The Export Scan

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Daan Zult and Floris van Ruth

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Explanation of symbols

.	data not available
*****	provisional figure
******	revised provisional figure (but not definite)
x	publication prohibited (confidential figure)
–	nil
–	(between two figures) inclusive
0 (0.0)	less than half of unit concerned
empty cell	not applicable
2011–2012	2011 to 2012 inclusive
2011/2012	average for 2011 up to and including 2012
2011/'12	crop year, financial year, school year etc. beginning in 2011 and ending in 2012
2009/'10–2011/'12	crop year, financial year, etc. 2009/'10 to 2011/'12 inclusive

Due to rounding, some totals may not correspond with the sum of the separate figures.

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Information
Telephone +31 88 570 70 70
Telefax +31 70 337 59 94
Via contact form:
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The Export Scan

Daan Zult and Floris van Ruth

Summary:

Statistics Netherlands has developed a new type of analytical tool for economic analysis. Its goal is to give early warning of developments influencing Dutch exports. The central idea is to focus on the demand for Dutch exports by identifying the most relevant sectors of the main trading partners. The developments in these sectors are monitored using selected signalling indicators with a leading character. In this system, only relevant sentiment indicators are used, mostly production expectations from the DG-ECFIN sentiment surveys. The aggregate of the indicatorset is leading when compared to the growth rate of Dutch exports. The construction of the system and the presentation of the indicators results in important additional analytical properties. The system takes the form a single visualisation in which the component indicators are individually shown, with a robust algorithm-based characterisation of their development. This allows the user to see how (broadly) observed developments are diffused among countries and industries. This also results in increased early warning capabilities, as changes in development in individual industries are immediately visible.

Keywords: Business cycles, leading indicators, sentiment indicators, exports, trade, production expectations

1. Introduction

Policymakers and analysts require accurate information on current and future economic developments. In the past decades, a whole range of indicators and econometric techniques have been developed to meet these needs. Sentiment or confidence indicators, like the producer and consumer surveys, as reported by the Directorate General European Commission of Economic and Financial Affairs (DG-ECFIN), play an important role in analysing current and near-term economic conditions. These can also be used for accurate assessments of the current stance of the business cycle, thus yielding insight into medium-term developments as well. Leading indicators, as produced by for example the Organisation for Economic Co-operation and Development (OECD) and the conference board, are constructed to pick up signals of relevant future developments as soon as these become visible in economic indicators. For a small open economy as The Netherlands, early information on export developments is crucial.

For this reason, Statistics Netherlands has developed the *export scan* (ES) indicator. It differs in several crucial aspects from most traditional leading and sentiment-based indicators. Most composite (leading) indicators focus on general economic conditions, though there are interesting exceptions such as the Conference Board's employment trends index, several of the Economic Cycle Research Institute (ECRI) indicators (in particular its leading indicator for exports but also their future inflation gauge) and finally Statistics Netherlands' vacancy indicator (van Ruth & Wekker, 2009). Two fundamental concepts lie at the foundation of the Export Scan. First and most important the demand-pull approach. The basic idea is that the development of Dutch Exports is driven by changes in demand from the main costumers. Thus monitoring the developments in the main export markets should yield information on (near) future export developments. This is done by using a signals approach, the second fundamental concept of the ES. For each individual export market a leading indicator is selected and monitored separately for signals of coming changes. This structured approach yields more meaningful and detailed information than a standard composite indicator.

Export indicators are important because nowadays, in many countries, the business cycle is very much determined by their export developments and developments in world trade. This means that accurate and quick information on trends in trade is crucial for policy makers and business alike, especially as trade has been shown to be very sensitive to the economic climate. However, there is no consensus on a single clear-cut optimal approach for monitoring trade. An obvious and existing example of trade monitoring is the monthly world trade statistics as provided by The Netherlands Bureau for Economic Policy Analysis (CPB), which provides monthly data on total world trade. This highly aggregated statistic provides us with a quick glance on the current state of world trade. However, this level of aggregation comes at a price, since the statistic is largely deprived of economic meaning. In other words, it does not tell us why world trade *is as it is* or *acts as it acts*.

The desire to understand, monitor and predict world trade is not new. For instance, already in 1962, Tinbergen introduced his gravity model that served to describe and analyse global trade flows. Nowadays, world trade analyses generally belong to the realms of econometrics and mathematical economics. However, in general these analyses are highly sophisticated and not very transparent, as illustrated by the 1750 equations that belong to the SAFFIER II model that is currently in use and developed by CPB (2010). Moreover, these sophisticated models, as applied by public forecasting agencies, did not foresee the great collapse in world trade that occurred at the end of 2008 (Baldwin, 2010). An important reason is that these models did not consider 'soft' variables such as (financial) sentiments (Baldwin, 2010) and the high level of integration and synchronization of global supply chains (Araujo, 2009). These shortcomings create precedence for other, more basic approaches where simplicity, transparency and sentiment/financial/other (e.g. internet search behaviour) variables are more prominent. The ES uses such soft variables with the aim of constructing an indicator that contains information on (near) future developments while being economically meaningful.

In the remaining of this paper we first discuss the ES concept in further detail. Next we apply the ES to The Netherlands and we evaluate its performance with respect to the resulting ES indicatorset. Finally, we introduce a visualisation tool (which we consider an important component of the ES) that aims to show the ES in an economically meaningful way (see figure 9 to get an idea of this visualisation).

2. The Export Scan Concept

The ES-concept can be viewed as a general technique that aims to identify appropriate (leading) indicators for a country's export flow via a structured approach and then to extract relevant signals of future developments. The resulting indicators should allow one to monitor developments influencing the export flow in an economically meaningful and insightful way. With meaningful and insightful we mean that the result is relatively non-technical and easy to interpret using basic economic insights. This is important, as the aim of the ES is to construct a monitoring system that is able to serve a broad audience and yield rich information. In order to assure this, the ES consists of two independent components. The first (more technical) component is a *detection method* (Export Scan Detection Method, ESDM) that aims to identify the main customers, or markets for a country's exports (i.e. the first 'scan'). In general, this will result in identifying the most important destination sectors in an exporting country's main trading partners. These end-users are then linked to leading indicators that monitor developments within these country-sector combinations. Consecutively, the setup of the system is optimised by analysing the relation between signals of individual indicators and more general developments. In the case study we present in the next section of this paper we will limit ourselves to using sentiment variables as the leading indicators. This is partly due to time considerations, but also because of the excellent statistical properties of sentiment indicators. Some possess the required leading character, and these are then available at a monthly frequency, with little or no publication lag, and all are free of data revisions. Moreover, they tend to have a clear and easy to interpret meaning, making the system more useful to the user. However, despite these excellent properties it might be that better, i.e. more leading, monitoring variables could be found.

The signalling indicators can be expected to lead export sub-flow developments and can therefore serve as input for an ES composite leading indicator (ESI) for total exports. In this context the ES shows similarities with the ECRI approach to constructing business cycle indicators, most notably their Export Leading Indicators (Dua & Banerji, 2001, Hiris et al., 1995). Here ECRI constructs leading indicators for exports by combining data on real exchange rates with leading indicators of major trading partners. The ES approach differs mainly in the fact that it focuses on specific end-users (i.e. specific users instead of complete countries) within the major trading partners, and is therefore a more powerful analytical tool. An indicator constructed in a related fashion is the leading economic indicator of The Netherlands' centre for policy analysis (Kranendonk et al., 2004), which is constructed using sub-indicators representing developments in major sectors and demand categories of the Dutch Economy. The indicators attained by the ESDM have a direct and intuitive connection to the development of exports, making the system of greater value to its users. It also means that a disaggregate representation can be as informative as the composite indicator.

The leading character of the composite indicator might well depend on its exact composition. One might therefore be tempted to perform some statistical optimisation, data mining techniques such that the composite leading indicator shows an optimal lead. In fact, many leading indicators have a composition that depends on some quantitative criteria such as optimal correlation, maximum lead profile or best predictions. However, an undesirable side effect is that the theoretical link between the leading indicator and a reference series can become rather loose. As a consequence, these leading indicators are sometimes perceived as a "black box". It can be difficult for users to ascertain why the indicator is giving a positive or negative signal, and what this means. This vagueness is in contrast with the ES philosophy, so we suggest trying to avoid data mining when possible and use simple techniques in the construction of an ESI when possible. This more structured and disaggregate set-up allows for a meaningful and intuitive signals approach. Each of the selected indicators monitors demand developments in a specific export market. Therefore, each signal of an indicator has distinct and individual meaning. This allows for a signal approach, in which each indicator can be monitored separately for signals of coming changes.

