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LEADING INDICATORS FOR THE REAL ESTATE MARKET

REAL ESTATE MARKETS, CONSTRUCTION ACTIVITY, MACROECONOMY, COMMODITY PRICES

RESEARCH REPORT
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Leading indicators for the real estate economy

Real estate markets, construction activity, macroeconomy, commodity prices

Real estate markets are similar to other markets and the economy in general in that they undergo cycles. These cycles are irregular in terms of their length and amplitude, however. It is always a challenge for institutional investors to align their real estate investments to new market developments. The search for, negotiation, approval and execution of transactions lead to considerable delays along the time line. The market data received on a particular day is based on decisions which have generally been taken months beforehand – and in the case of some construction projects many years ago. With this information basis market trends are often identified too late to bring about effective and efficient reactions. As real estate markets do not exist in splendid isolation from the general economic environment, leading indicators elsewhere in the economy can possibly be useful, however. This study is dedicated to the search for corresponding parameters which correlate with the real estate market and precede it where possible, therefore. Thus a number of leading indicators with striking correlations can be identified, which when taken alone do not allow for reliable conclusions to be drawn, but taken as a whole could serve as early indicators for possible developments on the real estate markets.

Inhalt

1. Use of leading indicators for decisions on investment and disinvestment

For many years now private and institutional investors have focused on real estate. In this respect there is considerable interest in a stable and economically sustainable capital investment that can be easily planned. Since the beginning of the new millennium there has been a significant increase in real estate values in virtually every European country. In this respect, their underpinning with real economic factors such as rents, incomes, economic strength and construction costs differs greatly. Time and again we see cyclical movements with market values, therefore.

Timing of portfolio restructuring

The right timing of portfolio restructuring can generate significant additional income or avoid unnecessary losses. Especially with exogenous shocks that impact on the market, triggered for example by a financial crisis or as of late by the coronavirus pandemic, there is a high degree of uncertainty with regard to future market developments. Even though it is no longer possible to hedge earlier values once a market decline has already commenced, there is at least the question of the ideal point in time for market re-entry.
The right timing for purchases and sales, as well as for far-reaching decisions in asset and portfolio management (e.g. a change of use, new lease), is thus a parameter that is decisive to success in the asset and portfolio management of institutional real estate investors. The precise implementation of this requirement is always difficult in practice. Real estate portfolios can only be amended with a major time delay and with large transaction costs. Time lags are typical for the fundamental decision-making process and for the corresponding search for, negotiation, approval and execution of real estate transactions. This means the pronounced cyclic in many real estate markets justifies the repeated purchase and sale of real estate, as well as the associated costs and workload, in arithmetical terms. However, a tactic that follows the cycle is often unsuccessful due to unfavourable timing and the corresponding loss of efficiency.
The main reason for this is the delay in the provision of information on real estate market developments. The ratios stated in the latest real estate market reports are an assessment of transactions which were initiated and executed months ago and in the case of construction projects often some years ago. New market trends and turning points are thus almost inevitably identified too late. In many cases data-related analytics have to be replaced by subjective assessments, therefore. In the case of larger portfolios and growing requirements in terms of risk management and compliance this is increasingly becoming a problem.

Leading indicators in market forecast

The development of the value of real estate on a specific market is a decisive parameter for investors and owner-occupiers (profitability, security), as well as for the remaining social and economic environment (jobs, taxes, city). A market prognosis is generally complicated by the fact that real estate values do not develop in a linear manner or in ideal cycles. Real property cycles and crisis scenarios follow a very irregular course (for European house price indices see Fig. 1). Accordingly, time series-based methods (e.g. chart-based methods) on their own are only of limited suitability for making market forecasts.

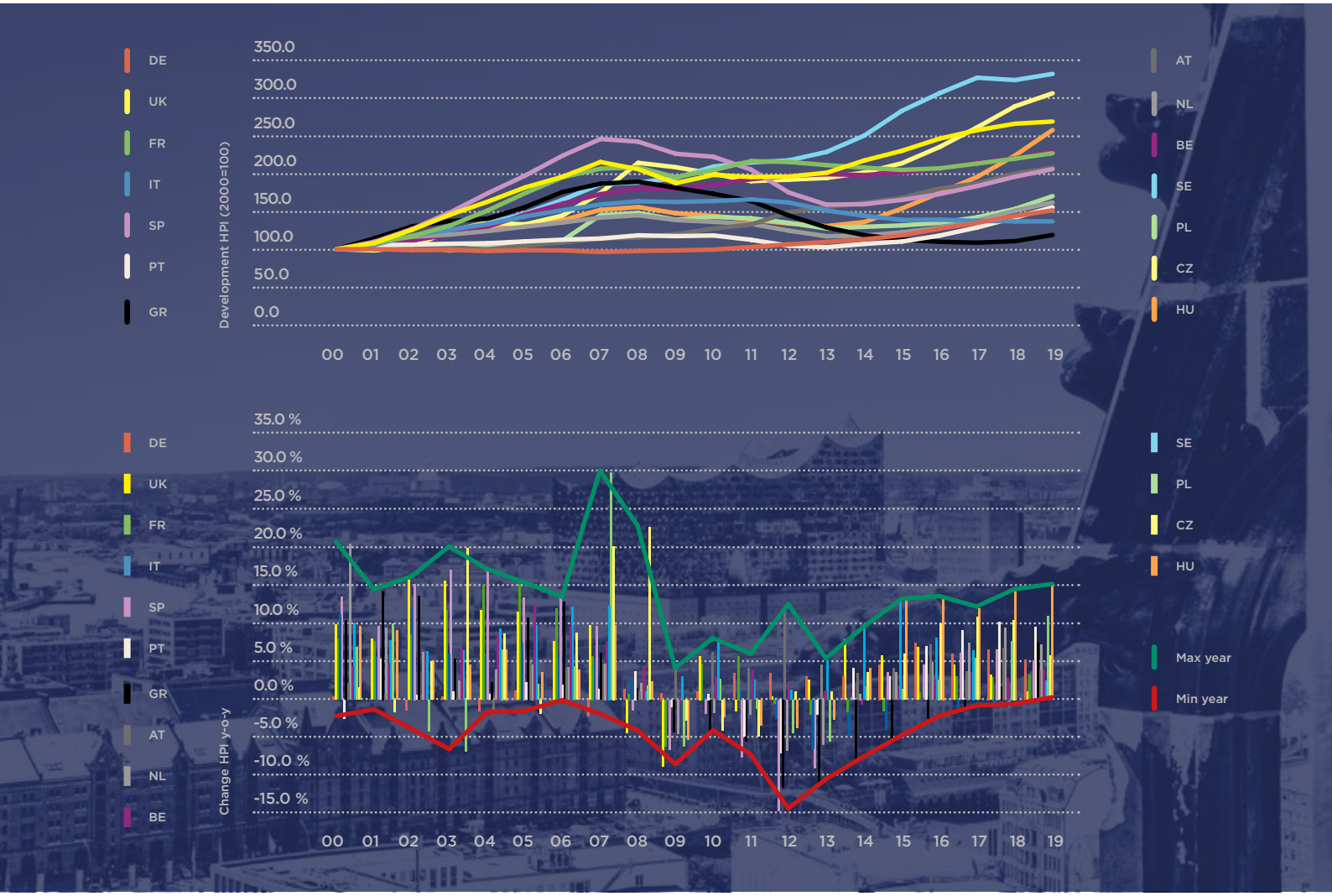


Fig. 1: Development of the house price indices in 14 European countries; source: Eurostat; own calculation and illustration.

Even with the progressive digitalisation and transparency of the real estate industry the delays in market observation cannot be eliminated completely. An appropriate reaction time in portfolio management can only be attained with other indicators that precede the actual market development. In this respect it is not individual factors which play a role but rather a number of parameters with differing levels of relevance. Accordingly, the search is one for relevant leading indicators. These have to be determined in an analytical manner.

As real estate markets do not exist in a world of their own, totally separate from other submarkets, the construction industry and the general economic environment, the existence of such leading indicators that allow for conclusions to be drawn on future developments on the real estate market appears more than probable. These indicators are to be sought in parameters that are dependent on the real estate markets or are at least closely related to these, yet also in other segments of the macroeconomy. The further away an indicator is from the real estate market in the narrower sense, the better the lead time can

be, but at the same time the interpretation of the correlation becomes more difficult. In the following a broad-based test is conducted via various data streams on the real estate market, and also using economic indicators and commodity prices. What is being sought are indicators which correlate more strongly with the real estate market and which precede these in terms of time where possible. What is not initially compulsory for this first explorative study is an actual direct causal link between the respective markets (e.g. supply chain in the construction industry, prices for newly-built houses, rents). The effects can also be indirect.

2. Indicator systems in economic and market research

The use of leading indicators is common in general economic and market research. Leading indicators for the real estate industry can thus be based on experience gathered in the course of many years and on existing models. Various research results have also been published for real estate markets in recent years. These are often only applicable to very specific sub-markets, situations or problems, however. In the following, examples are presented from both areas so as to give an impression of possible approaches and results in the determination of leading indicators.

Indicator systems on real estate market trends

Real estate market research on leading indicators is often conducted in a quantitative manner, databased therefore and using correlation and/or regression analyses. One example of this is the study by Miller and Sklarz "A note on leading indicators of housing market price trends" (1986), which examined the correlation between various real estate market parameters and the prices on the US housing market. As a result it was possible to determine a number of indicators which preceded the price development to a minor extent (by up to twelve months). The authors conclude that additional indicators from the financial sector and the real economy are necessary to predict price developments. The analysis of additional indicators for price changes on the US real estate market was the subject matter of the study by Tsolacos, Brooks and Nneji, "On the Predictive Content of Leading Indicators: The Case of U.S. Real Estate Markets" (2014). Among the aspects evaluated were the "Conference Board leading economic index" and the "OECD leading indicator" for the development of rents. Tests were conducted with various additional models which also differentiate between market phases (Probit and Markov switching approaches). For certain indicators it was possible to see that these preceded the real estate market by as much as eight quarters. A number of German studies on the housing market have a more long-term approach. Thus Dick/Westerheide (ZEW) considered "Determinanten für die langfristige Wertentwicklung von Wohnimmobilien" [Determinants for the long-term value development of residential real estate] (2010), whereby above all structural and long-term factors such as demographics play a role here. Short-term market developments are not taken into account, therefore.

The analysis of indicators less closely related to the market, such as commodity prices in relation to real estate prices, can produce leading indicators in certain macroeconomic constellations. Thus in "Commodity House Prices" (2013) Leung, Shi and Tang examined the residential markets in Australia and New Zealand. Two economies with a high proportion of commodity exports and the corresponding price sensitivity were examined, therefore. The authors noted a fundamental relationship between commodity markets and real estate markets. In the two economies an increase in commodity prices led at least indirectly to positive income shocks. Via va-

rious macroeconomic parameters and causal chains there are coupling effects to the local real estate markets.

Other indicator systems are geared to establishing price bubbles and market risks. In his study "Is the Housing Bubble Collapsing? 10 Economic Indicators to Watch" (2006) Baker pointed out ten indicators which can signal an overheating of the US residential real estate market. Alongside transaction figures (single-family homes), these also included applications for mortgage loans, vacancies and the employment levels in business sectors closely related to the real estate markets. Such indicator systems are also useful in current observations of the economy and its management by politicians and administrators. Thus, DIW Berlin developed a corresponding early-warning system for the Federal Ministry of Finance (cf. Dreger/Kholodilin, "Spekulative Preisentwicklung an den Immobilienmärkten: Elemente eines Frühwarnsystems", [Speculative price development on the real estate markets: Elements of an early-warning system] 2011). The parameters used include various interest rates, price-income ratios related to the real estate market, credit and money supply growth, as well as public indebtedness ratios. The system works with various threshold values, which indicate a critical status if surpassed and encourage reactions at a political-fiscal level.

These and other real estate sector studies (Fig. 2) display very interesting correlations. Unfortunately the points of reference are very specific and it is scarcely possible to make any generalisations. Outside of the specific models and designated uses there are hardly any leading indicators that may be used in a flexible manner and which are stable in the medium term at least for real estate markets.

AUTHOR/SOURCE	TITLE	CONTENT/INDICATORS
Miller, Sklarz; The Journal of Real Estate Research Vol. 1, No. 1 (1986)	**A Note On Leading Indicators of Housing Market Price Trends**	Study of the relationship between various real estate market parameters (incl. sales volume, number of sold vs. listed properties in a specific period) and the price trends on the US housing market; determination of leading predictive qualities for price developments for as much as twelve months; observation and analysis of other indicators from the financial sector and the real economy noted as being significant for the prediction of price developments
Baker; CEPR Issue Brief (2006)	**Is the Housing Bubble Collapsing? 10 Economic Indicators to Watch**	Presentation of ten indicators to predict developments on the US residential housing market; including time series on apartment construction, on employment levels in areas closely related to the real estate sector, house price index
Dick, Westerheide; ZEW-Gutachten (2010)	**Determinanten für langfristige Wertentwicklung von Wohnimmobilien** **[Determinants for the longterm value development of residential real estate]**	Demographic developments of particular significance (incl. development of population and household figures, increasing burden of taxes as a consequence of society aging), other determinants are the development of housing supply, financing conditions etc.

Dreger, Kholodilin; DIW Wochenbericht Vol. 78 (2011)	**Spekulative Preisentwicklung an den Immobilienmärkten: Elemente eines Frühwarnsystems** **[Speculative price development on the real estate markets: Elements of an early-warning system]**	Development of an early-warning system by DIW Berlin on behalf of the Federal Ministry of Finance; diagnosis of price development and forecasting of speculative price-jumps on the basis of various parameters, e.g. credit growth, development of per capita GDP, public budget deficit ratio, liquidity growth
Beracha, Wintoki; The Journal of Real Estate Research Vol. 35, No. 3 (2013)	**Forecasting Residential Real Estate Price Changes from Online Search Activity**	Study of the extent to which online searches (Google Search) with the words "real estate" or "rent" in combination with the name of a location can be used to predict extraordinary price developments in a city; consequently the intensity of online search queries can be used to establish a deviation (upward or downward) from the average price development on the US market
Leung, Shi, Tang; Regional Science and Urban Economics 43 (6) (2013)	**Commodity House Prices**	Study of the impact of a change in commodity prices on house prices in economies dependent on commodities (ones which primarily export raw materials – Australia, New Zealand); highlighting of the fundamental significance of price movements for raw materials, increases have the same effect as positive income shocks, energy raw materials generally have an indirect impact on macroeconomic parameters, other raw materials have a more direct impact on local house prices
Tsolacos, Brooks, Nneji; The Journal of Real Estate Research Vol. 36, No. 4 (2014)	**On the Predictive Content of Leading Indicators: The Case of U.S. Real Estate Markets**	Study of the predictive ability of index series (incl. Conference Board leading economic index, OECD leading indicator) for changes in rents on the US real estate market on the basis of various models (Probit and Markov switching approaches); consequently Conference Board leading economic index has the most exact forecasts on changes in direction of rent movements, models in part as much as eight quarters in advance
Ferrari, Pirovano, Cornacchia; European Systemic Risk Board, Occasional Paper Series No. 8 (2015)	**Identifying early warning indicators for real estate-related banking crises**	Search for and assessment of suitable early warning indicators for real estate-related banking crises at EU level as well as for individual countries; test of a number of indicators (e.g. credit growth of private households, money supply growth, GDP growth in real terms, ratio of bank loans to GDP, public indebtedness, average mortgage interest rate); the best performers are combinations of variables in the framework of multivariate logit models for the early identification of crises; in particular structural real estate price variables (incl. price-income gap), inflation, short-term money market variables and credit variables identified as good indicators

Marcato, Nando; The Journal of Real Estate Research Vol. 38, No. 2 (2016)	**Information Content and Forecasting Ability of Sentiment Indicators: Case of Real Estate Market**	Test of the predictive ability of sentiment indicators for the US real estate market on the basis of VAR models; along-side macroeconomic variables (GDP growth rate in real terms, change in consumer price index etc.), sentiment indicators such as procurement manager index, index on the mood on the housing market etc. are included in models; these increase the predictive ability of the tested models for development on real estate markets, primarily restricted to the residential segment
Wang et al.; International Journal of Computational Intelligence Systems Vol. 13, No. 1 (2020)	**Urban Real Estate Market Early Warning Based on Support Vector Machine: A Case Study of Beijing**	Construction of a prediction model (support vector machine model) for locations on the housing market in Peking; among the parameters used as early-warning indicators were the ratio of real estate development investments to GDP, ratio of real estate investments to fixed assets, growth rates of residential real estate prices

Fig. 2: Selected studies on real estate sector indicator systems.

Indicator systems for economic development

In general economic research the models and findings on leading indicators are, as is to be expected, more diverse, more detailed and often also more well-founded than in the specific segment real estate. Here there is verifiable research going back about one hundred years. As long ago as at the beginning of the 1920s the "Harvard Barometer" was designed, an instrument to assess the US economy and predict developments. A number of leading, coincident and lagging economic indicators were integrated here. This system was not able to predict the global economic depression of 1929, however. It did initiate a number of global research projects in the field of economic indicators and early-warning systems (see Winker, "Empirische Wirtschaftsforschung", [Empirical Economic Research], 1997). In the determination of indicators – also – relevant to the real estate market a number of studies offer interesting models.

