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Volatility, diversification and development in the Gulf Cooperation Council countries

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Abstract

This paper studies the evolution of volatility and its sources in the six Gulf Cooperation Council (GCC) countries from 1970 to the present. We break down volatility into three main components. The first component relates to the volatility caused by sector-specific shocks (e.g. shocks to the oil sector). The second component relates to aggregate country-specific shocks that affect all sectors in the economy (e.g. shocks due to policy or political instability). The third component relates to the covariance between country-specific and sector-specific shocks (e.g. the degree of pro- or counter-cyclicality of macroeconomic policy vis-à-vis sectoral shocks). We find that volatility has significantly declined in the past four decades, in part due to a higher degree of sectoral diversification in most GCC economies. There is, however, considerable scope for progress, which could stem, for example, from more countercyclical fiscal and monetary policies. Moreover, the global financial crisis has revealed financial-sector vulnerabilities in some GCC countries that need to be addressed in order to limit future economic disruptions.

1. INTRODUCTION

Confronting the economic and security challenges posed by an unstable regional environment, the governments of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates agreed in 1981 to form the Cooperation Council for the Arab States of the Gulf, also known as the Gulf Cooperation Council (GCC). Initially a common trade bloc, the GCC launched a common market on 1 January 2008 and plans to establish a common currency, the Khaleeji.

The economic history of these six countries has been strongly shaped by the discovery of oilfields, which started in Bahrain in the early 1930s, Saudi Arabia and Kuwait in the late 1930s, and Qatar, Oman, and the United Arab Emirates in the 1940s and 1950s. While initially the oilfields were exploited by British companies, by the early 1970s all six countries had gained independence and were in full control of the fields and means of production, as well as being active members (except for Bahrain and Oman) of the Organization of the Petroleum Exporting Countries (OPEC). Oil had by then become the dominant sector in these economies.

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The steep rises in oil prices caused by the 1973 Arab oil embargo and the 1979 Iranian revolution, and the dramatic six-year-long decline in prices caused by the oil glut that followed, led to increased concern over the insurmountable volatility brought about by the economies' heavy reliance on oil. These developments were to a large extent the motivation for one of the central objectives of the 1981 Unified Economic Agreement between the Countries of the Gulf Cooperation Council, which seeks to 'coordinate industrial activities and formulate policies and mechanisms which will lead to industrial development and the diversification of their products on an integrated basis' (Article 12).

In this paper we seek to study whether and to what extent the objectives of industrial development and diversification envisioned in the formation of the GCC have materialised.[1] Concretely, we study the patterns of economic diversification and volatility in all six countries, breaking down volatility into three main components.

The first component relates to the volatility of sectoral shocks. In general, the more diversified a country and the less the intrinsic variability of each sector, the lower is the level of volatility. Sectoral shocks can be global (affecting all countries in the world in the same direction) or country-specific (having different effects in different countries, as, we shall argue, is the case with oil shocks).

The second component relates to aggregate country-specific shocks. This component captures aggregate shocks that affect all sectors in the economy, reflecting, for example, policy, institutional or political changes, as well as technological shocks that are common to all sectors.

The third component relates to the covariance between country-specific and sector-specific shocks; in particular, changes in fiscal or monetary policy instruments in some countries might be a response to shocks experienced by different sectors. This component would be negative, and hence reduce aggregate volatility, for example if macro-economic policies are countercyclical, that is, they are aimed at neutralizing or mitigating the effect of economic cycles. In the context of GCC countries, this would entail reducing government spending or tightening credit during downturns or periods of relatively low demand for oil and gas. As we show in the paper, in most GCC countries this component is instead positive

[1] For theories linking risk, diversification and development, see Acemoglu and Zilibotti (1997), Greenwood and Jovanovic (1990), Kraay and Ventura (2007), Obstfeld (1994) and Saint-Paul (1992). For theories of sectoral transformation, see Caselli and Coleman (2000) and the references therein.

and large, contributing to aggregate volatility. We argue that this is largely due to the lack of actively countercyclical monetary policy (due to the choice of a fixed exchange-rate regime) and a generally pro-cyclical government spending pattern.

We put the results into context by comparing the countries' patterns of volatility with those observed in other countries at the same level of development, as well as with those observed in other resource-rich economies.

The paper is organized as follows. Section 2 describes the evolution of growth rates, volatility and the shares of different sectors in the six GCC economies from 1970 to 2006. Section 3 studies the sources of economic volatility and compares the performance of GCC countries vis-à-vis countries at the same level of development or rich in natural resources. Section 4 offers concluding remarks.

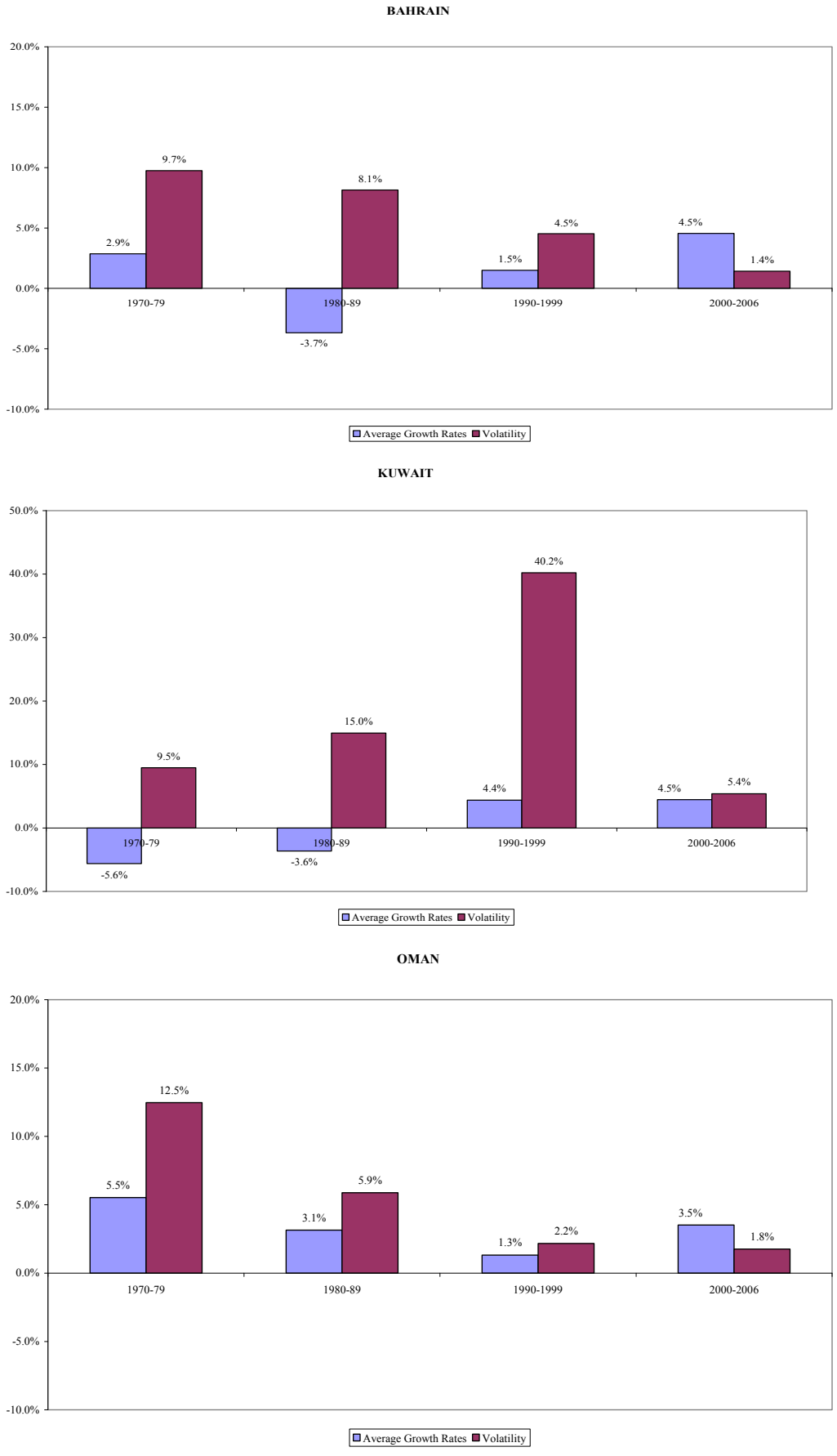
2. ECONOMIC GROWTH, VOLATILITY AND DIVERSIFICATION

The economic performance of GCC countries has been anything but uniform, as is illustrated in Figure 1.[2] The figure depicts the average yearly growth rate of per capita gross domestic product (GDP – blue bars) and the level of volatility, measured as the standard deviation of annual growth rates (red bars), by decade, from 1970 to 2006, for all GCC countries.[3] Measured as such, volatility captures deviations, both up and down, from the average growth rate of the decade. These deviations are what we refer to as 'shocks'. The 1970s witnessed large growth rates in the United Arab Emirates (12 per cent), Saudi Arabia (5.7 per cent), Oman (5.5 per cent), and Bahrain (3 per cent), together with negative growth rates in Kuwait and Qatar. The common denominator for the period was the extremely high volatility faced by all six countries. The 1980s opened a grim chapter of negative growth rates for all countries (except Oman), with losses ranging from 3.6 per cent per year in Kuwait to 6.5 per cent per year in Saudi Arabia, and continually high levels of volatility.

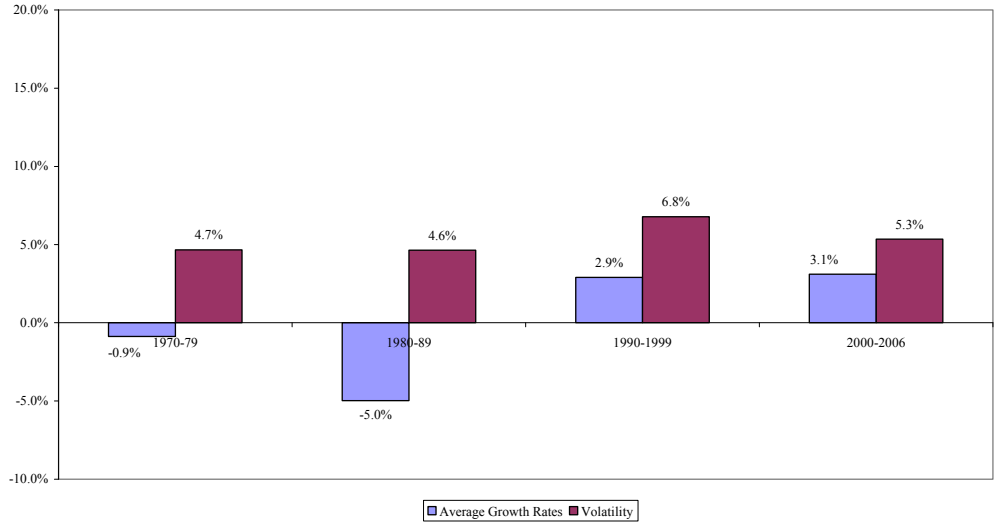
In the 1990s, despite the difficult start, most countries posted net gains, with the exception of the United Arab Emirates. Kuwait, in particular, experienced an average growth rate over the decade of 4.4 per cent, after two decades of negative growth. Volatility during the decade was still high in all countries, with Kuwait's being dramatically high by any

[2] All subplots share the same scale, except for Kuwait's, since the high volatility of the 1990s, caused mainly by the war, is exceedingly large.
[3] The raw data come from the UN statistical database from 1970 to 2006.

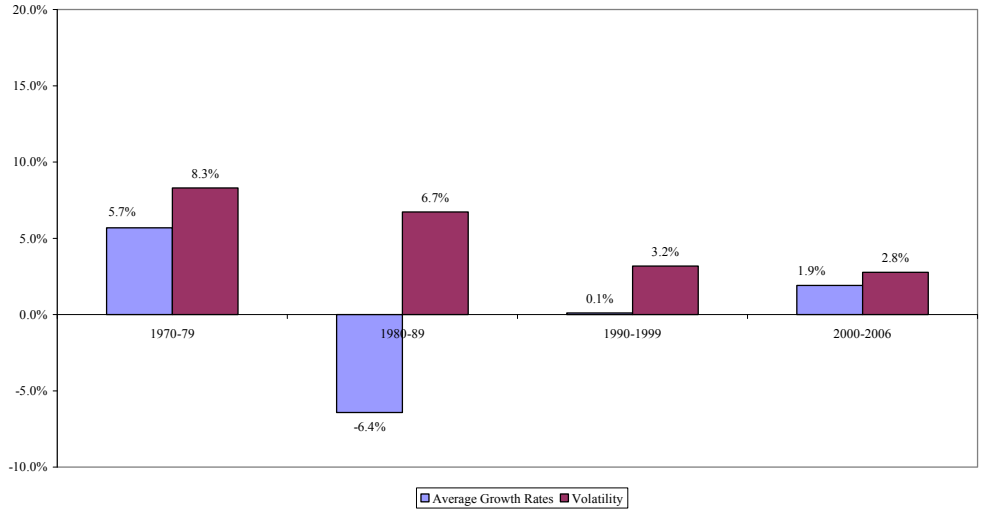
Figure 1. *Average yearly growth rates and volatility, by country, 1970–2006.*



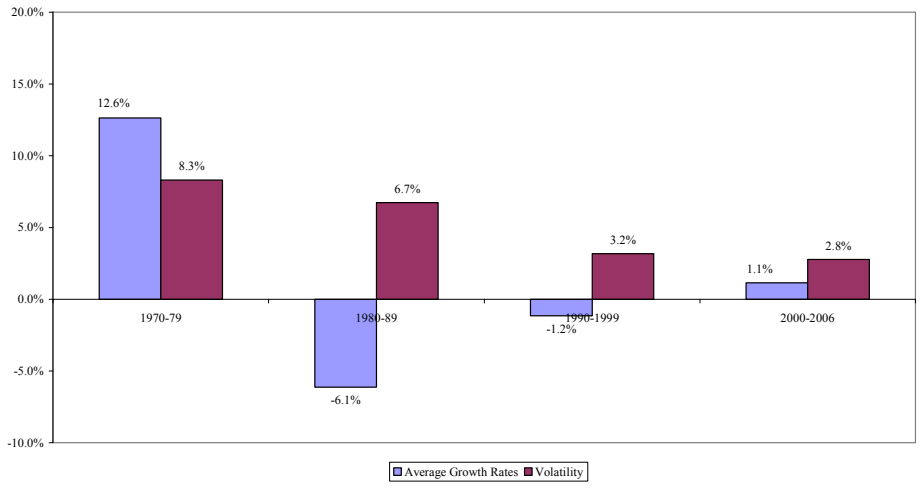
QATAR



SAUDI ARABIA



UNITED ARAB EMIRATES



metric. The early 2000s paint a totally different picture: positive growth in all countries, together with unprecedented stability.

