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»» Uncertainty and economic activity in Germany

Author: Marius Orthey, research@kfw.de
Contact: Dr Katrin Ullrich, phone +49 69 7431 9791, katrin.ullrich@kfw.de

The global spread of COVID-19 and the measures adopted to contain the pandemic have led to a rapid rise in uncertainty. In theory, a reduction in (planning) certainty can affect economic decisions through a range of different channels. The wait-and-see attitude is in the foreground. Individuals exercise restraint, put off investment and consumption decisions and wait for the uncertainty to dissipate. In order to support this hypothesis with empirical findings, uncertainty indicators draw on sources such as media reports, financial market data and business surveys. The current state of research paints a divided picture: While there is widespread agreement on the negative economic impact of uncertainty in the short term, there is no scientific consensus on the magnitude and duration of the effect.

Uncertain times

The past weeks and months have shown: A life in the coronavirus pandemic is a life in uncertainty. Are healthcare capacities adequate? What measures are necessary over what period of time to effectively contain the spread of the virus? How can businesses and private households be reasonably supported? Is the economic support package that has been adopted sufficient to restart the economy? What lessons can be learned from the coronavirus pandemic? At a time when questions outnumber answers, only one thing appears to be certain: The coronavirus pandemic has led to a significant increase in uncertainty.[1]

There are many other sources of uncertainty besides the spread of an infectious disease. Events such as the Iraq war in 2003 or the Paris terror attacks of 13 November 2005 are often attributed to **geopolitical uncertainty**. The Brexit referendum of 2016 or the election of a new government, on the other hand, are classic examples of **policy-related economic uncertainty**.

An increase in uncertainty is generally associated with a reduction in (planning) certainty. From an economic viewpoint, the question therefore arises whether uncertainty influences individuals' economic decisions and thus has consequences for a country's economic activity. The present paper addresses this question and provides an overview of the theoretical concepts and empirical findings in this field of research.

The range of uncertainty indicators is multifaceted

Among other things, measuring uncertainty is fraught with two problems: First, uncertainty is not directly observable, and second, uncertainty and risk often cannot be sufficiently distinguished in practice. The consequence is that the uncertainty indicator applied usually describes a mix of uncertainty and risk and therefore merely represents a very good approximation at best. The most frequently used uncertainty indicators can be divided into three categories:[2]

Box 1: Distinction between uncertainty and risk

There is no generally accepted definition of the expressions 'uncertainty' and 'risk', which makes a clear distinction difficult. Both terms are often used interchangeably.

A widely adopted distinction between the terms is based on the fundamental concept put forward by the economist Frank H Knight.[3] He describes *risk* as a situation in which a logically demonstrated or empirically identified probability of occurrence can be attributed to a specific event. When, on the other hand, no objective probability of occurrence can be calculated for any event, he refers to this as 'true *uncertainty*' or '*indeterminateness*'.[4]

A classic example of a situation of *risk* in the meaning described above is the coin toss: The probability of the coin landing on heads or tails is 50%. In contrast, unique events that cannot be analysed using the known mathematical methods for lack of experience-based values are attributed to *uncertainty*. Examples are the terror attacks of 11 September 2001, the Brexit referendum of 2016 and the current coronavirus pandemic. In practice, uncertainty and risk often occur together as a type of **hybrid form**.

Newspaper-based uncertainty indicators reflect the intensity of reporting about different types of uncertainty. The Economic Policy Uncertainty Index measures policy-related economic uncertainty.[5] For Germany, it captures the number of reports in the daily newspapers Handelsblatt and Frankfurter Allgemeine Zeitung that contain keywords such as 'uncertainty' and 'economy', as well as economic-policy terms such as 'deficit' or 'regulation'. The higher the index value, the greater the relative frequency of reports about policy-related economic uncertainty. The Geopolitical Risk Index is based on a similar method but describes the degree of international reporting on global geopolitical tensions.[6] The advantage of a

newspaper-based indicator is that it captures the overall sentiment in an economy through media reports and can therefore be understood as a relatively broad measure of uncertainty. Furthermore, such indexes draw on highly frequent data and are therefore also suitable for analysing dynamic developments in the short term. At the same time, however, newspaper-based indicators can also convey a distorted image of uncertainty, for example as a result of an insufficiently representative selection of media or possible herd mentality in journalism.

