

Dear readers,

Everybody seems to be talking about infrastructure investments these days. Hardly a day goes by without a utility company selling its electricity grid or a municipality privatising its water supply. The arguments put forward by the buyers are often identical: they are looking for stable and secure cash flows that can be planned in the long term, that if possible do not correlate with those of other asset classes and that generate secure income even in economically uncertain times. The term “hedge against inflation” is often heard, too. But how can infrastructure fulfil these expectations? How much weighting should infrastructure be given in a portfolio and what effect does its inclusion have in terms of risks and returns? These questions are addressed in this Research LAB. After the previous edition showed that real estate and infrastructure are different asset classes, this LAB will therefore focus explicitly on infrastructure investments and the question of their underlying characteristics and the “optimal” allocation in a portfolio.

1. Infrastructure – portfolio allocation on the rise

In recent years, investments in infrastructure projects have increasingly become a focus of attention for institutional investors who are now increasingly looking for supposedly safer investments following the experiences of the financial and economic crisis. Infrastructure seems to offer this safety. Stable and secure cash flows that can be planned in the long term, that are largely detached from macroeconomic cycles and that do not correlate to the returns on other investments are considered the traditional characteristics of infrastructure investments.

Numerous studies have shown that national and international investors are seeking to increase their infrastructure allocation. For instance, the average infrastructure allocation ratio of the 1,350 investors surveyed worldwide by Preqin in 2012 is currently 4%. An average allocation of significantly more than 5% is planned. 15% of investors questioned are aiming for an allocation of between 10% and 50%, while 5% stated that they even wished to invest more than half of their assets under management in infrastructure investments.

But can infrastructure investments **fulfil the expectations** placed on them – are they actually low-risk and can they really reduce the overall risk of a portfolio through their **low correlation** with other assets? What **proportion of a portfolio** should infrastructure investments account for and what effects can be achieved by including infrastructure in the portfolio? Do infrastructure investments really offer protection from inflation due to their alleged pricing power, and what kind of investors are they suited to? These questions will be analysed and answered in the present study. Firstly, the theoretical expectations will be compared with the empirical reality and it will be shown what conclusion academic studies have come to with regard to the above questions. The study will then deal with how to structure an infrastructure portfolio at the level of the individual assets, while also addressing their specific characteristics.

Table of contents

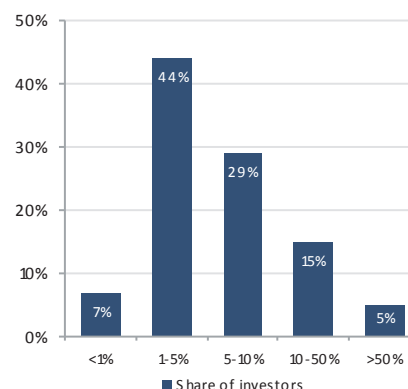
1. Infrastructure – portfolio allocation on the increase
2. The role of infrastructure in a multi-asset portfolio
3. Investing at property level
4. Summary

Infrastructure sectors

Economic infrastructure	Social infrastructure
Transportation	Healthcare
Telecommunications	Waste disposal
(Renewable) energy	Public institutions
Utilities	

Source: University of Regensburg (2012)

Infrastructure target allocations



Source: Preqin (2012)

2. The role of infrastructure in a multi-asset portfolio - characteristics and allocation

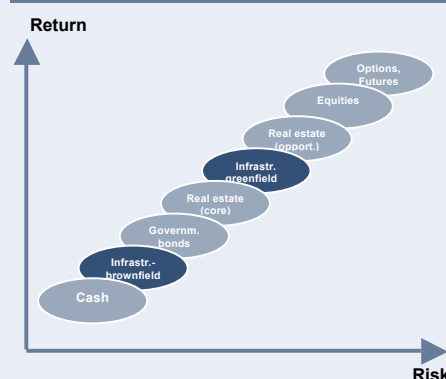
The role of infrastructure in a portfolio has been examined in several studies by the University of Regensburg analyzing both European (2012) and US (2010, 2011, 2012) infrastructure transactions. In both case, the data pool consists of a broadly diversified, transaction-based (no appraiser values and thus no “smoothing effect”) infrastructure index comprising almost 650 and 1,000 brownfield transactions respectively between 1990 and 2010 (monthly data frequency). The index was created by the Center of Private Equity Research (CEPRES) in collaboration with the University of Regensburg. The transactions are allocated to the sectors of (alternative) energy, transport, telecommunications, waste/recycling, healthcare, and construction of infrastructure. **For the first time**, the resulting prices and the associated cash flows give a valid picture of the **total return performance of direct infrastructure investments (no share or fund returns)** and their role in the portfolio. The empirical results of the studies relate to brownfield infrastructure projects. In contrast to greenfield projects, which are comparable with project developments, brownfield projects are already established on the market and generate positive cash flows. According to Preqin (2012), investors show a clear preference for brownfield investments.