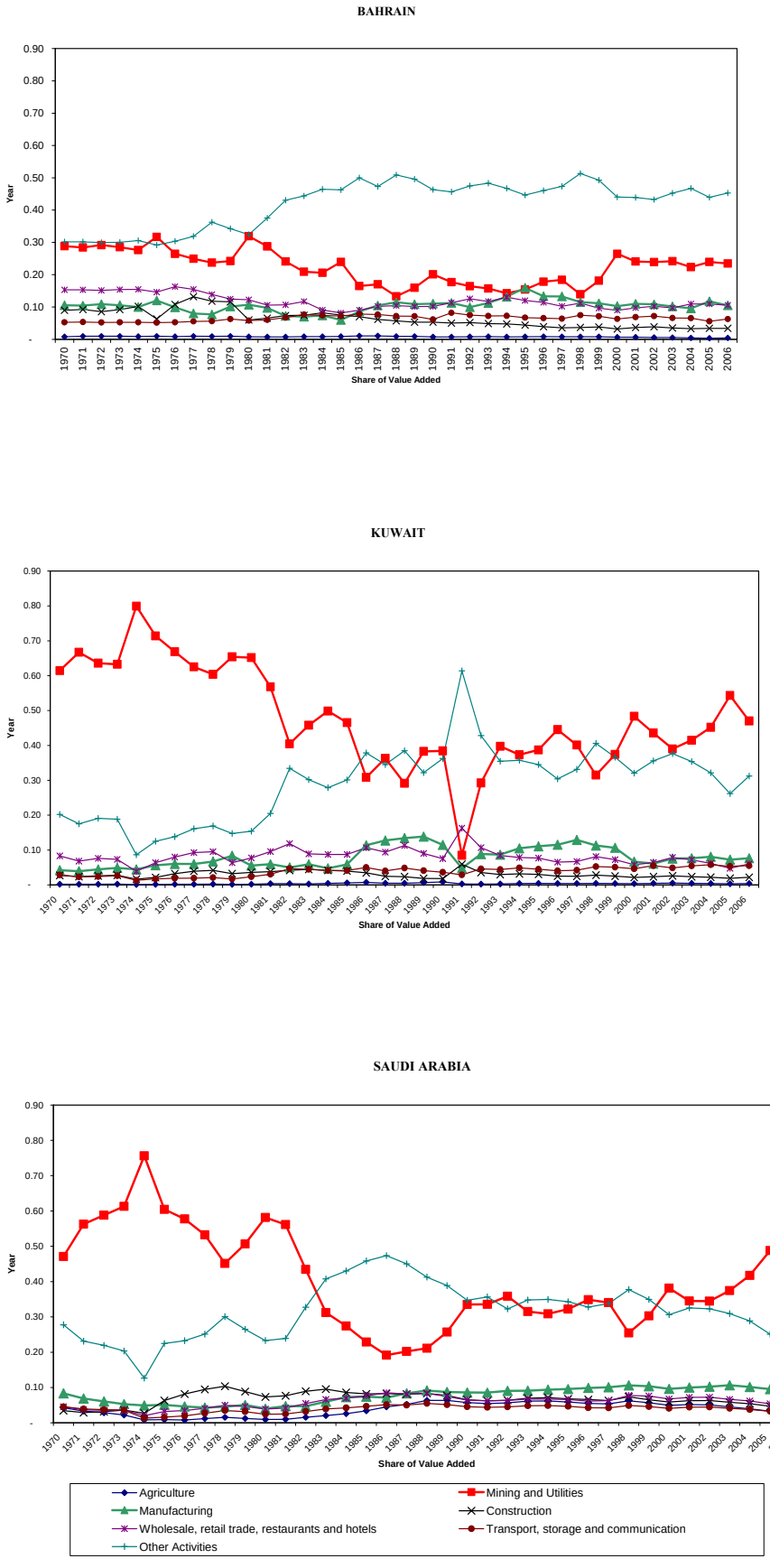
The lower volatility of the later period does not seem simply to be the result of positive contagion from the so called 'Great Moderation', or the long period of low volatility enjoyed by most developed countries before the onset of the current financial crisis. More fundamental changes seem to have taken place in GCC countries, as illustrated in Figure 2. This figure shows the shares of different sectors in total GDP from 1970 to 2006 for all six GCC countries.

As Figure 2 shows, the most prominent sector in all subplots is mining and utilities (squares), reflecting the preponderance of oil in GCC economies.[4] The prevalence of oil, however, has been decreasing. Most notably, the United Arab Emirates have seen a steady decline in mining as a share of GDP, from above 70 per cent in the 1970s to around 30 per cent in the 2000s, despite the sharp increase in oil prices in recent years. 'Other activities', comprising financial intermediation, real estate, public administration, education, health and other services, have gained ground during this period to reach above 20 per cent of the Emirates' GDP by the end of the period. Other GCC countries have undergone a similar, though less steep, structural transformation. The earliest diversifier is Bahrain, where services grouped under 'other activities' had already reached roughly 50 per cent of the economy in the 1980s. Manufacturing, which was virtually non-existent at the beginning of the 1970s has also increased significantly as a share of GDP in all countries, accounting for about 10 per cent or more of GCC economies.

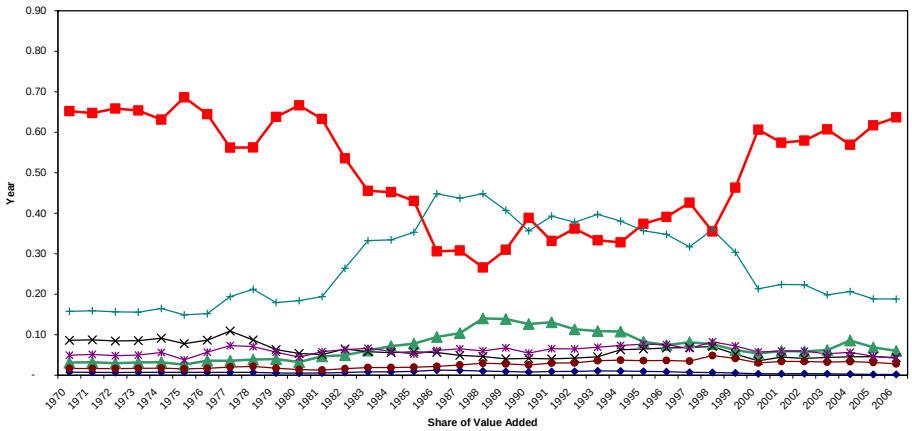
In spite of the progress over the past decades, however, GCC economies continue to be highly volatile. In the next section we study the sources of volatility and, in particular, we measure the extent to which sectoral concentration accounts for the observed outcome volatility.

[4] Mining and quarrying refer mostly to oil, while utilities include electricity, gas and water supply. Unfortunately, the source (United Nations Statistics) does not disaggregate the data further.

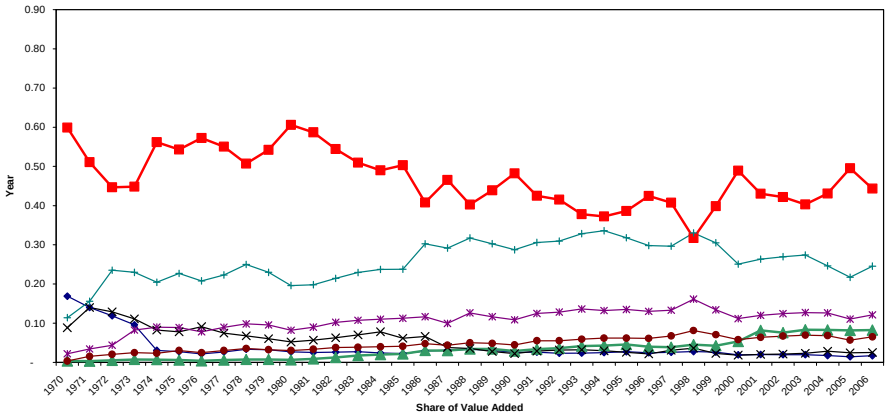
Figure 2. *Sectoral shares of GDP, by country, 1970–2006.*



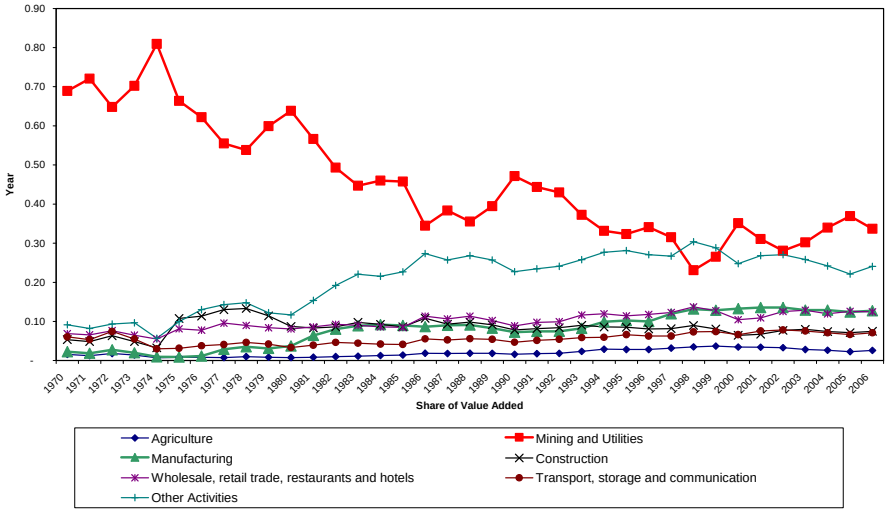
QATAR



OMAN



UNITED ARAB EMIRATES



3. SOURCES OF VOLATILITY AND THE ROLE OF SECTORAL DIVERSIFICATION: A COMPARATIVE ANALYSIS

3.1. Volatility components

In this section we study the sources of economic volatility in GCC countries. Following Koren and Tenreyro (2007), the analysis identifies three main components of the volatility of aggregate GDP growth.[5] The first component relates to the volatility of sectoral shocks: an economy that specializes in sectors that exhibit high intrinsic volatility will tend to experience higher aggregate volatility. Two different elements play a role: one is the degree of sectoral concentration (how concentrated or diversified the economy is in terms of the number and relative sizes of the sectors) and the other is the volatility of the different sectors. In GCC economies, traditionally, the two elements have played in the same direction: the economies have been highly concentrated in one, very volatile, sector.

The second component relates to aggregate country-specific shocks that are common to all sectors in the economy. This component aims at capturing volatility due to macroeconomic policy or political instability. In our study it will also capture the volatility induced by the war. It may also capture other aggregate shocks, such as technological developments that affect all sectors in the economy.

The third component of volatility relates to the covariance between country-specific and sector-specific shock. Concretely, any change in fiscal or monetary policy in some countries might be a deliberate response to shocks experienced by particular sectors. This component will be negative, for example, if macro-economic policies are countercyclical, that is, they are aimed at mitigating or neutralizing the effect of economic cycles; in the context of GCC economies, a countercyclical policy would imply reducing government spending or tightening credit during periods of relatively weak demand for oil. We show later that this component tends to be positive in most countries, largely reflecting the lack of actively countercyclical policies.

This breakdown of volatility is important because it allows us to asses the extent to which volatility in GCC countries is due to high exposure to the oil sector as opposed to country-specific shocks which are more likely to be caused by domestic macroeconomic

[5] For alternative or complementary empirical studies see Forni and Reichlin (1996); Brooks and del Negro (2004); del Negro (2003); Kose, Otrok and Whiteman (2003); Imbs and Wacziarg (2003); Imbs (2007); Lehmann and Modest (1985); Ramey and Ramey (1995); Stockman (1988).

policy; in other words, aggregate volatility might result from possibly inadequate domestic policies.

Formally, as in Koren and Tenreyro (2007), the variance of GDP growth, Var(y), can be decomposed as follows (see technical appendix):

Var(y)=Sectoral Variance + Country Variance + Sector-Country Covariance,

where the sectoral-variance component can be further decomposed into the variance due to global shocks, that is, shocks that affect all countries in the world in the same fashion, and the variance due to idiosyncratic (or country-specific) sectoral shocks, which affect different countries in different ways.

Sectoral Variance=Global Sectoral Variance + Idiosyncratic Sectoral Variance.

In the case of GCC countries, we expect both the idiosyncratic sectoral variance (mostly generated by the oil sector) and the country-specific variance (mostly due to policy and political instability, including the war) to account for a large part of the volatility of the economies.

The method used for the volatility decomposition can be summarized in words as follows. We first compute for each country (c), sector (s) and year (t), a measure of 'shock', denoted y_{cst}. This is calculated as the deviation from the average growth rate of the growth rate of a given sector in a given country over the period. We measure sector-specific shocks (λ_{st}) as the average of y_{cst} over all countries for a given sector.[6] Put differently, a sector-specific shock is the average shock affecting a given sector in all countries. Country-specific shocks are then identified as the average shock in a given country after subtracting the sector-specific shock.[7] In other words, a country-specific shock is the average shock affecting all sectors in a given country. The residual is the country and sector specific shock, ε_{js}.[8] Once the three different shocks (λ_{st}, $\mu_{jt,}$ ε_{jst}) are identified, we compute variances and covariances as detailed in Appendix 2.

To carry out the sectoral decomposition, we use data on GDP in constant 2000 US dollars from the UN statistical database from 1970 to 2006. The countries in the analysis are listed in Appendix 1. Before proceeding, it should be acknowledged that one limitation in studying the productive structure of GCC economies is the paucity of organized information on the

[6] In formula, this is $\lambda_{st}=(1/C)\sum^{C}_{i=1} y_{cst}$, where C denotes the number of countries

[7] In formula, this is $\mu_{jt}=(1/S)\sum^{S}_{i=1} y_{cst}-\lambda_{st,}$ where S is the number of sectors.