– **Financial-market-based uncertainty indicators** refer to the implicit volatility of a stock-market index, for example. The volatility index *VDAX-NEW* calculates the range of volatility within the next 30 days for the German benchmark index *DAX* on the basis of option contracts.[7] A low (high) value reflects expectations for weak (strong) stock price variations and thus suggests a relatively calm (turbulent) and (un)certain market. A common point of criticism of financial-market-based uncertainty indicators is that stock price variations are influenced by a range of factors – e.g. changes in risk aversion – and therefore cannot necessarily be attributed to a rise in uncertainty about economic developments.[8] The very high frequency of data can be regarded as an advantage.

– In addition, many uncertainty indicators are based on the assumption that an increase in uncertainty is associated with growing **heterogeneity of expectations** and, accordingly, is accompanied by a broader **forecast spread**. That is why the estimates of analysts are drawn on at the macro level. The more strongly their forecasts about the future development of a macro-economic variable deviate from one another, the higher the uncertainty.[9] At *micro level*, on the other hand, company surveys are undertaken. In Germany, the ifo Institute conducts a monthly economic survey in which it collects data on business expectations for the next six months, among other information. A broader dispersion of these expectations within a sector – measured by the *ifo Dispersion Measure* – indicates higher uncertainty.[10] On the one hand, indicators at company level provide the advantage that they give information on the uncertainty of real decision-makers and are therefore closely linked to economic activity. On the other hand, heterogeneous expectations are not an unequivocal sign of high uncertainty. When many companies rate the business trend as unchanged owing to an uncertain situation – i.e. their expectations are relatively homogeneous – then the ifo Dispersion Measure drops despite a real increase in uncertainty.[11]

Uncertainty can influence economic activity through various transmission channels

In theory, an increase in uncertainty can impact on economic activity on both the supply and the demand side. **Three key transmission channels** can be derived from the relevant literature:[12]

Figure 1: The transmission channels of uncertainty
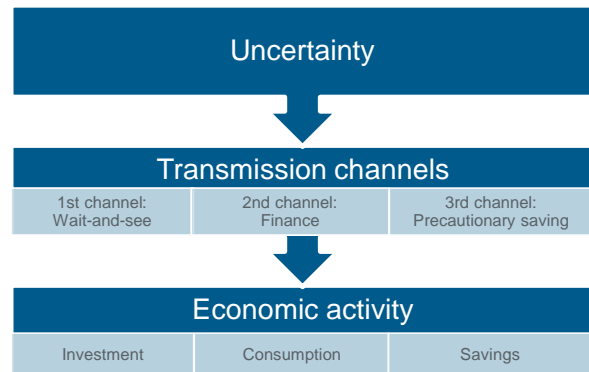
Source: KfW Research.

The primary channel **wait-and-see** builds on the hypothesis that businesses and private households respond to uncertain times with restraint. The assumption is that it is an advantage for subjects to put off irreversible decisions and first wait for further information in order to minimise the danger of costly misguided decisions.[13] For companies, that can mean putting off capital expenditure and hiring, and for private households it can mean buying fewer goods and services.