The second major component of the ES is the (user friendly) ES *visualisation tool* that aims to give quick and easy to interpret insight into the developments in the important export markets (i.e. the second 'scan'). It is a new tool in which we show both the individual indicators collected during the ESDM phase and an ESI in a comprehensive fashion. This means that both the individual signals can be monitored, but also the overall situation for Dutch Exports. We will discuss this into more detail after we applied the selection method on Dutch exports in section 3. Hereby we can test and present the visualisation tool with real data.

2.1 The Export Scan Detection Method

The ES builds upon the fact that an export flow can always be divided into a number of country and product specific sub-flows, which we refer to as the country's *export portfolio*. For most countries in the world this portfolio is easily constructed with the help of databases like the United Nations COMTRADE[1] database. The next step of the ESDM builds upon the fact that an export sub-flow is always destined for either the inputs of some branch of industry, or for a final demand category (i.e. consumption or fixed capital formation). This implies that by monitoring the situation of the end-users (i.e. the demand side) of these sub-flows, we can hope to foresee export developments earlier. It will be interesting to see how this information compares to signals given by indicators such as the Dutch manufacturing industries export order book level assessments (i.e. supply side information). In concept, the ESDM is related to the bullwhip concept in business cycle analysis, (see e.g. Banerji & Dua, 2010). An obvious way to establish this link between the export sub-flows and end-users is by using the National Accounts' use-tables of the importing countries. Here we should realise that use-tables are not as widely available as trade data, which limits the scope of the ES. However, since they are available for most industrialised countries, which are also the main importing countries in the Dutch case, the problem seems limited in practise. The idea is that use-tables connect inputs to different end-users, so they allow us to connect exported sub-flows to likely end-users. We say likely, because the use-table of a country has a level of aggregation that does not allow us to assure whether an end-user uses imports or locally produced inputs. For instance, by combining trade data and use-tables, we can conclude that Belgium imports Dutch chemicals and that the Belgian coke and refined petroleum industry uses such chemicals. However, we cannot ascertain whether the imported Dutch chemicals are actually used by the Belgian coke and refined petroleum industry, or that (for some unknown reason) this industry uses a different source for input of chemicals. Therefore, in order for the ES to work, we assume that imported goods are treated similarly to locally produced goods. This implies both are equally likely to serve as input for each end-user.

So far, the ESDM uses trade data and use-tables to construct a country's export portfolio and to identify its end-users. Now the last step is to link the identified end-users to (leading) indicators that monitor their developments. Here we should keep in mind that we are looking for economically meaningful indicators. This implies that the connection between the indicators and end-users' demand for Dutch exports must be clear-cut. This requirement suggests the use of sentiment indicators, which to our knowledge are the only high-frequent up-to-date data that are directly linked to a broad set of end-users. For instance, DG-ECFIN provides us with the sentiment of the Belgian coke and refined petroleum industry, exactly as it is defined in the use-tables. However, like with the use-tables, we should realise that the use of sentiment data limits the scope of the ES in practice, since detailed sentiment data is currently only publicly available for EU countries. Therefore, the use of sentiment indicators limits the scope of the ES towards countries that have EU countries as important export partners, which mainly holds for EU countries themselves and countries proximate to the EU. For non-EU export countries one might be able to find alternative monitoring variables, but this is beyond the scope of this paper. Using a more mixed set of indicators would of course be an option as well.

So far we discussed all the elements of the ESDM, which allows us to summarise them more schematically. We discussed three minimal data requirements and three analytical steps. The minimal data requirements are:

I. Export data suited to construct an export portfolio, where on the product level a degree of aggregation is allowed (e.g. the Standard International Trade Classification (SITC) 1-digit level should suffice).

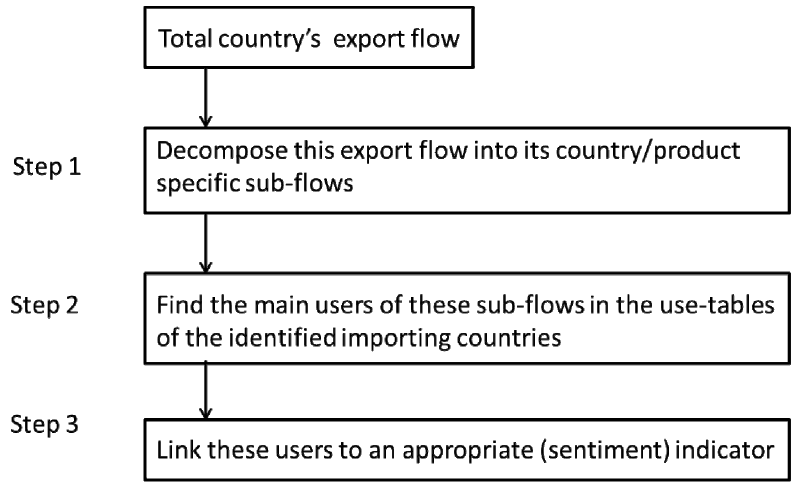
II. Data that links an export flow to its actual users, in general this implies there should be use-tables of the importing countries available.

III. High frequent data with low publication lag that meaningfully reflect, and preferably lead, end-users demand. In general, it can be assumed that developments in sector activity will translate into matching developments in demand. This implies that there should be sector specific (sentiment) indicators available.

Now, when I, II and III hold, we can perform the analytical ESDM in three steps, as presented in figure 1 below.

[1] http://comtrade.un.org/db/

Figure 1: Schematic overview of the ESDM



Step 3 in figure 1 concerns the collection of indicators that are preferably leading. This implies that simply collecting a set of related indicators can be insufficient. Further analysis is required to detect and select the indicators that are leading. We will discuss this issue in the next section, where it is part of the case study that we present.

Now that we discussed and schematised the ESDM, we should discuss some common practical issues that occur during its execution. First, during step 1 it is likely that one finds a rather diverse and large export portfolio. For instance, in 2010 The Netherlands had 2312 SITC 1-digit sub-flows towards 244 countries, which of course is too much data to present in an intelligible fashion. Therefore, in order to prevent ending up in an inscrutable jungle of data it is sensible to restrict the dataset by focussing on the major export sub-flows. Here, the definition of 'major export sub-flows' can vary for each country, depending on practical and statistical conditions. For instance, in the case study of The Netherlands that we present in the next section we apply the (arbitrary) rule that we only consider sub-flows that represent over 1% of the total Dutch export portfolio. This rule reduces the 2312 sub-flows to a more manageable amount of 25 that together represent 55.7% of total Dutch exports.

A second practical issue that arises with step 2 is when one links the export sub-flows to the use-tables of the receiving countries. Here we encounter two problems. The first is a nomenclature mismatch. Exports are defined in different types of nomenclature like the SITC or the Harmonized Commodity Description and Coding System (HS), while in the EU member state use-tables the input is defined by the Statistical Classification of Products by Activity (CPA). Unfortunately there is no formal link between the CPA and any of the trade nomenclatures. However, by using their descriptions we can establish a reasonable linkage between SITC and CPA. We formalise this link in table 1 below.

Table 1: The SITC codes linked to CPA codes

SITC code	Description	CPA*
0	*Food and live animals*	01 & 05
1	*Beverages and tobacco*	15, 16 & 41
2	*Crude materials, inedible, excepts fuels*	02, 13, 20, 21 & 37
3	*Mineral fuels, lubricants and related materials*	10, 11, 12, 14, 23 & 40
4	*Animal and vegetable oils, fats and waxes*	None
5	*Chemicals and related products, n.e.s.*	24, 25 & 26
6	*Manufactured goods classified chiefly by material*	17, 18, 19, 27, 28
7	*Machinery and transport equipment*	29, 30, 31, 32, 33, 34 & 35
8	*Miscellaneous manufactured articles*	22 & 36
9	*Commodities and transactions not classified elsewhere in the SITC*	None

*The CPA code descriptions can be found in appendix A.

Table 1 allows us to link export data to use-tables for any EU member state, which is required to perform step 2 of the ESDM. The second issue that arises in step 2 is similar to the issue encountered in step 1. Namely, most export sub-flows seem to serve as at least a marginal amount of input for all industries. This implies that all of a country's industries can be considered being end-users of any sub-flow. This is undesirable since such a number of end-users will make the indicatorset inscrutable. A simple solution is to select, for each sub-flow, only the major end-users. As we will see in the next section, when for a Dutch export partner we select the 5 major end-users of the Dutch imports, this adds up to a share between 51% and 76% of its total usage.