For Germany, for example, in the HWWA paper from 2003 "Prognoseleistung von Frühindikatoren: Die Bedeutung von Frühindikatoren für Konjunkturprognosen – Eine Analyse für Deutschland" [Predictive ability of leading indicators: The significance of leading indicators for economic forecasting – An analysis for Germany] Hinze studied the suitability of leading indicators and the quality of indicator systems. In doing so quality yardsticks were developed for leading indicators (incl. fundamental context, lead time, stability, availability) and these were then compared with well-established indicator systems (incl. survey-based systems such as business climate, statistical analyses on incoming orders). In this way leading indicator properties of the regularly published ifo business expectations vis-a-vis the gross domestic product and industrial output could be shown. This lead time amounts to a number of months at most, a period that is too short to be transferred to real estate market decisions. In general this is probably also the case for other opinion- and survey-based indicators as these sentiments are usually based on economic changes that are already clearly perceptible.

The results in a study by Santero and Westerlund, "Confidence Indicators and Their Relationship to Changes in Economic Activity" (1996), are to be seen in a similar light. This compares the predictive ability of consumer and corporate surveys on the economic cycle

in a number of economies. The predictive ability differs from country to country. At the same time it is established that it is generally only possible to forecast significant changes in a meaningful manner using survey techniques. This classification is confirmed by Kholodilin and Kooths in "Konjunkturelle Frühindikatoren in der Krise: Weiche Fakten stärker als harte" [Leading economic indicators in the crisis: Soft facts are stronger than hard facts] (2009). Accordingly, survey-based indicators are above all of use in economically turbulent times. Calmer economic phases, in contrast, are better recorded with more complex and quantitative prognosis models.

Concrete ratio prognoses are modelled more frequently for aggregated economic parameters such as GDP. Thus Grasmann and Keereman looked at the topic "An indicator-based short-term forecast for quarterly GDP in the euro area" (2001). Using OLS estimates (ordinary least squares) it was possible to determine the quarterly development of GDP relatively well. Indicators included exchange rates, passenger vehicle sales, survey results (retail trade, construction industry) as well as key data for bonds (e.g. spread Germany and USA with 10-year government bonds). In an expanded observation in "Leading Indicators in a Globalised World" (ECB Working Paper, 2009) Fichtner / Rüffer / Schnatz used not only regional indicators but also international parameters and thus optimised the prognosis for the respective domestic industrial production.

An interesting research approach is the evaluation of internet texts, publications and other texts. A recent study by Kalamara et al. "Making text count: economic forecasting using newspaper text" (2020) searched articles and keywords from three British daily newspapers (The Guardian, The Daily Mirror, The Daily Mail). Specific relevant words/word groups (e.g. "uncertainty") are counted and processed using machine learning processes. The objective is the forecasting of macroeconomic key indicators such as GDP, inflation and unemployment levels using text-based predictions. This alternative form of forecasting can attain good results in particular with upcoming crises.

AUTHOR/SOURCE	TITLE	CONTENT/INDICATORS
Santero, Westerlund; OECD Economics Department Working Papers No. 170 (1996)	**Confidence Indicators and Their Relationship to Changes in Economic Activity**	Study of the predictive quality of consumer and corporate surveys on trade cycles and output in various economies, corporate surveys have advantages over consumer surveys, degree of predictive ability varies from country to country, mostly only clear output changes can be anticipated in corresponding survey results
Fritsche, Stephan; DIW Discussion Paper No. 207 (2000)	**Leading Indicators of German Business Cycles: An Assessment of Properties**	Test of a number of putative leading indicators (e.g. ifo Business Climate Index, new orders in the manufacturing industry, short- and long-term interest rates, money supply) to a reference series for industrial production; in particular ifo indicators and series for new orders promising, others only with little predictive ability; VAR model with four best indicators only suitable with a lead time of up to three months

Grasmann, Keereman; European Commission Economic Paper No. 154 (2001)	**An indicator-based short-term forecast for quarterly GDP in the euro area**	Quarterly GDP prognosis on the basis of various indicators (incl. effective exchange rate in real terms, vehicle sales, survey on status in retail trade and construction sector, spread between German and US bonds); generally promising results on the basis of OLS estimates
Hinze; HWWA Discussion Paper 236 (2003)	**Prognoseleistung von Frühindikatoren: Die Bedeutung von Frühindikatoren für Konjunkturprognosen - Eine Analyse für Deutschland [Predictive ability of leading indicators: The significance of leading indicators for economic forecasting – An analysis for Germany]**	General study of the requirements placed on leading indicators and their quality for predictions (e.g. ifo Business Climate Index, Early Bird Indicator); suitable for short-term forecasts based on the current status; other than this generally only suited to a limited degree to deriving conclusions on developments in the real economy
Fichtner, Rüffer, Schnatz; ECB Working Paper Series No. 1125 (2009)	**Leading Indicators in a Globalised World**	Study of the predictive ability of OECD composite leading indicators (CLI) for eleven countries, in addition to country-specific series and their predictive ability for the respective industrial production, the value added of the implementation of international indicators to forecast domestic development is also tested; models with CLI generally prove themselves to be suitable or better alternatives to tested benchmark models, above all with a lead time of four to eight months better results, the inclusion of international CLI series improves forecasts for some countries, in particular over the observed time periods, increasing impact of globalisation in the national context is highlighted
Kholodilin, Kooths; DIW Wochenbericht Nr. 21 (2009)	**Konjunkturelle Frühindikatoren in der Krise: Weiche Fakten stärker als harte [Leading economic indicators in the crisis: Soft facts are stronger than hard facts]**	Creation of a meaningful leading indicator system; comparison of the projection quality of hard and soft indicators; disaggregated method with leading indicators at sector level perform best, survey-based indicators have advantages in times of a turbulent economy, more comprehensive models in calmer times

Drechsel, Giesen, Lindner; IWH Discussion Papers 4 (2014)	**Outperforming IMF Forecasts by the Use of Leading Indicators**	Study of possible improvements to the IMF World Economic Outlook taking into consideration individual leading indicators (e.g. world trade, oil price, OECD leading indicators, global industrial production) for the entire world, as well as separately in advanced economies and developing countries; in general improvements to IMF forecasts can be attained with series observed in the course of a year (on a monthly basis), however there are differing results for advanced and emerging economies
Galli; SNB Working Papers Issue 08 (2017)	**Which indicators matter? Analyzing the Swiss business cycle using a large-scale mixed-frequency dynamic factor model**	Construction of an index for the monthly illustration of the Swiss economy as an alternative to consideration of GDP, based on a broad compilation of available monthly and quarterly indicators (total of 17 indicator categories, incl. GDP, labour market, construction sector, retail trade sector, financial markets, consumption, banking sector, each with numerous variables); broad indicator set proves to be useful in the factor model for forecasting the Swiss business cycle, taking into account variables from other economies as well as the financial sector predicts Swiss GDP development better than a model merely based on domestic indicator series not closely related to the financial markets
Garnitz, Lehmann, Wohlrabe; cesifo Working Paper Series (2019)	**Forecasting GDP all over the world using leading indicators based on comprehensive survey data**	GDP prognosis in a sample of 44 countries and three country aggregates (EU27, eurozone, world) on the basis of leading survey data from the ifo World Economic Survey (WES); on average WES indicators perform better than autoregressive benchmark models, inclusion of WES indicators for the three most important trading partners often improve the forecast for the respective domestic GDP development
Kalamara et al.; Bank of England Staff Working Paper No. 865 (2020)	**Making text count: economic forecasting using newspaper text**	Forecasting of macroeconomic key parameters such as GDP, inflation, level of unemployment by analysing articles (editorials, comment pieces/ opeds) in three British daily newspapers (The Guardian, The Daily Mirror, The Daily Mail); test of various methods from simply counting certain words/word groups (e.g. uncertainty) through to a combination of machine learning processes; text-based forecasts with good performance, in particular with upcoming crises

Fig. 3: Selected studies on economic indicator systems.

3. Explorative approach to find leading indicators

From the experiences with and approaches to economic and business research, and also from various real estate market studies, it is possible to derive potential indicators for which one would assume there to be correlations to the real estate market. The corresponding tests are necessary to rank the relevance. In the framework of this study numerous data series have been gathered and analysed to this end, not only on the real estate market in the narrower sense, but also on the economic environment, such as economic development, the prices for raw materials, transportation, the labour market and energy.

Derive leading indicators from extended cause-effect chains

The studies and indicator systems presented above show two largely independent research areas to date: on the one hand there is extensive real estate market-related research, which is devoted intensively to parameters such as rents, purchase prices, vacancies, letting performance, absorption, transaction volume etc. and which explains the corresponding correlations. On the other hand, there is the large field of macro-economic research, which is conducted by numerous institutes and qualified economists and which considers factors from all areas of the economy, and in particular from the labour, financial and commodity markets. Interdependence and thus also in part leading indicators are discussed within the respective research fields. Above all in the field of real estate research the lead time is usually very short and thus scarcely allows for any timely analysis, decision or reaction on the part of the investor. What would be interesting is a combination of the respective cause-effect chains which are the subject of research in both fields. Based on the following approach the two research areas are to be considered holistically, and interlinked with one another therefore (Fig. 4):

Fig. 4: Principle for the ascertainment of leading indicators using an inductive approach.

Typically there is a correlation between the economic strength of a location and its real estate market. Although the absolute price levels for rents and purchase prices cannot be computed directly from income and purchasing power ratios, because numerous location-specific factors such as commuter flows, the attractiveness of the city/town, and real estate offerings in the region likewise have an effect. Above all the impact of the regional economic strength as an individual parameter is often strong enough to generate corresponding amendments in supply and demand in the event of changes, and thus affect real estate prices and rents at a location. The interdependencies can in some cases only partially be visible and/or with a time lag. Nevertheless, a trend reversal, for example in per capita GDP (an expression of the economic strength of the location therefore), would also be an important signal for the real estate market.

A fundamental benefit of the extension of the real estate market analysis to the upstream economic and socioeconomic environment is that interesting ratios, prognosis systems and publications are generally available there in greater numbers, more frequently and earlier than for the real estate market in the narrower sense. Fundamentally the use of economic forecasts or the components therein for the real estate markets has an excellent outlook for success. In detail, leading indicators which are already used in these systems are interesting. It may be possible to use these to draw a direct inference on the real estate market (shortening of the causal chains by "skipping" the general economic model).

Test of various real estate and macroeconomic time series

In an extensive indicator test various data series are compared using correlation analysis. For the real estate market the house price index (HPI) and construction costs index (CCI) from Eurostat and the rent index (RI) of the OECD for 14 European real estate markets were used.

The macroeconomic and socioeconomic indicators are based on various data series incl. on GDP in real terms, import/export of goods, private consumption, unemployment rates, number of working hours per person employed, residential construction approvals, haulage and transportation figures (e.g. container transhipment), passenger vehicle registrations, prices for raw materials and energy (e.g. coal, diesel, natural gas, aluminium, iron ore), as well as interest rates. Insofar as possible country-specific series were utilised, in all other cases the relevant world market prices. The primary sources used were the publicly-accessible databases of the OECD, Eurostat and IndexMundi. The underlying data were fundamentally available with just a few exceptions from the year 2000 onwards. An overview of the tested parameters is shown in Fig. 5.

INDICATOR	COUNTRIES	YEARS	SOURCE
House price index	14 of 14	2000-2019	Eurostat
Construction costs index residential building	14 of 14	2000-2019	Eurostat
Rent index	14 of 14	2000-2019	OECD
Construction approvals (apartments in apartment buildings)	14 of 14	2000-2016	Eurostat
GDP (chain-linked volume)	14 of 14	2000-2019	Eurostat
Industrial production	14 of 14	2000-2019	OECD
Working hours per person employed	14 of 14	2000-2019	OECD

Gross income (couple, two incomes, each 100% of average, two children)	14 of 14	2000-2019	Eurostat
Number of persons in employment (15-64 years)	14 of 14	2000-2019	Eurostat
Employees (15-64 years)	14 of 14	2000-2019	Eurostat
Unemployment rate (15-74 years)	14 of 14	2000-2019	Eurostat
Imports of goods	14 of 14	2000-2019	OECD
Exports of goods	14 of 14	2000-2019	OECD
Private consumption spending	14 of 14	2000-2019	OECD
Overnight stays in accommodation facilities for tourists	14 of 14	2000-2018	Eurostat
Retail trade turnover	14 of 14	2000-2019	Eurostat
Number of construction companies	13 of 14	2005-2018	Eurostat
Producer prices (output) manufacturing industry	14 of 14	2000-2019	OECD
Investment in domestic transport infrastructure	14 of 14	2000-2017	OECD
Passenger vehicle registrations	14 of 14	2000-2019	OECD
12-month Euribor	14 of 14	2000-2019	Deutsche Bundesbank
1-month Euribor	14 of 14	2000-2019	Deutsche Bundesbank
Road haulage	8 of 14	2000-2018	Eurostat
Rail freight	13 of 14	2003-2018	Eurostat
Rail passenger traffic	12 of 14	2004-2018	Eurostat
Index container transhipment (ca. 60% of global transhipment)	14 of 14	2007-2019	RWI/ISL
Primary energy consumption	9 of 14	2000-2019	Federal Ministry for Economic Affairs and Energy (BMWi)
Passenger transport (domestic total)	10 of 14	2000-2018	OECD
Coal (price/t)	14 of 14	2000-2019	IndexMundi
Benzene (price/gallon)	14 of 14	2000-2019	IndexMundi
Diesel (price/gallon)	14 of 14	2000-2019	IndexMundi
Natural gas (price/million BTU)	14 of 14	2000-2019	IndexMundi
Crude oil (price/barrel)	14 of 14	2000-2019	IndexMundi
Heating oil (price/gallon)	14 of 14	2000-2019	IndexMundi
Kerosene (price/gallon)	14 of 14	2000-2019	IndexMundi
Propane (price/gallon)	14 of 14	2000-2019	IndexMundi
Iron ore (price/t)	14 of 14	2000-2019	IndexMundi
Steel (price/t)	14 of 14	2000-2019	IndexMundi
Aluminium (price/t)	14 of 14	2000-2019	IndexMundi
Copper (price/t)	14 of 14	2000-2019	IndexMundi
Nickel (price/t)	14 of 14	2000-2019	IndexMundi
Zinc (price/t)	14 of 14	2000-2019	IndexMundi
Tin (price/t)	14 of 14	2000-2019	IndexMundi
Lead (price/t)	14 of 14	2000-2019	IndexMundi
Gold (price/troy ounce)	14 of 14	2000-2019	IndexMundi
Silver (price/troy ounce)	14 of 14	2000-2019	IndexMundi

Uranium (price per pound)	14 of 14	2000-2017	IndexMundi
Plywood (price/sheet)	14 of 14	2000-2019	IndexMundi
Standing timber (price/m^2)	14 of 14	2000-2019	IndexMundi
Sawn timber (price/m^2)	14 of 14	2000-2017	IndexMundi

Fig. 5: Overview of reference values used and tested indicators.

In an automated test procedure all the relevant combinations for the development of the real estate market and the respective available parameters are evaluated. Preference is given to the use of national information, and alternatively to multi-country information. From case to case the respective rates of change are calculated from stock figures. Additional scenarios and variants contain correction factors in the form of time lags (alongside concurrent series also preceding the parameter by one and two years), exchange rates and inflation.

4. Correlation of real estate prices among various countries

In the first segment correlations are tested within 14 selected European real estate markets. A comparison is made of the respective change in the house price index. International economic interdependence and investment-related arbitrage effects would lead one to expect reciprocal effects and in particular between similar and neighbouring locations. Of interest are possible lead times, which can also be portrayed with a time lag of one and of two years.

In a comparison of the neighbouring states Germany and Austria there is an arithmetical correlation coefficient of 0.53. As the graphic analysis shows (Fig. 6) the markets do not fundamentally develop in parallel, there are also phases in which there are significant discrepancies in the dynamism. Close economic interdependence does not necessarily have to be accompanied by uniform developments on the real estate market, therefore.

Impressive is the much stronger correlation between France and the neighbouring Belgium. The house price indices appear to develop almost concurrently, the correlation coefficient amounts to 0.91. What can also be seen is a certain lead on the part of France. With a time lag of one year the correlation is still high at 0.60. The market development in France can thus definitely serve as a leading indicator for Belgium.

A similar picture is seen in the comparison between France and Spain, likewise also closely linked markets located next to one another. Here too the correlation is high at c=0.78 in the concurrent consideration. With a shift of the Spanish market by one or two years ahead the correlations are c=0.77 and c=0.63, respectively. It is to be assumed that there is a regular lead of the real estate values on the Iberian peninsula compared to those in France.

In the combination of both market interrelationships (Spain ▸ France; France ▸ Belgium) the Spanish market development is thus also a leading indicator for Belgium. The correlation coefficients in all three national market interrelationships are higher than 0.70 (see correlation table Fig. 7).

Fig. 6: Correlation of real estate markets (on the basis of the HPI) based on various examples; source: Eurostat; own calculation and illustration.

Other strong correlations are displayed by the markets of Great Britain and the Netherlands, by Greece and Italy, as well as by Hungary and Portugal. The countries with strong correlations do not always border on one another. Real economy correlations may also be derived from similar economic structures, an analogous proneness to crises and also distinctive trade relationships and labour markets. Above all leading markets are of interest for investors. For the phase of economic recovery and the related recovery of real estate markets Greece is conspicuous, for example; here there was a certain lead time over Italy. When the comparisons are viewed as a whole we repeatedly see a faster reaction by the markets in Spain and Great Britain. In several but by no means in all country combinations these can provide early signals for other markets.