From a macroeconomic viewpoint, that does not bode well for economic output. For one thing, businesses' reluctance reduces the production factors capital (through wear and tear) and labour (through employment terminations and dismissals). For another, households' consumption restraint leads to a reduction in aggregate economic demand. In addition, uncertainty can also adversely impact an economy's productivity growth. Subjects' wait-and-see attitude leads to (un)productive enterprises expanding, (contracting) less. This slows down the efficiency-enhancing reallocation of available resources and stifles productivity growth.[14]

In line with the theory, various studies demonstrate that the negative impact of uncertainty depends on the *degree of irreversibility*. Thus, a relatively irreversible decision – i.e. a decision that is impossible or expensive to modify – should be more heavily affected by an increase in uncertainty than a relatively reversible decision. An analysis of production figures before and during the Great Depression in the US from 1929 supports this assumption. An increase in uncertainty (in the form of stock market volatility) negatively correlates with real production of durable consumer goods (such as motor vehicles). This indicates that consumers buy fewer goods from this category in uncertain times because a misguided decision would have far-reaching and costly consequences owing to the long durability and high price of the good. The results could thus explain the sharp drop in production of durable consumer goods in the US after the stock market crash of 1929.[15]

In addition, the negative effect of uncertainty may also depend on the *degree of impact*. An analysis of corporate investment in the US provided multiple evidence of this. For one thing, an increase in the *Geopolitical Risk Index* increases investment activity of companies that are active in geopo-

litically sensitive sectors such as tourism, for example.[16] For another, the negative correlation between the *Economic Policy Uncertainty Index* and capital expenditure is particularly strong for companies with a high share of public-sector demand.[17]

The **finance** channel describes the correlation between uncertainty, risk and credit cost. The theory is based on the assumption that an increase in uncertainty leads to an increase in risk, for example as a result of an increasing probability of defaults. As investors generally want to be rewarded for taking risks, higher uncertainty leads to rising financing costs through an increase in the risk premium. The uncertain situation and resulting deterioration of funding opportunities, for its part, reduces aggregate economic production and employment. Companies act with greater caution, lower the use of production factors such as labour or capital and thereby seek to prepare for possible shocks.[18]

A study exploring the correlation between uncertainty and planned capital expenditure by German manufacturing firms illustrates the relevance of the financing channel.[19] An increase in uncertainty (in the form of the dispersion of corporate expectations within a sector) adversely affects investment projects of the type with low irreversibility only in conjunction with a poor financing situation. For this category, companies with almost unrestricted funding options exhibit no significant change to planned investment activity. For investment projects of the type with high irreversibility, however, the effect of uncertainty is negative, as expected, irrespective of the companies' funding options.[20] The findings thus provide empirical evidence for the fact that, first, the financing channel primarily affects enterprises that are already in a tight financial situation and, second, that it unfolds its effect via fewer irreversible investments.

The channel **precautionary savings** refers to the motive of smoothing consumption. Accordingly, private households prefer a steady path of consumption over time without heavy income fluctuations in any one period. In times of high uncertainty, however, they become increasingly concerned over future losses of income, which creates a growing incentive to take precautions by forming savings.[21] This trend could be observed in the Great Recession between 2007 and 2009, for example. An analysis of household savings rates of 27 OECD countries during the period from 1980 to 2010 provides a positive and significant correlation between households' income uncertainty and savings behaviour. According to estimates, more than 40% of the increase in the average savings rate during the Great Recession can be attributed to the channel of precautionary savings.[22]

Consequently, households' uncertainty-induced spending restraint plays its part in the slow recovery phase after the crisis.

Uncertainty indicators for Germany and the world

In order to obtain as broad a measure of uncertainty as possible, the index observed for Germany is made up of the following three components (weighted at one third each):

– *Economic Policy Uncertainty Index (EPU-Index)*

– *VDAX-NEW*

– *Ifo Dispersion Measure.*

The strength of this composite index on a monthly basis lies in the fact that it is not based on the assessment of a single indicator. The very weak correlation of +0.10 between uncertainty at company level (i.e. the ifo Dispersion Measure) and policy-related economic uncertainty (i.e. the EPU Index) points to the fact that some individual indicators may arrive at very different estimates. A composite index is more suitable for capturing the various facets of uncertainty and therefore delivers a more comprehensive overall picture of general uncertainty in an economy.