Finally we should note that in step 3 we encounter a second nomenclature matching issue, which fortunately is easily solved. Since the end-users in the EU member state use-tables are defined by the Statistical Classification of Economic Activities in the European Community (NACE) nomenclature, they can be linked one-to-one with the sentiment indicators, because they are defined by NACE nomenclature as well. Now, in order to see whether the ES works and has any value in practice, we apply it to Dutch exports in the next section.

3. A Case Study: ES of the Netherlands

The Netherlands is a small and open economy and therefore strongly affected by developments in international trade. For instance, in 2009 total exports equalled 54.1% of total GDP while total imports were equal to 47.9%. The development of international trade is therefore of major interest to investors, companies and policymakers in The Netherlands and is therefore worth monitoring. In this section we apply the ESDM in The Netherlands and derive sentiment indicators that should give us information of developments at major Dutch export end-users. Next we perform an empirical analysis on this set of indicators. Finally we introduce and discuss the second major element of the ES, i.e. the ES visualisation tool.

3.1 Identifying the End-Users of Dutch Exports

We start with the analysis of the Dutch export portfolio. We use Eurostat data of Dutch exports of goods over the years 2008-2010 and decompose it into country and SITC 1-digit level sub-flows, as described under step 1 in figure 1. The result can be seen in table 2.

Table 2: Dutch export sub-flows, separated on the country and SITC 1-digit level

Country	SITC code	Description	Share*
Germany	*7*	*Machinery and transport equipment*	*6,9%*
Belgium	*3*	*Mineral fuels, lubricants and related materials*	*4,6%*
France	*7*	*Machinery and transport equipment*	*3,4%*
Germany	*5*	*Chemicals and related products n.e.s.*	*3,4%*
Germany	*0*	*Food and live animals*	*3,3%*
Germany	*6*	*Manufactured goods classified chiefly by material*	*3,3%*
United Kingdom	*7*	*Machinery and transport equipment*	*2,9%*
Germany	*3*	*Mineral fuels, lubricants and related materials*	*2,9%*
Germany	*8*	*Miscellaneous manufactured aticles*	*2,6%*
Belgium	*7*	*Machinery and transport equipment*	*2,3%*
Belgium	*5*	*Chemicals and related products n.e.s.*	*2,0%*
Italy	*7*	*Machinery and transport equipment*	*1,8%*
Germany	*2*	*Crude materials inedible except fuels*	*1,8%*
France	*5*	*Chemicals and related products n.e.s.*	*1,4%*
Spain	*7*	*Machinery and transport equipment*	*1,4%*
Belgium	*6*	*Manufactured goods classified chiefly by material*	*1,4%*
United Kingdom	*5*	*Chemicals and related products n.e.s.*	*1,3%*
United Kingdom	*0*	*Food and live animals*	*1,3%*
Belgium	*0*	*Food and live animals*	*1,3%*
United States	*7*	*Machinery and transport equipment*	*1,3%*
France	*0*	*Food and live animals*	*1,1%*
France	*8*	*Miscellaneous manufactured aticles*	*1,0%*
Belgium	*8*	*Miscellaneous manufactured aticles*	*1,0%*
France	*6*	*Manufactured goods classified chiefly by material*	*1,0%*
Italy	*5*	*Chemicals and related products n.e.s.*	*1,0%*
Total			55,7%

*Equal for export value and volume

In table 2 we can see that the Dutch export flow is dominated by 25 sub-flows towards Germany, Belgium, France and the United Kingdom, i.e. the countries geographically closest to The Netherlands. The United States, Italy and Spain receive a substantial share as well. Furthermore, table 1 reveals that ‘machinery and transport equipment’ (SITC 7) is an important export product category, while also SITC 3, 5 and 0 occur frequently. We should further note that these 25 export sub-flows together represent a substantial part (i.e. 55.7%) of total Dutch exports of goods.

Next, we can link these sub-flows to their major end-users in their designated countries, i.e. step 2 of the ESDM. Here we use the most recent use-tables that are available (at the Eurostat or OECD database). For each country in the Dutch export portfolio (as presented in table 1), this was the use-table over 2007. In table 3 further below we present the 5 most important end-users for each country. We limit our scope by selecting, for each country, only the 5 major end-users. For all countries over 50% of their Dutch imports is used by these end-users.

Now that we identified the major end-users of Dutch exports, we can link them to the appropriate sentiment indicators, i.e. step 3 of the ESDM. Here we link the end-users to the relevant business and consumer surveys as provided by DG-ECFIN. As said, the business survey categories have a clear-cut link with the end-users as defined in the use-tables. For instance, there are end-users named ‘manufacturers of machinery and equipment n.e.c.’ and ‘manufacturers of chemicals and chemical products’. The only ‘end-user’ that is an exception is ‘fixed capital formation’, because it cannot be linked to a specific subsector. Our ‘solution’ is to link this end-user to the general industry sentiment indicator. This is reasonable when we assume that it is likely that at least a major part of fixed capital formation will take place in industry. A further approximation which may have to be made is that the rate of capital formation is proportional to general activity levels in industry, i.e. lots of orders and high turnover mean that capital investment is more necessary and attractive. When the end-user is consumption, indicators for the countries consumer survey will be used. The selected set of business survey questions is presented in table 4 further below.

In table 4 there are 35 business survey questions that under the ES have a structural relation with Dutch exports. We should however note that unfortunately for the US there is no sub-sector sentiment data available in the public domain. Only the OECD publishes a monthly sentiment indicator that represents the whole US industry. This reduces the 35 sentiment indicators to a total of 31 sentiment indicators. In order to investigate the properties of this set of indicators, in the next section we will perform some basic empirical analysis.

Table 3: The major end-users of Dutch imports for each country

Germany	Share of Dutch export inflow processed by:
Final consumption expenditure by households	*26.8%*
Fixed capital formation	*11.1%*
Manufacture of motor vehicles, trailers and semi-trailers	*6.0%*
Manufacture of machinery and equipment n.e.c.	*4.0%*
Construction	*3.7%*
Total:	51.6%

Belgium	Share of Dutch export inflow processed by:
Final consumption expenditure by households	*20.5%*
Fixed capital formation	*13.0%*
manufacture of coke and refined petroleum products	*9.7%*
manufacture of basic metals	*7.8%*
manufacture of motor vehicles, trailers and semi-trailers	*6.3%*
Total:	57.3%

France	Share of Dutch export inflow processed by:
Final consumption expenditure by households	*32.2%*
Fixed capital formation	*13.0%*
manufacture of motor vehicles, trailers and semi-trailers sentiment	*5.1%*
manufacture of chemicals and chemical products	*4.8%*
Construction sector	*4.6%*
Total:	59.7%

United Kingdom	Share of Dutch export inflow processed by:
Final consumption expenditure by households	*31.0%*
Service of land transport and transport via pipelines	*9.5%*
Fixed capital formation	*9.1%*
manufacture of chemicals and chemical products	*4.2%*
manufacture of coke and refined petroleum products	*4.2%*
Total:	58.0%

United States of America	Share of Dutch export inflow processed by:
Final consumption expenditure by households	23.5%
Fixed capital formation	17.6%
manufacture of motor vehicles, trailers and semi-trailers sentiment	8.8%
manufacture of chemicals and chemical products	7.4%
Construction	6.0%
Total:	63.3%

Italy	Share of Dutch export inflow processed by:
Final consumption expenditure by households	21.8%
Fixed capital formation	20.5%
manufacture of chemicals and chemical products	7.1%
Construction	6.4%
manufacture of machinery and equipment n.e.c.	5.5%
Total:	61.3%

Spain	Share of Dutch export inflow processed by:
Producer sentiment	32.2%
Fixed capital formation	19.5%
manufacture of motor vehicles, trailers and semi-trailers sentiment	13.1%
Construction	6.2%
Wholesale and retail trade and repair of motor vehicles and motorcycles sector	4.3%
Total:	75.3%

Table 4: Sentiment indicators linked to end-users of Dutch exports

Germany	Share of Dutch export inflow linked to sentiment:
Consumer sentiment	*26.8%*
Producer sentiment	*11.1%*
Manufacturers of motor vehicles, trailers and semi-trailers sentiment	*6.0%*
Manufacturers of machinery and equipment n.e.c. sentiment	*4.0%*
Construction sentiment	*3.7%*
Total:	51.6%