All the other correlations are shown in Fig. 7 (correlations of |c| = 0.4 and greater highlighted). The calculated values relate to the study period between 2000 and 2018. The overriding image is one of pronounced parallelism of the market developments. Markets with clear lead times are rare. Suitable leading indicators have to be sought elsewhere, therefore, e.g. in other segments of the real estate industry and in upstream markets.

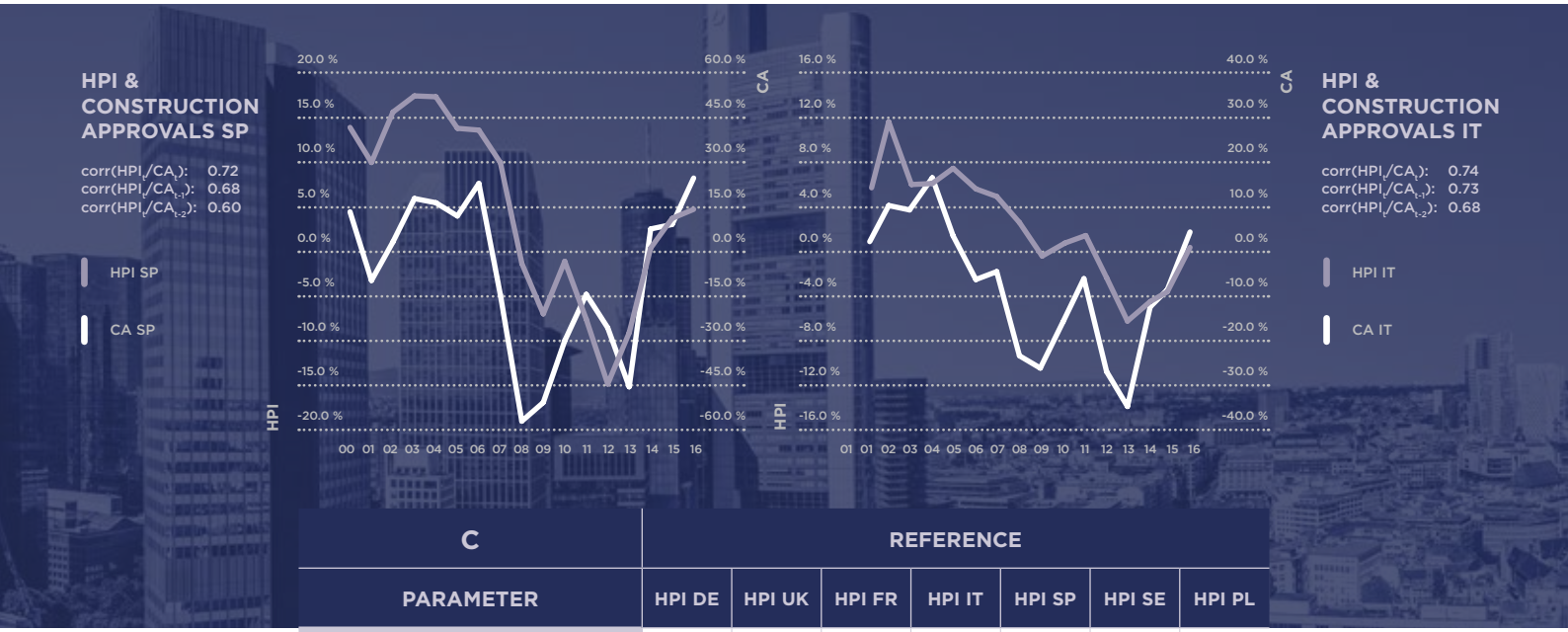
REGION/ COUNTRY (PARAMETER)		REGION/COUNTRY (VARIABLE)												
		DE	UK	FR	IT	SP	PT	GR	AT	NL	BE	SE	PL	CZ	HU
DE	Concurrent	1	-0.38	**-0.52**	**-0.66**	**-0.40**	**0.47**	**-0.49**	**0.53**	-0.04	**-0.53**	-0.39	-0.17	-0.06	0.34
	Time Lag -1 Year		-0.28	**-0.47**	**-0.62**	-0.29	**0.50**	-0.37	**0.45**	0.02	**-0.51**	-0.28	0.04	-0.10	**0.42**
	Time Lag -2 Years		-0.10	-0.36	**-0.56**	-0.17	**0.63**	-0.28	0.38	0.09	-0.38	-0.31	0.18	0.09	**0.53**
UK	Concurrent	-0.38	1	**0.72**	**0.58**	**0.79**	0.07	**0.53**	-0.37	**0.45**	**0.58**	**0.62**	0.18	0.19	0.37
	Time Lag -1 Year	-0.30		**0.70**	**0.60**	**0.77**	0.15	**0.62**	**-0.62**	**0.53**	**0.68**	0.36	0.19	**0.50**	**0.44**
	Time Lag -2 Years	**-0.43**		**0.49**	**0.62**	**0.67**	0.17	**0.65**	-0.32	**0.47**	**0.60**	0.30	0.29	0.34	0.34
FR	Concurrent	**-0.52**	**0.72**	1	**0.78**	**0.78**	-0.03	**0.71**	**-0.45**	**0.42**	**0.91**	0.38	0.21	0.11	0.16
	Time Lag -1 Year	**-0.61**	**0.41**		**0.70**	**0.58**	-0.17	**0.69**	-0.31	0.28	**0.87**	0.25	0.28	0.26	0.05
	Time Lag -2 Years	**-0.71**	0.25		**0.48**	0.39	-0.10	**0.53**	-0.27	0.01	**0.65**	0.23	0.27	**0.41**	-0.11
IT	Concurrent	**-0.66**	**0.58**	**0.78**	1	**0.75**	-0.12	**0.85**	**-0.51**	**0.59**	**0.73**	0.29	0.20	0.12	0.14
	Time Lag -1 Year	**-0.72**	0.38	**0.70**		**0.57**	-0.18	**0.72**	**-0.50**	0.29	**0.69**	0.13	0.12	0.23	-0.08
	Time Lag -2 Years	**-0.88**	0.35	**0.60**		**0.46**	-0.29	**0.55**	**-0.52**	0.04	**0.62**	0.08	0.10	0.15	-0.28
SP	Concurrent	**-0.40**	**0.79**	**0.78**	**0.75**	1	0.36	**0.83**	**-0.62**	**0.72**	**0.70**	**0.52**	0.35	0.37	**0.58**
	Time Lag -1 Year	**-0.44**	**0.49**	**0.77**	**0.77**		0.30	**0.84**	**-0.54**	**0.57**	**0.81**	0.28	**0.41**	**0.46**	**0.45**
	Time Lag -2 Years	**-0.57**	0.25	**0.63**	**0.74**		0.11	**0.75**	-0.39	0.31	**0.77**	0.08	0.27	0.37	0.11

PT	Concurrent	**0.47**	0.07	-0.03	-0.12	0.36	**1**	0.28	-0.14	**0.44**	-0.01	-0.03	0.37	0.37	**0.77**
	Time Lag -1 Year	0.24	0.02	0.09	0.30	**0.44**		**0.43**	-0.16	**0.69**	0.07	-0.06	0.30	0.22	**0.66**
	Time Lag -2 Years	0.13	-0.02	0.23	0.29	0.30		**0.47**	-0.01	**0.49**	0.19	-0.23	0.38	0.17	**0.47**
GR	Concurrent	**-0.49**	**0.53**	**0.71**	**0.85**	**0.83**	0.28	**1**	**-0.51**	**0.71**	**0.71**	0.31	0.38	0.19	**0.42**
	Time Lag -1 Year	**-0.70**	0.45	**0.63**	**0.87**	**0.71**	0.01		**-0.54**	**0.48**	**0.65**	0.20	0.32	**0.41**	0.19
	Time Lag -2 Years	**-0.78**	0.31	**0.58**	**0.81**	**0.55**	-0.19		**-0.61**	0.35	**0.56**	0.07	0.19	0.31	-0.06
AT	Concurrent	**0.53**	-0.37	**-0.45**	**-0.51**	**-0.62**	-0.14	**-0.51**	**1**	-0.37	-0.32	-0.26	-0.05	-0.26	-0.16
	Time Lag -1 Year	**0.47**	**-0.43**	**-0.51**	**-0.69**	**-0.57**	0.10	**-0.51**		-0.35	**-0.46**	-0.26	0.01	0.02	-0.07
	Time Lag -2 Years	**0.46**	-0.36	**-0.71**	**-0.67**	**-0.52**	0.13	**-0.62**		-0.28	**-0.69**	-0.33	0.00	0.05	0.01
NL	Concurrent	-0.04	**0.45**	**0.42**	**0.59**	**0.72**	**0.44**	**0.71**	-0.37	**1**	0.31	0.29	**0.47**	0.20	**0.75**
	Time Lag -1 Year	-0.20	0.28	0.39	**0.67**	**0.61**	0.33	**0.82**	**-0.40**		0.33	0.06	0.34	0.14	**0.54**
	Time Lag -2 Years	**-0.48**	**0.41**	**0.47**	**0.77**	**0.61**	0.16	**0.79**	**-0.51**		0.38	-0.03	0.14	0.14	0.24
BE	Concurrent	**-0.53**	**0.58**	**0.91**	**0.73**	**0.70**	-0.01	**0.71**	-0.32	0.31	**1**	0.39	0.30	0.23	0.13
	Time Lag -1 Year	**-0.62**	0.24	**0.60**	**0.64**	**0.49**	-0.15	**0.63**	-0.28	0.26		0.23	0.31	0.39	-0.03
	Time Lag -2 Years	**-0.77**	0.07	0.29	**0.47**	0.31	-0.12	**0.50**	-0.32	0.12		0.24	**0.45**	0.34	-0.12
SE	Concurrent	-0.39	**0.62**	0.38	0.29	**0.52**	-0.03	0.31	-0.26	0.29	0.39	**1**	0.34	0.04	0.25
	Time Lag -1 Year	-0.14	0.35	0.34	**0.44**	**0.45**	0.17	**0.41**	-0.22	**0.46**	**0.42**		0.38	**0.45**	0.38
	Time Lag -2 Years	-0.10	-0.11	0.03	0.39	0.28	0.24	**0.44**	-0.16	0.37	0.18		0.16	**0.46**	0.27
PL	Concurrent	-0.17	0.18	0.21	0.20	0.35	0.37	0.38	-0.05	**0.47**	0.30	0.34	**1**	0.34	**0.56**
	Time Lag -1 Year	-0.05	-0.26	-0.03	0.32	0.07	0.21	**0.41**	-0.19	0.35	0.15	-0.29		0.35	0.18
	Time Lag -2 Years	-0.24	-0.31	-0.25	0.18	-0.02	-0.04	0.20	-0.11	0.02	-0.23	-0.24		0.00	-0.19
CZ	Concurrent	-0.06	0.19	0.11	0.12	0.37	0.37	0.19	-0.26	0.20	0.23	0.04	0.34	**1**	**0.43**
	Time Lag -1 Year	-0.04	-0.32	-0.09	0.01	0.15	0.37	0.06	-0.36	0.08	0.04	-0.20	0.17		0.18
	Time Lag -2 Years	-0.06	-0.20	0.10	0.19	0.13	0.24	0.24	0.01	0.17	0.14	-0.02	0.01		-0.05
HU	Concurrent	0.34	0.37	0.16	0.14	**0.58**	**0.77**	**0.42**	-0.16	**0.75**	0.13	0.25	**0.56**	**0.43**	**1**
	Time Lag -1 Year	0.25	0.15	0.20	0.37	**0.55**	**0.72**	**0.59**	-0.28	**0.74**	0.23	-0.07	0.32	**0.42**	
	Time Lag -2 Years	-0.07	0.18	0.29	**0.52**	**0.59**	**0.50**	**0.67**	-0.31	**0.70**	0.24	-0.10	0.23	0.22	

Fig. 7: Correlation matrix of the studied real estate markets among each other on the basis of the HPI; source: Eurostat; own calculation and illustration.

5. Correlation of other indicators for the real estate market (construction prices, rents)

Developments in other segments of the real estate and construction industry regularly have an impact on the house prices observed here (HPI). This has to be assumed in particular in the case of rents and construction costs. Various data series for construction activity (approvals, completions, construction costs) and the rental market are available so as draw comparisons. The sources in this regard differ (e.g. official national statistics, Eurostat, OECD, private data providers); the availability and quality are not always the same for all countries. Generally those markets in which the cycle is clearly pronounced may be analysed best of all. Correlations with parallel markets may be seen, for example, between the house price index (HPI) and the construction costs index (CCI) in Great Britain and Italy, the rent indices (RI) in Germany and Belgium, as well as the construction approvals in Spain and Italy (Fig. 8, respective rates of change scaled on the left-hand and right-hand axes).



C	REFERENCE						
PARAMETER	**HPI DE**	**HPI UK**	**HPI FR**	**HPI IT**	**HPI SP**	**HPI SE**	**HPI PL**
CCI [Land], Time Lag 0	0.08	0.51	0.58	0.79	0.46	0.18	0.72
CCI [Land], Time Lag -1	0.16	0.55	0.02	0.46	0.09	-0.23	-0.05
CCI [Land], Time Lag -2	-0.13	0.52	0.02	0.10	-0.10	-0.08	-0.05
RI [Land], Time Lag 0	0.54	0.09	0.55	0.60	0.61	-0.25	0.25
RI [Land], Time Lag -1	0.51	0.07	0.38	0.49	0.43	0.25	-0.28
RI [Land], Time Lag -2	0.53	0.15	0.12	0.40	0.24	0.63	-0.26
Construction approvals [Country], Time Lag 0	0.67	0.55	0.63	0.74	0.72	0.43	0.63
Construction approvals [Country], Time Lag -1	0.50	0.37	0.45	0.73	0.68	0.60	0.59
Construction approvals [Country], Time Lag -2	0.69	0.02	0.15	0.68	0.60	0.04	-0.03

Fig. 8: Correlation of HPI and other indicators for the real estate market (selection); sources: Eurostat, OECD; own calculation and illustration.

The table shows examples of some correlations of real estate market-related indicators to the house price index of the respective country. In several countries CCI and HPI correlate, in Germany and Sweden this is not the case, however. The respective rent indices likewise display a correlation with the HPI in several countries, in individual cases there is also a lead time (e.g. in Germany, Italy, Spain). In Sweden the image lacks uniformity, the ab-

normally high coefficient with a time lag for rents of two years (c=0.63) cannot be meaningfully interpreted in terms of real market correlations. With the construction approvals many countries display high correlations, often also with a short lead time (time lag 1 year). Italy and Spain are striking with coefficients of 0.6 and higher.

Although there are – as expected – correlations in the respective market (country), the parallelism of developments predominates, however. In part the changes with rents, construction costs and construction approvals also take place with a slight delay. This is particularly noticeable in the graphic analysis of the time series. It is to be assumed that the actors from the project development sector react with a delay to the increase (or decrease) in market prices. Accordingly, there is an increase in construction approvals, construction services and construction prices at a later date.

Although the computed correlations are thus an initial selection criterion, they are somewhat less reliable due to the shorter data series available for analysis (usually a single market cycle). These additional key ratios for the real estate market are thus scarcely suitable as generally applicable leading indicators. In the group of real estate market indicators real estate values usually react in a timely manner to changes in the environment, other indicators tend to do so with a delay. In the overall image there are no universally reliable leading indicators which precede the HPI in this segment across all markets.

6. Correlation of general economic indicators (GDP, income, consumption)

Alongside indicators that are related to the real estate market to a large extent, a number of macroeconomic, socioeconomic and other parameters upstream of economies are to be considered. Fundamentally, the causal chains become longer the further they move away from the real estate sector (see Fig. 4). Established effects are thus indirect and have to be explained across a number of effect levels. Nevertheless, the analysis of such parameters is important as, on the one hand, the largest lead time is to be assumed and, on the other hand, the data availability for macroeconomic indicators is often better than that for data relating to the real estate market. Which other indicators not directly relating to the real estate sector can serve to explain the development of values on the residential markets is examined below.

It would seem obvious for there to be a correlation between parameters from the real economy on the one hand and from the real estate market on the other hand. Accordingly, a clear correlation is seen with the rate of change for private consumption and the rate of change for the HPI. This was to be observed (see table in 10) in virtually all countries (12 of 14, c>=0.4). With regard to the search for leading indicators it is particularly interesting that higher correlation coefficients are also seen with a lead time for consumption of one or two years. In this respect particularly high correlations were identified in Spain and the Netherlands (Fig. 9).