Table: Correlation between uncertainty indicators and economic activity in Germany

	EPU Index	VDAX-NEW	Ifo Dispersion Measure	UI Germany	UI World	WAI
EPU Index	1.00	0.40	0.10	0.88	0.51	-0.29
VDAX-NEW	-	1.00	0.35	0.78	0.67	-0.43
Ifo Dispersion measure	-	-	1.00	0.31	0.44	-0.45
UI Germany	-	-	-	1.00	0.70	-0.43
UI World	-	-	-	-	1.00	-0.52
WAI	-	-	-	-	-	1.00

Note: All indicators on monthly basis. The two *uncertainty indicators (UI)* for Germany and the world consist of several components.
For Germany, the *Economic Policy Uncertainty Index*, the *VDAX-NEW* (monthly averages of daily closing prices) and the *ifo- Dispersion Measure* are used (weighting: 1/3; 1/3; 1/3). The indicator for the world takes into account the *Global Economic Policy Uncertainty Index*, the two volatility indexes *VIX* and *VSTOXX* (monthly averages of daily closing prices) and the *Citi Global Economic Surprise Index* (absolute values) (weighting: 1/3; 1/6; 1/6; 1/3).
For the *weekly activity index*, only the month-end values are taken into account. Period: January 2005 to August 2020.

Source: Baker et al. (2016), Davis (2016), Eraslan und Götz (2020), ifo (2020), Macrobond, KfW Research.

In order to be able to analyse the correlation between global and national uncertainty, an uncertainty indicator for the world is additionally generated. It is based on the *Global Economic Policy Uncertainty Index (GEPU-Index)* – a weighting of 21 national EPU indexes – the two volatility indexes *VIX* and *VSTOXX* as well as the *Citi Global Economic Surprise Index* – an indicator of the deviation between expected and actual economic data.[23]

Uncertainty is high in times of crisis

In the period between June 2005 and August 2020, sharp spikes are noticeable for both the global indicator and the one for Germany. Events such as the global economic and financial crisis of 2008/2009 and the subsequent euro crisis from 2010 are characterised by a relatively high level of uncertainty in Germany and the world. From a global perspective, uncertainty also reached particularly high levels at the start of Donald Trump's presidency in January 2017 and at the height of the trade conflict between the US and China in the year 2019. From a German perspective, the Brexit referendum in June 2016 triggered a sharp rise in uncertainty. The observations are thus in line with the scientific consensus that recessions, elections and geopolitical events come with high uncertainty.

What is also striking is the fact that both uncertainty indicators take a very similar course over time and correlate closely (+0.70). This may be an indication that the influence of global uncertainty is of great significance for relatively open economies such as Germany.

### The coronavirus pandemic is breaking records

As expected, the coronavirus pandemic is also leaving a clear imprint. In Germany, the spread of the virus sent the index soaring to a record level of around 227 points in March 2020. In the subsequent months, uncertainty already decreased noticeably but was still above average in August 2020, at 123 index points. So the situation remains tense, particularly because of the fear of a second wave fuelled by the higher number of new infections in July and August.

Globally, the picture is somewhat different. Unlike in Germany, global uncertainty increased further beyond March and reached 271 index points in May 2020, which is a new record but only slightly above the level registered in the global economic and financial crisis of 2008/2009. An analysis of the individual components of the indicators shows that the *VIX*, the *VSTOXX* and Citigroup's *Global Economic Surprise Index* all hit their highest levels in the year 2008. Only the *GEPU Index* reached a much higher level during the coronavirus pandemic than at the time of the economic and financial crisis (difference: +116%). Thus, the policy-related economic uncertainty is ultimately responsible for the global indicator moving on a similar level during the coronavirus crisis as it did in the year 2008.

In Germany, the differences between the two crises are greater because the maximum value of both the *EPU Index* and the *ifo Dispersion Measure* lies in the year 2020. Here the corresponding values for uncertainty in the financial markets and at company level are comparable to those of the crisis year 2008/2009; the figures for policy-related economic uncertainty, on the other hand, exhibit wide deviations (difference between March 2020 and October 2008: +94%).