Belgium	Share of Dutch export inflow linked to sentiment:
Consumer sentiment	*20.5%*
Producer sentiment	*13.0%*
Manufacturers of coke and refined petroleum products sentiment	*9.7%*
Manufacturers of basic metals sentiment	*7.8%*
Manufacturers of motor vehicles, trailers and semi-trailers sentiment	*6.3%*
Total:	57.3%

France	Share of Dutch export inflow linked to sentiment:
Consumer sentiment	*32.2%*
Producer sentiment	*13.0%*
Manufacturers of motor vehicles, trailers and semi-trailers sentiment	*5.1%*
Manufacturers of chemicals and chemical products sentiment	*4.8%*
Construction sentiment	*4.6%*
Total:	59.7%

United Kingdom	Share of Dutch export inflow linked to sentiment:
Consumer sentiment	*31.0%*
Service of land transport and transport via pipelines sentiment	*9.5%*
Producer sentiment	*9.1%*
Manufacturers of chemicals and chemical products sentiment	*4.2%*
Manufacturers of coke and refined petroleum products sentiment	*4.2%*
Total:	58.0%

United States of America*	Share of Dutch export inflow linked to sentiment:
Consumer sentiment sentiment	23.5%
Producer sentiment sentiment	17.6%
Manufacturers of motor vehicles, trailers and semi-trailers sentiment	8.8%
Manufacturers of chemicals and chemical products sentiment	7.4%
Construction sentiment	6.0%
Total:	63.3%

*As yet, a linkage to USA sub-sector sentiment data cannot be constructed in practise due to absence of this data in the public domain. However, OECD provides an aggregated sentiment indicator on total USA manufacturing that can be considered as an (inferior) alternative.

Italy	Share of Dutch export inflow linked to sentiment:
Consumer sentiment	21.8%
Producer sentiment	20.5%
Manufacturers of chemicals and chemical products sentiment	7.1%
Construction	6.4%
Manufacturers of machinery and equipment n.e.c. sentiment	5.5%
Total:	61.3%

Spain	Share of Dutch export inflow linked to sentiment:
Producer sentiment	32.2%
Consumer sentiment	19.5%
Manufacturers of motor vehicles, trailers and semi-trailers sentiment	13.1%
Construction sentiment	6.2%
Wholesale and retail trade and repair of motor vehicles and motorcycles sector sentiment	4.3%
Total:	75.3%

3.2 Empirical Analysis of the Dutch ES Indicatorset

So far we collected a number of sentiment indicators that, according to our ESDM, should contain information on the development of demand for Dutch exports. We will now try to utilise this set in the construction of an ESI. However, we first need to take some practical and technical issues into account. First we should note that each survey consists of a number of different questions, yielding different indicators. For instance, consumers are asked twelve different questions that vary from 'assessing their financial situation over the last 12 months' to 'plans they have on doing major purchases over the next 12 months'. This implies that the actual number of sentiment variables is far larger than the 31 we mentioned in the previous section. In fact, the number of series for which DG-ECFIN has sufficiently long time series available (over 10 years) is 277. For the majority of these survey questions, data is available over the period January 1985 - October 2011. This large number of time series re-introduces the danger of data mining, which we tried to minimise when we used the structured approach of the ESDM. However, this larger set of data can make it worthwhile to investigate whether we can construct an ESI with more attractive statistical and statistical story telling properties than we could by restricting ourselves to the general confidence indicators.

In order to derive a valuable ESI from this large number of potential explanatory variables, without getting into substantial data mining, we will make use of a number of conceptual considerations. We distinguish three conceptually different categories of business survey questions and investigate each of them on their aggregate statistical properties towards the development of Dutch exports. The first category is simply the *general confidence* indicator, as defined in the business surveys. The second category we define is the *order assessment* indicator, which consists of survey questions that relate to the assessment of order positions. The third category we define is the *production expectation* indicator, which consists of survey questions that relate to production expectations. In table 5 below we present the questions we link to each of the three types and refer to them as business survey categories.

Table 5: The business survey questions linked to each category and sector

Business survey categories	
General confidence	**Question/indicator**
Industry	*General confidence*
Services	*General confidence*
Consumers	*General confidence*
Retail	*General confidence*
Construction	*General confidence*
Order assessment	**Question/indicator**
Industry	*Assessment of order-book levels*
Services	*Expectation of the demand over the next 3 months*
Consumers	*Financial situation over next 12 months*
Retail	*Orders expectations over the next 3 months*
Construction	*Evolution of your current overall order books*
Production expectation	**Question/indicator**
Industry	*Production expectations for the months ahead*
Services	*Expectation of the demand over the next 3 months*
Consumers	*Major purchases at present*
Retail	*Business activity expectations over the next 3 months*
Construction	*Evolution of your current overall order books*

This categorisation reduces the 277 variables into three groups of 31 variables, which is only a small fraction of all the possible combinations and thus prevents substantial data mining. Moreover, the three categories all have a clear and cohesive economic meaning, which improves the statistical story telling properties of the ESI.

We can now investigate whether, which and what type of relation the sentiment indicators presented in table 4, for the three categories defined in table 5, have with Dutch exports. In our empirical analysis our reference series will be year on year (YoY) growth in Dutch export volume. We focus on growth rates because business surveys consist of questions where respondents are asked to evaluate their current status in relation to their past. The simplest way to combine the indicator series is by taking their sum. This is relatively non-technical and will contribute to the simplicity of the ES as a whole, so we first focus on this. We will refer to this as the simple ESI (SESI) and can be written as:

$$SESI_t = \sum_{i=1}^{31} X_{it} \ , \qquad (1)$$

where X_{it} are the individual indicator series. Later we will investigate whether we can and should improve (1) by using alternative compositions. This is also important in the context of the visualisation, which introduces alternative restrictions. We will discuss these in the next section. Now, in figure 2 below we present the SESI for all three categories.

Figure 2: Time series of general confidence, order assessment and production expectation indicator series and YoY growth of total Dutch exports (volume)

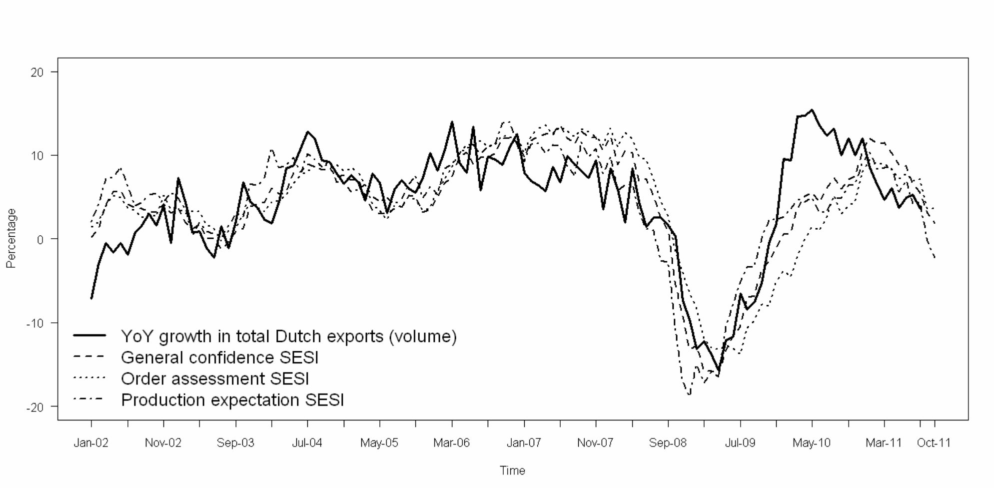
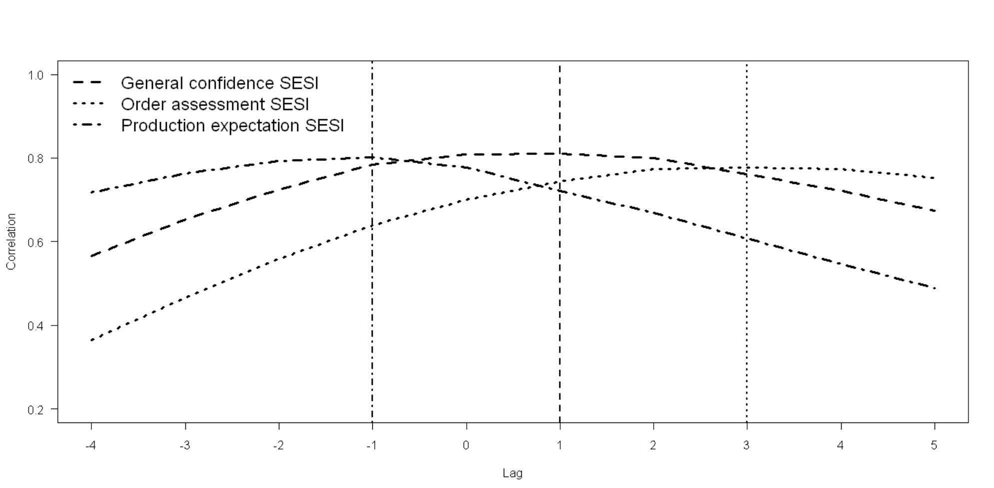


Figure 2 reveals that the three indicatorsets exhibit a similar pattern, which is also present in the reference series. Second, the 'production expectations SESI' indicatorset seems to lead both the reference series and the other two indicatorsets. This observation is further confirmed in figure 3 below, in which we present the correlation spectrum of the indicatorsets with the export series.