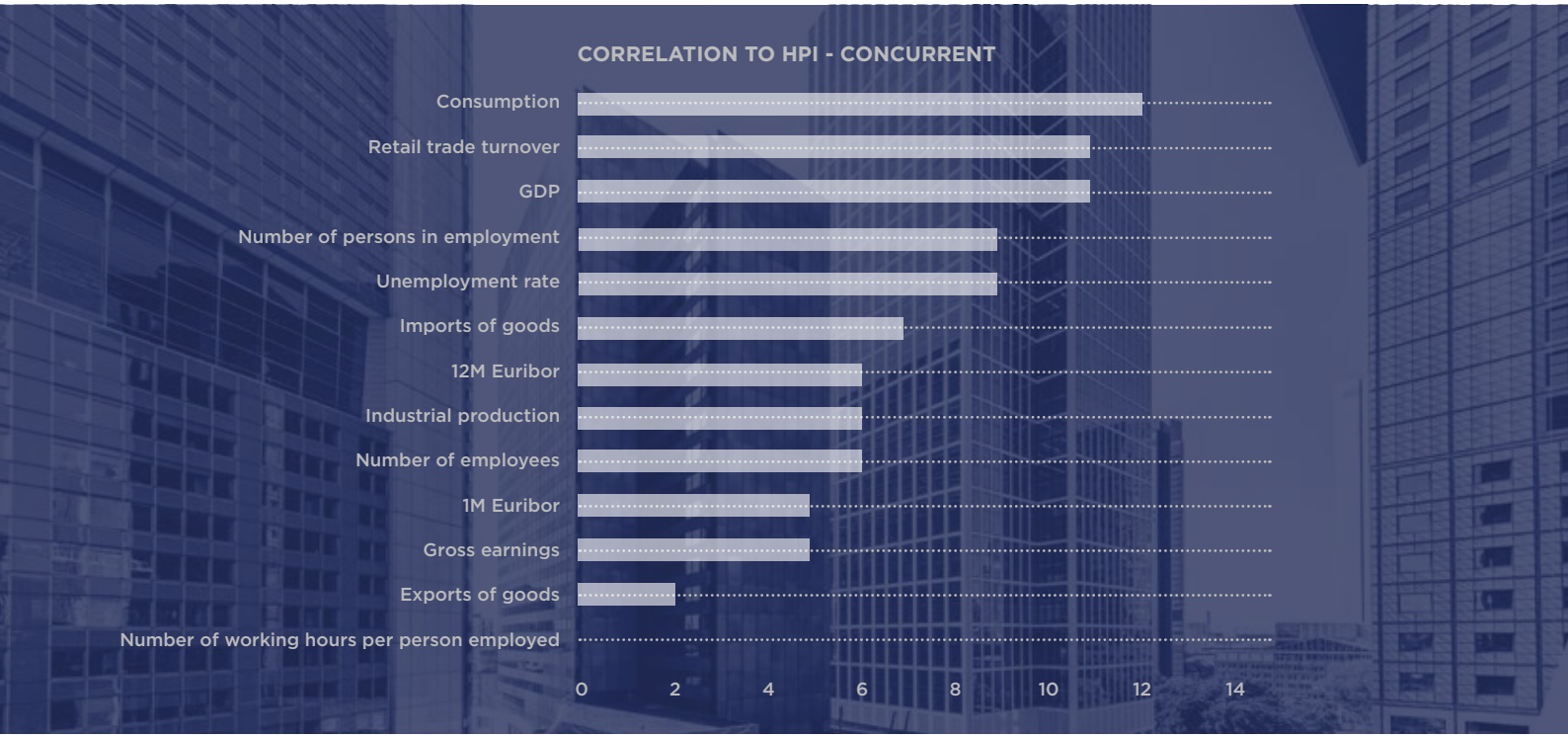
Upstream of private consumption and household incomes in the financial consideration are wage payments by companies. In turn these are based on sales and production output. A correlation with the real estate market is likely to exist both in a time of crisis and one of economic recovery. In this respect it has to be assumed that there is a certain reaction time on the real estate market. As the two examples Spain and Greece – each with a clear slump and a corresponding recovery – show, industrial production precedes real estate prices and in particular in the recovery phase (Fig. 9).

REAL EXPERTS.
REAL VALUES.

Fig. 9: Correlation of consumption, industrial production, numbers of employees and retail trade turnover with the house price index (HPI) in selected countries;
sources: Eurostat, OECD; own calculation and illustration.

The correlations between industrial production and HPI are generally only seen in those economies whose HPI development is characterised by strong fluctuations or phases of heavily declining or rising industrial production output. In total, nine of the 14 countries examined display such correlations (|c|>=0.4). In contrast, twelve of the countries considered in this analysis display a correlation of their real estate price development with another macroeconomic aggregate, one which represents the entire breadth of economic activity: GDP (in real terms). This frequently also delivers high correlation coefficients even when considered with a lead time, thus in the Czech Republic (c=0.50 and 0.53 with a lead time of one and two years), for example, as well as in the Netherlands (c=0.63 and 0.43 with a lead time of one and two years).

Fig. 10 shows an overview of all the observed economic indicators by the number of correlations to the HPI with the studied time lags (concurrent, one year lead time, two years lead time). In addition to the parameters already presented – private consumption, industrial production and GDP in real terms – it is above all labour market figures (in particular the unemployment rate, alongside the numbers of persons in employment and the number of employees) as well as data on retail trade turnover (total: 22, with lead time: 11) which have a strong impact. As labour market figures typically lag behind GDP and industrial production, it may be assumed that GDP is the stronger leading indicator for the real estate economy. Labour market effects in turn impact with a delay on incomes, consumption and retail trade turnover. These thus tend to correlate concurrently with the HPI; there can be a certain lead time, however. Of less relevance under this analysis, for example, are the exports of goods, short-term interest rates and the number of working hours for employees.



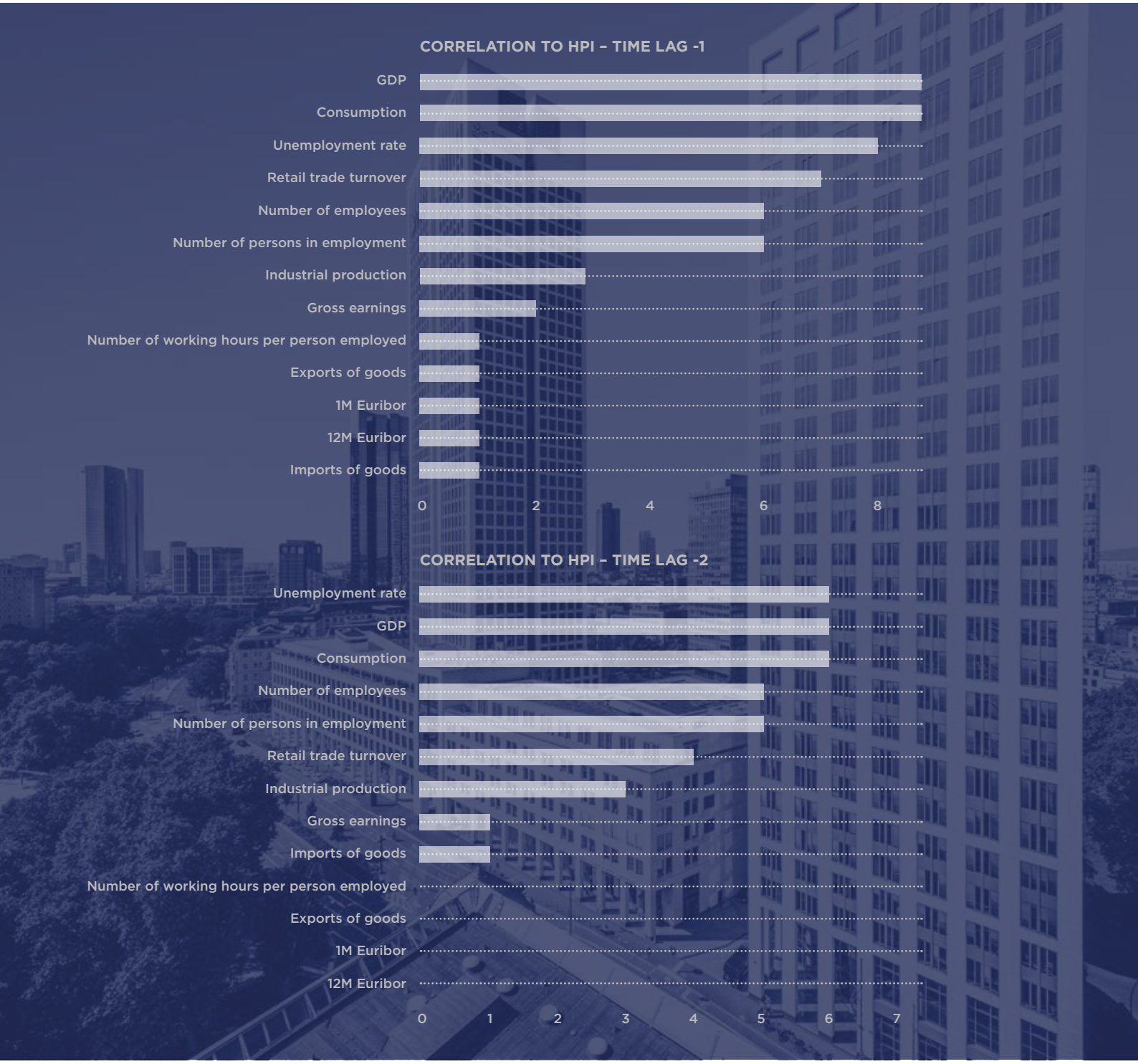


Fig. 10: Economic indicators by number of correlations concurrently, with a lead time of one year and with a lead time of two years to the house price index (HPI, taking into account in each case |c|>=0.4; maximum per indicator=14); sources: Deutsche Bundesbank, Eurostat, OECD; own calculation and illustration.

The established economic indicators are for the most part comprehensible in terms of their content. Thanks to their excellent reporting and early establishment, developments may be identified at an early stage and integrated into more advanced prognosis models for real estate market developments. The relevant economic indicators may also be used directly in transaction and portfolio management, for instance when differentiating between markets and in the prioritisation of investments.

7. Correlation of specific economic indicators (raw materials, transport, energy)

Usually upstream of the macroeconomic parameters from the preceding section of the analysis are various procurement markets, and in particular for raw materials and energy. These are, in turn, predominantly traded at uniform prices for the entire global market and thus also reflect global developments in terms of supply and demand. At the same time an identification of correlations between country-specific real estate market developments and changes in uniform prices for raw materials makes the use of these as leading indicators particularly interesting. If raw materials prove to be suitable indicators, this would not make a consideration of national macroeconomic data series and key ratios unnecessary, but they could be supplemented with an overlapping component. Alongside various raw materials, a number of variables from transport markets in the broader sense (incl. freight traffic by road and rail, domestic passenger transport) and the primary energy consumption were tested in this segment.

A surprisingly frequent correlation seen on many markets in the analysis – and one that is admittedly difficult to interpret – is the respective HPI to the price for uranium. With a total of 15 higher correlations (based on the threshold |c| >= 0.4) uranium thus occupies second place of all the indicators in this section of the analysis. It is possible that this raw material, whose price is very volatile, reacts sensitively to short-term economic changes and thus indicates the corresponding follow-won effects on the real estate market. Particularly pronounced correlations are seen for the development of HPI in France and Belgium, whereby the uranium price here displays coefficients of significantly more than 0.4 even with a lead time of one year (FR: 0.58/ BE: 0.75). In Germany only a small number of raw material indicators correlate with the HPI, yet here too uranium is one of them alongside a few others (nickel, sawn timber).

Other frequent correlations with the HPI of a country are displayed by indicators such as the number of construction companies (17), new passenger vehicle registrations and the number of rail passengers (both 13). Interesting leads are shown by new passenger vehicle registrations (9 of 13), the price of silver (7 of 7), road freight (6 of 7) and the price of diesel (5 of 6). Other indicators from the raw materials, transport and energy sectors appear to play less of a role or concentrate on a small number of countries. The prices for propane and lead are the only parameters which do not display any notable correlation to the respective HPI. Fig. 11 shows a corresponding overview of the results.

Fig. 11: Correlations of indicators for the raw materials, transport and energy markets with the house price index (HPI) by number of concurrent and delayed correlations (|c|>=0.4; maximum per indicator left 14 / right 28); sources: Eurostat, IndexMundi, OECD, RWI/ISL; own calculation and illustration.

8. Results overview

An overview of all the computed correlations – with the exception of countries with one another (already shown in Fig. 7) is shown in the following matrix (Fig. 13).