[8] In formula $\varepsilon_{jst}= y_{cst,}- \lambda_{st} - \mu_{jt.}$

Figure 3. *Sources of volatility in Bahrain, by decade.*

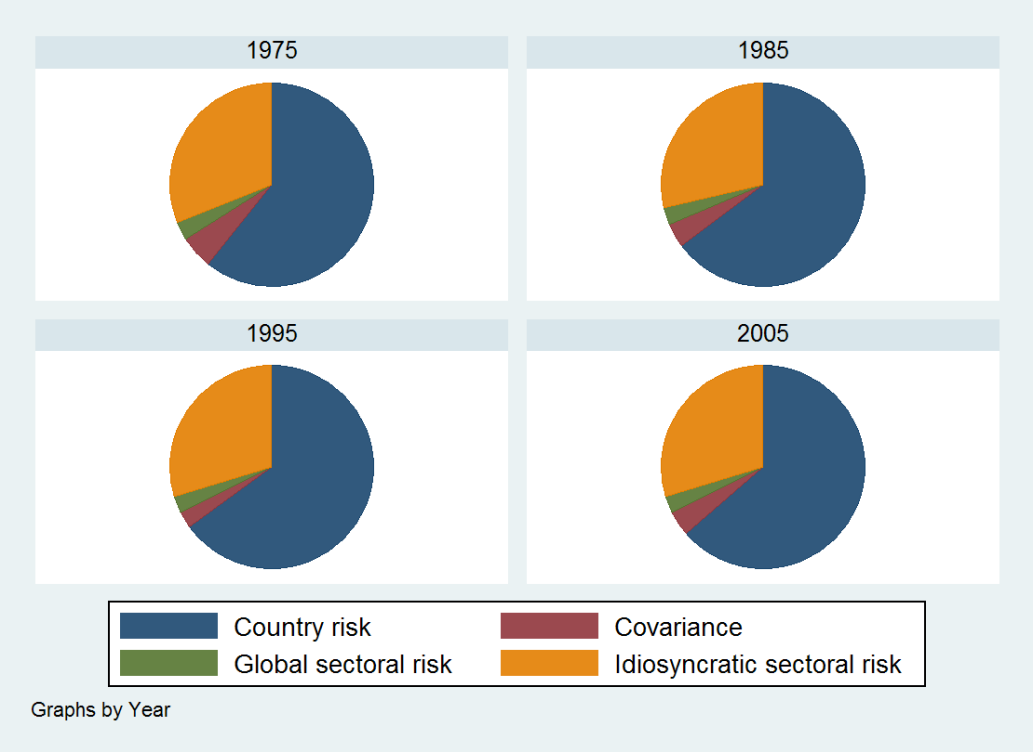
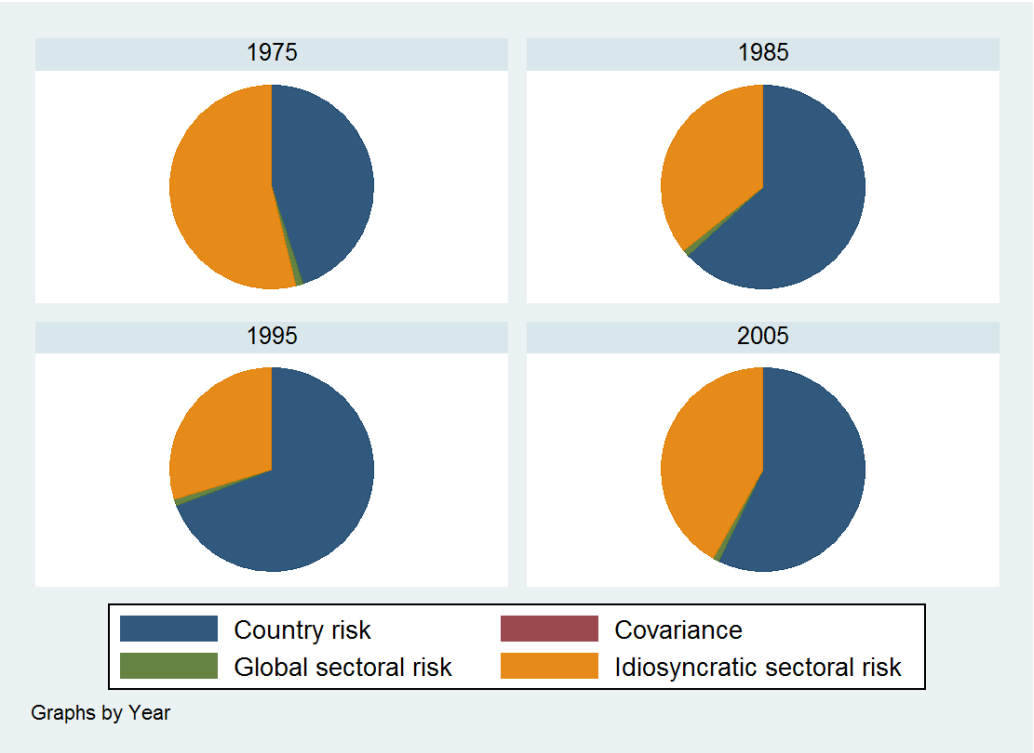


Figure 4. *Sources of volatility in Kuwait, by decade.*



subject, especially for the early period. The UN database is the only source available with comparable data across GCC countries. We are hence unavoidably exposed to inaccuracies due to measurement error by the source.

The estimation procedure yields a decomposition of volatility into different sources for each country and year. Figures 3 to 8 plot the decomposition for the six GCC countries in 1975, 1985, 1995 and 2005.

Figure 3 shows the volatility decomposition for Bahrain, which is surprisingly stable over the thirty-year period we analyse. The most important source of volatility is the aggregate country-specific variance, the component that is common to all sectors in the economy. This accounts for more than 60 per cent of overall volatility. The second biggest component is the idiosyncratic sectoral variance, which accounts for almost 30 per cent of volatility. The covariance term and the global sectoral variance component account for the remaining 10 per cent.

Figure 4 shows the volatility decomposition in Kuwait. As the plot shows, in the 1970s the idiosyncratic sectoral variance – mostly dominated by shocks to the oil sector – was the biggest source of volatility, accounting for more than 50 per cent of overall volatility. Country-specific volatility in the decade accounted for about 45 per cent of aggregate volatility, while the other two components were jointly below 5 per cent. The picture changes in the 1980s and particularly the 1990s, when the idiosyncratic sectoral variance becomes less important, accounting for about 35 and 30 per cent of overall volatility, respectively, in the 1980s and 1990s. Country-specific volatility became the dominant source of volatility, reaching 70 per cent in the 1990s.

This pattern only slightly reverted in the 2000s, with the idiosyncratic-sectoral-volatility component accounting for 40 per cent and the country-volatility component accounting for 57 per cent of overall volatility. As the picture shows, global shocks play a relatively small role in the Kuwaiti economy.

The volatility decomposition for Oman, depicted in Figure 5, shows a similar pattern. In the 1970s the idiosyncratic component accounted for about 45 per cent of the variance, while the country-specific component accounted for about 57 per cent. The role of idiosyncratic sectoral shocks decreased over the 1980s and 1990s, reaching just a third of the overall volatility in the 1990s. The 2000s saw a reversal, with the idiosyncratic component climbing back to 42 per cent of the variance. The time-series evolution of the country-

Figure 5. *Sources of volatility in Oman, by decade.*

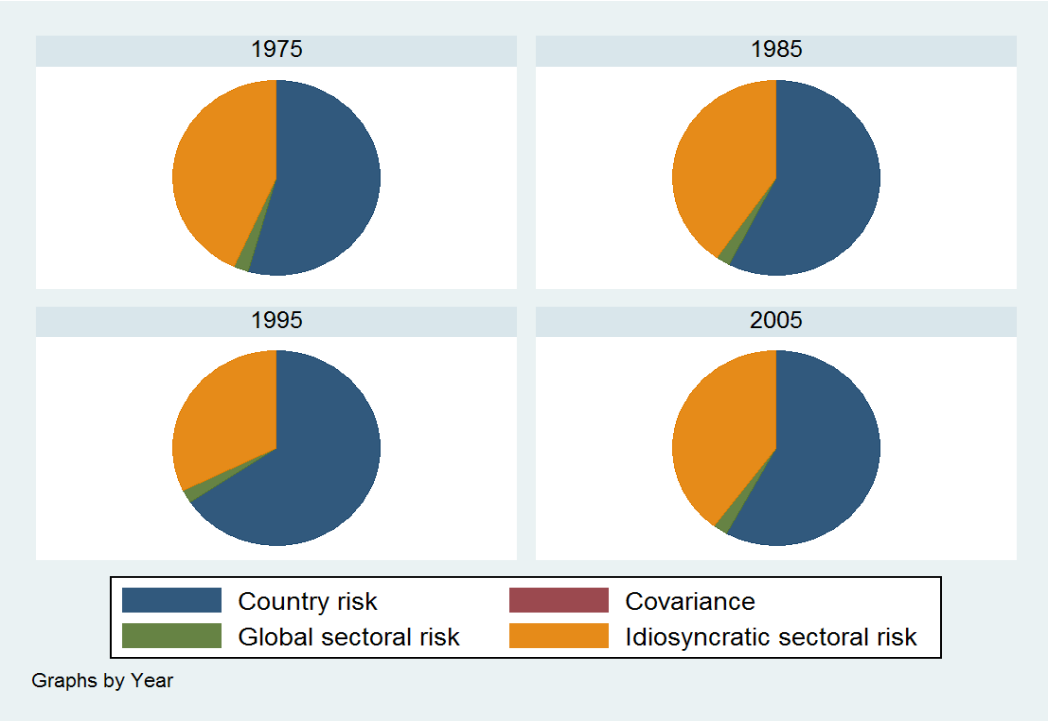


Figure 6. *Sources of volatility in Qatar, by decade.*

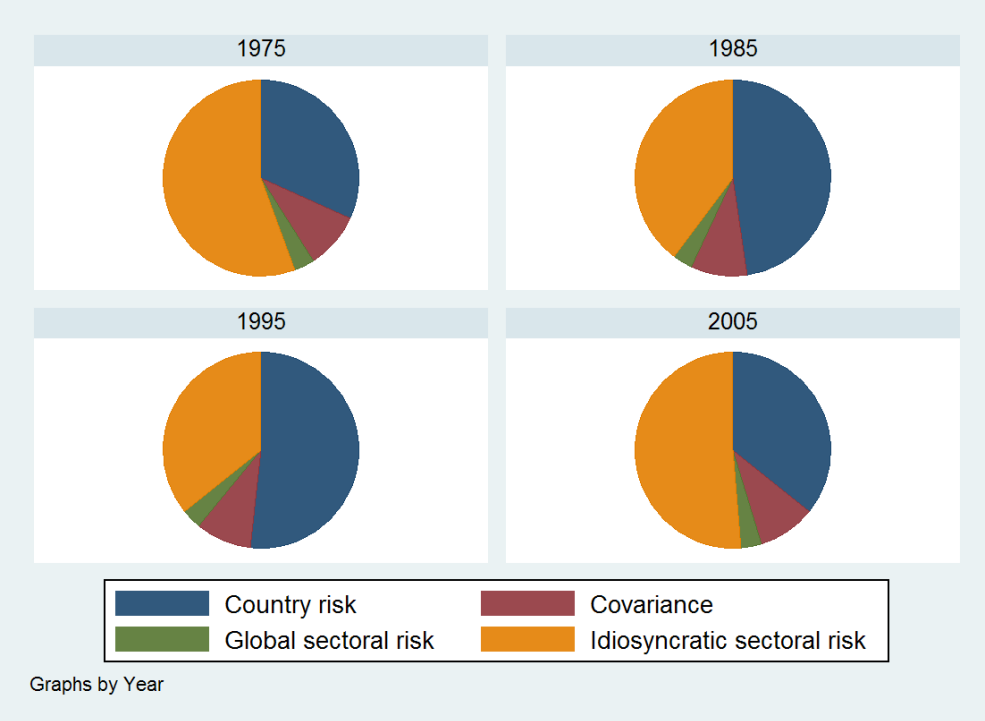


Figure 7. *Sources of volatility in Saudi Arabia, by decade.*

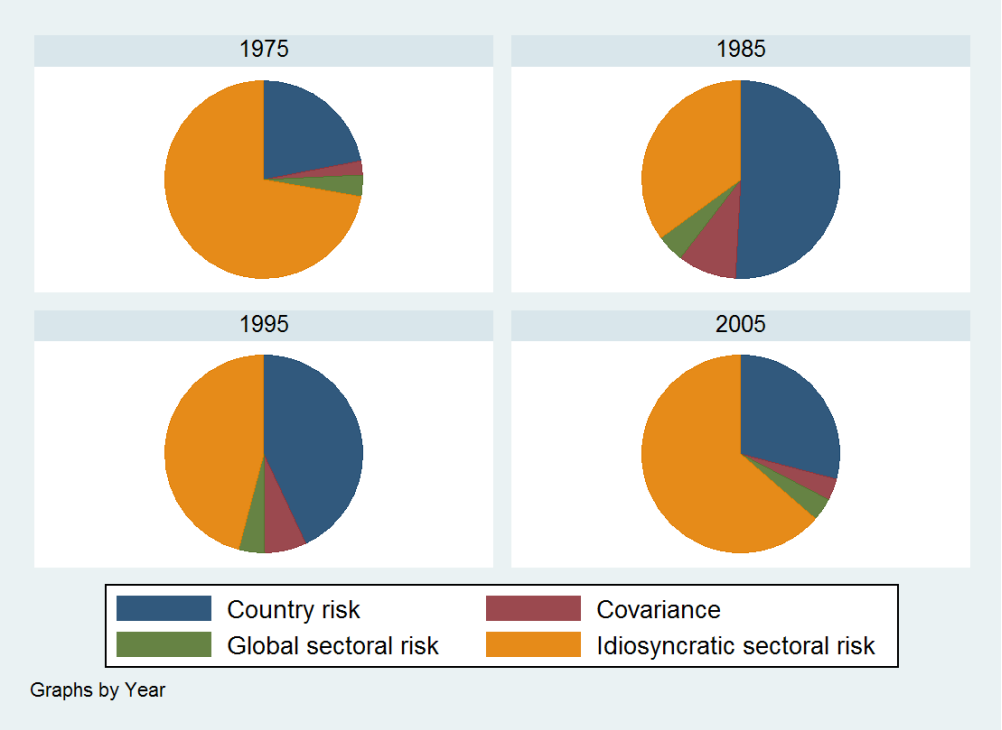
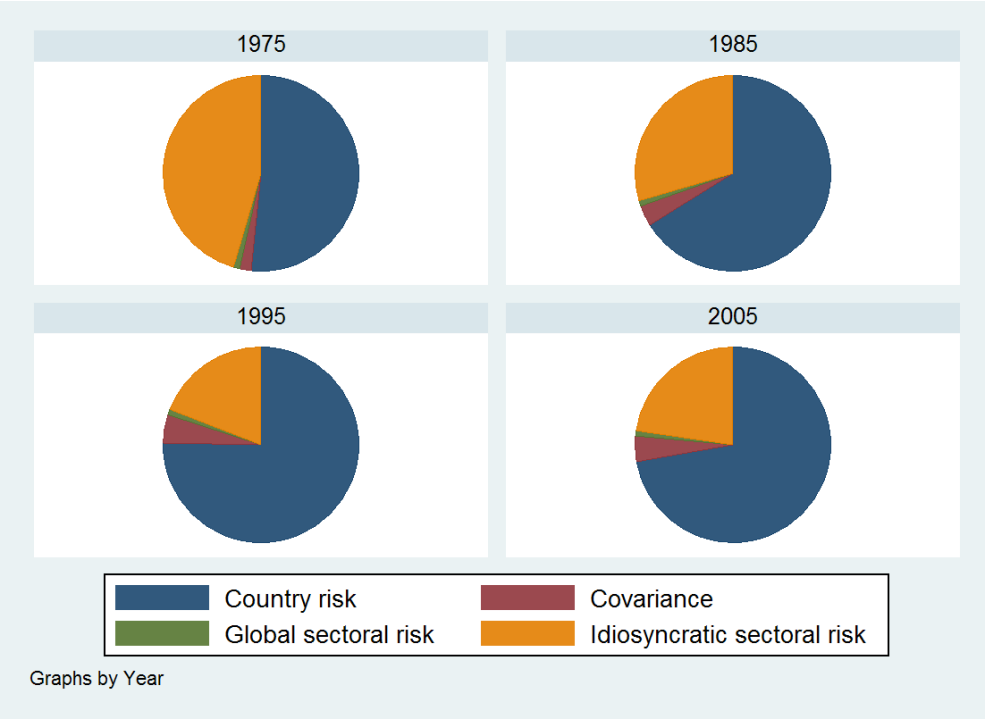


Figure 8. *Sources of volatility in United Arab Emirates, by decade.*



specific component is the mirror image of the idiosyncratic component, increasing over the 1980s and 1990s and decreasing in the 2000s. The covariance of sectoral and aggregate shocks was actually negative in Oman (the only GCC country for which this was the case), contributing to lower volatility (not shown in the pie chart); its magnitude, however, was relatively small. Finally, the global volatility component played virtually no role in the economy.

Qatar's volatility decomposition is portrayed in Figure 6. As was the case in Kuwait and Oman, the idiosyncratic component in Qatar was high in the 1970s, reaching 55 per cent of overall volatility. It fell to 35 per cent in the 1980s and 1990s and then increased again in the 2000s to about half of the overall volatility. The opposite trend is followed by the country-specific component. Unlike in the other economies, the covariance between macroeconomic and sector-specific shocks accounts for a non-negligible share of the overall volatility, in the order of 10 per cent throughout most of the period, suggesting that more could be done in terms of enacting countercyclical fiscal or monetary policies in the economy. Finally, global sectoral shocks account for roughly 3 per cent of volatility, with no significant changes over time.