Figure 3: Correlation spectrum of indicators with reference series



The vertical lines in figure 3 indicate for which lead/lag the aggregate of an indicatorset correlates maximally, where a minus sign on the horizontal-axis represents a lead. This implies that figure 3 confirms that the production expectation SESI, on average, leads the other sets, and also the export series, by one month. We should further note that the maximum correlation of all the three aggregate indicators is around 0.8, which indicates quite a strong relation between the sets and export development. Therefore we conclude that all three indicator categories provide signals that beside their structural relation also have a strong statistical relation with Dutch exports. Furthermore, figure 3 reveals that when we are interested in the short-term developments in Dutch exports, we can use the SESI production expectation indicator.

3.3 Empirical Analyses in the Context of the ES Visualisation Tool

In this section we continue our empirical analysis, but address it in the context of the ES visualisation tool in which we want to present the data in an economical meaningful, and easily interpretable fashion. We want this visual monitoring system to give users a quick, insightful and easy to interpret picture of both the overall Dutch export situation and of the state of individual export markets. Moreover, the visualisation should give us a statistical story on Dutch exports. It should communicate the major destinations of Dutch exports, and the situation in each of these markets. Therefore, the size and composition of the indicatorset becomes a relevant issue. In this context we think that the set of 31 variables we derived in section 3.1 is both too large to present simultaneously and too asymmetric (due to lack in US data) to present in a clear (symmetric) fashion. Therefore we will investigate the empirical properties of some reduced datasets that meet our visualisation demands. With the visualisation of the data in mind, we consider three reduced datasets that we refer to as *size scenarios*, i.e.:

- 3 major countries with its 3 major industries (i.e. 9 variables)
- 4 major countries with its 4 major industries (i.e. 16 variables)
- 5 major countries with its 5 major industries (i.e. 25 variables)

Here we should note that due to data limitations in the US, we replace the US by Italy (i.e. the 6th country) in the 5 x 5 dataset. Furthermore, in order to test whether the superiority of the production expectation indicator is robust to our choice of the number of countries and industries, we retain the general confidence and order assessment indicator in the analysis.

First we present the figures similar to figure 2 and 3, but now for all three size scenarios. They aggregate indicators are constructed similarly to (1), except for the smaller number of indicator series involved, and can be found in appendix C in figure 10a to 12b. From these figures we can learn a few things. First, in terms of correlations with the reference series, the three aggregate indicators, and therefore the indicators sets, perform reasonably well in all three size scenarios. Furthermore, (surprisingly) the 3 x 3 and 4 x 4 scenarios provide earlier signals (max correlation at two months lead instead of one month). So it seems that the 5 x 5 set does not improve upon the other sets, which implies that including Italy in the indicatorset does not improve its statistical performance. Finally, we can conclude that the superior performance of the production expectations indicator is robust over the three size scenarios.

Since the outcomes of this analysis are inconclusive with respect to the comparison of the 3 x 3 and 4 x 4 size scenarios, we perform a second analysis in which we compare the sets with respect to the quality of their turning point signals. Turning point detection is a major function of business cycle analysis and therefore an important criterion for the ES composite indicator. Here we define a turning point in the reference series as a local minimum or maximum in the growth rate of export volume. Ideally, our indicatorset should give an early warning when a turning point approaches while not producing any false signals. Because the turning point analysis is more extensive, we restrict ourselves to comparing the different size scenarios for only the SESI production expectations indicator.

In appendix D we present figure 13a-c in which the reference series and the production expectations indicator series, after we have filtered them with a Christiano-Fitzgerald (CF) filter (Christiano & Fitzgerald, 1999) with a minimum period of oscillation of 12 months and a maximum period of 180 months. Filtering is necessary due to the volatile nature of the export growth rate series and the sentiment indicators, which makes a clear detection of turning points difficult. It also isolates the most relevant movements for business cycle analysis, removing irrelevant short-term developments. After the filtering we can easily identify major turning points in the indicator series, marking them as a signal. This allows us to count the number of early, late and false signals. The results are summarised in table 6 below.

Table 6: Summary of the signals as provided under the different size categories

Signal\Series	3 x 3	4 x 4	5 x 5
Early signal	*5*	*4*	*4*
Late signal	*2*	*3*	*3*
False signal	*2*	*1*	*1*

As we can see the quality of the signals of the 4 x 4 and 5 x 5 size indicatorsets do not differ. Furthermore, table 5 indicates that although the 3 x 3 set provides more early signals, it also gives an additional false signal. Since we consider false signals more undesirable than late signals, we are inclined to reject the 3 x 3 set as the preferred indicatorset. Combining the outcomes of these two analyses, we conclude that the 4 x 4 set is to be preferred over the 3 x 3 and 5 x 5 set. It offers a good balance of quality in information and parsimony. Therefore, in the remaining of this paper we use the 4 x 4 size category and the production expectation business survey questions as our ES indicatorset. The exact set of indicators is presented in table 7 below.

Table 7: The indicators included in the 4 x 4 ES indicatorset.

Country	End-user	Business survey question	DG-ECFIN code
Germany	*Consumers*	*Major purchases at present*	CONS.DE.TOT.8.BS.M
Germany	*Total industry*	*Production expectations for the months ahead*	INDU.DE.TOT.5.BS.M
Germany	*Manufacture of motor vehicles, trailers and semi-trailers*	*Production expectations for the months ahead*	INDU.DE.29.5.BS.M
Germany	*Manufacture of machinery and equipment n.e.c.*	*Production expectations for the months ahead*	INDU.DE.28.5.BS.M
Belgium	*Consumers*	*Major purchases at present*	CONS.BE.TOT.8.BS.M
Belgium	*Total industry*	*Production expectations for the months ahead*	INDU.BE.TOT.5.BS.M
Belgium	*Manufacture of coke and refined petroleum products*	*Production expectations for the months ahead*	INDU.BE.19.5.BS.M
Belgium	*Manufacture of basic metals*	*Production expectations for the months ahead*	INDU.BE.24.5.BS.M
France	*Consumers*	*Major purchases at present*	CONS.FR.TOT.8.BS.M
France	*Total industry*	*Production expectations for the months ahead*	INDU.FR.TOT.5.BS.M
France	*Manufacture of motor vehicles, trailers and semi-trailers*	*Production expectations for the months ahead*	INDU.FR.29.5.BS.M
France	*Manufacture of chemicals and chemical products*	*Production expectations for the months ahead*	INDU.FR.20.5.BS.M
United Kingdom	*Consumers*	*Major purchases at present*	CONS.UK.TOT.8.BS.M
United Kingdom	*Land transport and transport via pipelines*	*Expectation of the demand over the next 3 months*	SERV.UK.49.3.BS.M
United Kingdom	*Total industry*	*Production expectations for the months ahead*	INDU.UK.TOT.5.BS.M
United Kingdom	*Manufacture of chemicals and chemical products*	*Production expectations for the months ahead*	INDU.UK.20.5.BS.M

In the next sections we will both compare the SESI with competing leading indicators and investigate whether we can improve its leading properties.