Figure 2: Progression of uncertainty in Germany and the world

Index 2007–2016=100
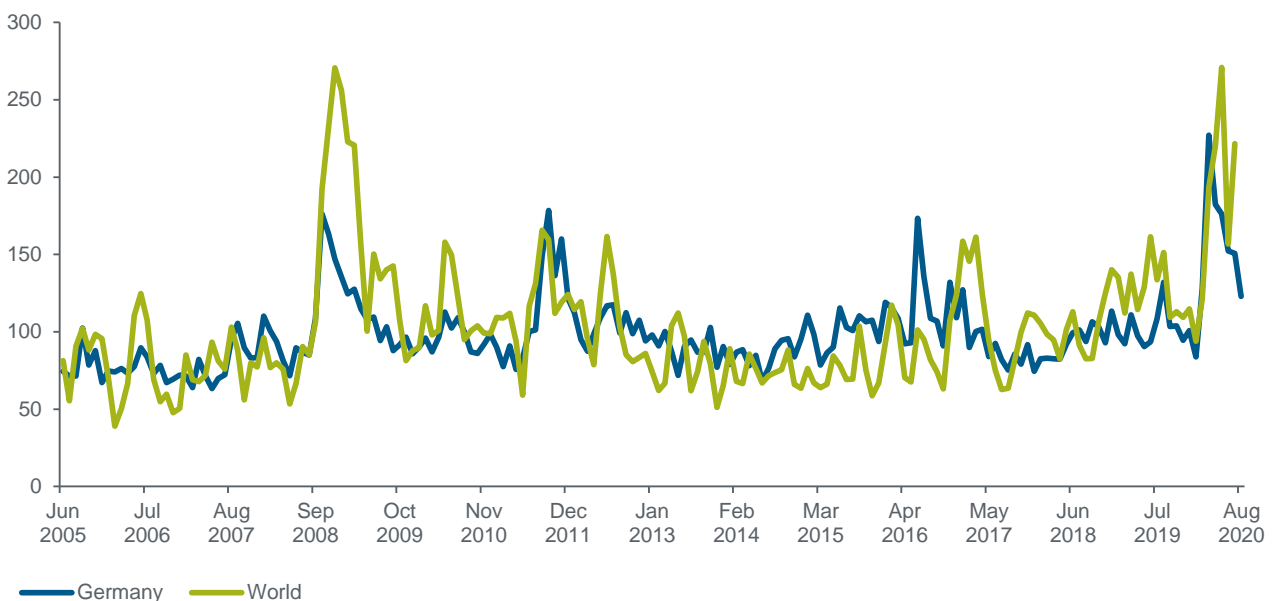
Note: see Table 1.

Source: Baker et al. (2016), Davis (2016), ifo (2020), Macrobond, KfW Research.

The special role of politics as a driver of uncertainty in the coronavirus crisis is due to the nature of the event. The global spread of COVID-19 requires a drastic response (such as restrictions on contacts and movement) that goes far beyond state intervention in a financial or economic crisis. The decisions of policymakers on individual containment measures and relaxations have enormous implications as they influence not just the economic development but also the further progression of the pandemic. The fine line between reviving the economy and a rise in new infections inevitably means that a considerable portion of current uncertainty results from policy decisions. The very close correlation (+0.88) between the *uncertainty indicator for Germany* and the national *EPU Index* supports this hypothesis.