The pattern of decrease in idiosyncratic sectoral volatility from the 1970s to the 1980s and 1990s and the reversal in the 2000s is intensified in Saudi Arabia. The idiosyncratic component accounted for 72 per cent of overall volatility in the 1970s, for 35 and 45 per cent in the 1980s and 1990s, respectively, and for 63 per cent in the 2000s. Country volatility, in turn, moved from 20 per cent in the 1970s to peak at 50 per cent in the 1990s and fall to 29 per cent in the 2000s. The covariance between aggregate and sectoral shocks was high in the 1980s and 1990s, at just below 10 per cent of overall volatility, and smaller in the 1970s and 2000s.

The volatility decomposition for the United Arab Emirates is shown in Figure 8. Differently from the other GCC economies, the idiosyncratic component fell steadily over time in the Emirates, going from 45 per cent in the 1970s to about 20 per cent in the 2000s. The country-specific component increased accordingly, from 50 per cent to 70 per cent during the period. The covariance term as well as the global-sectoral-volatility component accounted for a small share of overall volatility during the period.

The general message from these pictures is that the idiosyncratic component of volatility, which is to a large extent unavoidable in a resource-rich economy, is of the same

order of magnitude as the country-specific component, which is to a large extent a reflection of aggregate domestic policy. Equally important, the covariance between aggregate shocks and sectoral shocks is positive in most countries. This suggests that there is scope for improvement in terms of domestic policies. Specifically, more aggressively countercyclical monetary and fiscal policy should help attenuate the fluctuations in output caused by the inherently volatile nature of the oil sector. With regard to monetary policy, however, most GCC countries have maintained a fairly passive stance. In particular, most currencies of GCC countries have been formally pegged to the SDR (special drawing right), except for the Omani rial, which has been pegged to the dollar since the 1970s, and the Kuwaiti dinar, which has been pegged to an undisclosed basket of currencies. De facto, however, most countries have been pegged to the US dollar for the last three decades, with the peg becoming official in the early 2000s. Pegging the exchange rate under free movement of capital implies that GCC countries have relinquished monetary policy autonomy, and the scope for actively counteracting shocks is hence limited. (Only Kuwait and Oman have used direct instruments – ceilings on certain types of credit – in order to use monetary policy more actively.)

With regard to fiscal spending, GCC countries have failed to undertake countercyclical policies (Fasano and Wang 2002), although the extent of pro-cyclicality in spending is hard to gauge, partly because of the lack of clear and comparable fiscal concepts, methods and data across GCC countries. Fasano and Wang (2002) argue that most GCC countries have followed highly procyclical spending policies (that is, increasing government spending in times of oil booms and decreasing it in downturns).

3.2. Volatility patterns in perspective: comparative analysis of volatility patterns vis-à-vis other countries

In this section we study the evolution of the different components of volatility over time for the six GCC countries. We compare their performance with that of countries at the same level of development, measured by the level of GDP per capita in the year analysed. We also compare their performance with countries that are also rich in oil, which we call our control group.

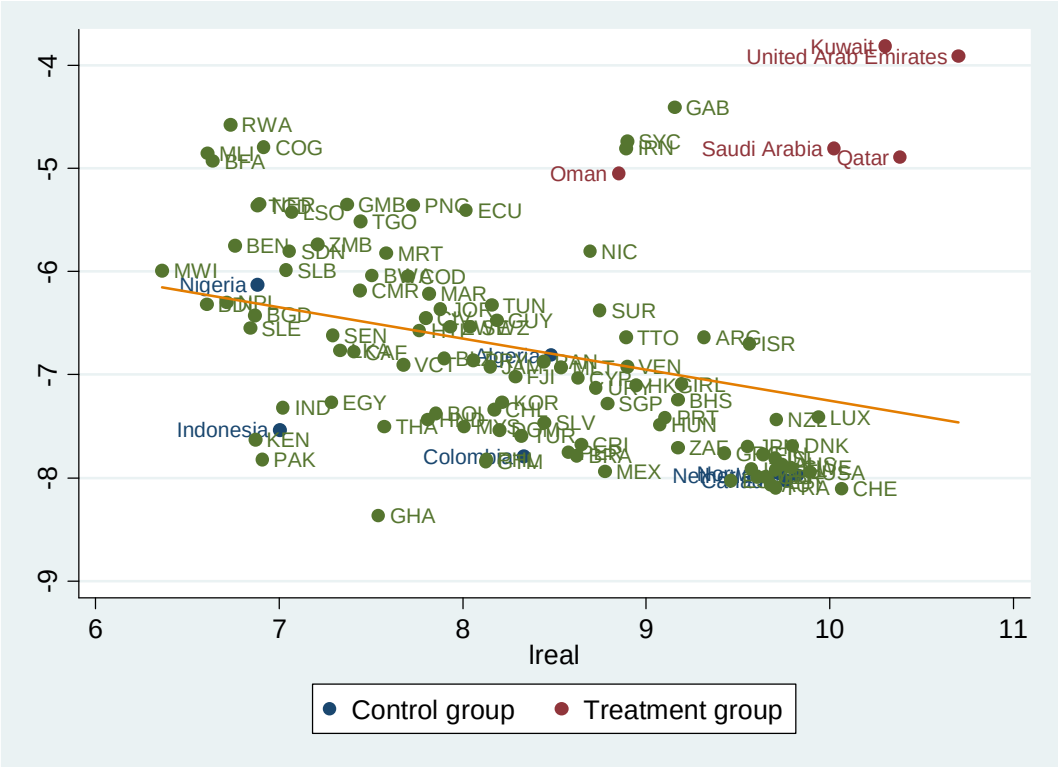
To build the control group we sorted countries by the share of petroleum, petroleum products and gas in their exports in 2000. We selected the top twenty-five countries. Of these twenty-five we selected a control group according to the following two criteria: (i) the country is not in the Persian Gulf region; and (ii) it exports oil or gas worth a total of more

than $4 billion. This resulted in the following countries being chosen: Algeria, Canada, Colombia, Indonesia, Nigeria, Netherlands and Norway.

In what follows, we graphically show the performance of each component of volatility in 1975, 1985, 1995 and 2005, plotted against the level of real GDP per capita in the corresponding country and year. Data on real GDP, adjusted by purchasing power parity (PPP), come from the World Bank's World Development Indicators.[9] We highlight in the plots both the 'treatment group', that is, the group of six GCC countries, and the 'control group', listed above. For ease of comparison, we also plot in a separate graph only the control and treatment groups. The list of countries and the conventional alphabetic code abbreviations are displayed in Appendix A.

3.2.1. Sectoral volatility

Figure 9. *Sectoral volatility (global and idiosyncratic) component and development, 1975, all countries.*



[9] Heston, Summers and Aten (2002). Data for Bahrain in 1975 and for Oman in 2005 are not available from this source.

Figure 10. *Sectoral volatility (global and idiosyncratic) component and development, 1975, GCC countries and 'treatment' countries.*

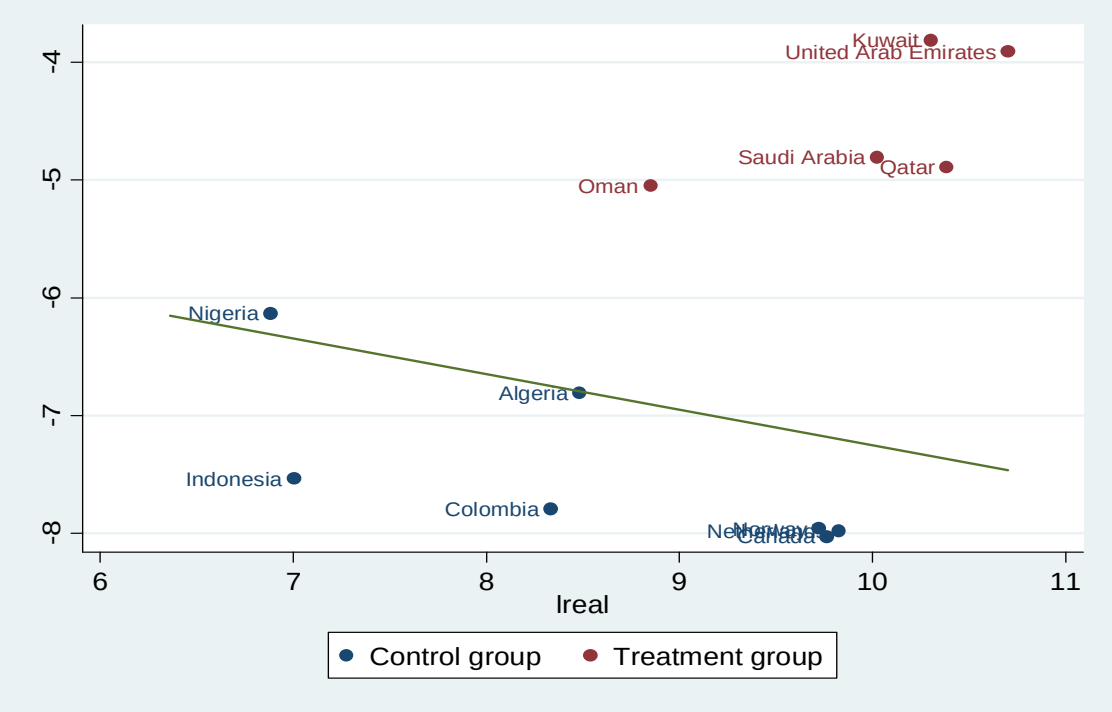


Figure 11. *Sectoral volatility (global and idiosyncratic) component and development, 1985, all countries.*

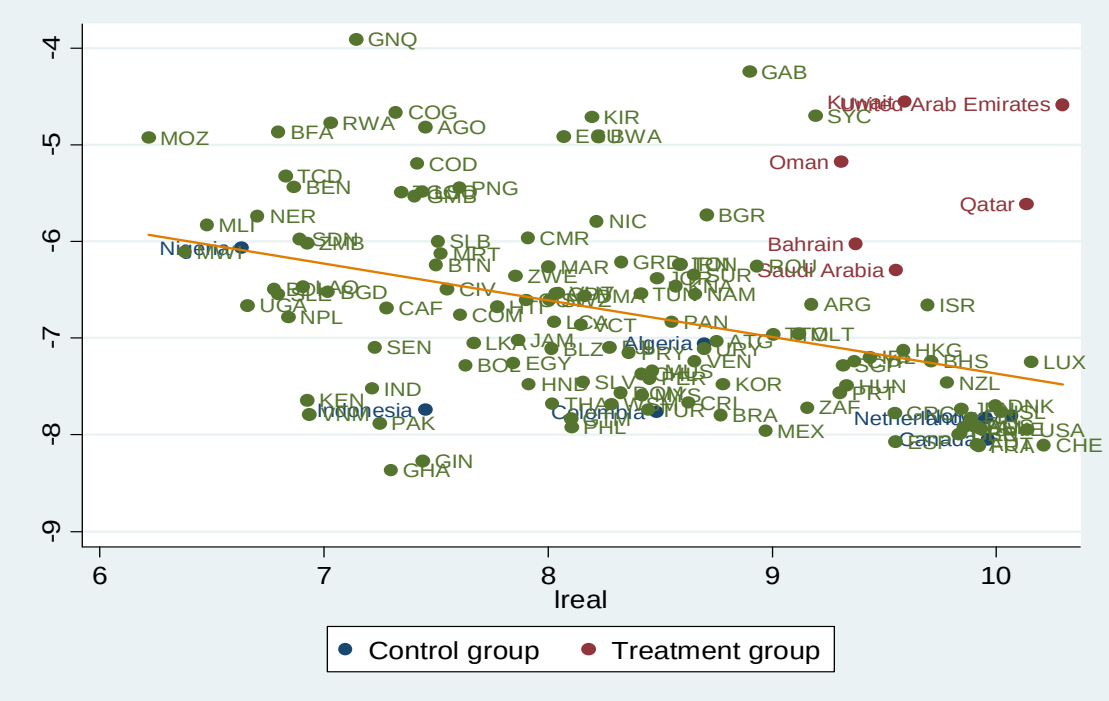


Figure 12. *Sectoral volatility (global and idiosyncratic) component and development, 1985, GCC countries and 'treatment' countries.*

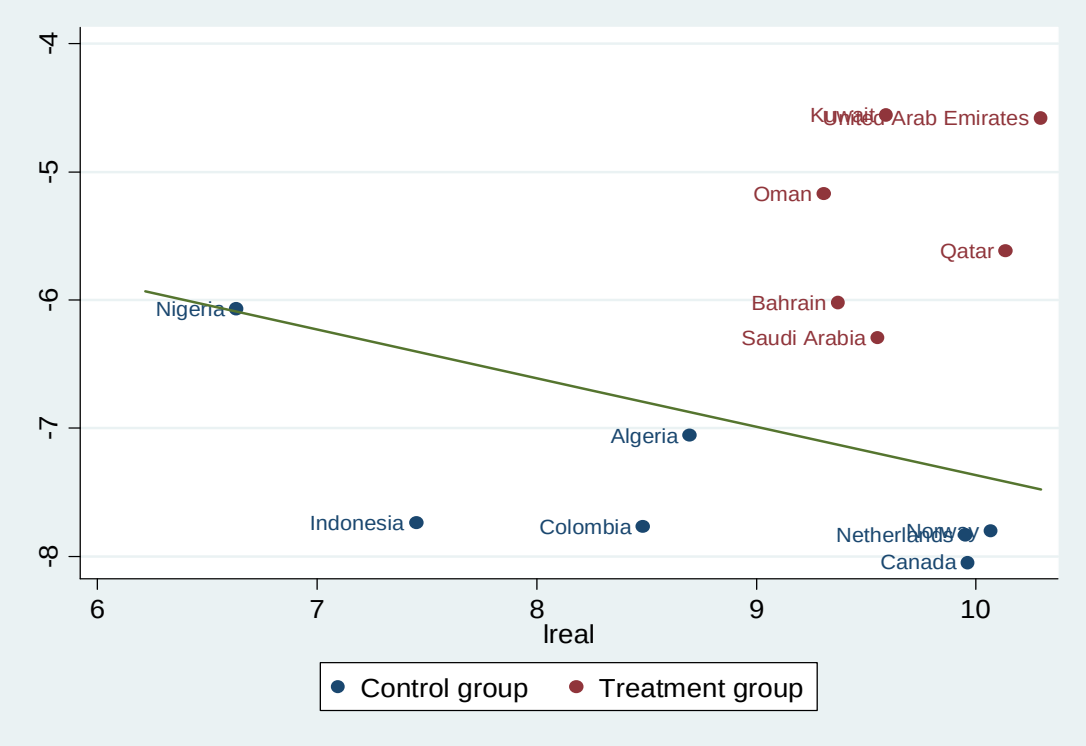


Figure 9 shows the plot of the (natural logarithm of) the Sectoral Volatility Component (the aggregate of both global and idiosyncratic volatility) against the (log of) level of development in 1975. The fitted line is the result of a linear regression.[10]

As the plot shows, sectoral volatility tends to fall quite markedly with the level of development. Strikingly, all six GCC countries stand out as the biggest outliers in the plot, meaning that their levels of sectoral volatility are significantly above those in countries at similar levels of development.