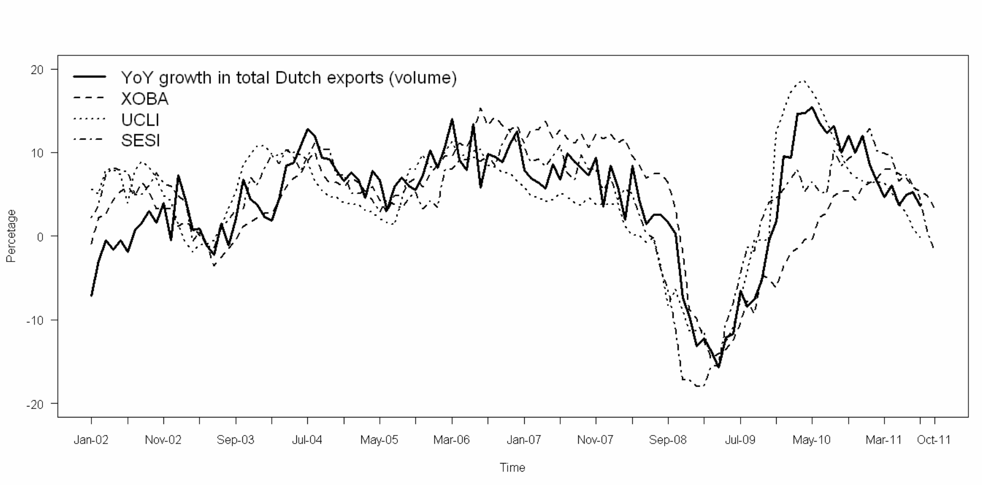
3.4 Assessing and Improving the SESI

Now that we have selected a series of 4 x 4 indicators and analysed its relation of the simple summation with Dutch exports, we can investigate whether it is possible to construct a composite indicator that has better properties than the simple aggregate SESI. The aim of this search is twofold. In the first place we are interested in the potential lead that is hidden in the ESDM indicatorset and how this compares to traditional leading indicators such as the industry export order book assessment (XOBA) from the Dutch manufacturing industry survey or the unrevised composite leading indicator (UCLI) of The Netherlands, as monthly published by the OECD. Additionally, we intend to optimise the composite leading indicator with respect to the visualisation tool. This implies we should keep non-statistical properties in mind. This is because we want the message of the composite leading indicator to be synchronised with the visual message given by the 4 x 4 = 16 individual indicators, because in the visualisation tool we intend to present all 16 series simultaneously and with equal importance. This implies that when we optimise the summarising indicator such that its statistical properties are optimal, we might get a different summarising signal than the general visual message given by the 16 indicators. For instance, it might occur that most indicators are producing slightly negative signals, but one indicator produces such a positive signal that it overrules all the other signals in an optimal indicator. And albeit statistically optimal, it might confuse users of the visualisation tool when they observe many negative signals summarised into a single positive signal.

We will treat these two subjects separately and start with the comparison exercise. In order to establish a benchmark for this analyses, in figure 4 below we present the 4 x 4 production expectation SESI (which for the remaining of this paper we refer to as

SESI) from section 3.3, together with the XOBA and UCLI indicators. Due to some data limitations we focus on the period January 2002 – October 2011.

Figure 4: YoY growth in Dutch export volume, export order book assessment (XOBA), unrevised composite leading indicator (UCLI) and the (4 x 4) SESI



In figure 4 we can see that the UCLI, like the YoY export growth itself, is published two months later than the XOBA. This is due to data that are not immediately available. This is good news for the ES sentiment indicatorset, since it is available around the same time as the XOBA, i.e. at the end of the reporting month. This gives the SESI and the XOBA a 'head start' over the UCLI of two months. We further see that the XOBA is lagging the export series itself, which makes it inappropriate as leading indicator. This observation is confirmed in figure 5, where we present the correlation spectrum of these indicators together with the YoY growth in volume of Dutch' exports.

Figure 5: Correlations of lagged indicators with reference series

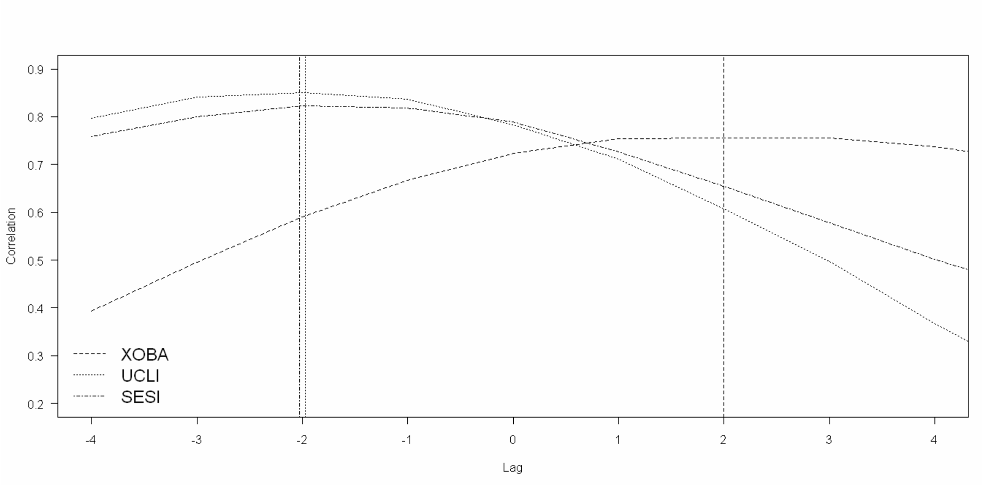
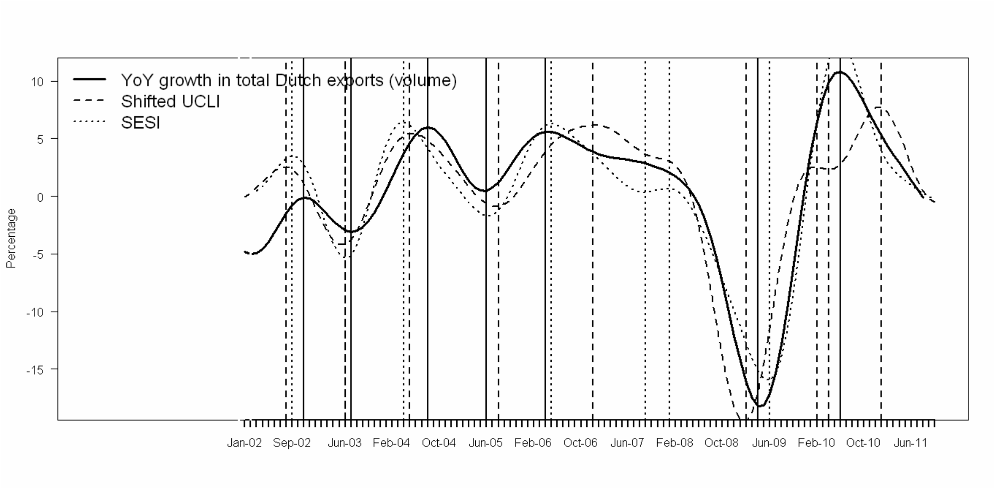


Figure 5 reveals a few things. First, it seems that, even when we take the head start of the XOBA into account, the XOBA is not a leading indicator. Instead it lags the reference series by two months on average, making it coincident when we take its head start into account. On top of this, the XOBA has a lower overall correlation with the reference series compared to both the UCLI and the SESI indicator. This implies that, as a leading indicator, the XOBA is inferior to both the UCLI and the SESI. Furthermore we see that the UCLI and the SESI are close to equivalent in terms of lead and magnitude of correlation. However, as the UCLI is published with a lag of 2 months compared to the SESI, the SESI outperforms the UCLI with respect to its correlation. However, a more important criterion is its turning point signalling criteria. Since the UCLI seems to be a less volatile series, it might be able to detect turning points earlier. We therefore repeat the turning point analysis from section 3.2. Here we perform the analysis such that we correct for the SESI's head start by shifting the UCLI two months such that their publication date is equal. We refer to this UCLI as the 'shifted UCLI'. Both CF filtered series are presented in figure 6 below.

Figure 6: CF filtered series and their turning points of export growth, the shifted UCLI and the SESI



We summarise the comparison results in table 8.