Parameters		HPI DE	RI DE	CCI DE	HPI UK	RI UK	CCI UK	HPI FR	RI FR	CCI FR	HPI IT	RI IT	CCI IT	HPI SP	RI SP	CCI SP	HPI PT	RI PT	CCI PT	HPI GR	RI GR	CCI GR	HPI AT	RI AT	CCI AT	HPI NL	RI NL	CCI NL	HPI BE	RI BE	CCI BE	HPI SE	RI SE	CCI SE	HPI PL	RI PL	CCI PL	HPI CZ	RI CZ	CCI CZ	HPI HU	RI HU	CCI HU
CCI country	Corr. 0	0.08			0.51			0.58			0.79			0.46			0.17			0.68			-0.29			0.53			0.59			0.18			0.72			0.34			0.48		
	Corr. 1	0.16			0.55			0.02			0.46			0.09			0.00			0.47			-0.02			0.03			0.22			-0.23			-0.05			0.08			0.16		
	Corr. 2	-0.13			0.52			0.02			0.10			-0.10			0.03			0.23			0.06			-0.14			-0.18			-0.08			-0.05			0.12			-0.01		
RI country	Corr. 0	0.54			0.09			0.55			0.60			0.61			0.13			0.70			0.32			-0.20			0.50			-0.25			0.25			0.07			0.25		
	Corr. 1	0.51			0.07			0.38			0.49			0.43			-0.18			0.48			0.29			0.20			0.45			0.25			-0.28			-0.40			-0.20		
	Corr. 2	0.53			0.15			0.12			0.40			0.24			-0.19			0.30			0.34			0.43			0.39			0.63			-0.26			-0.61			-0.29		
Construction approvals	Corr. 0	0.67	-0.13	0.29	0.55	-0.27	-0.42	0.63	0.18	0.04	0.74	0.46	0.09	0.72	0.09	0.07	0.72	0.08	-0.21	0.62	0.22	0.34	-0.48	-0.15	-0.17	0.28	-0.05	0.36	0.28	-0.10	0.10	0.43	-0.32	-0.31	0.63	0.32	-0.27	0.51	0.29	-0.47	0.74	0.06	0.04
	Corr. 1	0.50	0.18	0.15	0.37	0.10	0.26	0.45	0.51	0.07	0.73	0.67	0.37	0.68	0.33	0.35	0.62	0.27	-0.36	0.71	0.46	0.53	0.48	-0.07	0.37	0.31	0.10	-0.25	0.35	0.40	0.21	0.60	0.15	-0.40	0.59	0.78	0.12	0.62	0.36	-0.13	0.65	0.43	0.20
	Corr. 2	0.69	0.26	0.31	0.02	0.26	0.26	0.15	0.21	0.34	0.68	0.56	0.54	0.60	0.46	0.57	0.58	0.13	0.12	0.56	0.59	0.59	-0.03	0.13	-0.34	0.23	0.27	-0.56	0.26	0.39	0.23	0.04	0.42	-0.38	-0.03	0.27	0.37	0.26	0.54	0.06	0.56	0.21	0.27
Consumption	Corr. 0	0.66	0.07	0.20	0.84	0.08	0.37	0.65	0.31	0.19	0.45	-0.28	0.08	0.91	0.37	0.36	0.66	0.27	0.44	0.73	0.40	0.44	-0.31	-0.10	0.30	0.91	-0.20	0.50	0.08	-0.31	0.14	0.72	-0.26	0.13	0.50	0.12	0.66	0.68	-0.34	0.49	0.70	0.27	0.29
	Corr. 1	0.34	0.29	0.05	0.53	0.17	0.72	0.57	0.21	0.62	0.61	0.07	0.41	0.78	0.65	0.50	0.41	0.05	0.14	0.74	0.67	0.56	-0.18	-0.36	0.41	0.81	-0.36	0.64	-0.13	-0.09	0.25	0.20	-0.25	0.51	0.20	0.22	0.51	0.59	0.08	0.63	0.67	0.44	0.55
	Corr. 2	0.30	0.69	-0.16	0.53	0.02	0.73	0.37	0.32	0.25	0.60	0.42	0.39	0.62	0.79	0.49	0.16	0.05	0.09	0.71	0.88	0.72	-0.29	-0.73	0.23	0.65	-0.08	0.37	-0.29	0.08	-0.22	-0.09	0.03	0.30	0.00	0.39	0.21	0.30	0.37	0.48	0.54	0.59	0.57
GDP	Corr. 0	0.09	0.14	0.56	0.81	0.16	0.26	0.64	0.01	0.49	0.47	-0.29	0.21	0.87	0.33	0.36	0.65	0.03	0.43	0.76	0.35	0.40	-0.07	-0.46	0.54	0.71	-0.23	0.50	0.54	0.03	0.61	0.64	-0.45	0.22	0.61	-0.22	0.52	0.37	-0.57	0.50	0.64	0.12	0.32
	Corr. 1	0.19	0.21	0.25	0.37	0.40	0.61	0.29	0.03	0.43	0.50	0.09	0.42	0.72	0.62	0.41	0.46	0.10	0.19	0.80	0.64	0.59	-0.08	-0.38	0.20	0.63	-0.43	0.79	0.43	0.18	0.52	0.09	-0.10	0.47	0.53	0.22	0.85	0.50	-0.01	0.40	0.63	0.37	0.47
	Corr. 2	0.05	0.21	-0.37	0.39	0.17	0.61	0.09	0.22	0.01	0.44	0.39	0.26	0.61	0.74	0.41	0.18	0.17	0.08	0.80	0.85	0.74	-0.20	-0.33	0.11	0.43	-0.18	0.42	0.10	0.53	-0.13	-0.03	-0.02	0.31	-0.03	0.32	0.29	0.53	0.49	0.22	0.53	0.48	0.54
Unemployment rate	Corr. 0	-0.38	-0.39	-0.59	-0.43	0.10	0.04	-0.40	0.18	-0.48	-0.53	0.13	-0.24	-0.54	0.12	-0.06	-0.64	0.04	-0.27	-0.60	-0.03	-0.16	-0.12	0.25	-0.37	-0.58	0.43	-0.63	0.07	0.37	-0.51	-0.27	0.71	-0.29	-0.39	0.27	-0.50	-0.45	0.51	-0.24	-0.60	0.07	-0.18
	Corr. 1	-0.41	-0.54	-0.08	-0.12	-0.02	-0.39	-0.06	0.06	-0.31	-0.68	-0.20	-0.56	-0.55	-0.22	-0.17	-0.66	-0.02	0.21	-0.59	-0.39	-0.29	0.08	0.36	0.04	-0.42	0.45	-0.60	0.14	0.25	0.10	0.22	0.08	-0.16	-0.20	0.37	-0.40	-0.54	-0.08	-0.08	-0.66	-0.07	-0.41
	Corr. 2	-0.32	-0.58	0.35	-0.42	0.39	-0.34	-0.14	-0.25	0.27	-0.48	-0.57	-0.42	-0.55	-0.43	-0.03	-0.41	0.01	-0.03	-0.51	-0.64	-0.51	-0.15	-0.09	0.22	-0.26	0.15	-0.15	0.23	-0.17	0.47	0.20	-0.10	0.18	-0.20	0.35	-0.26	-0.39	-0.22	-0.09	-0.61	-0.33	-0.26
Retail trade turnover	Corr.	0.70	0.31	0.38	0.12	-0.47	0.19	0.51	-0.12	0.68	0.62	0.11	0.53	0.93	0.47	0.37	0.83	0.09	0.47	0.87	0.60	0.71	0.30	-0.03	0.50	0.81	-0.37	0.75	0.54	0.21	0.66	0.37	-0.24	0.31	0.70	0.17	0.61	0.52	-0.42	0.63	0.44	0.46	0.48
	Corr.	0.60	0.42	-0.01	0.08	-0.02	0.37	0.18	0.27	0.27	0.52	0.53	0.64	0.78	0.72	0.50	0.55	0.25	0.26	0.78	0.79	0.72	0.36	-0.10	0.16	0.48	-0.41	0.74	0.09	0.50	0.14	0.34	-0.18	0.41	0.47	0.57	0.82	0.38	0.18	0.49	0.35	0.56	0.61
	Corr.	0.41	0.62	-0.07	-0.07	-0.10	0.42	0.17	0.44	-0.01	0.31	0.55	0.37	0.61	0.82	0.50	0.30	0.27	0.25	0.64	0.87	0.82	0.54	-0.04	-0.19	0.13	-0.15	0.15	-0.17	0.40	-0.39	0.17	-0.02	0.55	-0.34	0.50	0.15	0.40	0.49	0.07	0.24	0.65	0.43
Persons in employment	Corr. 0	0.30	0.09	0.25	0.52	0.14	0.16	0.41	0.15	0.26	0.64	-0.02	0.39	0.90	0.38	0.36	0.78	0.20	0.30	0.67	0.23	0.21	0.42	-0.12	-0.04	0.59	-0.44	0.76	0.35	-0.14	0.56	0.21	-0.59	0.37	0.36	-0.29	0.53	0.46	-0.37	0.10	0.28	-0.38	-0.17
	Corr. 1	0.07	0.34	0.15	0.08	0.16	0.23	0.28	0.12	0.29	0.63	0.36	0.48	0.78	0.66	0.46	0.62	0.02	0.05	0.72	0.59	0.44	-0.10	-0.30	0.41	0.39	-0.27	0.39	0.17	0.08	0.19	-0.19	-0.11	0.19	0.24	-0.28	0.41	0.62	0.15	-0.05	0.63	-0.18	0.29
	Corr. 2	0.10	0.42	-0.04	0.32	-0.36	0.18	0.38	0.39	-0.13	0.60	0.43	0.42	0.70	0.79	0.46	0.22	0.07	0.20	0.69	0.78	0.68	0.16	0.05	-0.11	0.29	0.06	-0.08	-0.03	0.39	-0.01	-0.19	0.15	-0.05	0.22	-0.26	0.24	0.45	0.30	0.19	0.75	0.25	0.32
Number of employees	Corr. 0	0.39	0.24	0.24	0.47	0.15	0.20	0.40	0.13	0.30	0.62	-0.04	0.38	0.92	0.39	0.35	0.66	0.20	0.30	0.64	0.22	0.18	0.40	-0.06	-0.01	0.55	-0.43	0.71	0.32	-0.11	0.54	0.20	-0.56	0.35	0.30	-0.35	0.47	0.30	-0.43	0.18	0.24	-0.36	-0.13
	Corr. 1	0.17	0.43	0.14	0.09	0.08	0.30	0.22	0.10	0.21	0.58	0.37	0.36	0.79	0.67	0.45	0.50	-0.11	-0.01	0.75	0.56	0.41	-0.03	-0.23	0.37	0.39	-0.25	0.32	0.18	0.04	0.15	-0.22	-0.08	0.17	0.29	-0.34	0.43	0.49	0.05	-0.17	0.61	-0.10	0.34
	Corr. 2	0.22	0.45	-0.03	0.36	-0.38	0.27	0.38	0.38	-0.18	0.54	0.37	0.39	0.70	0.81	0.48	0.31	0.01	0.25	0.71	0.75	0.65	0.16	0.00	-0.11	0.33	0.10	-0.11	0.03	0.44	-0.10	-0.18	0.14	-0.09	0.27	-0.23	0.32	0.50	0.23	0.10	0.73	0.32	0.42
Number of construction companies	Corr. 0	-0.05	0.22	-0.29	0.59	-0.04	0.26	0.33	0.29	0.20	0.87	0.43	0.66	0.52	-0.28	-0.10	0.83	-0.07	0.43				-0.35	-0.62	0.59	-0.26	-0.08	-0.09	0.02	0.33	-0.25	0.47	0.16	0.20	0.86	0.51	0.79	0.14	0.63	0.38	0.91	0.06	0.25
	Corr. 1	0.03	-0.15	-0.23	0.14	-0.28	0.65	-0.01	0.32	0.26	0.69	0.67	0.60	0.58	-0.01	0.11	0.78	0.17	0.30				-0.31	-0.04	0.17	-0.18	0.09	-0.23	-0.08	0.16	-0.06	0.08	0.34	0.41	0.17	0.75	0.69	-0.20	0.51	0.09	0.70	0.56	0.46
	Corr. 2	0.33	-0.15	-0.32	0.06	-0.71	0.37	-0.65	0.31	-0.26	0.56	0.75	0.45	0.26	0.29	-0.17	0.56	0.01	0.04				0.17	0.07	0.15	-0.30	-0.23	0.22	0.24	-0.10	0.12	-0.61	0.71	0.37	-0.05	0.54	0.18	-0.51	0.37	-0.08	0.44	0.57	0.46

Parameters		VARIABLES																																									
		HPI DE	RI DE	CCI DE	HPI UK	RI UK	CCI UK	HPI FR	RI FR	CCI FR	HPI IT	RI IT	CCI IT	HPI SP	RI SP	CCI SP	HPI PT	RI PT	CCI PT	HPI GR	RI GR	CCI GR	HPI AT	RI AT	CCI AT	HPI NL	RI NL	CCI NL	HPI BE	RI BE	CCI BE	HPI SE	RI SE	CCI SE	HPI PL	RI PL	CCI PL	HPI CZ	RI CZ	CCI CZ	HPI HU	RI HU	CCI HU
Passenger vehicle registrations	Corr. 0	0.24	-0.09	-0.22	0.38	0.25	-0.03	-0.20	-0.30	-0.31	0.01	-0.45	-0.37	0.40	-0.35	-0.26	0.49	0.12	0.17	0.30	-0.27	-0.15	-0.14	0.41	-0.02	0.15	-0.30	0.07	0.22	-0.12	0.28	0.47	-0.31	-0.24	0.43	-0.04	0.06	0.26	-0.34	-0.26	0.58	-0.28	0.19
	Corr. 1	0.07	-0.06	-0.04	0.44	0.22	0.22	0.08	-0.25	0.10	0.19	-0.35	-0.03	0.53	-0.12	0.07	0.31	-0.18	-0.04	0.56	0.11	0.05	0.38	0.31	0.31	0.13	-0.52	0.31	0.15	-0.10	0.48	0.03	-0.12	0.17	0.11	0.21	0.22	0.52	-0.01	-0.24	0.62	0.01	0.53
	Corr. 2	0.21	0.16	0.44	0.31	-0.11	0.18	0.15	-0.30	0.17	0.19	-0.04	0.04	0.41	0.20	0.06	0.20	-0.31	-0.11	0.72	0.47	0.32	0.20	-0.21	0.00	0.01	-0.06	0.16	0.01	0.02	-0.04	-0.19	-0.05	0.05	-0.42	0.02	-0.21	0.27	0.19	0.13	0.72	0.18	0.38
Industrial production	Corr. 0	-0.11	-0.06	0.56	0.54	-0.21	-0.16	0.48	-0.16	0.35	0.21	-0.40	0.09	0.60	-0.12	0.17	0.43	-0.26	0.02	0.37	-0.13	0.03	-0.04	-0.28	0.57	0.36	-0.26	0.14	0.53	0.00	0.55	0.40	-0.48	0.31	0.38	-0.24	0.16	0.15	-0.59	0.43	0.39	-0.12	0.23
	Corr. 1	0.07	0.00	0.28	-0.04	0.18	0.21	0.15	-0.12	0.36	0.16	-0.10	0.23	0.47	0.24	0.23	0.33	-0.01	0.15	0.55	0.10	0.24	-0.06	-0.40	0.09	0.24	-0.24	0.50	0.31	0.27	0.51	-0.17	-0.01	0.42	0.45	0.13	0.71	0.38	-0.14	0.34	0.37	0.44	0.55
	Corr. 2	-0.12	0.04	-0.37	-0.01	0.00	0.39	-0.03	0.08	-0.14	0.10	0.14	0.00	0.42	0.40	0.08	0.37	0.01	-0.03	0.70	0.35	0.27	-0.08	-0.32	0.07	-0.02	0.10	0.24	0.02	0.36	-0.22	-0.04	-0.02	0.23	-0.08	0.12	0.27	0.44	0.28	-0.04	0.19	0.53	0.57
Imports of goods	Corr. 0	-0.27	-0.16	0.63	0.54	0.02	0.10	0.65	0.35	0.68	0.47	0.15	0.56	0.59	0.35	0.63	0.29	0.02	0.66	0.45	0.35	0.59	-0.34	-0.31	0.65	0.18	-0.29	0.24	0.64	0.21	0.50	0.16	-0.11	0.43	0.38	0.05	0.42	0.40	-0.22	0.59	0.18	0.14	0.17
	Corr. 1	-0.26	-0.28	0.37	-0.06	0.52	0.19	0.21	0.32	0.42	0.29	0.36	0.56	0.24	0.53	0.44	0.06	0.28	0.29	0.36	0.42	0.48	-0.16	-0.10	0.36	0.00	-0.18	0.30	0.42	0.41	0.41	-0.22	0.40	0.44	0.17	0.19	0.61	0.22	0.17	0.51	0.05	0.37	0.44
	Corr. 2	-0.30	-0.27	-0.29	-0.05	0.46	0.20	0.04	0.50	-0.15	0.18	0.50	0.26	0.21	0.46	0.23	0.00	0.24	0.10	0.42	0.49	0.40	0.13	-0.10	0.02	-0.21	0.06	0.04	0.29	0.43	-0.02	0.01	0.23	0.19	-0.02	-0.05	0.20	0.13	0.36	-0.02	-0.11	0.31	0.29
Gross earnings	Corr. 0	0.17	0.33	0.42	0.39	0.15	-0.19	0.41	0.43	0.50	0.51	0.75	0.70	0.28	0.85	0.61	-0.09	0.15	0.16	0.63	0.67	0.48	-0.03	-0.21	0.16	0.33	0.03	0.41	0.29	0.36	0.11	0.08	0.06	0.09	0.59	0.22	0.53	0.33	0.19	0.47	0.45	0.64	0.57
	Corr. 1	0.24	-0.03	-0.13	0.22	0.39	0.15	0.19	0.50	0.24	0.41	0.79	0.53	0.05	0.70	0.40	-0.10	0.13	0.05	0.57	0.75	0.70	-0.23	-0.14	0.50	0.18	0.00	0.26	0.13	0.42	-0.18	-0.25	0.39	0.06	0.01	0.40	0.25	0.32	0.50	0.10	0.08	0.58	0.40
	Corr. 2	-0.08	-0.14	-0.46	0.02	0.15	0.45	0.11	0.51	0.08	0.26	0.67	0.48	-0.04	0.49	0.49	-0.12	0.43	0.55	0.60	0.67	0.75	-0.09	-0.17	0.07	-0.06	-0.10	0.12	0.08	0.37	-0.13	-0.01	0.24	-0.16	0.10	0.30	0.02	0.23	0.49	0.45	0.02	0.66	0.34
12M Euribor	Corr. 0	-0.06	0.01	0.44	0.47	-0.09	-0.03	0.49	0.24	0.26	0.26	-0.26	0.18	0.41	-0.04	0.45	0.03	-0.19	0.39	0.26	-0.04	0.17	0.01	-0.23	0.27	0.39	-0.02	-0.04	0.46	0.04	0.65	0.50	-0.49	0.27	0.41	-0.37	0.08	0.06	-0.63	0.24	0.28	-0.40	-0.02
	Corr. 1	0.01	-0.02	0.41	-0.06	0.41	0.16	0.13	-0.02	0.59	0.10	-0.06	0.23	0.10	0.22	0.33	0.17	0.10	0.31	0.26	0.09	0.30	0.03	-0.32	0.35	0.35	-0.28	0.73	0.26	0.13	0.60	0.05	-0.20	0.55	0.53	0.27	0.64	0.40	-0.14	0.33	0.34	0.21	0.52
	Corr. 2	-0.16	0.04	-0.15	-0.23	0.27	0.38	-0.29	0.14	-0.06	0.09	0.23	0.09	-0.04	0.27	-0.04	0.07	0.15	0.22	0.18	0.12	0.17	0.01	-0.43	0.07	0.06	-0.15	0.39	-0.04	0.19	-0.03	-0.12	0.08	0.27	0.10	0.41	0.32	0.27	0.46	0.02	0.08	0.49	0.58
1M Euribor	Corr. 0	-0.05	0.03	0.43	0.47	-0.06	-0.05	0.44	0.18	0.22	0.23	-0.30	0.13	0.35	-0.11	0.39	-0.02	-0.21	0.36	0.22	-0.11	0.11	0.08	-0.20	0.26	0.40	0.01	-0.03	0.40	0.01	0.65	0.51	-0.52	0.25	0.45	-0.37	0.06	0.01	-0.68	0.23	0.30	-0.40	0.06
	Corr. 1	0.05	0.07	0.34	-0.03	0.43	0.20	0.10	-0.08	0.54	0.06	-0.12	0.19	0.09	0.18	0.27	0.19	0.08	0.30	0.25	0.01	0.26	0.02	-0.37	0.29	0.36	-0.21	0.74	0.22	0.08	0.55	0.03	-0.23	0.51	0.51	0.31	0.61	0.39	-0.17	0.28	0.35	0.22	0.55
	Corr. 2	-0.13	0.11	-0.23	-0.20	0.24	0.44	-0.33	0.09	-0.09	0.07	0.17	0.02	-0.02	0.23	-0.11	0.11	0.25	0.18	0.18	0.07	0.09	-0.05	-0.40	0.01	0.08	-0.05	0.39	-0.11	0.25	-0.08	-0.12	0.07	0.17	0.03	0.41	0.24	0.29	0.44	-0.01	0.12	0.49	0.59
Overnight stays tourists	Corr. 0	0.22	-0.23	0.20	-0.16	0.44	-0.04	0.09	-0.08	-0.09	0.31	-0.41	-0.03	0.26	-0.37	0.21	0.39	-0.25	0.08	-0.23	-0.21	-0.32	0.42	-0.29	0.17	-0.23	0.36	-0.26	-0.21	-0.29	0.15	0.41	-0.52	-0.21	0.24	-0.71	0.03	0.14	-0.55	-0.16	0.07	-0.63	-0.04
	Corr. 1	0.18	-0.15	-0.23	-0.02	0.00	-0.02	0.07	-0.20	0.36	0.32	-0.03	0.12	0.22	0.15	0.14	0.53	-0.22	0.12	-0.16	-0.11	-0.04	-0.10	-0.08	-0.12	0.38	0.27	0.11	-0.23	-0.40	0.13	0.40	-0.59	0.24	0.16	-0.14	0.32	0.03	-0.46	0.13	0.19	-0.10	0.24
	Corr. 2	0.03	0.25	0.08	0.16	0.01	-0.06	-0.19	-0.01	-0.02	0.36	0.16	0.17	0.27	0.32	-0.09	0.58	-0.12	0.03	-0.16	-0.04	-0.17	-0.06	0.28	-0.06	0.57	-0.02	0.18	-0.18	-0.30	-0.24	-0.13	0.02	0.26	0.02	-0.57	-0.01	-0.05	-0.22	0.00	0.37	-0.07	0.12
Investment in transport infrastructure	Corr. 0	0.18	0.58	-0.01	0.12	0.33	0.07	0.32	0.61	0.13	0.37	-0.11	0.38	0.73	0.74	0.48	0.19	0.09	-0.06	-0.10	-0.24	-0.22	-0.75	-0.37	0.38	0.33	-0.10	0.35	-0.24	0.02	-0.25	-0.06	0.09	0.32	0.39	0.02	0.50	0.33	-0.01	0.34	0.10	0.21	0.23
	Corr. 1	0.10	0.31	-0.04	0.24	0.01	0.01	0.22	0.39	0.35	0.31	0.18	0.29	0.61	0.80	0.42	-0.04	-0.30	-0.18	-0.14	-0.23	-0.20	-0.05	-0.04	0.15	0.02	0.35	-0.19	-0.15	-0.16	-0.50	-0.39	0.42	0.09	0.35	0.71	0.52	0.19	0.13	-0.07	0.04	-0.14	-0.26
	Corr. 2	0.28	-0.04	-0.15	0.08	-0.15	0.16	-0.05	0.47	0.00	0.49	0.18	0.29	0.53	0.75	0.59	-0.31	0.31	0.13	0.12	-0.10	-0.13	-0.42	-0.56	0.20	0.18	0.44	-0.49	-0.01	0.04	0.10	0.04	0.25	0.03	-0.04	0.31	0.18	0.20	0.08	0.30	0.13	-0.12	-0.14
Producer prices manufacturing industry	Corr. 0	-0.13	0.00	0.81	-0.22	0.00	0.00	0.54	0.21	0.79	0.42	0.19	0.65	0.21	0.35	0.76	-0.21	-0.04	0.52	0.37	0.47	0.75	0.12	-0.18	0.66	0.37	-0.47	0.40	0.48	0.04	0.50	0.02	-0.34	0.59	0.30	-0.04	0.40	0.04	-0.20	0.65	-0.01	0.37	0.54
	Corr. 1	-0.16	-0.01	0.07	-0.62	0.12	-0.07	-0.05	0.20	0.23	0.11	0.45	0.37	-0.15	0.44	0.31	-0.23	0.18	-0.12	0.22	0.36	0.38	0.31	-0.20	0.10	-0.09	-0.26	0.52	0.20	0.25	0.32	-0.22	-0.14	0.51	0.05	0.38	0.38	-0.18	0.16	0.08	-0.19	0.63	0.51
	Corr. 2	-0.35	0.07	-0.39	-0.22	0.09	-0.36	-0.14	0.42	-0.18	0.00	0.37	0.06	-0.12	0.25	0.00	-0.18	0.54	0.18	0.05	0.24	0.29	0.35	-0.14	-0.12	-0.38	0.21	-0.03	0.02	0.41	0.03	-0.18	0.16	0.19	-0.13	0.28	-0.13	-0.03	0.22	-0.32	-0.30	0.38	0.22
Exports of goods	Corr. 0	-0.37	-0.18	0.55	0.38	-0.02	0.13	0.63	0.30	0.69	0.36	0.12	0.54	0.40	0.33	0.60	-0.02	-0.12	0.55	0.17	0.32	0.62	-0.38	-0.39	0.64	0.18	-0.28	0.23	0.63	0.24	0.47	0.11	-0.10	0.41	0.30	0.17	0.35	0.38	-0.22	0.63	0.14	0.20	0.15
	Corr. 1	-0.29	-0.28	0.31	-0.05	0.41	0.12	0.19	0.33	0.37	0.13	0.30	0.48	0.02	0.44	0.32	-0.16	0.24	0.30	0.08	0.23	0.35	-0.24	-0.12	0.34	-0.03	-0.16	0.33	0.44	0.41	0.41	-0.22	0.43	0.42	0.14	0.29	0.55	0.25	0.15	0.47	-0.02	0.35	0.39
	Corr. 2	-0.33	-0.40	-0.33	0.01	0.46	0.12	0.05	0.48	-0.15	0.00	0.39	0.06	0.02	0.27	0.09	-0.10	0.23	0.10	-0.01	0.15	0.17	0.04	-0.12	0.07	-0.23	0.08	0.01	0.30	0.42	-0.02	0.03	0.22	0.21	-0.04	-0.06	0.18	0.12	0.33	0.00	-0.19	0.29	0.27
Working hours per person employed	Corr. 0	0.00	0.09	0.44	-0.13	0.15	-0.29	0.11	0.12	0.22	0.04	-0.43	-0.04	-0.20	-0.13	-0.29	0.18	0.06	-0.02	0.13	-0.02	0.06	-0.19	-0.30	0.20	-0.21	0.27	-0.33	0.01	-0.28	0.47	0.13	-0.05	0.04	0.02	-0.01	-0.22	0.12	-0.09	0.08	0.09	-0.37	-0.38
	Corr. 1	0.12	-0.01	0.46	-0.08	0.14	-0.09	-0.05	0.20	0.21	0.21	-0.16	0.20	-0.06	-0.22	-0.52	0.52	0.05	0.25	0.19	-0.09	0.04	-0.04	0.22	-0.08	0.04	-0.09	-0.16	-0.09	-0.21	0.20	-0.08	0.01	0.00	-0.05	0.33	-0.06	-0.18	-0.17	0.00	0.15	-0.50	-0.14
	Corr. 2	0.16	-0.09	-0.01	-0.06	-0.09	-0.16	-0.32	0.08	-0.27	0.15	0.25	0.02	0.12	-0.16	-0.05	0.07	-0.18	-0.24	0.27	-0.02	0.13	0.03	-0.11	0.00	0.05	-0.25	0.09	-0.29	0.16	-0.43	-0.18	-0.31	0.11	-0.29	-0.58	-0.22	-0.36	-0.08	0.08	0.37	0.01	0.10