First of all, here are the key findings: It is not currently possible to give a definitive answer to the question of the **optimal infrastructure allocation**. This **depends** on a number of factors such as the **definition of risk, the required return or/and the investment horizon** of the investor concerned. However, the calculated portfolio weighting is on average much higher than the current weighting of infrastructure in institutional portfolios. The effects on the portfolio depend on what assets are already included and what assets are replaced, but on the whole including infrastructure tends to **significantly reduce risks**.

The study on the basis of **European data** shows very clearly that on average infrastructure investments are **low-risk**, generate **attractive risk-adjusted returns** and do not correlate with the returns of other asset classes. The fundamental key figures are presented below:

With a **real (inflation-adjusted) average annual return of 4.15% p.a.**, infrastructure may not make a significant contribution to the portfolio performance but with a standard deviation of 3.63% it displays a very low risk. Only the returns on money market securities have lower fluctuation. Another measure of risk shown in the table is the **risk of loss**, calculated as the percentage of the (monthly) points in time between 1990 and 2010 when the real return of the infrastructure index was negative. This was the case in only 8% of all points in time. Another interesting finding is that the **expected loss** in the event of a negative return, which amounts to -1.30% annually, is **low** both in absolute terms and in comparison to the other asset classes – a result of the low range of fluctuation of infrastructure returns. The 99% value-at-risk (VaR) ratio is also a common definition of risk. This ratio indicates the loss (-2.70%) for which there is a 99% probability that it will not be exceeded within a month. On the basis

Risk/ return profiles of infrastructure



Source: IVG Research (2012)

	Return (real)	Risk (stand.-ard dev.)	Sharpe ratio	Probability of loss	Expected loss	VaR 99%
Infrastructure	4.15%	3.63%	0.48	8%	-1.30%	-2.70%
Real estate	5.00%	4.70%	0.42	18%	-15.04%	-5.56%
Gov. bond (mid-term)	4.75%	5.19%	0.37	19%	-2.67%	-3.09%
Gov. bond (long-term)	5.36%	7.80%	0.27	21%	-5.17%	-5.00%
Commod.	1.73%	22.61%	0.05	42%	-22.33%	-15.60%
Equities	6.53%	17.93%	0.14	31%	-20.35%	-14.29%
Cash	1.78%	1.02%	1.04	12%	-0.33%	-0.52%

Source: University of Regensburg (2012),
Data: CEPRES, Thomas Reuters Datastream

of this measure, too, infrastructure can be classified as a conservative asset, as the ratio is considerably lower than the values for the other assets. Only cash displays a lower risk. All of the key figures presented therefore underscore – independently of one another – the **low-risk character** of this asset class.

In addition to its low risk, the diversification potential of infrastructure is often cited as an argument for including it in a portfolio. The correlations calculated in the study confirm this hypothesis: infrastructure does not show a significant positive **correlation** with **any other asset**, meaning that this asset can make any important contribution to **portfolio diversification**. Only with money market securities is there a certain correspondence due to the generally positive returns of both assets.

The low risk and the attractive diversification potential imply an important role for infrastructure within the portfolio. This is backed up by the theoretical portfolios constructed as part of the study, which once again place a focus on infrastructure's capacity to reduce risks. Adding infrastructure to a portfolio consisting of equities, bonds, real estate, commodities and money market securities can thus **reduce risks by up to 35% with the same return**. The calculated **infrastructure allocation** here ranges **between 3% and 40%** depending on the required return. If the examination is limited to market phases in which the returns on equities were negative, i.e. phases of macroeconomic uncertainty, then the maximum theoretical infrastructure allocation increases to 47%, while the risk-reduction potential still represents up to 20% – with identical returns. This result demonstrates that, particularly for investors wishing to protect their portfolio from losses in value during phases of macroeconomic uncertainty, infrastructure represents an attractive investment option and should be added to the portfolio.