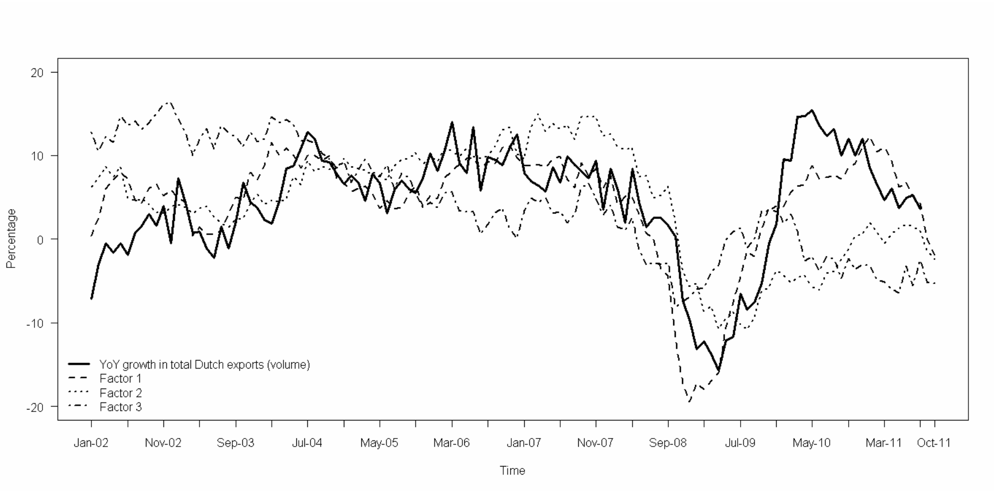
Table 8: Comparison of quality of turning point signals of both the OECD leading indicator and EDP series

Signal	Shifted UCLI	SESI
Earliest	*4*	*2*
Equal	*1*	*1*
False Signal	*1*	*1*

Given the number of earliest warnings, table 8 indicates that the shifted UCLI outperforms the simple SESI in terms of turning point detection. This is not surprising, since the SESI has, unlike the UCLI, not been subject to any statistical optimisation procedure; it is simply the sum of a set of indicators.

The superior performance of the UCLI with respect to turning point signalling tempts us to perform a simple statistical optimisation procedure on the ES indicatorset, such that its leading indicator properties are improved. We will not go into this subject extensively, but in order to see whether the ES indicatorset has some latent lead potential, we will perform one basic analysis. In this analysis we return to the complete dataset of 31 production expectation business survey questions. We perform a factor analysis (see e.g. Rummel (1967) for an introduction and discussion) in which we generate three factors. Here we should note that 65% of the variance in the data can be described by these three factors. In order to pick the best factor we first plot the 3 factors in figure 7 below.

Figure 7: The three factors derived from the full ESDM indicatorset



As we can see, both the 1st and 2nd factor are more or less leading while the 3rd behaves differently. In order to keep things simple we simply add the blue and green factor together and rescale the resulting series. We name this series the optimised export scan leading indicator (OESI). In figure 8 below we repeat the turning point analysis.

Figure 8: CF filtered series and their turning points of export growth, the shifted UCLI and the optimised export scan leading indicator (OESI).

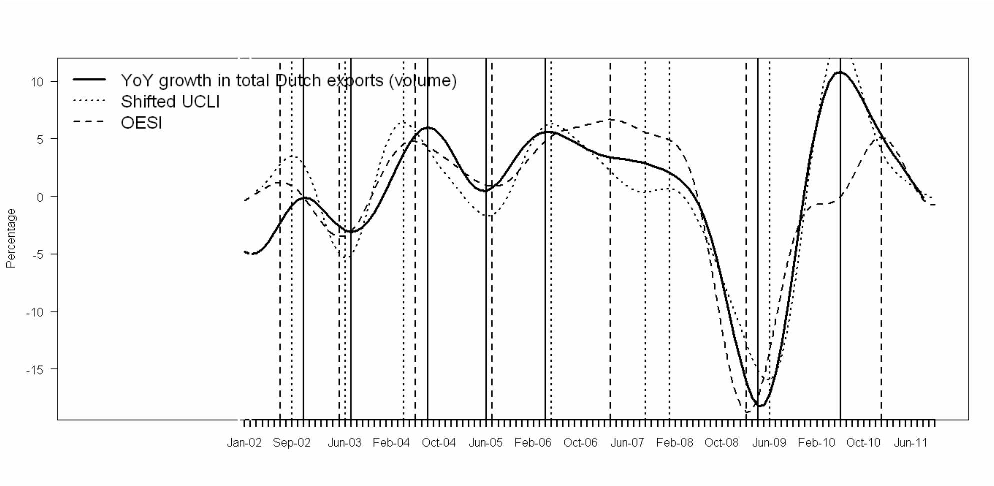


Figure 8 reveals that the OESI is also clearly a leading indicator for Dutch export growth. In order to compare its turning point detecting abilities with the shifted UCLI we summarise figure 8 in table 9 below.

Table 9: Summary of figure 8

Signal	Shifted UCLI	OESI
Earliest	*4*	*3*
Equal	*0*	*0*
False Signal	*1*	*0*

Table 9 shows that, after only a relatively simple and unsophisticated optimisation procedure (i.e. picking the latent factors that look best), the statistical properties of the UCLI and OESI are already comparable.

We therefore conclude that, with respect to its statistical properties, both the SESI and OESI survive the comparison with alternative leading indicators. Especially, it seems that when we are not restricted by limitations that evolve from our desired data visualisation, we can use the ESDM to collect a valuable indicatorset from which we can construct leading indicators that can outperform other leading indicators such as the XOBA and the UCLI. This optimisation exercise could be part of further research. For now we can conclude that the 4 x 4 indicatorset has adequate statistical properties, and its 'statistical story telling capabilities' give it an edge over the alternative leading indicators we investigated. Therefore, in the next section we continue with the discussion of the 4 x 4 ESDM indicatorset, and how it can serve as input for a visualisation tool to monitor Dutch exports developments in an economically meaningful fashion.

4. Visualising the ESDM indicatorset

So far, we collected and analysed a set of sentiment indicators (i.e. the 4 x 4 ESDM indicatorset) that is related to economic sectors that are important end-users of Dutch exports and is sufficiently parsimonious and symmetric to visualise clearly. In this section, we discuss additional issues that are related to the visualisation of this indicatorset. We first discuss some important visualisation considerations that aim to make it easier to interpret 16 indicator series. Consecutively, we analyse how the visualisation and its properties are affected by these considerations. A short description of the final methodology chosen and used here in deriving the Export Scan can be found in Appendix A.

4.1 Visualisation Considerations

The indicatorset that we intend to visualise consists of 16 variables that represent the 4 most important destination sectors of Dutch exports within the 4 most important export countries, as presented in table 7 in section 3.3. Our intention is to simultaneously show the developments that occur in all these 16 sectors individually, together with some type of composite indicator that summarises these 16 developments into a single signal for total export growth. Moreover, we want it to be easy to understand the presented information. Ideally it should be possible to correctly interpret the main message within a glance. However, interpreting 16 time series simultaneously can be difficult. In order to simplify the presented information, we use the fact that sentiment indicators are defined on an ordinal scale and mainly serve to provide insight in their general tendency. This implies that we can, without affecting its main message, reduce the series into a simplified series that consists only of four phases. We name them *weak demand, recovering, weakening* and *strong demand*. Here strong demand implies an indicator that is above its long-term average and increasing, while weak demand implies the opposite. Strengthening implies an indicator that is below its long-term average but increasing, while weakening implies the opposite. This 'phasing' simplifies the task of quickly translating the 16 indicator series into economical meaningful statements, e.g. 'the German car industry is strengthening' or 'UK consumers are gaining faith'. A phasing algorithm was developed, which compares the current realisation of an indicator to a short-term average (growth) and a longer-term average (the average). We can formalise this phasification as:

$$P_{it} = \text{Weak demand} \quad \text{if} \quad X_{it} < \overline{X}_{it}^{ST} \ \& \ X_{it} < \overline{X}_{it}^{LT} \tag{2a}$$

$$P_{it} = \text{Recovering} \quad \text{if} \quad X_{it} < \overline{X}_{it}^{ST} \ \& \ X_{it} > \overline{X}_{it}^{LT} \tag{2b}$$

$$P_{it} = \text{Weakening} \quad \text{if} \quad X_{it} > \overline{X}_{it}^{ST} \ \& \ X_{it} < \overline{X}_{it}^{LT} \tag{2c}$$

$$P_{it} = \text{Strong demand} \quad \text{if} \quad X_{it} > \overline{X}_{it}^{ST} \ \& \ X_{it} > \overline{X}_{it}^{LT} \tag{2d}$$

where X_{it} represents the indicator *i* at time *t*, P_{it} is the phase of indicator *i* at time *t*, $\overline{X}_{it}^{ST}$ is the short term average of indicator *i* at time *t* and $\overline{X}_{it}^{LT}$ is the long term average of indicator *i* at time *t*. In order to complete this formal framework we should write (2a-d) and replace X_{it}, $\overline{X}_{it}^{T}$, $\overline{X}_{it}^{LT}$, P_{it} with Y_t, $\overline{Y}_t^{ST}$ and $\overline{Y}_t^{T}$ and P_t^Y respectively where Y_t is the export growth series. This allows us phasificate the export growth series as well.