Interestingly, as is made clearer in Figure 10, they also stand out in 1975 when compared with other resource-rich countries. The latter systematically fall on or below the predicted regression line for the whole sample, showing that natural resource endowments do not necessarily imply high volatility.[11]

Figure 11 shows the relation between the (log of) Sectoral Volatility and the (log of) level of development in 1985. As before, the relationship is strongly negative, and hence we

[10] We aggregate both sources of sectoral risk for ease of exposition.
[11] Note that the prediction line in these and the following graphs, are obtained from a regression that uses the whole sample. So, for example, the regression line in Figure 10 is the same as that displayed in Figure 9.

should expect relatively richer countries to display lower levels of sectoral volatility. GCC countries are, as before, remarkable outliers in the regression. Compared with the levels a decade earlier, however, some progress can already be appreciated: while still outliers, the GCC countries are relatively closer to the prediction line, with Saudi Arabia particularly close to it.

Figure 12 more clearly shows where resource-rich countries stand in the sectoral-volatility-development line. GCC countries are overwhelmingly more volatile than other resource-rich economies outside the Persian Gulf, with Kuwait and the United Arab Emirates at the high end of the group.

Figures 13 and 15 show the relation between (logged) sectoral volatility and (logged) GDP per capita in 1995 and 2005, respectively. The overall relation continues to be significantly negative. The most salient change from previous decades is the decline in

Figure 13. *Sectoral volatility (global and idiosyncratic) component and development, 1995, all countries.*

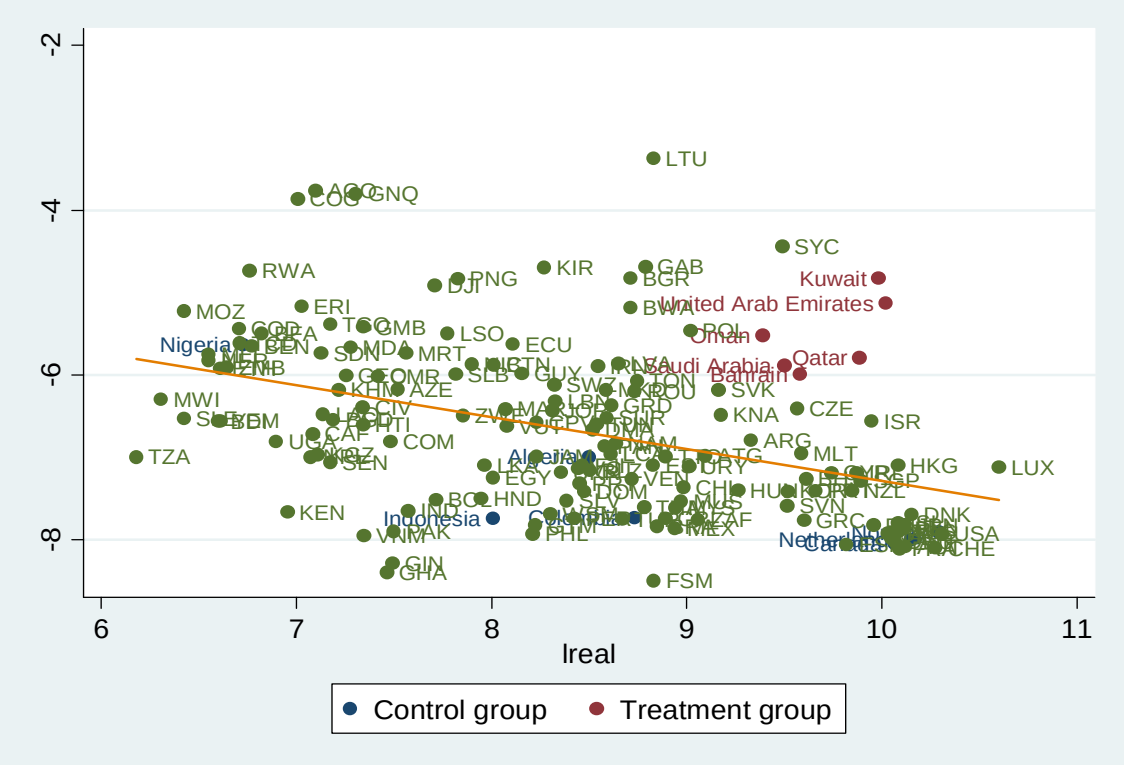


Figure 14. *Sectoral volatility (global and idiosyncratic) component and development, 1995, GCC countries and 'treatment' countries.*

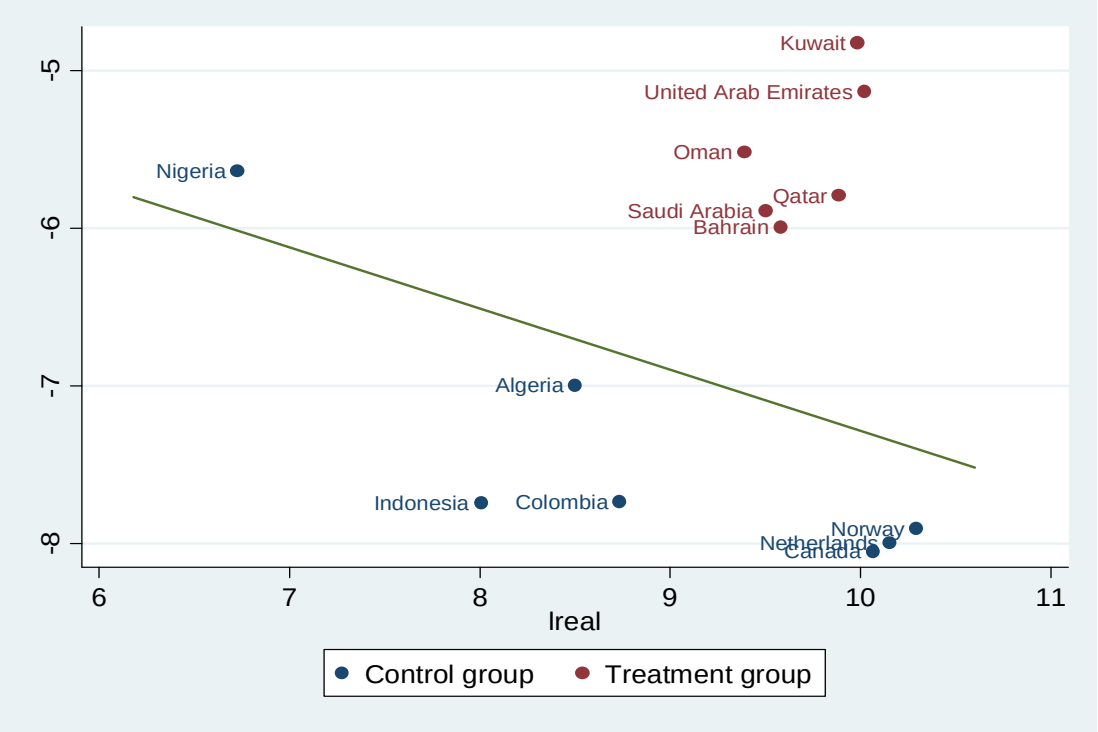


Figure 15. *Sectoral volatility (global and idiosyncratic) component and development, 2005, all countries.*

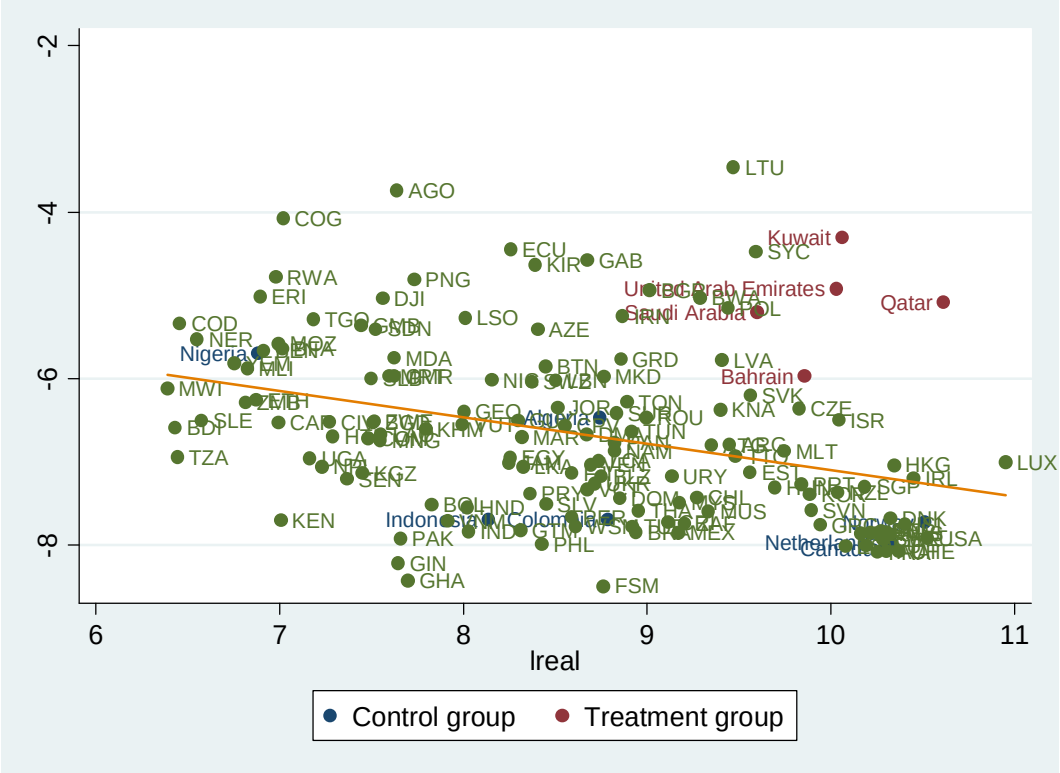
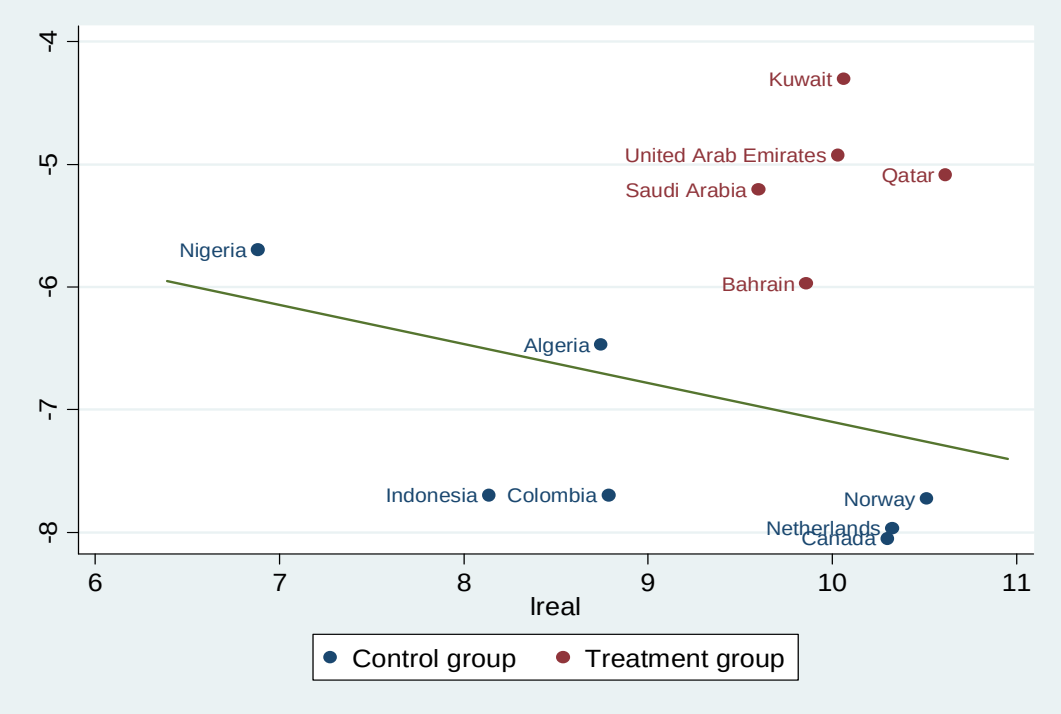


Figure 16. *Sectoral volatility (global and idiosyncratic) component and development, 2005, GCC countries and 'treatment' countries.*



sectoral volatility of GCC countries. While still above the prediction line, the countries appear to be much closer to other countries at the same level of development.[12]

In comparison with other resource-rich countries, significant progress can be appreciated as well, as two of the seven control-group countries are now above the fitted line. While still above the levels typical of other countries rich in natural resources, the convergence is evident.

3.2.2. Covariance of sector-specific and country-specific shocks

Figure 17 shows the covariance of sector-specific and country-specific shocks in 1975 for all countries, plotted against the (log of) real GDP per capita in that year. The scatter plot, together with the regression line, shows that there is no systematic relation between the two. All GCC countries, however, with the exception of Oman, appear to have above-average covariance. This suggests, as argued earlier, that there is no systematic countercyclical response of policies to shocks. More concretely, monetary and fiscal policies have failed at being sufficiently countercyclical (that is, they have not been expansionary in recessionary

[12] Oman is not displayed in the 2005 figures, since data on real GDP per capita is not available from WDI for that year.