Parameters		VARIABLES																																									
		HPI DE	RI DE	CCI DE	HPI UK	RI UK	CCI UK	HPI FR	RI FR	CCI FR	HPI IT	RI IT	CCI IT	HPI SP	RI SP	CCI SP	HPI PT	RI PT	CCI PT	HPI GR	RI GR	CCI GR	HPI AT	RI AT	CCI AT	HPI NL	RI NL	CCI NL	HPI BE	RI BE	CCI BE	HPI SE	RI SE	CCI SE	HPI PL	RI PL	CCI PL	HPI CZ	RI CZ	CCI CZ	HPI HU	RI HU	CCI HU
Road freight	Corr. 0	0.24	0.14	0.61																0.13	0.53	0.38	-0.03	-0.36	0.22	-0.11	0.01	-0.33	-0.02	0.03	0.15				0.17	0.40	0.38	0.02	-0.70	0.15	0.50	-0.16	0.31
	Corr. 1	0.22	0.08	0.32																0.34	0.49	0.26	0.00	-0.15	0.25	0.16	-0.37	0.14	-0.08	0.00	-0.06				-0.06	0.30	0.18	0.72	-0.43	0.04	0.58	0.17	0.31
	Corr. 2	0.28	0.13	-0.24																0.55	0.46	0.55	-0.13	-0.46	0.30	-0.18	-0.32	0.26	-0.06	0.14	-0.08				0.45	0.58	0.45	0.84	-0.24	0.08	0.52	0.21	-0.19
Passenger transport by rail	Corr. 0	0.11	0.05	0.34	0.31	0.48	-0.26	0.48	0.54	0.33	0.41	0.26	0.59	0.53	-0.08	0.24	0.41	0.16	-0.12	0.29	0.13	0.37	0.63	-0.01	0.09							-0.09	-0.43	0.62	0.60	0.17	0.33	0.02	-0.84	0.19	-0.57	-0.55	-0.34
	Corr. 1	-0.19	-0.20	-0.07	-0.39	0.76	0.16	0.23	0.42	0.42	0.32	0.50	0.35	0.45	0.21	0.14	0.46	-0.15	0.10	0.21	0.29	0.19	-0.28	-0.17	-0.38							-0.22	0.23	0.22	0.30	0.53	0.53	0.43	-0.50	0.38	-0.03	-0.31	0.04
	Corr. 2	-0.04	0.08	-0.08	-0.04	0.33	0.06	-0.10	0.45	0.10	0.11	0.54	0.16	0.54	0.36	0.17	0.71	0.00	0.24	0.05	0.39	0.01	-0.27	0.33	0.02							0.07	0.12	-0.07	0.14	0.55	0.32	0.47	-0.04	0.11	0.06	-0.36	0.21
Passenger transport (domestic)	Corr. 0	0.02	-0.22	-0.17	0.31	0.22	0.51	-0.12	-0.51	-0.23	-0.08	-0.30	-0.43	0.52	0.46	-0.01													0.28	0.61	0.35	0.53	-0.47	0.10	0.26	-0.40	0.30	0.39	-0.44	0.01	0.66	-0.10	0.18
	Corr. 1	0.10	0.08	-0.15	0.41	-0.18	0.35	0.09	-0.29	0.00	0.11	-0.31	-0.19	0.55	0.42	0.31													0.23	0.43	-0.15	0.04	-0.23	0.30	0.39	0.32	0.42	0.44	-0.01	0.25	0.76	0.14	0.31
	Corr. 2	0.20	-0.10	0.06	0.19	-0.41	0.21	0.16	-0.33	-0.04	0.31	-0.08	0.09	0.45	0.51	0.55													0.17	0.50	-0.16	-0.21	-0.03	0.06	0.12	0.18	0.18	0.20	0.14	0.28	0.51	0.20	0.25
Primary energy consumption	Corr. 0	0.08	-0.28	-0.24	0.38	0.11	0.41	0.34	-0.07	0.25	0.46	-0.11	0.25	0.70	0.31	0.19							-0.17	0.10	0.09	0.25	-0.01	-0.01	0.01	-0.23	-0.30	0.27	-0.48	-0.13									
	Corr. 1	-0.07	0.09	-0.08	0.20	0.04	0.60	0.25	0.16	0.11	0.53	0.20	0.45	0.68	0.53	0.40							-0.35	-0.21	0.09	0.22	-0.22	0.20	-0.02	-0.06	0.12	-0.02	-0.11	0.02									
	Corr. 2	0.05	0.23	0.14	0.41	0.23	0.32	0.22	0.16	0.09	0.52	0.36	0.39	0.69	0.66	0.56							0.16	0.12	0.24	0.16	-0.21	0.37	0.13	0.03	-0.02	-0.27	-0.01	0.19									
Rail freight	Corr. 0	-0.14	-0.25	0.26	0.12	0.09	0.05	0.17	-0.08	0.34	0.39	-0.15	0.30	0.18	-0.24	0.10	0.09	0.24	0.40	0.54	0.28	0.46	-0.39	-0.42	0.62	0.30	0.10	0.11				0.22	-0.43	0.17	-0.01	-0.08	0.00	0.05	-0.61	-0.07	0.13	-0.01	0.04
	Corr. 1	-0.12	-0.14	0.34	0.14	0.50	0.22	-0.31	-0.12	0.02	0.42	0.03	0.54	0.08	-0.04	-0.15	-0.11	-0.21	0.21	0.51	0.38	0.57	-0.19	-0.26	0.21	0.12	-0.13	0.49				-0.18	0.04	0.27	0.04	0.09	0.15	0.47	-0.22	0.18	0.14	-0.11	0.09
	Corr. 2	-0.14	-0.07	-0.08	0.17	0.48	0.32	-0.45	-0.11	-0.44	0.13	0.30	0.18	0.27	0.01	-0.18	0.02	0.14	-0.12	0.29	0.57	0.32	0.19	-0.36	0.42	-0.05	0.07	0.09				-0.13	0.18	0.18	0.01	0.00	0.05	0.47	0.26	-0.11	0.20	0.21	0.44
Index container transhipment	Corr. 0	0.09	-0.20	-0.06	0.25	-0.38	-0.54	0.20	-0.20	-0.40	-0.02	-0.01	-0.28	-0.09	-0.40	-0.10	-0.19	-0.31	-0.64	-0.34	-0.07	-0.34	0.36	0.62	-0.35	-0.18	-0.05	-0.67	-0.23	-0.24	-0.26	0.18	-0.18	-0.46	-0.18	-0.41	-0.65	-0.70	-0.21	-0.39	-0.24	-0.54	-0.73
	Corr. 1	0.24	0.38	0.77	0.38	0.06	-0.21	0.77	-0.29	0.82	0.09	-0.29	0.55	-0.04	-0.36	0.37	-0.10	-0.36	0.77	-0.02	-0.15	0.38	0.31	-0.22	0.71	0.13	-0.24	0.53	0.69	-0.52	0.71	-0.15	-0.31	0.48	0.31	-0.06	0.26	0.02	-0.59	0.39	0.09	-0.33	0.08
	Corr. 2	0.31	0.16	-0.10	-0.55	0.32	0.50	-0.37	-0.04	0.17	-0.31	0.03	0.17	-0.37	-0.05	-0.24	-0.23	-0.04	-0.16	-0.16	-0.39	-0.27	0.29	-0.30	-0.40	-0.18	0.10	0.40	-0.12	0.11	0.48	-0.53	0.40	0.06	-0.29	0.05	0.17	0.13	-0.50	0.03	-0.03	0.15	0.40
Uranium	Corr. 0	-0.56	-0.51	0.08	0.53	0.17	0.20	0.73	0.61	0.33	0.39	0.35	0.40	0.57	0.55	0.58	0.11	0.23	0.17	0.52	0.51	0.53	-0.23	-0.05	0.42	0.10	0.11	0.05	0.74	0.57	0.37	0.55	-0.08	0.45	0.31	0.20	0.20	0.00	-0.30	0.52	0.05	0.16	0.04
	Corr. 1	-0.51	-0.33	0.45	0.34	0.49	0.27	0.58	0.69	0.66	0.53	0.33	0.74	0.43	0.57	0.69	-0.16	0.16	0.67	0.50	0.50	0.67	-0.18	-0.65	0.54	0.19	-0.21	0.42	0.75	0.47	0.86	0.35	0.01	0.73	0.45	0.06	0.59	0.36	-0.13	0.50	0.10	0.11	0.14
	Corr. 2	-0.38	-0.42	0.14	-0.17	0.54	0.17	0.09	0.58	0.44	0.15	0.55	0.41	0.02	0.59	0.38	-0.11	0.26	0.30	0.18	0.50	0.58	-0.05	-0.38	0.42	-0.22	-0.29	0.49	0.38	0.51	0.31	0.05	0.28	0.51	0.20	0.19	0.57	0.51	0.39	0.15	-0.18	0.26	0.19
Silver	Corr. 0	-0.29	-0.51	-0.09	-0.03	-0.18	-0.14	0.22	0.37	-0.07	0.22	0.47	0.09	0.12	0.32	0.22	-0.11	0.10	-0.27	0.15	0.54	0.23	0.07	0.24	0.01	-0.19	-0.25	-0.28	0.23	0.31	-0.08	0.14	0.12	0.05	-0.06	-0.02	-0.10	-0.24	0.29	0.00	-0.28	0.05	-0.34
	Corr. 1	-0.29	-0.28	0.65	0.08	0.07	-0.24	0.43	0.34	0.46	0.23	0.30	0.48	0.00	0.21	0.57	-0.31	-0.37	0.35	0.05	0.39	0.52	0.08	-0.19	0.55	-0.11	-0.49	0.05	0.45	-0.06	0.43	0.10	0.00	0.43	0.30	-0.06	0.28	-0.04	-0.02	0.24	-0.27	-0.14	-0.22
	Corr. 2	-0.10	-0.05	0.47	-0.42	0.43	-0.01	0.02	0.24	0.56	-0.03	0.34	0.42	-0.41	0.21	0.36	-0.40	0.03	0.23	-0.14	0.16	0.35	0.25	-0.25	0.31	-0.38	-0.37	0.37	0.15	0.20	0.48	-0.49	0.34	0.29	-0.04	0.05	0.40	0.02	0.16	0.12	-0.48	-0.04	-0.03
Diesel	Corr. 0	-0.13	-0.49	0.02	0.05	-0.29	-0.18	0.27	0.16	-0.17	0.43	0.32	0.05	0.07	0.21	0.13	-0.10	-0.20	-0.36	0.19	0.42	0.14	0.31	0.06	-0.15	-0.04	-0.43	-0.15	0.29	-0.11	-0.01	0.06	-0.07	0.13	0.27	0.18	-0.01	-0.20	0.12	0.02	-0.08	0.22	-0.14
	Corr. 1	-0.19	0.38	0.77	0.02	-0.01	0.18	0.63	0.11	0.68	0.28	0.10	0.58	-0.09	0.22	0.74	-0.04	-0.09	0.61	0.07	0.19	0.66	-0.06	-0.33	0.86	0.04	-0.36	0.43	0.59	-0.01	0.34	-0.37	-0.07	0.51	0.21	0.31	0.39	0.19	0.04	0.45	-0.19	-0.06	0.18
	Corr. 2	-0.19	0.10	-0.04	-0.66	0.19	0.22	-0.30	0.19	0.06	-0.10	0.34	0.36	-0.41	0.42	0.16	-0.33	0.15	-0.30	-0.06	0.05	0.03	0.06	0.05	-0.27	-0.26	0.06	0.14	-0.25	0.35	0.23	-0.65	0.60	0.18	-0.29	0.41	0.31	-0.27	0.24	0.10	-0.28	0.19	0.18
Gold	Corr. 0	-0.38	-0.33	0.11	0.00	-0.12	0.08	0.26	0.43	0.16	0.40	0.51	0.31	0.22	0.54	0.35	-0.04	0.27	-0.09	0.33	0.71	0.45	-0.08	-0.04	0.08	-0.08	-0.43	0.10	0.34	0.39	0.14	0.03	0.16	0.28	0.13	0.22	0.21	0.05	0.42	0.18	-0.17	0.23	-0.17
	Corr. 1	-0.35	-0.38	0.62	-0.08	0.06	-0.17	0.33	0.43	0.51	0.20	0.57	0.57	-0.05	0.40	0.52	-0.32	-0.29	0.45	0.00	0.56	0.67	0.02	-0.15	0.70	-0.27	-0.55	0.12	0.40	0.05	0.26	-0.16	0.26	0.49	0.09	0.02	0.35	0.21	0.31	0.27	-0.36	0.04	-0.17
	Corr. 2	-0.23	-0.26	0.29	-0.46	0.22	-0.12	0.05	0.39	0.30	0.01	0.50	0.41	-0.39	0.26	0.39	-0.47	0.07	0.08	-0.18	0.27	0.31	0.11	-0.14	0.20	-0.45	-0.27	-0.04	0.15	0.15	0.25	-0.47	0.59	0.16	-0.09	-0.06	0.32	-0.15	0.31	0.17	-0.63	-0.05	-0.16
Plywood	Corr. 0	-0.16	-0.27	0.45	0.35	-0.06	0.18	0.60	0.38	0.62	0.40	0.20	0.42	0.45	0.36	0.45	0.05	-0.09	0.52	0.37	0.47	0.50	-0.09	-0.29	0.48	0.10	-0.35	0.23	0.61	0.36	0.60	0.18	-0.25	0.42	0.06	-0.07	0.11	0.35	-0.27	0.32	0.14	0.03	-0.10
	Corr. 1	-0.26	-0.38	0.48	0.09	0.09	0.12	0.36	0.41	0.33	0.33	0.35	0.50	0.23	0.41	0.51	-0.18	-0.14	0.26	0.21	0.37	0.48	0.00	-0.13	0.43	0.20	-0.38	0.23	0.48	0.07	0.47	0.03	0.20	0.56	0.48	0.01	0.55	0.38	-0.01	0.47	0.09	0.09	0.33
	Corr. 2	-0.29	-0.12	0.16	-0.25	0.33	0.26	0.12	0.25	0.44	0.09	0.34	0.31	-0.02	0.43	0.48	0.11	0.37	0.45	0.22	0.26	0.51	-0.14	-0.42	0.53	0.00	-0.12	0.39	0.25	0.34	0.11	-0.22	0.19	0.43	0.16	0.31	0.58	0.14	0.35	0.40	-0.15	0.34	0.43