One possible explanation for the recently declining trend in uncertainty in Germany is definitely the development of case numbers. The containment measures imposed under the nationwide lockdown at the end of March successfully and consistently reduced average new infection rates and kept death rates low. What is more, the rise in daily new infections since mid-July has been moderate compared with other European countries. In contrast, global infections have increased in the past months as well and remain on a high level, driven by hotspots such as the US, Brazil and India. In light of this, the persistent rise in global uncertainty in the months of April and May 2020 is plausible, and the surprising drop in global uncertainty to around 157 index points in June was offset to a substantial degree in the following month. A glance at the figures reveals that the decline in June was due to the development of *Citigroup's Global Economic Surprise Index*. In similarity to the global recession of 2009, fewer data surprises are shown during the month that is marked by the economic turnaround. In that case, data publications are below

expectations at the beginning of the month, while the second half of the month is characterised by positive surprises. An uncertainty factor that is composed merely of the *GEPU Index*, the *VIX* and the *VSTOXX*, however (weighting: ½; ¼; ¼), also exhibits a declining global uncertainty but the value for the month of June 2020 is only marginally below the level recorded at the end of 2008 (difference: -5%).

Does uncertainty reduce economic activity?

Economic activity in Germany is measured using the *Weekly Activity Index (WAI)* of the Deutsche Bundesbank. As this index is published on a weekly basis – as opposed to gross domestic product – it is a timely measure of real economic activity in Germany. Supplementing the quarterly GDP and monthly industrial production figures, the *WAI* covers data on electricity consumption, kilometres run by lorries and the number of people in shopping streets.[24]

As expected, uncertainty and economic activity correlate negatively (-0.43). In similarity to the *uncertainty indicator*, the *WAI* also exhibited the highest spike during the coronavirus pandemic. For May 2020 the index showed that the average trend-adjusted economic activity of the past 13 weeks (from the 10th to the 22nd calendar week of 2020) dropped by around 6.1% compared with the preceding 13 weeks (from the 49th calendar week of 2019 to the ninth of 2020). Economic activity thus declined much more sharply in the course of the coronavirus pandemic than during the global economic and financial crisis (-3%). This is also evident in the figures supplied by the Federal Statistical Office, according to which the collapse in gross domestic product in the second quarter of 2020 was significantly stronger, at -9.7% on the previous quarter, than even the most pronounced quarterly decline, by comparison, during the global economic and financial crisis, which was -4.7% and occurred in the third quarter after the crisis began.[25]

Figure 3: Uncertainty and economic activity in Germany

Index 2007–2016=100

13-week growth rate (in per cent), **inverted scale**
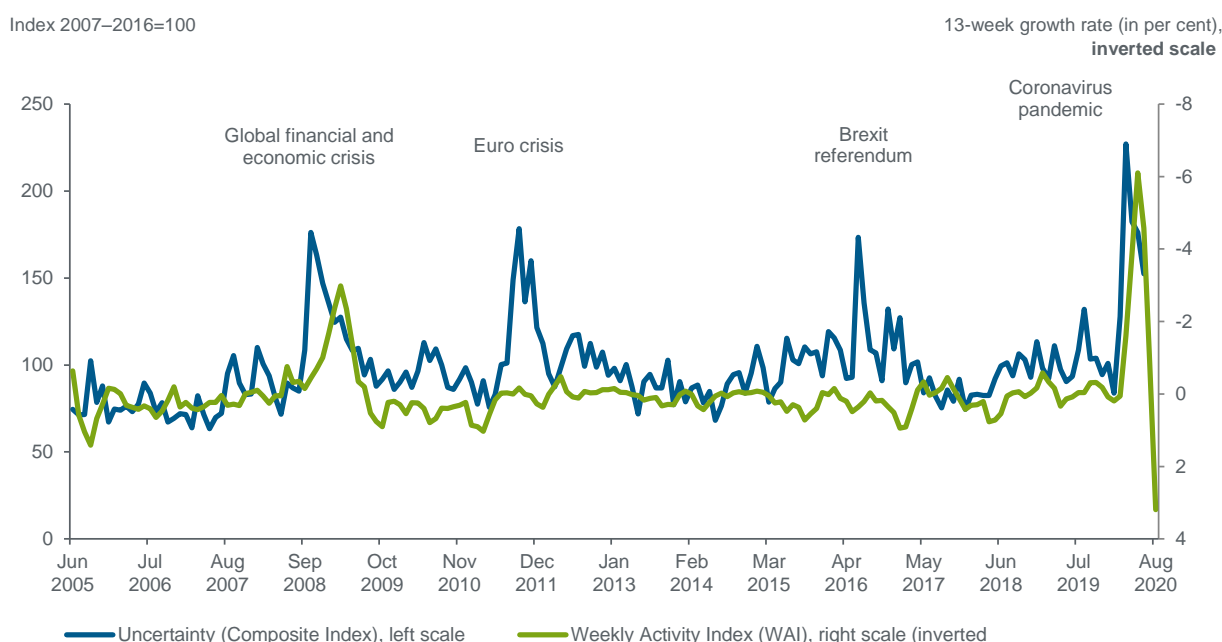
Note: see table