Figure 17. *Covariance of sectoral and country-specific volatility and development, 1975, all countries.*

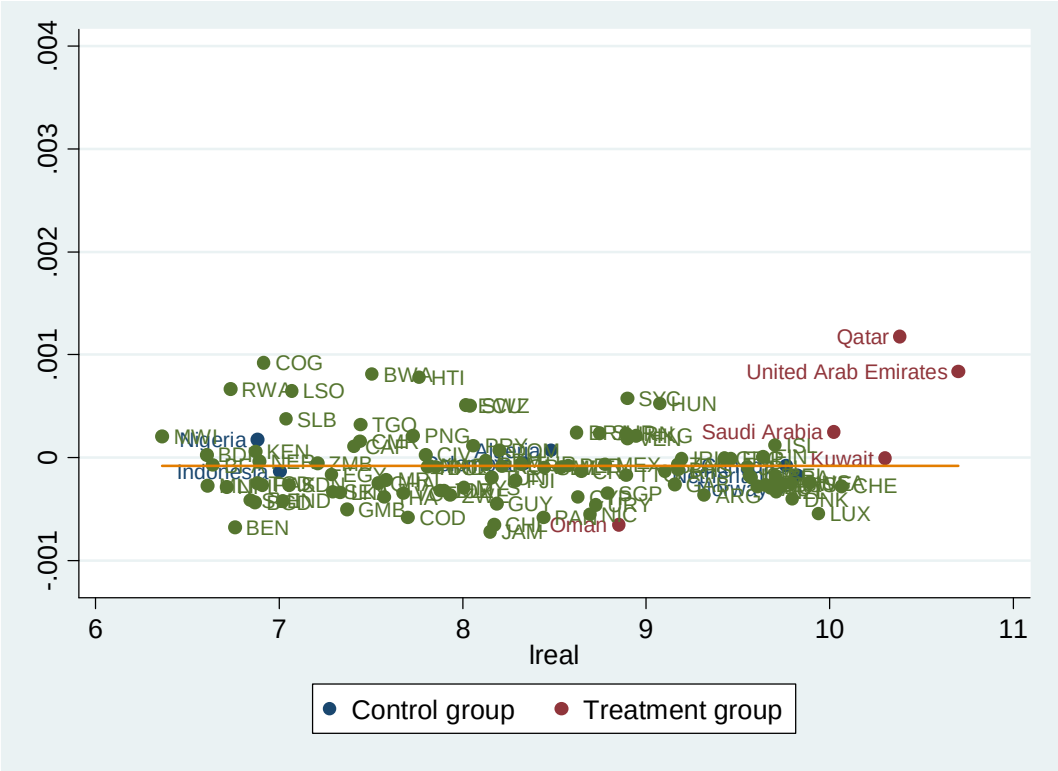
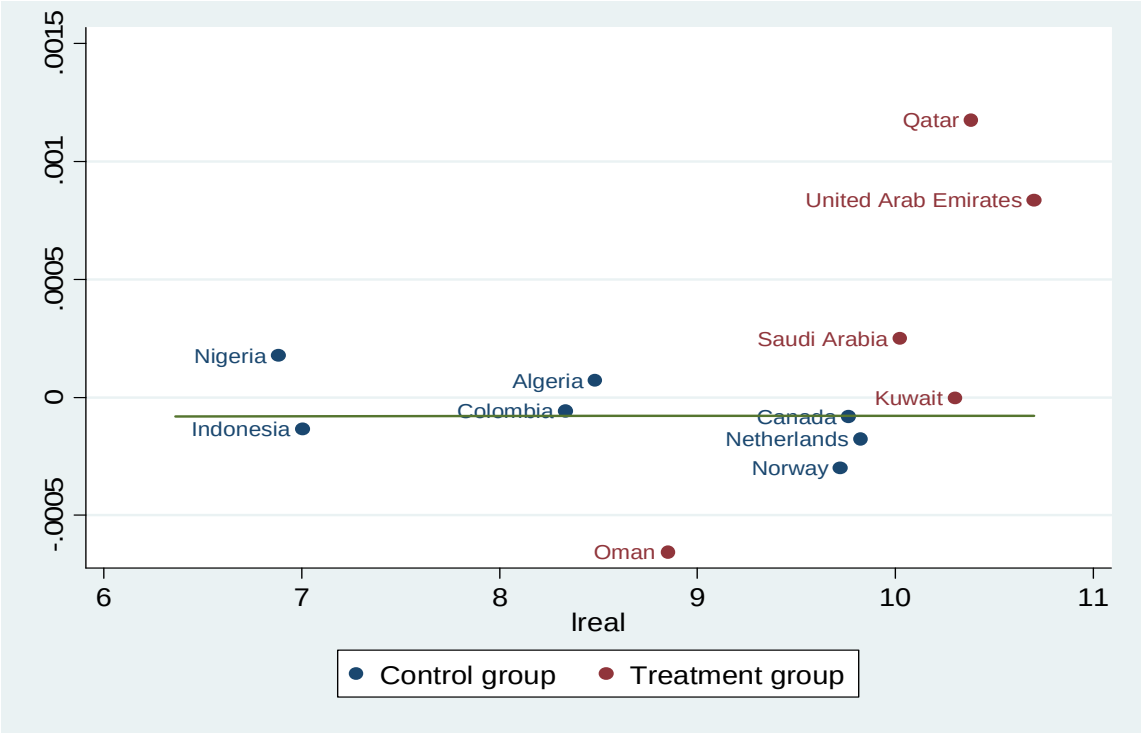


Figure 18. ***Covariance of sectoral and country-specific volatility and development, 1975, GCC countries and 'treatment' countries.***



times – or in times when oil prices are low); this lack of countercyclicality can explain why most countries feature negative values for the covariance.

When compared with other resource-rich economies, as depicted in Figure 18, GCC countries also perform rather poorly, again with the exception of Oman, which shows a negative covariance.

The picture proves resilient to the passage of time. In 1985, there is a change in rankings, with the United Arab Emirates becoming the country with the highest covariance in the group and in the world. This is shown in Figures 19 and 20, which show the plots of the covariance against the (logged) level of development in 1985, for the whole sample and the sample of resource-rich countries respectively.

Oman is systematically the country with the lowest (most negative) covariance among the resource-rich group.

Figures 21 to 24 show the covariance component of volatility in 1995 and 2005, plotted as before against the level of development, correspondingly for all countries in the sample and for the control and treatment groups only.

The conclusion from these pictures is that no significant progress has been made in terms of lowering the level of the covariance over time, whether in absolute terms or relative to other countries at the same level of development or endowed with natural resources.

As argued before, this is perhaps one of the determinants of volatility that policymakers could more effectively influence, through more aggressive counterbalancing policies.

Figure 19. *Covariance of sectoral and country-specific volatility and development, 1985, all countries.*

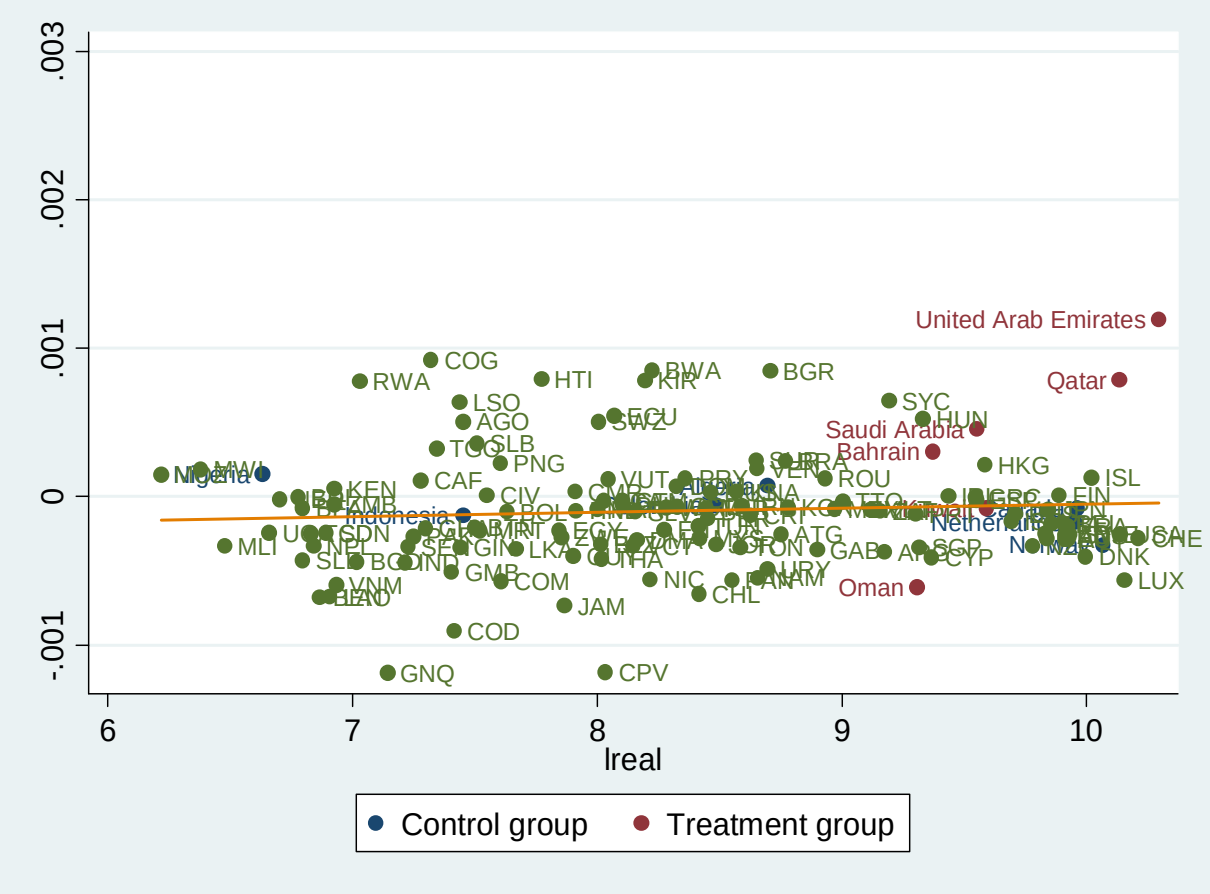


Figure 20. *Covariance of sectoral and country-specific volatility and development, 1985, GCC countries and 'treatment' countries.*

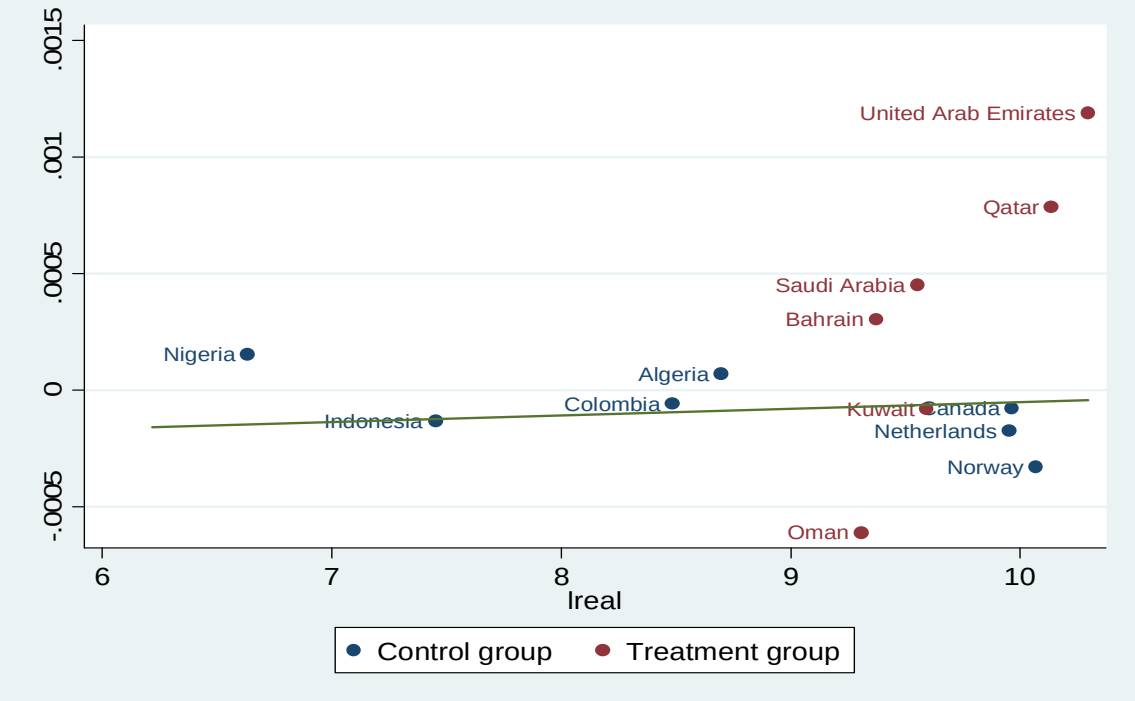


Figure 21. *Covariance of sectoral and country-specific volatility and development, 1995, all countries.*

Figure 22. *Covariance of sectoral and country-specific volatility and development, 1995, GCC countries and 'treatment' countries.*

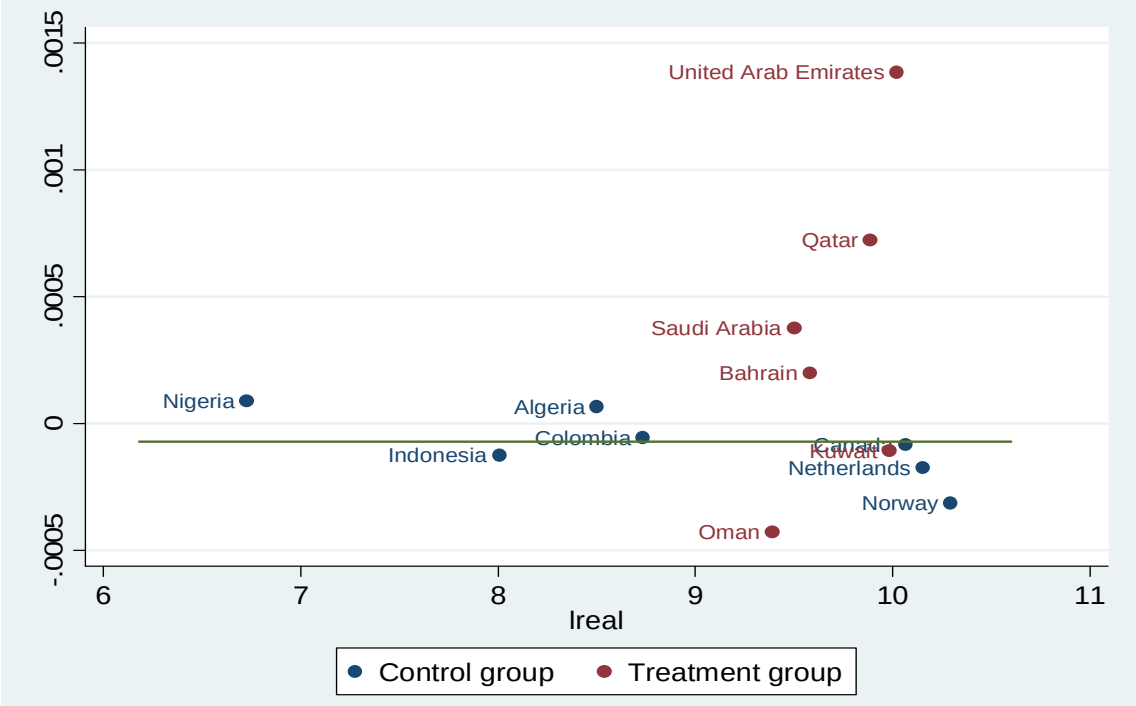


Figure 23. *Covariance of sectoral and country-specific volatility and development, 2005, all countries.*