The study shows that **infrastructure returns do not correlate** with those of European **government bonds** – an important implication for investors who hold a large part of their portfolio in government bonds and are looking for diversification options. The **long-term investment character** of infrastructure is also emphasised. As the investment horizon increases, the returns generated rise relatively substantially in comparison to other asset classes – a consequence of the decreasing relative transaction costs and the low probability of loss. Investing in infrastructure therefore offers better-than-average opportunities particularly for investors with a long-term orientation.

Despite the different approaches applied, the results of the studies based on the US market do not differ fundamentally from the results in Europe as described above, but rather they also stress the importance of the asset class in a multi-asset portfolio.

- The first US study (“**Real Estate: A Victim of Infrastructure? Evidence from Conditional Asset Allocation**”, 2010) primarily deals with the question of whether and to what extent the allocation of real estate is negatively impacted by the inclusion of infrastructure (see IVG Research LAB 04/12). Although the study

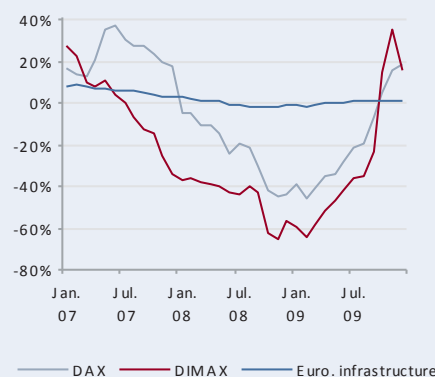
Infrastructure correlations	
Property	0.12
Govt. bonds (medium-term)	0.03
Govt. bonds (long-term)	0.02
Commodities	0.04
Equities	0.11
Cash	0.29
Govt. bonds (France)	0.03
Govt. bonds. (Spain)	0.04
Govt. bonds (Italy)	0.04

Source: IVG Research (2012)

shows that there is a slight substitution effect, the important role of both types of asset in periods of weak equity market performance is emphasised in particular. In these phases, both assets contribute to stabilising the portfolio return: whereas real estate generates relatively high returns and hardly correlates at all with other assets, **infrastructure displays very low risk and high diversification potential**, although its returns are lower than those of real estate. Simultaneous inclusion of both assets in particular therefore results in an **attractive risk/return profile, including in times of macro-economic uncertainty**.

- Another study (“**How much into Infrastructure? Evidence from Dynamic Asset Allocation**“, 2011) deals with the role of infrastructure in a multi-asset portfolio, particularly taking into account the investor’s investment horizon. Since infrastructure investments have a low risk and a relatively low return, they are mainly added to the portfolios of risk-averse investors. It is interesting to note that infrastructure can protect portfolios from a large loss in value particularly during the financial crisis – the theoretical **optimal allocation** in this period was **up to 32%**. Infrastructure’s capacity to reduce risks is therefore particularly emphasised. The authors also show that infrastructure investments become more attractive as the investment horizon increases and may also be of interest to investors who are looking for not only moderate returns. This is due to the low probability of loss, which means that no major asset losses (caused for example by extreme price slumps such as frequently occur with equities) need to be compensated. However, infrastructure is not suitable as a “return booster”.
- The most recent study (“**Infrastructure Investments in a Multi-Asset Portfolio – A Drawdown Risk Perspective**“, 2012) analyses the role of direct infrastructure investments when the reference value for risk definition is not the fluctuation in the portfolio return, but rather the difference between the portfolio value and a maximum level that was previously reached. This approach is entirely in line with the risk definition of many investors, as it explicitly examines the value of the portfolio. The results underscore the important role of infrastructure, particularly for investors with moderate return expectations. The proposed **infrastructure allocation** amounts to **up to 40%** in some cases, but fluctuates considerably over time. The results are less sensitive if **fixed payment obligations** are assumed (relevant to insurance companies, for example) and investments must cover these payment obligations. Based on this approach, the role of infrastructure in portfolios with moderate returns is emphasised once again, and the results clearly show that the asset class can make an important contribution to securing these liabilities. Another finding that is already known can also be confirmed: infrastructure does not correlate with the returns on equities when the equity market is experiencing a downturn. It therefore represents an attractive hedge against systematic equity market risk.