Source: Baker et al. (2016), Eraslan und Götz (2020), ifo (2020), Macrobond, KfW Research.

However, it can be assumed that the nationwide and global lockdown measures account for a considerable portion of the current decline in economic activity. The rise in the *WAI* in the month of June 2020 heralded the beginning of the recovery phase for the German economy.

As the values for the euro crisis and Brexit referendum illustrate, however, a strong increase in uncertainty is not always accompanied by a slump in economic activity. And then there is the major problem of simultaneity. For one thing, an increase in uncertainty can have a negative impact on economic activity and, for another, poor economic developments, for their part, can contribute to increased uncertainty.[26] A simple correlation analysis thus provides no insight into the qualitative and quantitative causal effect of uncertainty.

Negative consequences for the economy in the short term; magnitude and duration of impact still unclear

Even a small sample of studies can reflect the current state of research about the impact of uncertainty on economic activity in Germany relatively well. Even if the direction of the impact appears unequivocal, the findings are not directly comparable because the studies used different uncertainty indicators. Most of the studies used the methodology of *vector autoregressive modelling (VAR)* for their empirical analysis.

Rieth et al. (2016)[27] measure the impact of uncertainty from the Brexit referendum based on the increase in the *VDAX-NEW*. The findings show an increase in the unemployment rate by around 0.1 percentage points (after approx. 15 months) and a decline in gross domestic product of no more than 0.4% (after around nine months). The drop in economic output is due in part to a fall in aggregate investment, which declined by as much as 1% (after approx. six months). As the key figures will not recover fully from the shock even after two years, an increase in uncertainty can conceivably have lasting economic consequences.

Box 2: Vector autoregressive modelling (VAR)
The first step is to estimate the coefficients of a linear equation system that takes into account a measure for uncertainty as well as various economic indicators. Here each variable depends on both its own past value and the past values of the other variables. Then the impacts of a simulated uncertainty shock are analysed with the aid of what is known as an impulse response function.[28] The assumption is that the shock is exogenous, i.e. that a rise in uncertainty has a contemporary effect on all the variables in the system, but the uncertainty itself is not directly influenced by variations in the other variables.[29]

Grimme (2017)[30] draws on the *ifo Dispersion Measure* and studies the impact of corporate uncertainty on the turnovers of a range of economic sectors. According to the estimates, the construction industry and manufacturing sector are most severely affected. A 1% increase in uncertainty in each of these sectors leads to variations in turnover of up to -1%

(after approx. six months) and -0.8% (after approx. eight months). Turnover is back on the previous course after around three and 1.5 years, respectively. The negative impact is also reflected in the figures for gross domestic product. Thus, a one per cent increase in uncertainty in trade and industry is associated with a drop in economic output by up to 0.15% (after three quarters); output returns to the previous path after around two years. Given that the *ifo Dispersion Measure* indeed rose by around 14% between October 2007 and April 2009, the findings point to an economically relevant correlation between uncertainty and economic activity.