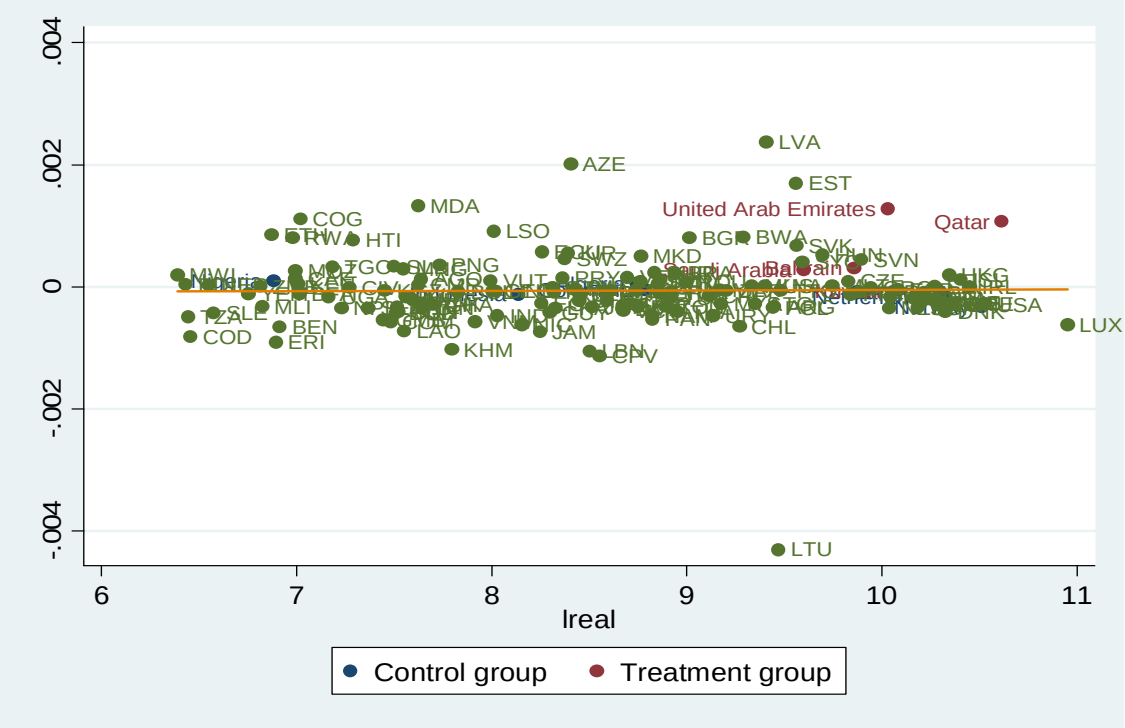
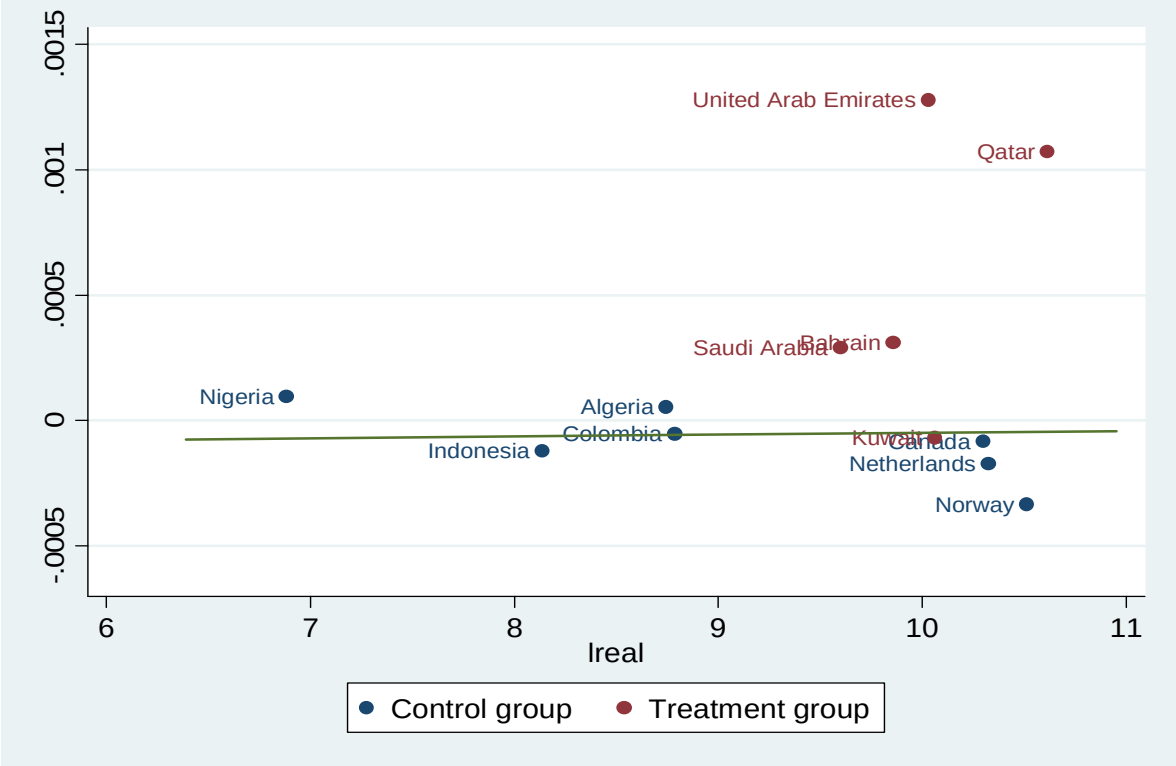


Figure 24. *Covariance of sectoral and country-specific volatility and development, 2005, GCC countries and 'treatment' countries.*



3.2.3. Country-specific volatility

The last component of volatility – country-specific volatility – is studied in Figures 25 and 26. (As explained in the technical appendix, by construction the country-specific volatility component is invariant over time.) Figure 25 shows the (log of) country-specific volatility against the (logged) real GDP per capita in 1995. (The picture does not change substantially when volatility is plotted against GDP per capita in other years.)

As before, the line shows the fitted values from a regression of (log) country volatility on real GDP per capita. The relation is significantly negative, that is, countries at lower level of development tend to experience higher country-specific volatility.

Figures 25 and 26 both show that GCC countries tend to be outliers when compared with the reference groups, showing higher country volatility than countries at the same level of development or countries that are also rich in natural resources.

Figure 25. *Country-specific volatility component (1970–2006) and development (1995), all countries*.

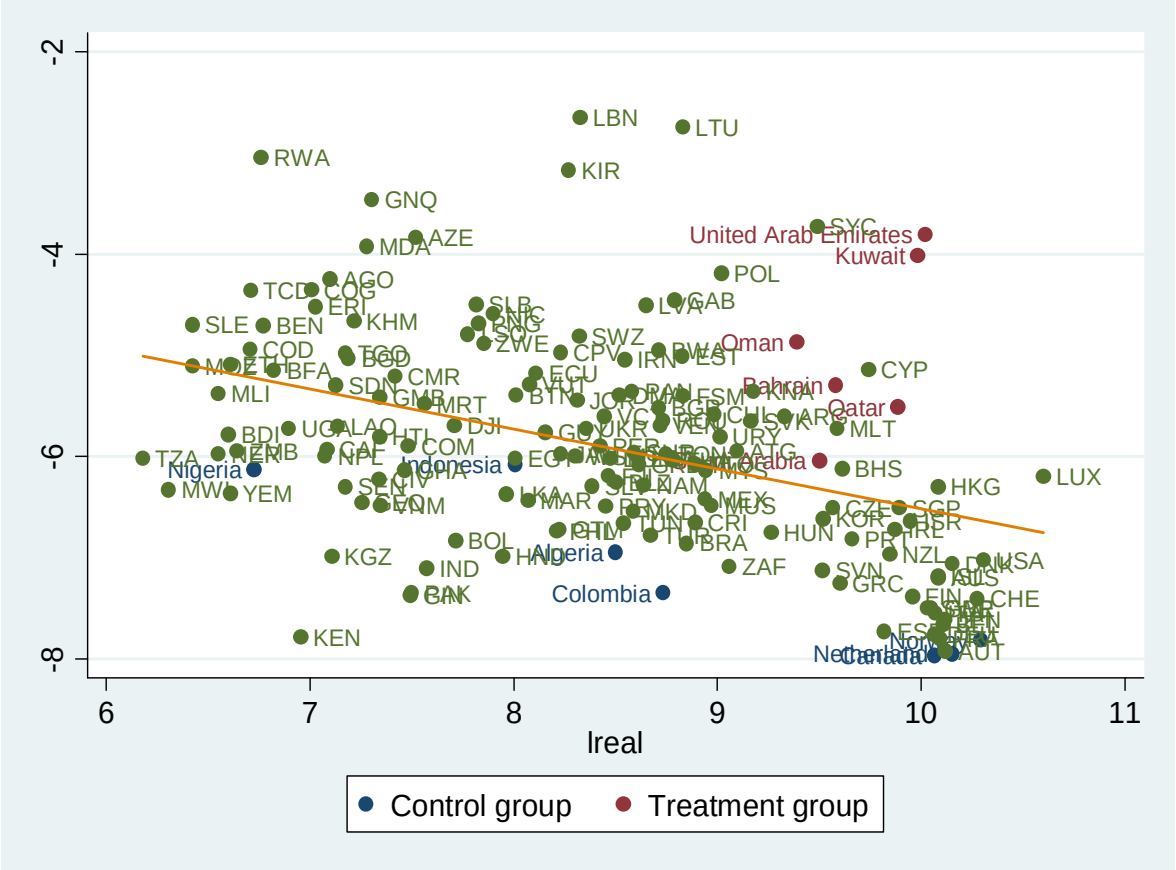
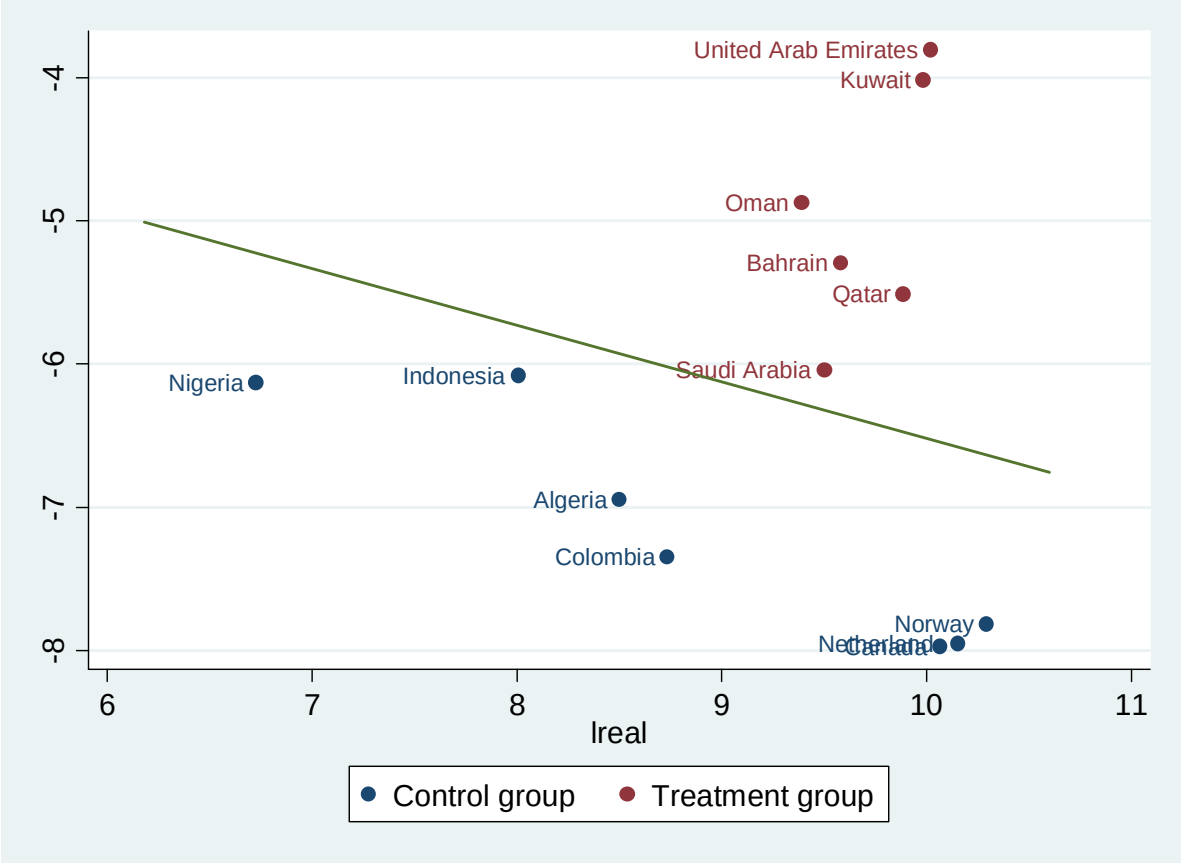


Figure 26. *Country-specific volatility component (1970–2006) and development (1995), GCC countries and 'treatment' countries.*



Saudi Arabia is the best performer, being just above the level predicted for countries at the same level of development. The United Arab Emirates and Kuwait show the highest level of country volatility.

4. Concluding remarks

In part due to their strong dependence on oil, GCC economies are intrinsically more volatile than other economies at the same level of development. Startling progress has been achieved, however, since the 1970s, volatility falling in most GCC countries by a factor of 4 or more by 2005. The fall in volatility is mostly due to two factors. The first is the rise of the service economy (comprising, among others, financial intermediation, tourism and real estate), which is inherently less volatile than the oil sector and has led to higher levels of sectoral diversification. The second is the general decline in volatility in world markets since the 1980s, a period that economists have called the 'Great Moderation'. The current Great Credit Crisis, however, has interrupted this trend.

Our comparative analysis of the sources of volatility suggests that, despite the progress achieved, there is still scope for improvement. First, other resource-rich economies facing the same challenges (and shocks) as GCC countries tend systematically to display lower levels of volatility.

Second, and perhaps more relevant, the high levels of country-specific volatility and the positive covariance between sectoral shocks and country-specific shocks suggest that macroeconomic policy could be improved to mitigate volatility further. Concretely, it seems that more aggressively countercyclical fiscal and monetary policies could be put in place in GCC economies to lower the macroeconomic impact of oil shocks. With regard to monetary policy, most GCC countries have maintained a fairly passive stance. In particular, most currencies of GCC countries have been de facto pegged to the US dollar for the last three decades, with the peg becoming official in the early 2000s. Pegging the exchange rate in a context of free movement of capital implies that GCC countries have relinquished monetary policy autonomy. The scope for actively counteracting shocks through credit policy is hence limited. (Only Kuwait and Oman have used direct instruments – ceilings on certain types of credit – in order to use monetary policy more actively.)

With regard to fiscal spending, GCC countries have failed to undertake countercyclical policies (e.g. cutting government spending during booms and increasing spending in downturns); on the contrary, fiscal policy in most GCC countries has been highly pro-cyclical (Fasano and Wang 2002), contributing to higher volatility.

In sum, the overall balance for GCC countries over the past four decades is positive: significant progress has been made in terms of increasing stability in the region. There is, however, scope for further gains, as the experience from other resource-rich economies shows. More countercyclical policies appear to be a promising route. Last, but not least, the current global financial crisis has also underscored financial-sector vulnerabilities that need to be addressed (in this GCC countries are by no means unique). Diversification alone is not enough, as it does not shield countries from aggregate shocks; Dubai is perhaps the best case in point. Its efforts to diversify and develop other sectors (real estate, tourism, finance) have led to significant improvements in performance and living standards, along with lower dependence on oil. But it opened the door to other sources of shocks (e.g. financial and real-estate bubbles) that led to sharp disruptions in the economy when the global credit crunch caused substantial falls in real estate and stock markets. We leave for future work the new challenges underscored by the global crisis.