E

VARIABLES

Parameters		HPI DE	RI DE	CCI DE	HPI UK	RI UK	CCI UK	HPI FR	RI FR	CCI FR	HPI IT	RI IT	CCI IT	HPI SP	RI SP	CCI SP	HPI PT	RI PT	CCI PT	HPI GR	RI GR	CCI GR
Natural gas	Corr. 0	-0.10	-0.09	-0.16	0.36	-0.04	0.40	0.23	0.26	-0.13	0.51	0.07	0.26	0.32	0.10	0.10	-0.22	0.00	0.06	0.25	0.06	0.03
	Corr. 1	-0.15	-0.14	-0.19	0.16	0.08	0.32	0.30	-0.13	0.24	0.16	0.10	-0.02	0.30	0.27	0.22	0.26	0.11	-0.12	0.41	0.19	0.20
	Corr. 2	-0.39	0.01	-0.07	0.41	0.16	0.48	0.26	0.20	0.05	0.43	0.16	0.36	0.38	0.35	0.10	0.01	0.29	0.20	0.39	0.28	0.22
Coal	Corr. 0	-0.27	-0.46	0.27	0.32	-0.13	-0.07	0.27	0.27	0.13	0.27	0.25	0.20	0.34	0.22	0.27	-0.03	-0.14	0.18	0.10	0.34	0.30
	Corr. 1	-0.05	-0.08	0.63	-0.15	0.10	0.09	0.25	0.07	0.51	0.16	0.12	0.43	0.06	0.29	0.48	0.18	-0.08	0.50	0.12	0.29	0.50
	Corr. 2	0.00	0.01	-0.02	-0.47	0.04	0.14	-0.12	0.15	0.04	0.00	0.35	0.10	-0.20	0.26	0.15	-0.05	0.11	-0.12	0.07	0.19	0.16
Kerosene	Corr. 0	-0.25	-0.37	0.03	0.25	-0.19	0.13	0.34	0.39	-0.12	0.43	0.34	0.31	0.26	0.27	0.19	-0.21	-0.10	-0.08	0.20	0.41	0.20
	Corr. 1	-0.21	-0.10	0.48	0.20	0.03	0.23	0.45	0.24	0.43	0.40	0.21	0.37	0.25	0.28	0.58	-0.16	-0.07	0.36	0.29	0.26	0.54
	Corr. 2	-0.32	-0.18	-0.06	-0.14	0.41	0.23	0.10	0.03	0.25	0.09	0.33	0.22	-0.01	0.40	0.22	-0.04	0.21	-0.05	0.26	0.26	0.26
Nickel	Corr. 0	-0.20	-0.19	-0.25	0.18	-0.24	0.16	0.24	0.35	-0.02	0.20	0.28	-0.04	0.27	0.25	0.16	0.00	0.21	-0.22	0.25	0.30	0.12
	Corr. 1	-0.42	-0.29	0.54	0.39	-0.02	-0.10	0.44	0.29	0.27	0.34	0.14	0.40	0.36	0.21	0.49	-0.18	-0.14	0.37	0.18	0.29	0.40
	Corr. 2	-0.07	-0.18	0.24	-0.21	0.53	0.24	0.18	0.09	0.58	0.16	0.24	0.45	-0.06	0.37	0.30	0.01	0.15	0.38	0.19	0.27	0.43
Sawn timber	Corr. 0	-0.42	-0.12	0.29	0.18	0.16	0.18	0.41	0.63	0.37	0.22	0.37	0.46	0.18	0.43	0.42	-0.05	0.19	0.56	0.21	0.43	0.54
	Corr. 1	-0.28	-0.26	0.17	0.08	0.11	-0.01	0.25	0.58	0.15	0.27	0.32	0.35	0.15	0.28	0.41	-0.40	0.07	0.02	0.14	0.25	0.26
	Corr. 2	-0.41	-0.46	0.17	-0.12	0.49	-0.04	0.12	0.22	0.39	0.11	0.34	0.24	-0.02	0.26	0.37	-0.22	0.17	0.28	0.10	0.27	0.36
Heating oil	Corr. 0	-0.24	-0.34	0.07	0.26	-0.21	0.13	0.31	0.36	-0.12	0.44	0.30	0.30	0.26	0.23	0.17	-0.22	-0.09	-0.04	0.19	0.38	0.18
	Corr. 1	-0.19	-0.08	0.44	0.16	0.04	0.23	0.44	0.16	0.45	0.36	0.20	0.36	0.22	0.27	0.57	-0.11	-0.08	0.32	0.28	0.25	0.51
	Corr. 2	-0.32	-0.15	-0.08	-0.14	0.37	0.25	0.08	0.05	0.21	0.10	0.34	0.21	-0.01	0.39	0.20	-0.06	0.24	-0.06	0.25	0.25	0.23
Steel	Corr. 0	-0.24	-0.40	0.46	0.42	-0.15	-0.07	0.56	0.20	0.42	0.23	0.14	0.29	0.38	0.15	0.42	0.00	-0.16	0.43	0.09	0.26	0.35
	Corr. 1	-0.05	-0.15	0.42	0.02	0.28	0.16	0.36	0.22	0.35	0.25	0.08	0.50	0.13	0.28	0.41	-0.03	-0.10	0.25	0.22	0.20	0.33
	Corr. 2	-0.12	-0.05	-0.09	-0.18	0.28	0.30	0.03	0.30	0.27	0.08	0.28	0.11	-0.03	0.28	0.23	-0.03	0.28	0.18	0.24	0.15	0.27
Aluminium	Corr. 0	-0.10	-0.39	-0.30	0.11	-0.24	0.06	0.17	0.26	-0.32	0.14	0.24	-0.09	0.19	0.11	0.03	-0.04	0.12	-0.45	0.05	0.20	-0.08
	Corr. 1	-0.18	-0.14	0.49	0.39	-0.09	-0.13	0.52	0.16	0.26	0.24	-0.02	0.25	0.34	0.09	0.52	0.02	-0.34	0.32	0.23	0.15	0.36
	Corr. 2	0.00	0.03	0.40	-0.16	0.35	0.17	0.19	0.04	0.63	0.14	0.05	0.34	-0.01	0.29	0.34	0.06	0.16	0.34	0.25	0.19	0.34
Crude oil	Corr. 0	-0.23	-0.40	-0.13	0.08	-0.17	0.06	0.19	0.36	-0.25	0.31	0.39	0.18	0.15	0.28	0.10	-0.16	-0.06	-0.26	0.16	0.42	0.14
	Corr. 1	-0.23	-0.04	0.52	0.22	-0.04	0.16	0.42	0.26	0.39	0.39	0.19	0.35	0.22	0.21	0.56	-0.18	-0.05	0.41	0.24	0.25	0.52
	Corr. 2	-0.26	-0.18	0.04	-0.21	0.38	0.13	0.08	-0.02	0.28	0.05	0.31	0.22	-0.07	0.35	0.24	-0.09	0.08	-0.09	0.19	0.24	0.24
Iron ore	Corr. 0	-0.21	-0.40	0.00	0.20	-0.04	-0.11	0.20	0.29	-0.12	0.23	0.22	0.12	0.20	0.25	0.15	0.03	-0.02	-0.10	0.21	0.34	0.23
	Corr. 1	-0.13	0.12	0.64	-0.12	0.14	0.13	0.23	0.19	0.71	0.13	0.11	0.36	0.02	0.26	0.58	0.12	0.02	0.68	0.14	0.25	0.56
	Corr. 2	-0.15	-0.05	0.08	-0.46	0.08	-0.02	-0.26	0.15	-0.08	-0.03	0.36	0.13	-0.23	0.23	0.12	-0.25	0.07	-0.25	-0.08	0.16	0.08
Copper	Corr. 0	-0.24	-0.51	-0.32	-0.03	-0.20	0.00	0.12	0.38	-0.35	0.16	0.46	0.00	0.12	0.26	0.08	-0.15	0.07	-0.47	0.06	0.37	0.04
	Corr. 1	-0.28	-0.21	0.48	0.28	-0.05	-0.21	0.50	0.26	0.34	0.20	0.13	0.30	0.20	0.15	0.56	-0.05	-0.17	0.34	0.14	0.26	0.44
	Corr. 2	-0.09	-0.04	0.48	-0.27	0.42	0.04	0.16	0.18	0.59	0.11	0.17	0.43	-0.16	0.24	0.41	-0.23	-0.01	0.26	0.10	0.21	0.33

Parameters		HPI AT	RI AT	CCI AT	HPI NL	RI NL	CCI NL	HPI BE	RI BE	CCI BE	HPI SE	RI SE	CCI SE	HPI PL	RI PL	CCI PL	HPI CZ	RI CZ	CCI CZ	HPI HU	RI HU	CCI HU
Natural gas	Corr. 0	-0.03	-0.10	-0.17	0.53	0.00	-0.22	0.16	0.00	0.00	0.12	0.13	0.06	-0.05	-0.16	-0.15	-0.05	-0.12	-0.01	0.13	-0.05	0.19
	Corr. 1	-0.38	0.02	0.15	0.30	0.10	0.30	0.16	0.24	-0.16	0.15	-0.13	0.22	0.11	0.57	0.08	-0.04	-0.08	0.18	0.17	0.47	0.49
	Corr. 2	-0.24	-0.38	0.01	0.18	0.09	0.18	0.26	0.28	0.23	0.13	0.03	0.26	0.17	0.38	0.10	-0.03	0.02	0.32	0.15	0.39	0.10
Coal	Corr. 0	-0.08	-0.09	0.40	0.13	-0.24	-0.04	0.25	0.08	0.16	0.41	-0.16	0.35	0.40	-0.10	0.10	0.40	0.00	0.16	0.15	0.06	-0.11
	Corr. 1	-0.23	-0.28	0.56	0.12	-0.50	0.36	0.33	-0.14	0.27	-0.22	0.12	0.41	0.29	0.21	0.63	0.24	0.19	0.53	0.03	0.17	0.18
	Corr. 2	0.25	0.04	-0.04	-0.22	-0.28	0.09	0.03	0.31	0.05	-0.51	0.22	0.10	-0.31	0.08	0.13	-0.16	0.39	-0.06	-0.31	0.04	-0.04
Kerosene	Corr. 0	0.03	-0.02	-0.06	0.04	-0.27	-0.27	0.37	0.08	0.10	0.11	0.16	0.10	0.07	-0.08	-0.05	-0.13	0.05	0.17	-0.09	0.04	-0.15
	Corr. 1	-0.12	-0.06	0.44	0.46	-0.25	0.23	0.33	0.18	0.23	0.07	-0.04	0.38	0.13	0.08	0.27	0.06	-0.10	0.28	-0.02	-0.05	0.36
	Corr. 2	-0.18	-0.27	0.11	-0.07	0.01	0.40	0.13	0.29	0.21	-0.11	0.20	0.36	0.25	0.64	0.37	-0.20	0.13	0.34	-0.07	0.57	0.33
Nickel	Corr. 0	-0.02	0.13	-0.07	-0.09	0.06	-0.18	0.20	0.58	-0.04	0.16	-0.09	-0.04	-0.26	-0.08	-0.34	0.00	-0.01	-0.16	-0.16	-0.05	-0.20
	Corr. 1	-0.22	-0.09	0.53	0.34	-0.10	0.03	0.36	-0.07	0.38	0.43	-0.03	0.47	0.62	-0.02	0.35	0.20	-0.16	0.50	0.17	0.00	0.19
	Corr. 2	-0.11	-0.44	0.27	-0.02	-0.30	0.53	0.29	0.10	0.34	-0.30	0.26	0.41	0.07	0.40	0.59	0.09	0.16	0.34	-0.07	0.39	0.19
Sawn timber	Corr. 0	-0.16	-0.38	0.47	-0.26	-0.06	0.04	0.51	0.47	0.35	0.00	0.13	0.25	-0.10	0.02	0.17	0.03	0.02	0.41	-0.29	0.04	-0.18
	Corr. 1	0.03	0.02	0.07	0.07	-0.04	-0.08	0.31	0.33	0.39	0.13	0.25	0.25	0.08	-0.29	0.15	0.15	-0.02	0.00	-0.18	-0.31	-0.07
	Corr. 2	-0.13	-0.22	0.52	0.07	-0.05	0.29	0.15	0.21	0.17	0.29	0.16	0.41	0.40	0.21	0.45	0.04	0.19	0.30	-0.08	0.30	0.43
Heating oil	Corr. 0	0.03	-0.04	-0.05	0.11	-0.27	-0.26	0.32	0.03	0.11	0.11	0.14	0.11	0.12	-0.10	-0.03	-0.08	0.05	0.18	-0.04	0.05	-0.11
	Corr. 1	-0.16	-0.04	0.45	0.43	-0.25	0.25	0.32	0.13	0.15	0.01	-0.01	0.37	0.11	0.16	0.29	0.06	-0.06	0.28	-0.02	0.02	0.37
	Corr. 2	-0.16	-0.25	0.07	-0.08	0.03	0.34	0.12	0.32	0.21	-0.14	0.22	0.32	0.18	0.60	0.31	-0.24	0.14	0.31	-0.09	0.54	0.28
Steel	Corr. 0	-0.21	-0.04	0.66	0.12	-0.09	-0.10	0.40	0.08	0.27	0.33	-0.17	0.30	0.26	-0.12	0.03	0.20	-0.31	0.43	0.10	0.00	-0.10
	Corr. 1	0.00	-0.20	0.19	0.14	-0.30	0.26	0.50	-0.06	0.55	-0.11	0.19	0.40	0.30	0.10	0.53	0.03	-0.16	0.47	0.07	0.04	0.14
	Corr. 2	0.22	-0.22	0.19	-0.07	-0.08	0.32	0.19	0.53	0.17	-0.14	-0.01	0.25	-0.15	0.06	0.17	0.12	0.15	-0.03	-0.14	0.10	0.34
Aluminium	Corr. 0	0.04	0.46	-0.19	-0.09	0.07	-0.49	0.13	0.33	-0.24	0.18	0.11	-0.25	-0.27	-0.20	-0.40	-0.25	-0.01	-0.09	-0.19	-0.14	-0.29
	Corr. 1	0.00	-0.02	0.51	0.32	-0.17	-0.02	0.45	-0.08	0.35	0.40	-0.36	0.41	0.44	-0.08	0.17	-0.02	-0.35	0.30	0.17	-0.18	0.04
	Corr. 2	0.01	-0.55	0.18	0.03	-0.34	0.63	0.29	0.16	0.70	-0.24	-0.03	0.45	0.31	0.31	0.60	0.13	-0.09	0.38	0.08	0.27	0.18
Crude oil	Corr. 0	0.05	0.05	-0.19	-0.11	-0.25	-0.29	0.27	0.11	-0.03	0.06	0.21	0.03	0.02	-0.01	-0.07	-0.19	0.18	0.06	-0.17	0.10	-0.20
	Corr. 1	-0.09	-0.08	0.46	0.41	-0.26	0.14	0.29	0.15	0.19	0.10	-0.09	0.32	0.12	-0.03	0.19	0.05	-0.04	0.21	-0.06	-0.15	0.25
	Corr. 2	-0.17	-0.19	0.11	-0.09	-0.06	0.37	0.10	0.19	0.22	-0.16	0.23	0.35	0.22	0.60	0.37	-0.20	0.12	0.29	-0.10	0.49	0.27
Iron ore	Corr. 0	0.21	-0.11	-0.01	0.03	-0.27	-0.03	0.34	-0.01	0.16	0.31	-0.10	0.30	0.52	0.03	0.25	0.05	0.05	0.16	0.11	0.13	-0.06
	Corr. 1	-0.22	-0.50	0.70	0.02	-0.42	0.46	0.30	0.20	0.36	-0.13	-0.12	0.40	0.11	0.09	0.45	0.34	0.16	0.27	-0.12	0.00	0.11
	Corr. 2	0.17	0.14	-0.04	-0.20	-0.21	0.07	-0.12	0.19	0.10	-0.36	0.36	0.17	0.01	0.08	0.22	-0.01	0.44	-0.04	-0.26	0.01	-0.01
Copper	Corr. 0	0.00	0.41	-0.16	-0.19	-0.02	-0.49	0.14	0.32	-0.29	0.11	0.30	-0.14	-0.24	-0.12	-0.28	-0.24	0.24	-0.09	-0.31	-0.03	-0.27
	Corr. 1	0.00	-0.08	0.56	0.07	-0.20	-0.07	0.44	0.00	0.27	0.30	-0.20	0.35	0.34	-0.08	0.18	-0.08	-0.16	0.28	-0.10	-0.16	-0.17
	Corr. 2	0.06	-0.38	0.21	-0.12	-0.36	0.45	0.28	0.17	0.71	-0.24	0.15	0.39	0.17	0.14	0.48	-0.02	-0.03	0.24	-0.18	0.03	0.01