Hanisch (2020)[31] found that geopolitical uncertainty has a relatively minor and short-lived effect on industrial production. Thus, an increase in the *Geopolitical Risk Index* (in a comparable degree as from the terror attacks of 11 September 2001) leads to a decline of up to 0.25% after six months in Germany. Compared with the US (-0.2% after four months), Germany's industrial production thus responds more sensitively to a geopolitical shock, which might be due to Germany's high foreign trade quota. However, the impact quickly becomes insignificant and is therefore not sustained.

In summary, theory and empirical evidence point to a negative correlation between uncertainty and economic activity. However, there is still no scientific consensus on the economic significance and duration of the impact because some of the studies differ very widely. Closing this gap in the future will require further research. Having said that, it will be useful to estimate the economic consequences of uncertainty with a standardised method and to compare them across a range of different countries.

Uncertainty poses challenges for policymakers – and opens up new opportunities

Finally, several implications can be derived from the findings presented above with the aim of mitigating the negative consequences of uncertainty.

First, before fighting its symptoms, the spotlight should be placed on the *causes* of uncertainty. For policymakers, this specifically means minimising the economic uncertainty that results from their policies. **Timely and transparent communication** to the public about imminent policies is indispensable to achieve this, as it increases predictability and reduces uncertainty for businesses and private households.

The consequences of climate change can also be a critical driver of uncertainty. This also applies to the framework for economic activity associated with climate action, such as the level of the carbon price or the type of technologies that will prevail in a carbon-neutral society. In addition, water and food shortages resulting from climate change and environmental destruction can create geopolitical tensions which, for their part, adversely impact on economic activity. The framework for a **carbon-neutral and future-oriented economy** must be established in such a way that it gives companies planning certainty, e.g. through a reliable and predictably in-

creasing carbon price, or in the form of public initial funding for promising climate technologies. This can additionally help harmonise societal goals in this field with the optimisation of individual enterprises. Carbon neutrality, environmental responsibility and sustainability play a particular role in this regard.

The *symptoms* of uncertainty can be mitigated by **economic-policy interventions**, among other things. But there is merit in being mindful of how uncertainty works. First, broad restraint means subjects respond less to monetary and fiscal policy impetus when uncertainty is high.[32] Second, the effect of uncertainty is heterogeneous and depends, among other things, on the degree of irreversibility of a subject's decision or on the degree to which it impacts on that subject. In order to be effective, relevant policies must therefore set a clear stimulus and be targeted at the same time. In order to prevent a further increase in uncertainty, interventions must first be communicated coherently and then implemented consistently. Especially when crises occur, it is necessary that policymakers send out reliable signals to the business community. These can include, for example, clear information on how long companies have access to support loans – coupled with grants where appropriate –, in what amounts and under what conditions.

To conclude, it will be necessary to strengthen the **robustness and crisis-resilience of the economy**. As a relatively open economy, Germany is not immune to global risks and drivers of uncertainty – as illustrated by the UK's exit from the EU and the trade conflict between the US and China. As foreign trade is of great importance to the German economy, it needs to expand the dense network of international trading partners further in order to better spread such risks. This could dampen the influence of global shocks somewhat because uncertainty and economic activity may be less exposed to global crisis hotspots as risk is spread more broadly. Thus, a stable economic system in Germany can help to bring more certainty into times of uncertainty.

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[4] Other distinctions between concepts are also possible. First, different forms of knowing and not-knowing can be put forward: The '*known unknowns*' can be attributed to risk, while the '*unknown unknowns*' can often be attributed to uncertainty. The second concept is that of the 'black swans' put forward by the finance researcher Nassim Nicholas Taleb. Here the metaphorical designation of uncertainty stands for a very rare event that often has a major impact. (Cf. Boeckelmann, L. and Mildner, S.-A. (2011), 'Unsicherheit, Ungewissheit, Risiko: Die aktuelle wissenschaftliche Diskussion über die Bestimmung von Risiken' (*Uncertainty, indeterminateness, risk: the current scientific debate on determining risks* – our title translation, in German only), SWP-Zeitschriftenschau, 2011/ZS 02.)

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