APPENDIX A: LIST OF COUNTRIES AND CODES

Afghanistan	AFG	Cyprus	CYP
Albania	ALB	Czech Republic	CZE
Algeria	DZA	Denmark	DNK
Andorra	AND	Djibouti	DJI
Angola	AGO	Dominica	DMA
Antigua and Barbuda	ATG	Dominican Republic	DOM
Argentina	ARG	Ecuador	ECU
Armenia	ARM	Egypt	EGY
Aruba	ABW	El Salvador	SLV
Australia	AUS	Equatorial Guinea	GNQ
Austria	AUT	Eritrea	ERI
Azerbaijan	AZE	Estonia	EST
Bahamas	BHS	Ethiopia	ETH
Bahrain	BHR	Fiji	FJI
Bangladesh	BGD	Finland	FIN
Barbados	BRB	France	FRA
Belarus	BLR	French Polynesia	YF
Belgium	BEL	Gabon	GAB
Belize	BLZ	Gambia	GMB
Benin	BEN	Georgia	GEO
Bermuda	BMU	Germany	DEU
Bhutan	BTN	Ghana	GHA
Bolivia	BOL	Greece	GRC
Bosnia and Herzegovina	BIH	Greenland	GRL
Botswana	BWA	Grenada	GRD
Brazil	BRA	Guatemala	GTM
Brunei Darussalam	BRN	Guinea	GIN
Bulgaria	BGR	Guinea-Bissau	GNB
Burkina Faso	BFA	Guyana	GUY
Burundi	BDI	Haiti	HTI
Cambodia	KHM	Honduras	HND
Cameroon	CMR	Hong Kong SAR of China	HKG
Canada	CAN	Hungary	HUN
Cape Verde	CPV	Iceland	ISL
Cayman Islands	CYM	India	IND
Central African Republic	CAF	Indonesia	IDN
Chad	TCD	Iran, Islamic Republic of	IRN
Chile	CHL	Iraq	IRQ
China	CHN	Ireland	IRL
Colombia	COL	Israel	ISR
Comoros	COM	Italy	ITA
Congo, Democratic Republic	COG	Jamaica	JAM
Congo	COD	Japan	JPN
Costa Rica	CRI	Jordan	JOR
Cote d'Ivoire	CIV	Kazakhstan	KAZ
Cuba	CUB	Kenya	KEN

Kiribati	KIR
Korea, Dem. People's Rep.	PRK
Korea, Republic of	KOR
Kuwait	KWT
Kyrgyzstan	KGZ
Laos	LAO
Latvia	LVA
Lebanon	LBN
Lesotho	LSO
Liberia	LBR
Libyan Arab Jamahiriya	LBY
Liechtenstein	LIE
Lithuania	LTU
Luxembourg	LUX
Macao SAR of China	MAC
Macedonia, TFYR of	MKD
Madagascar	MDG
Malawi	MWI
Malaysia	MYS
Maldives	MDV
Mali	MLI
Malta	MLT
Marshall Islands	MHL
Mauritania	MRT
Mauritius	MUS
Mexico	MEX
Micronesia, Fed. States	FSM
Moldova, Republic of	MDA
Monaco	MCO
Mongolia	MNG
Montenegro	MNE
Morocco	MAR
Mozambique	MOZ
Myanmar	MMR
Namibia	NAM
Nepal	NPL
Netherlands Antilles	ANT
Netherlands	NLD
New Caledonia	NCL
New Zealand	NZL
Nicaragua	NIC
Niger	NER
Nigeria	NGA
Norway	NOR
Oman	OMN
Pakistan	PAK
Palau	PLW
Panama	PAN
Papua New Guinea	PNG
Paraguay	PRY
Peru	PER
Philippines	PHL
Poland	POL
Portugal	PRT
Puerto Rico	PRI
Qatar	QAT
Romania	ROU
Russian Federation	RUS
Rwanda	RWA
Saint Kitts and Nevis	KNA
Saint Lucia	LCA
Saint Vincent and the Grenadines	VCT
Samoa	WSM
San Marino	SMR
São Tomé and Príncipe	STP
Saudi Arabia	SAU
Senegal	SEN
Serbia	SRB
Seychelles	SYC
Sierra Leone	SLE
Singapore	SGP
Slovakia	SVK
Slovenia	SVN
Solomon Islands	SLB
Somalia	SOM
South Africa	ZAF
Spain	ESP
Sri Lanka	LKA
Sudan	SDN
Suriname	SUR
Swaziland	SWZ
Sweden	SWE
Switzerland	CHE
Syrian Arab Republic	SYR
Tajikistan	TJK
Thailand	THA
Timor-Leste	TLS
Togo	TGO
Tonga	TON
Trinidad and Tobago	TTO
Tunisia	TUN
Turkey	TUR
Turkmenistan	TKM

Uganda	UGA
Ukraine	UKR
United Arab Emirates	ARE
United Kingdom	GBR
United Republic of Tanzania: Mainland	TZA
United States	USA
Uruguay	URY
Uzbekistan	UZB
Vanuatu	VUT
Venezuela	VEN
Vietnam	VNM
Yemen	YEM
Zambia	ZMB
Zimbabwe	ZWE

APPENDIX 2: TECHNICAL SUPPLEMENT

Two main ideas underlie the discussion of the determinants of the volatility of GDP growth. The first emphasizes the role of the sectoral composition of the economy as the main determinant of volatility: a high degree of specialization or specialization in high-volatility sectors translates into high aggregate volatility. The second idea points to domestic macroeconomic volatility, possibly related to policy mismanagement or political instability, among other country-specific factors.

The emphasis on sectoral composition motivates us first to break down the value added of a country into the sum of the value added of different sectors, each of which has a potentially different level of intrinsic volatility. Innovations in the growth rate of GDP in country j (j=1,...,J), denoted by q_j, can then be expressed, as the weighted sum of the innovations in the growth rates of value-added in every sector, y_{js}, with s=1,...,S:

$$q_j = \Sigma\, \alpha_{js}\, y_{js},$$

where the weights, α_{js}, denote the share of output in sector s of country j. The object of our study is the variance of q_j, $Var(q_j)$, and its components.

To separate the role of domestic aggregate volatility[13] from that of the sectoral composition of the economy, we can further breakdown innovations to a sector's growth rate, y_{js}, into three disturbances:

$$y_{js} = \lambda_s + \mu_j + \varepsilon_{js}. \quad (1)$$

The first disturbance (λ_s) is specific to a sector but common to all countries. This includes, for example, a shock to the price of a major input in production, such as steel, which may affect the productivity of sectors that are steel-intensive. More generally, technology and price shocks that affect a sector or group of sectors across countries in the same way will fall in this category.

The second disturbance (μ_j) is specific to a country but common to all sectors within a country. So, for example, a monetary tightening in country j might cause deterioration in the productivity of all sectors in country j, because all need some amount of liquidity to produce.

The third disturbance (ε_{js}) captures the shocks that are specific to a sector and country. In the previous example, if some sectors are more sensitive to the liquidity squeeze and have a steeper fall in productivity, the difference with respect to the average will be reflected in ε_{js}.

[13] The terms 'risk' and 'volatility' are used interchangeably.

Similarly, if some global shocks have a different impact on sectoral productivity in different countries, the differential impact will be captured by ε_{js}. Finally, any disturbance specific to both a country and sector will be reflected in ε_{js}. Oil shocks, which affect countries in different ways, depending on whether they are net exporters or importers, will tend to fall into this category. This is why, as the analysis will show, this term will be particularly high in GCC economies.

Of course, all three disturbances can potentially be correlated with each other. For example, λ_s and μ_j will tend to be correlated if in some countries macroeconomic policies are more responsive to global sectoral shocks, or, alternatively, if a country is highly influential in a particular sector, in which case an aggregate shock in that country may affect that sector in other countries. Moreover, as pointed out above, certain sectors may be more responsive to country-specific shocks (implying that ε_{js} and μ_j could be correlated), or sectoral productivity in certain countries may be affected differently by global sectoral shocks (implying that ε_{js} and λ_s could be correlated).

Expression (1) provides a convenient way of partitioning the data. Written as such, it is simply an accounting identity, since ε_{js} picks up everything not accounted for by the sector- or country-specific shocks, and since we do not place any restriction on the way in which the three disturbances covary. In what follows, we explain how to decompose the variance of q_j into the corresponding variances and covariances of these different disturbances. It is convenient to rewrite innovations to growth of GDP in matrix notation. Denoting by $\mathbf{y}_j$ the vector of sectoral innovations y_{js} and by $\mathbf{a}_j$ the vector of sectoral shares α_{js}, our object of interest, $Var(q_j)$, can be written as:

$$Var(q_j)= \mathbf{a'}_j \, E(\mathbf{y}_j \, \mathbf{y'}_j) \, \mathbf{a}_j \quad (2)$$

Thus in order to decompose $Var(q_{js})$ we need to decompose the variance-covariance matrix of the innovations to sectoral growth rates, $E(\mathbf{y}_j \, \mathbf{y'}_j)$. Simple matrix algebra shows that the variance-covariance matrix of country j's sectoral shocks can be written as

$$E(\mathbf{y}_j \, \mathbf{y'}_j)=\Omega_\lambda+\Omega_{\varepsilon j}+\omega_{\mu j}^2\mathbf{11'}+(\Omega_{\lambda\mu j} \, \mathbf{1'}+\mathbf{1} \, \Omega_{\lambda\mu j})+\Gamma_j,$$

where

$$\Omega_\lambda = E(\boldsymbol{\lambda\lambda'}),$$
$$\Omega_{\varepsilon j} = diag(\sigma_{j1}^2 ... \sigma_{js}^2),$$
$$\omega_{\mu j}^2 = E(\mu_j^2),$$
$$\Omega_{\lambda\mu j} = E(\boldsymbol{\lambda}\mu_j),$$

where **1** denotes the S×1 vector of ones, and **λ** and **μ** denote the vectors of sectoral shocks (λ_s) and country shocks (μ_j), respectively. The matrix Ω_λ is the variance-covariance of sector-specific global shocks; $\Omega_{\varepsilon j}$ is the matrix collecting the variances of the sector- and country-specific residuals $\varepsilon_{\varepsilon j}$, $\sigma_{js}^2=E(\varepsilon_{\varepsilon j}{}^2)$; $\omega_{\mu j}^2$ is the variance of country-specific shocks; $\Omega_{\lambda\mu j}$ is the covariance between country-specific and global sectoral shocks; and finally, the matrix Γ_j collects the remaining components of $E(\mathbf{y}_j\,\mathbf{y'}_j)$, that is, the covariances between the residuals and the sectoral and country-specific shocks, and the covariance among residuals.

It turns out that the term Γ_j plays a quantitatively negligible role in accounting for aggregate volatility. In anticipation of that result, the exposition that follows ignores this last component. More specifically, we shall maintain the working hypothesis that the residual shocks are idiosyncratic (uncorrelated with each other and with the sector- and country-specific shocks), and hence Γ_j is null. This implies that we can write the variance-covariance matrix as:

$$E(\mathbf{y}_j\,\mathbf{y'}_j)=\Omega_\lambda+\Omega_{\varepsilon j}+\omega_{\mu j}^2\mathbf{11'}+(\,\Omega_{\lambda\mu j}\,\mathbf{1'}+\mathbf{1}\,\Omega_{\lambda\mu j}) \quad (3)$$

Plugging (3) into (2), aggregate volatility can be written as:

$$Var(q_j)=\mathbf{a'}_j\,E(\mathbf{y}_j\,\mathbf{y'}_j)\,\mathbf{a}_j=\mathbf{a'}_j\,\Omega_\lambda\mathbf{a}_j+\mathbf{a'}_j\,\Omega_{\varepsilon j}\mathbf{a}_j+\omega_{\mu j}^2+2\,\mathbf{a'}_j\,\Omega_{\lambda\mu j}. \quad (4)$$

This formulation clearly shows that production in country j is more volatile:

1. If the country specializes in volatile sectors – that is, sectors exposed to large and frequent shocks. This is reflected in the first two terms:
    a. The first, $\mathbf{a'}_j\,\Omega_\lambda\mathbf{a}_j$, relates to global sectoral shocks. This term is large when sectors exposed to big and frequent global shocks account for a large share of the country's GDP.
    b. The second term, $\mathbf{a'}_j\,\Omega_{\varepsilon j}\mathbf{a}_j$, relates to idiosyncratic sectoral shocks. This term is large when sectors with high idiosyncratic volatility, σ_{js}^2, account for a large share of GDP.
2. If country risk ($\omega_{\mu j}^2$) is big – that is, the country is more volatile if aggregate domestic shocks are larger and more frequent.
3. If specialization is tilted towards sectors whose shocks are positively correlated with country-specific shocks ($\mathbf{a'}_j\,\Omega_{\lambda\mu j}$ is big). This term will tend to be small, for example, if policy innovations are negatively correlated with the shocks to sectors that have a large share in country j's GDP.

Thus the aggregate volatility of the economy can be decomposed as the sum of components with fundamentally different meanings.

In order to quantify the various components of volatility in equation (4), we need to estimate the variance-covariance matrices Ω_λ, $\Omega_{\varepsilon j}$, $\omega_{\mu j}^2$, and $\Omega_{\lambda\mu j}$. Our general strategy is to use data across countries, sectors and time to back out estimates of the sectoral shocks, λ_s, and the country shocks, μ_j. We then compute the sample variances and covariances of the estimated shocks and treat them as estimates of the corresponding population moments.

Innovations to growth in value-added in country j and sector s, y_{jst}, are computed as the deviation of the growth rate from the average (growth rate) of country j and sector s over time.

We measure global sector-specific shocks as the cross-country average of y_{jst} in each of the sectors. Country-specific shocks are then identified as the within-country average of y_{jst}, using only the portion not explained by sector-specific shocks. The residual is then the difference between y_{jst} and the two shocks. Formally,

$$\lambda^e_{st} \equiv (1/J) \times \sum y_{jst},$$

$$\mu^e_{jt} \equiv (1/S) \times \sum (y_{jst} - \lambda^e_{st})$$

$$\varepsilon^e_{jst} \equiv y_{jst} - \lambda^e_{st} - \mu^e_{jt},$$

where superscript 'e' stands for 'predicted'.

Note that we normalize shocks so that $\sum \mu^e_{jt} = 0$ – that is, country shocks are expressed as relative to world shocks.

An equivalent way to formalize this is to frame the analysis as a set of cross-sectional regressions of y_{jst} on country and sector dummies. More specifically, the formulas for λ^e_{st}, μ^e_{jt}, and ε^e_{jst} given above will be the result of running a regression, for each time t, of y_{jst}, on a set of sector-specific and country-specific dummies (see Koren and Tenreyro 2007.) Estimates of the matrices Ω_λ, $\Omega_{\varepsilon j}$, $\omega_{\mu j}^2$, and $\Omega_{\lambda\mu j}$ are then computed using the estimated shocks. In particular, $\Omega^e_\lambda = (1/T) \times \sum \boldsymbol{\lambda}^e_t \boldsymbol{\lambda}^e_t{}'$ is the estimated variance-covariance of global-sectoral shocks; $\omega^e_{\mu j}{}^2 = (1/T) \times \sum \mu^e_{jt}{}^2$ is the estimated variance of country-j-specific shocks; $\Omega^e_{\lambda\mu j} = (1/T) \times \sum \boldsymbol{\lambda}^e_t \mu^e_{jt}$ is the estimate of the covariance between sectoral shocks and country-j shocks; and $\sigma^e_{js}{}^2 = (1/T) \times \sum \varepsilon^e_{jst}{}^2$, with s=1,..., S are the estimated variances of the sectoral idiosyncratic shocks.

Given the estimates of the variance-covariance matrix of factors, we use data on sectoral GDP shares, α_{jst}, to compute the various measures of risk exposure:

$$GSECT_{jt} = \mathbf{a'}_{jt}\, \Omega^{e}_{\lambda} \mathbf{a}_{jt}$$

$$ISECT_{jt} = \mathbf{a'}_{jt}\, \Omega^{e}_{\varepsilon j} \mathbf{a}_{jt}$$

$$CNT_{j} = \omega^{e}_{\mu j}{}^{2}$$

$$COV_{jt} = 2\, \mathbf{a'}_{jt}\, \Omega^{e}_{\lambda \mu j}$$

where $GSECT_{jt}$ is the part of the volatility of country j at time t due to global sectoral shocks that are common to all countries (Global Sectoral Risk); $ISECT_{jt}$ is the part of volatility due to sectoral shocks idiosyncratic to country j (Idiosyncratic Sectoral Risk); CNT_j is the part of volatility due to country shocks, which, by construction, does not depend on time (Country-Specific Risk); and COV_{jt} is the covariance of global sectoral shocks with the jth country shock at time t (Covariance of Sector and Country-specific Risk). Total volatility can hence be expressed as the sum of these four components.

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