VARIABLES

Parameters		HPI DE	RI DE	CCI DE	HPI UK	RI UK	CCI UK	HPI FR	RI FR	CCI FR	HPI IT	RI IT	CCI IT	HPI SP	RI SP	CCI SP	HPI PT	RI PT	CCI PT	HPI GR	RI GR	CCI GR
Zinc	Corr. 0	-0.04	-0.38	-0.32	-0.03	-0.04	0.08	0.11	0.32	-0.17	0.07	0.25	-0.11	0.11	0.13	0.08	-0.05	0.04	-0.34	0.08	0.17	-0.04
	Corr. 1	-0.23	-0.10	0.45	0.34	-0.08	-0.24	0.30	0.21	0.13	0.09	-0.02	0.11	0.24	0.05	0.41	0.05	-0.19	0.22	0.10	0.12	0.29
	Corr. 2	0.07	0.16	0.63	-0.28	0.27	0.05	0.06	-0.02	0.68	0.05	-0.03	0.36	-0.09	0.19	0.39	0.10	0.02	0.58	0.10	0.09	0.37
Tin	Corr. 0	-0.32	-0.44	-0.02	0.20	-0.18	-0.14	0.18	0.40	-0.02	0.13	0.40	0.07	0.15	0.21	0.15	-0.15	0.06	-0.04	0.00	0.34	0.21
	Corr. 1	-0.21	-0.14	0.65	0.02	0.08	-0.21	0.31	0.24	0.41	0.10	0.09	0.41	0.03	0.15	0.52	-0.09	-0.20	0.47	-0.04	0.21	0.42
	Corr. 2	0.02	-0.07	0.19	-0.50	0.39	0.05	-0.11	0.13	0.32	-0.05	0.26	0.24	-0.33	0.17	0.21	-0.22	0.15	0.06	-0.08	0.09	0.17
Standing timber	Corr. 0	-0.13	0.01	0.48	0.20	0.03	0.18	0.43	0.36	0.57	0.40	0.14	0.47	0.25	0.31	0.42	-0.01	-0.04	0.56	0.31	0.42	0.49
	Corr. 1	-0.17	-0.36	0.35	-0.14	0.02	-0.01	0.13	0.30	0.26	0.19	0.43	0.33	0.00	0.29	0.32	-0.36	-0.18	-0.03	0.02	0.33	0.31
	Corr. 2	-0.24	-0.24	0.13	-0.24	0.23	-0.07	-0.01	0.15	0.19	-0.15	0.34	0.18	-0.22	0.24	0.20	0.00	0.14	0.32	-0.10	0.16	0.35
Benzene	Corr. 0	-0.26	-0.38	-0.25	0.04	-0.13	0.04	0.11	0.38	-0.36	0.28	0.42	0.14	0.09	0.26	0.03	-0.24	-0.02	-0.38	0.13	0.40	0.07
	Corr. 1	-0.24	-0.11	0.44	0.25	-0.04	0.08	0.43	0.25	0.39	0.37	0.20	0.33	0.20	0.17	0.53	-0.21	-0.09	0.37	0.20	0.25	0.47
	Corr. 2	-0.25	-0.19	0.11	-0.20	0.41	0.11	0.10	0.00	0.30	0.05	0.29	0.26	-0.10	0.31	0.24	-0.15	0.04	-0.07	0.13	0.23	0.23
Propane	Corr. 0	-0.20	-0.27	-0.18	0.17	-0.17	0.15	0.09	0.31	-0.37	0.31	0.26	0.11	0.19	0.13	0.05	-0.23	-0.24	-0.22	0.10	0.21	0.01
	Corr. 1	-0.13	0.00	0.33	0.21	-0.10	0.14	0.37	-0.04	0.39	0.25	0.04	0.18	0.25	0.15	0.45	0.11	0.13	0.20	0.22	0.15	0.35
	Corr. 2	-0.20	-0.10	0.06	-0.14	0.25	0.18	0.10	-0.03	0.17	0.14	0.21	0.25	0.03	0.30	0.15	-0.05	-0.03	0.00	0.25	0.25	0.17
Lead	Corr. 0	-0.30	-0.54	-0.33	-0.03	-0.08	-0.04	0.02	0.36	-0.33	0.10	0.48	-0.03	0.10	0.29	0.04	-0.18	0.06	-0.51	0.04	0.36	0.04
	Corr. 1	-0.27	-0.17	0.48	0.24	0.02	-0.17	0.37	0.26	0.34	0.14	0.12	0.33	0.14	0.15	0.43	0.03	-0.06	0.54	0.04	0.25	0.46
	Corr. 2	0.01	-0.02	0.35	-0.40	0.24	0.01	0.05	0.17	0.38	0.06	0.17	0.30	-0.18	0.19	0.35	-0.20	-0.06	0.06	0.03	0.17	0.20

Parameters		HPI AT	RI AT	CCI AT	HPI NL	RI NL	CCI NL	HPI BE	RI BE	CCI BE	HPI SE	RI SE	CCI SE	HPI PL	RI PL	CCI PL	HPI CZ	RI CZ	CCI CZ	HPI HU	RI HU	CCI HU
Zinc	Corr. 0	0.11	0.21	-0.17	-0.17	0.02	-0.33	0.16	0.47	-0.05	0.19	-0.01	-0.16	-0.35	-0.25	-0.36	-0.19	-0.04	-0.26	-0.23	-0.18	-0.30
	Corr. 1	0.11	-0.02	0.49	0.14	-0.15	0.01	0.33	-0.01	0.31	0.49	-0.40	0.36	0.61	-0.13	0.19	0.14	-0.22	0.21	0.14	-0.22	-0.02
	Corr. 2	-0.05	-0.57	0.39	0.07	-0.43	0.60	0.17	-0.03	0.64	-0.33	-0.04	0.48	0.29	0.14	0.67	0.33	0.07	0.34	0.09	0.10	0.13
Tin	Corr. 0	0.12	0.08	0.22	-0.23	-0.08	-0.25	0.18	0.32	-0.02	0.26	-0.03	0.12	0.07	-0.18	-0.16	0.15	0.10	-0.04	-0.19	-0.03	-0.30
	Corr. 1	-0.23	-0.22	0.57	-0.01	-0.27	0.06	0.34	-0.18	0.35	0.08	0.13	0.33	0.39	-0.07	0.45	0.17	-0.01	0.43	-0.10	-0.13	-0.05
	Corr. 2	0.26	-0.04	0.12	-0.23	-0.26	0.24	0.03	0.26	0.27	-0.43	0.30	0.15	-0.23	0.01	0.28	-0.10	0.25	-0.01	-0.35	-0.05	-0.05
Standing timber	Corr. 0	-0.08	-0.48	0.33	0.02	-0.44	0.28	0.49	0.26	0.56	0.01	-0.16	0.33	-0.05	-0.05	0.16	0.22	-0.04	0.15	-0.04	-0.07	-0.26
	Corr. 1	0.11	0.16	0.28	0.01	-0.39	0.15	0.19	0.14	0.26	-0.13	0.29	0.35	0.14	-0.05	0.26	0.31	0.15	0.12	-0.12	-0.01	0.18
	Corr. 2	0.00	-0.26	0.46	-0.32	-0.06	0.11	0.10	0.02	-0.08	-0.22	0.29	0.24	0.19	0.23	0.43	0.00	0.32	0.38	-0.25	0.33	0.17
Benzene	Corr. 0	0.07	0.15	-0.29	-0.15	-0.17	-0.36	0.19	0.14	-0.13	0.07	0.29	-0.05	-0.07	-0.01	-0.15	-0.28	0.26	-0.05	-0.24	0.06	-0.22
	Corr. 1	-0.08	-0.07	0.45	0.34	-0.22	0.06	0.28	0.13	0.14	0.15	-0.10	0.30	0.09	-0.05	0.10	0.02	-0.07	0.13	-0.11	-0.15	0.14
	Corr. 2	-0.17	-0.18	0.12	-0.13	-0.08	0.35	0.11	0.17	0.28	-0.14	0.26	0.32	0.22	0.54	0.35	-0.21	0.08	0.30	-0.14	0.43	0.21
Propane	Corr. 0	-0.10	0.03	-0.19	0.10	-0.10	-0.39	0.12	0.04	-0.16	0.21	0.15	-0.05	-0.06	-0.15	-0.24	-0.09	0.13	-0.15	-0.10	-0.07	-0.09
	Corr. 1	-0.15	0.06	0.44	0.39	-0.13	0.19	0.17	0.11	-0.01	0.05	-0.17	0.27	0.16	0.18	0.17	0.09	-0.04	0.24	0.05	0.05	0.21
	Corr. 2	-0.20	-0.21	0.01	0.00	-0.11	0.28	0.15	0.08	0.29	-0.15	0.20	0.29	0.16	0.50	0.30	-0.25	0.08	0.34	0.03	0.45	0.24
Lead	Corr. 0	-0.01	0.36	-0.13	-0.21	0.01	-0.33	0.08	0.35	-0.22	0.22	0.27	-0.02	-0.04	-0.01	-0.18	-0.07	0.25	-0.12	-0.22	0.07	-0.15
	Corr. 1	-0.06	-0.25	0.63	-0.02	-0.20	-0.01	0.36	-0.06	0.17	0.21	-0.12	0.33	0.31	-0.06	0.27	0.10	0.01	0.32	-0.09	-0.06	-0.18
	Corr. 2	-0.01	-0.16	0.04	-0.15	-0.34	0.22	0.16	0.16	0.48	-0.31	0.24	0.19	-0.09	0.00	0.29	-0.06	0.09	0.05	-0.27	-0.13	-0.14

Abb. 12: Results overview – Correlations with |c| >= 0.4 to the HPI marked in blue, to the CCI/from the CCI to the HPI marked in yellow, to the RI/from the RI to the HPI marked in green;
sources: Deutsche Bundesbank, Eurostat, IndexMundi, OECD, RWI/ISL; own calculation and illustration.

The analysis of numerous potential leading indicators with regard to their correlation to the real estate market (HPI for 14 countries) resulted in the fundamental interrelationships shown in Fig. 12. In this respect a number of relevant correlations can be established among the real estate-related and general economic indicators. Here the interesting leading indicators include private consumption, the GDP and the unemployment rate. With the indicators from the raw materials, transport and energy sector – which are not directly related to the real estate market – the correlations are less clear. But they are also present in this segment, for example with uranium prices, the number of construction companies, the number of new passenger vehicle registrations and passenger transport numbers.

CORRELATIONS TO HPI ECONOMIC INDICATORS	Corr. 0	Corr. 1	Corr. 2	Total	Total lead time	Number of countries
Consumption	12	9	6	27	15	12
GDP	11	9	6	26	15	12
Unemployment rate	9	8	6	23	14	10

Retail trade turnover	11	7	4	22	11	12
Persons in employment	9	6	5	20	11	10
Number of employees	6	6	5	17	11	8
Industrial production	6	3	3	12	6	9
Imports of goods	7	1	1	9	2	7
Gross earnings	5	2	1	8	3	5
12M Euribor	6	1	0	7	1	6
1M Euribor	5	1	0	6	1	5
Exports of goods	2	1	0	3	1	2
Working hours per person employed	0	1	0	1	1	1

INDICATORS RAW MATERIALS TRANSPORT ENERGY						
	Corr. 0	**Corr. 1**	**Corr. 2**	**Total**	**Total lead time**	**Number of countries**
Number of construction companies	7	4	6	17	10	9
Uranium	7	7	1	15	8	10
Passenger vehicle registrations	4	5	4	13	9	8
Passenger transport by rail	7	3	3	13	6	8
Passenger transport (domestic)	3	4	2	9	6	5
Silver	0	2	5	7	7	7
Road freight	1	2	4	7	6	4
Primary energy consumption	2	2	3	7	5	3
Rail freight	1	3	2	6	5	4
Diesel	1	2	3	6	5	6
Gold	1	0	5	6	5	6
Overnight stays tourists	2	2	2	6	4	4
Investment in transport infrastructure	2	1	3	6	4	3
Plywood	4	2	0	6	2	5
Index container transhipment	1	2	2	5	4	5
Natural gas	2	1	2	5	3	4
Nickel	0	4	0	4	4	4
Kerosene	1	3	0	4	3	3
Coal	2	0	2	4	2	3
Producer prices manufacturing industry	3	1	0	4	1	4
Sawn timber	3	0	1	4	1	3
Aluminium	0	3	0	3	3	3
Heating oil	1	2	0	3	2	3
Steel	2	1	0	3	1	3
Crude oil	0	2	0	2	2	2
Copper	0	2	0	2	2	2
Zinc	0	2	0	2	2	2
Tin	0	0	2	2	2	2
Iron ore	1	0	1	2	1	2
Standing timber	2	0	0	2	0	2
Benzene	0	1	0	1	1	1
Propane	0	0	0	0	0	0
Lead	0	0	0	0	0	0

INDICATORS REAL ESTATE MARKET						
	Corr. 0	Corr. 1	Corr. 2	Total	Total lead time	Number of countries
Construction costs index	9	3	1	13	4	9
Rent index	6	5	5	16	10	9
Construction approvals	12	11	6	29	17	12

Fig. 13: Summary of indicator performance (by number of correlations) to the house price index (HPI) – taking into account correlations with |c| >= 0.4;
sources: Deutsche Bundesbank, Eurostat, IndexMundi, OECD, RWI/ISL; own calculation and illustration.

9. Conclusion

A fundamental result of the extensive indicator test is a finding on parallel developments on differing markets. Suitable as comparative values are price developments such as those for raw materials as well as other indicators such as economic output, consumption, retail trade turnover and traffic volume.

Above all, possible leading indicators in the test have proven to be parameters which have a delayed impact on purchasing power and incomes (e.g. industrial production towards the end of recessions). Yet prices for various raw materials correlate in part surprisingly strongly with the real estate markets, something which can only be explained in part by supply relationships and the resulting construction costs and real assets. These parameters often provide general, i.e. across economies, economic information which also – but not exclusively – correlates with real estate values. In contrast, typical eRIrical parameters such as rents, income, economic strength and construction costs are to be regarded in terms of their size and development as specific for the respective market. Accordingly, they can be compared easily with the devel-opment of the respective real estate markets, yet offer only short lead times.

The usability of a catalogue of indicators expanded to include additional eRIrical parameters is dependent on its stability not least of all. It should be possible to use the indicators in a uniform manner for real estate market decisions in a wide variety of markets and economic phases where possible. Additional tests are necessary for this. Established correlations have to be backed up by a well-founded market analysis and causal relationships.

Suitable leading indicators allow for a timely analysis, decision and reaction to market changes for the real estate sector portfolio management. The room for manoeuvre, and above all in the tactical area, will then be significantly greater. None of the observed indicators dominates and when viewed in isolation none can provide reliable statements on the future development of real estate markets. Nevertheless, several indicators with strong correlations to the real estate market can as a whole provide an overview of the situation on the real estate market – and thus form an early-warning system for the real estate market.

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