**European infrastructure:
Stable returns during financial crisis**



Source: University of Regensburg (2012)

The studies analysed show that diversified brownfield infrastructure investments display similar **characteristics (low risk, low return)** irrespective of the geographical focus (Europe or the US) and that they have major importance in the context of asset allocation, particularly in portfolios with moderate return expectations. Specifically, they can contribute to **reducing portfolio risk** and balancing out fluctuations on the equities market. However, it is not possible to make a definitive statement regarding the amount of the infrastructure allocation. This depends very much on the investor's definition of risk, the investment horizon and the required return. However, in the majority of cases the theoretical allocation is significantly higher than the level currently seen in most institutional portfolios.

3. Investing at property level

The information provided above shows that infrastructure investments can play an important role in the portfolio and may represent a sensible addition for many investors. However, these results are based on a very broadly diversified infrastructure portfolio that an investor is unlikely to be able to replicate. For this reason, selecting the relevant infrastructure investment(s) and analysing them in detail at asset level is obviously extremely important. This section deals with a number of questions that arise when selecting the individual investments and that are important when structuring an infrastructure portfolio.

For reasons of diversification potential, Partners Group (2012) advises **including greenfield projects** (allocation of between 20% and 25%) alongside brownfield infrastructure. It is shown that greenfield and brownfield investments have different return distributions, meaning that the inclusion of both types can contribute to portfolio diversification. Although different return distributions do not necessarily imply significant diversification effects, brownfield and greenfield projects display differing risk/return profiles, which is why diversification potential certainly cannot be entirely dismissed. Similarly to real estate project developments, greenfield projects are on average considerably more risky than brownfield investments. Therefore, global allocation of **greenfield projects** cannot be considered unproblematic despite a theoretical diversification effect. Owing to the **high risk** often involved, they are suitable only for experienced investors with an adequate risk profile. Furthermore, diversification often proves difficult with such high lot sizes and as such, there is a risk that the inclusion of greenfield projects will overstretch the portfolio's risk profile. Risk-averse investors should therefore avoid investing in greenfield projects if they do not have the relevant expertise, if there is no suitable partner available or if sufficient diversification is no longer guaranteed.

One frequently quoted argument for investing in infrastructure is the potential **hedge against inflation** – that is, a correlation between the nominal returns on an infrastructure project and the inflation rate. However, not every infrastructure project will automatically offer protection against inflation. For example, the cash flows from wind energy projects in Germany are based on fixed feed-in tariffs but the operating costs are inflation-indexed. An unexpected rise in inflation therefore represents a

Research findings on infrastructure

Infrastructure as a separate asset class

Low risk

High risk-adjusted return

No correlation with other assets

Attractive for long-term investors

Hedge against fixed payment obligations

Hedge against downturn on equity market

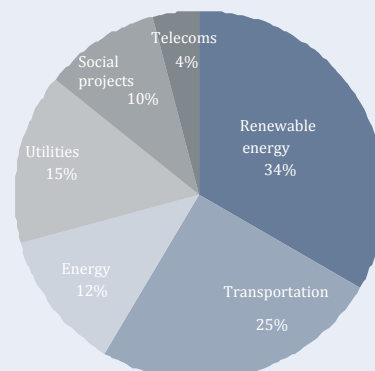
Portfolio allocation depends on:

- Target return
- Risk aversion
- Definition of risk
- Investment horizon

Theoretical allocation higher than in practise

Source: IVG Research (2012)

Infrastructure investment goals in 2011 by sector



Source: Preqin (2012)

high risk for the investor. On the other hand, the investor can benefit if inflation remains low or below expectations. Studies based on empirical data cannot confirm any general protection against inflation. JP Morgan Asset Management's analysis of 256 US core infrastructure assets in the period from 1986 to 2008 found that there was a moderate positive correlation between the cash flow growth and the inflation rate, with different infrastructure sectors also recording different values – for instance, utilities offer more protection against inflation than transport infrastructure.

