) in the VIX anticipates a greater fall in economic growth in the very short term, but a smaller and less persistent fall at longer terms.**

The findings shown by the foregoing Figures are consistent with the *global secular stagnation hypothesis* (described in the introduction) if they are explained as the product of the effectiveness of the developed economies’ non-conventional monetary policies (interest rates close to zero and QE) in “artificially” restoring calm on the financial markets despite the increase in underlying uncertainty. This should mean that the initial increase in the VIX in reaction to an uncertainty shock of equivalent magnitude would now evaporate much

26: The appendix shows the technical details of the exercise, but the following are the main results of interest obtained.

27: What is shown is the growth forecast as affected by an initial increase in the VIX (caused by alternative uncertainty shocks) compared with the unaffected forecast and its immediate reversion thereto. The initial increase is equal to the standard deviation of the residuals for the VIX.

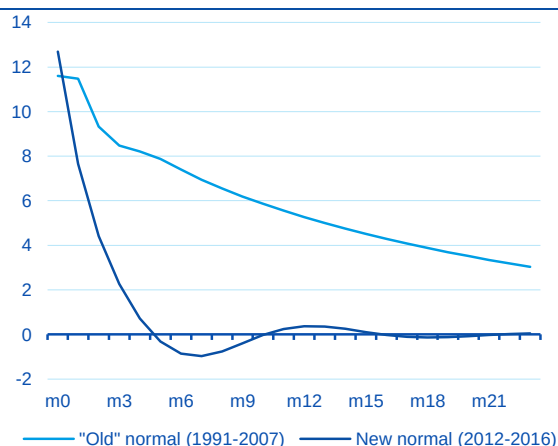
28: What is shown is the growth forecast as affected by a permanent increase in the VIX (caused by alternative uncertainty shocks) compared with the unaffected forecast. The increase is equal to the standard deviation of the residuals for the VIX.

more quickly and that consequently the negative impact on growth (albeit greater now than before, initially) would also do likewise.

However, other plausible hypotheses unconnected with monetary policy (or with the *global secular stagnation hypothesis*) can also be posited. For example, the results could simply be reflecting a change in the nature of the shocks (although the similarity and average magnitude of the shocks argue against this hypothesis), such that shocks in the pre-crisis period would predominantly reflect credible and fundamental information whereas now shocks would predominantly reflect less credible or more rumour-based information. An additional discovery of our exercise which supports this hypothesis, and other alternative hypotheses, is that **the frequency of major uncertainty shocks (see Figure 4.3) is now twice what it was in the pre-crisis period**, which might be interpreted as the reflection of a change in the nature of the shocks, but also as a reflection of the predominance of bad luck (sampling accident) or even of greater nervousness in the post-crisis period.

Figure 4.2

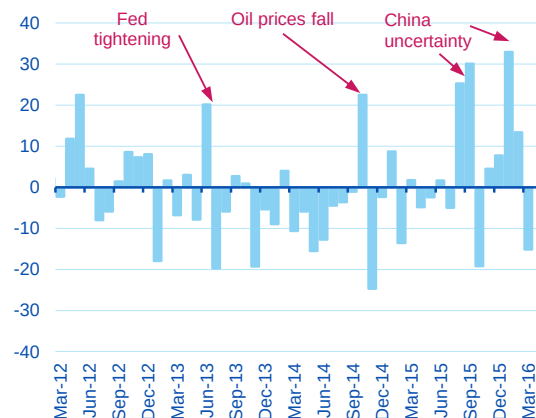
Reaction of the VIX to a shock that increases uncertainty (%). Horizontal axis: months



Source: BBVA Research

Figure 4.3

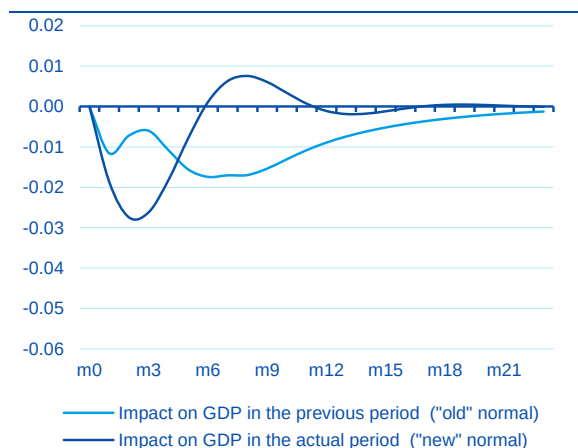
Uncertainty shocks (% immediate change in VIX)



Source: BBVA Research and CBOE

Figure 4.4

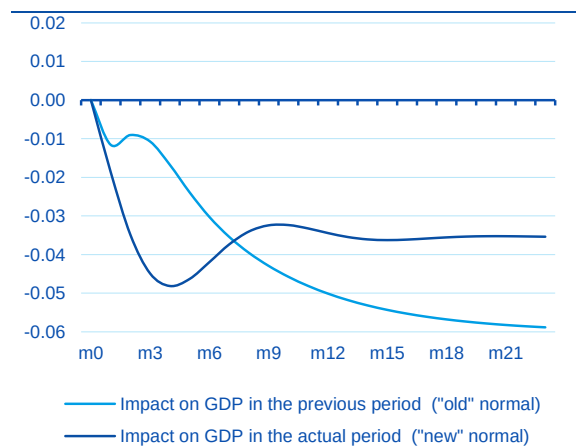
Effect on GDP (p.p., QoQ) of a transitory increase in the VIX (due to alternative uncertainty shocks)
Horizontal axis: months



Source: BBVA Research

Figure 4.5

Effect on GDP (p.p., QoQ) of a permanent increase in the VIX (due to alternative uncertainty shocks)
Horizontal axis: months



Source: BBVA Research

Methodological Appendix

Summary: we used two dual VAR models (logarithm of the VIX and world growth), one for the pre-crisis sample and another for the post-crisis sample, and their residuals are broken down into two types of shock: economic activity shocks (defined as “all those that contemporaneously affect economic growth”) and alternative uncertainty shocks (defined as “all those that contemporaneously affect the VIX”), which are orthogonal since the VAR residuals are too (so that it is not necessary to introduce identification restrictions). The exercise consists in comparing the impulse responses of these two VAR models.

- Model: vector autoregression (VAR)
- Lags: in accordance with AIC (Akaike Information Criterion)
- Frequency: monthly
- Endogenous variables: logarithm of the VIX, QoQ growth in world GDP (BBVA-GAIN)
- Pre-crisis sample: March 1997 – December 2007
- Post-crisis sample: January 2012 – March 2016
- Source of data: VIX (CBOE) and world GDP (National Accounts, IMF and calculations of BBVA Research)

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