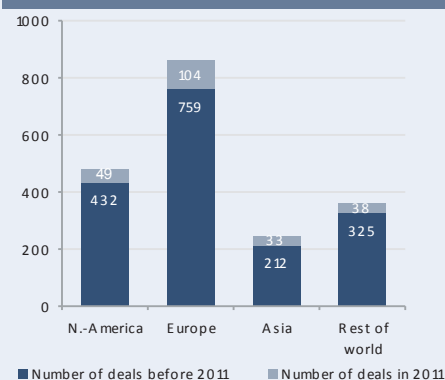
Investors who wish to **hedge against rising inflation** should primarily check how the protection against inflation is implemented. The greatest protection is afforded by contractual linking of the cash flows with the inflation rate. Wind energy projects in certain countries (UK, France, Spain, Italy) are structured in this way. However, investors should bear in mind that they may have to pay a premium for this high protection against inflation. Even if there is no contractually stipulated adjustment for inflation, there may still be protection against inflation if the operator of the infrastructure project can pass on price increases to its customers. Because high barriers to market entry, market power and low price flexibility with regard to demand are generally characteristic of infrastructure investments, there is often potential for shifting price increases. However, how fast and to what extent this can be done always depends on the contractual arrangements. If a fee adjustment cannot be enforced directly on the basis of contractual agreements, then in the event of unexpected inflation the investor will be exposed to inflation risk depending on the adjustment period.

With regard to the diversification of infrastructure investments within the portfolio, both a **geographical** and a **sectoral component** should be taken into account. According to Preqin (2012), the top 100 infrastructure investors currently still have a clear geographical preference for Europe and North America, as shown by the number of deals transacted in these regions. As regards the different sectors, there is a general preference for energy, utilities, transport infrastructure and the waste disposal industry.

Many infrastructure projects are subject to **political risk**, which is directly connected with the **geographical component**. Government regulation and guarantees are important arguments in favour of investing in infrastructure, as this is often what defines the secure nature of the asset class. However, such structures pose a not inconsiderable risk, since political changes can also have a significant impact on the general conditions for infrastructure projects. As a result of different legislation, the cash flow profiles of identical infrastructure projects may also vary considerably from country to country. For these reasons, the investor should not only diversify in terms of sector risks but should also primarily ensure diversification of geographical and political risks. On the whole, the political risks tend to be lower in industrialised nations than in developing countries. However, the investor is not entirely immune in industrialised nations either, as shown by the adjustment of the compensation structure for wind and solar power plants in Spain in 2010.

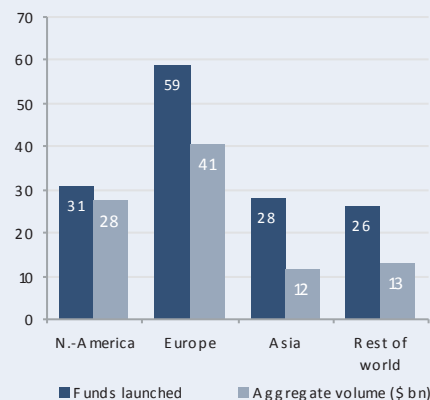
With regard to **diversification at asset level**, Partners Group (2012) ad-

Infrastructure deals by region



Source: Preqin (2012)

Non-listed infrastructure funds by region



Source: Preqin (2012)

vises that the extent to which the specific project is exposed to **demand risk** and **macroeconomic risk** should be taken into consideration. For instance, a port or airport will generally be more affected by the general economic situation than regulated energy (grid) projects or social infrastructure such as the healthcare sector. In general, however, the contractual arrangements play an important role. For example, the operator of a toll road can either be paid for provision/availability or it can generate its revenues from toll income depending on the frequency of use of the road. Whereas the first model can be considered relatively low-risk, the second is exposed to a higher systematic risk.

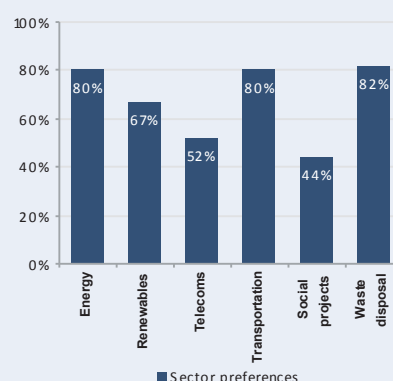
In addition, the **high degree of heterogeneity** among different infrastructure projects should also be taken into account. For instance, the characteristics of an investment in the energy sector differ substantially from those of an investment in healthcare or waste management. Distinctions must also be made within a sector: The telecommunications market is an example of a sector that has now been privatised and deregulated. The consequences of this have been competitive pressure and price cuts. So a telephone company does not necessarily have all the features of a classic infrastructure investment. A telephone network, however, does. A highly specific analysis is therefore essential.

Property-specific risks primarily relate to technical problems, although these generally occur independently of one another in different infrastructure projects and should therefore be diversifiable. With regard to diversification, wind and solar power plants should be mentioned here, since the number of hours of wind or sun is undoubtedly independent of the risks of other infrastructure projects.

As with the selection of the projects and their geographical location (greenfield vs. brownfield; emerging market vs. developed market infrastructure), the **share of external financing** depends on the investor's willingness to take risks. Because the lot sizes in the infrastructure sector are often substantial, it is usually essential to use external funds. Furthermore, a low equity share allows for greater diversification and thus less dependence on idiosyncratic property-specific risk. However, a higher share of external funds exposes the portfolio to other risks and the characteristics specific to infrastructure play less of a role as the share of external funds increases.

A precise statement as to how an efficient infrastructure portfolio should be structured cannot be made until the infrastructure market becomes more transparent. The decisive factor is the investor's expertise in the relevant sector and at the level of the individual asset. It is certainly advisable for the investor to diversify its portfolio, but not at the expense of investment expertise – at least not if the investor is involved directly at the asset level and it is not possible to include a sufficient number of investments in the portfolio.

Sector preferences of the TOP 100 infrastructure investors



Source: Preqin (2012)

4. Summary

The attention of institutional investors has shifted towards infrastructure projects in recent years due to their alleged low-risk characteristics and their cash flows that are largely independent of macroeconomic trends. However, owing to a lack of data and insufficient research, only very little is known about their actual characteristics. New studies show that **infrastructure investments** do in fact have the potential to **significantly reduce** the risk of an **investment portfolio** and **considerably improve** its **risk/return profile**. How high the **allocation of infrastructure** should be **depends** on several factors such as the **investment horizon**, the **target return**, **risk aversion** and the **definition of risk**. The theoretically calculated values for the infrastructure allocation therefore range from 0% to almost 50%. However, in particular for **conservative and risk-averse investors** who wish to **protect** their portfolios from **losses in value** during **economic downturns**, we recommend an **allocation between 10% and 20%** due to the low-risk and diversifying characteristics of infrastructure.

Some investors, particularly in the US and Canada, already hold up to 15% or more in infrastructure and are targeting values of over 20%. Many institutional investors – especially in Europe – are still considerably underinvesting in this asset class and exposing their portfolios to an overly high government bond risk. On account of its low correlation with government bonds, infrastructure can contribute significantly to portfolio diversification here as a supplementary asset.

On the basis of individual assets, investors should bear in mind that **not every infrastructure project** delivers **inflation-protected cash flows** and that the protection against inflation can be structured in different ways. Furthermore, **not all infrastructure projects are independent of macroeconomic trends and they often entail political risks**. Provided investors are aware of these facts and can control the existing risks, infrastructure investments can represent a **sensible addition to the portfolio** and should be given considerably more weighting than at present.

Sources and further reading:

IVG Immobilien AG (2011). Investment in infrastructure. The turnaround in the energy policy in Germany offers opportunities.

Dechant, Finkenzeller (2010). Real Estate: A Victim of Infrastructure? Evidence from Conditional Asset Allocation. University of Regensburg. IREBS Infrastructure Working Paper Series 2. Available on www.ssrn.com.

Dechant, Finkenzeller (2011). How much into Infrastructure? Evidence from Dynamic Asset Allocation. Forthcoming Journal of Property Research.

Dechant, Finkenzeller (2012). Infrastructure Investments in a Multi-Asset Portfolio – A Drawdown Risk Perspective. IREBS Infrastructure Working Paper Series 6. Available on www.ssrn.com.

Dechant, Finkenzeller (2012). The Effect of European Infrastructure Investments on an Institutional Multi-Asset Portfolio. University of Regensburg. IREBS study.

Partners Group Research Flash, March 2012.

Preqin Infrastructure Spotlight, January 2012.

Preqin Infrastructure Spotlight, March 2012.

Author:

Dr. Tobias Dechant
IVG Research
Zanderstrasse 5
53177 Bonn
Tel: 0228 844 418
Fax: 0228 844 6454
E-mail: research@ivg.de