Now, in order to utilise the phasification concept we need to resolve two issues. First we need to specify $\overline{X}_t$, $\overline{X}_t$, $\overline{Y}_t$ and $\overline{Y}_t$. This can be an important choice, because hypothetically it can make the difference between classifying a period as strong or weak demand. For instance, the situation might be worse than last month but still better than last year, while it might be good compared to the last three years and bad compared to the last ten years. Second, we need to define a relation between the 16 individual phase series, the aggregate indicator that summarises them and the export growth series. Unfortunately, there is no standard recipe available to resolve these issues. However, when we take the visualisation as a starting point, we can define some desirable properties.

First, since we intend to show developments in 16 sectors together with a summarising signal, we should ensure that there is no contradiction between the 16 individual signals and the summarising signal. For instance, it would confuse users when a majority of the indicators give a 'weak demand' signal, while the summarising signal is 'strong demand'. To exclude this option we simply define the summarising signal as the signal that occurs most frequently among the 16 indicators. This implies we can write:

$$P_t = Modus(P_{1t}, P_{2t}, ..., P_{16t}) \qquad (3)$$

where P_t is the summarising signal, i.e. P_t is determined via the majority vote.

Second, in the visualisation we intend to magnify a 5-year window of export developments, together with the summarising signals within that period. This implies that users of the visualisation tool will oversee a period of 5 years. This implies that the signalling function should also refer to this period, because otherwise a signal might contradict with the visual image. For instance, when a user sees that there is higher growth in the last month than there was on average over the last five years, this should not be defined as 'recovering', simply because it is still lower than the average growth over the last ten years. Thus, we choose the long-term average to be the average over the past five years.

$$\overline{X}_{it}^{LT} = \sum_{k=t-60}^{t-1} \frac{X_{ik}}{60} \qquad (4a)$$

$$\overline{Y}_{it}^{LT} = \sum_{k=t-60}^{t-1} \frac{Y_k}{60} \qquad (4b)$$

Third, we are interested in monthly developments but we also prefer signals to have a certain degree of stability. Monthly statistics might be more volatile than the 'real' short-term developments, i.e. there is a certain amount of randomness and statistical noise. For instance, when growth declines over a period of 6 months, it is not unlikely that there is also a month of positive growth during that period. We think a valuable signal should ignore such incidents. This implies we can set $\overline{Y}_t^{ST} = Y_{t-1}$ but should carefully choose $\overline{X}_{it}^{ST}$. One way to ensure some stability is to compare a value at time *t* with some average over the last $n \geq 1$ months, i.e.:

$$\overline{X}_{t}^{ST} = \sum_{=t-n}^{t-1} \frac{X}{n} \tag{5}$$

In order to find a good value for *n* we can utilise the (desired) leading property of the indicator phase signal P_t on the export growth series phase P_t^Y to define some criterion function. This criterion function should define the relation between short-term average period *n* and the match between P_t and P_{t+m}^Y, where *m* represents the number of months ahead. A function that complies with these conditions can be written as:

$$f(n, m_L, m_U) = \sum_{t=1}^{T-m_U} \frac{I\left(P_t = P_{t+m_U}^Y \middle| \ldots \middle| P_t = P_{t+m_L}^Y\right)}{T - m_U} \tag{6}$$

where *T* is the number of months in the total sample and *I* is a function that is equal to one when $P_t = P_{t+m}^Y$ for some $m \in (m_L, m_U)$ and zero otherwise. In words $f(n, m_L, m_U)$ simply measures the fraction of correct phase signals. Here a correct phase signal implies that the value of P_t is repeated by P_t^Y at some point in the near future. This 'near future' is defined by m_L and m_U, where m_L defines the number of months ahead from which we start looking and m_U defines the number of months ahead from which we stop looking.

Combining (2) to (6) allows us to perform some empirical analysis in which we can see the effect of different choices of *n,* m_L and m_U on $f(n, m\ , m_U)$. We use the period January 2002 – October 2011 but since we need 5 years to determine the long-term average and export data is only available till August 2011, we match the phases over the period January 2007 – August 2011. This gives us a total of 56 months for which we have signals and realisations. In table 10 below we present the fractions correct for combinations of *n,* m_L and m_U we think are interesting.

Table 10: Percentage of phase matches for different values of *n*, m_L and m_U

		n = 1	n = 2	n = 3	n = 4	n = 5
% correct 0 months later	$m_L = m_U = 0$	50,0%	51,8%	53,6%	51,8%	50,0%
% correct 1 month later	$m_L = m_U = 1$	38,2%	49,1%	45,5%	41,8%	47,3%
% correct 2 months later	$m_L = m_U = 2$	51,9%	57,4%	59,3%	59,3%	55,6%
% correct 3 months later	$m_L = m_U = 3$	37,7%	47,2%	45,3%	45,3%	47,2%
% correct 4 months later	$m_L = m_U = 4$	44,2%	51,9%	53,8%	50,0%	48,1%
% correct 5 months later	$m_L = m_U = 5$	36,5%	50,0%	40,4%	46,2%	50,0%
% correct between 2 and 4 months later	$m_L = 2 \cap m_U = 4$	84,6%	90,4%	92,3%	90,4%	90,4%

In table 10 we can see that when P_t provides us with a signal, for almost any *n* it is most likely that P_t^Y copies this signal two months later (almost 60%). Moreover, we see that when P_t provides a signal; it is around 90% certain that this signal is copied somewhere after 2, 3 or 4 months later. These percentages are significantly better than one would see with random signals. Furthermore, we highlighted the highest percentage in each row. These highlights show that the best prediction can be achieved when we set $n = 3$. This implies that we define X_{it} as increasing, when it is higher than its average over the last three months.

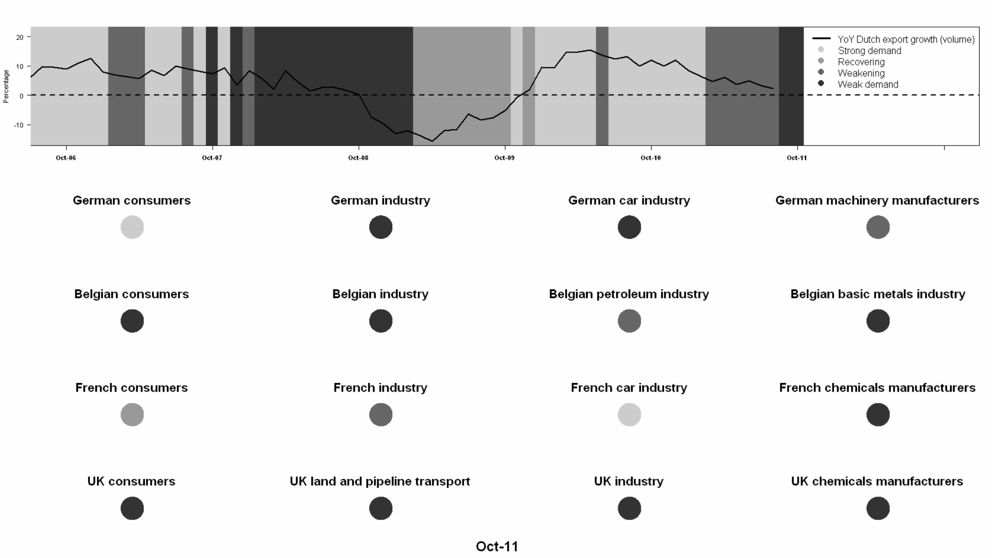
Now that we have translated the 16 indicator series into 16 individual phase signals together with a summarising phase signal that optimally predicts the general behaviour of Dutch export growth series, we can use these results to generate a visualisation. This will be the subject of next section.

4.2 Visualisation of ESDM indicatorset

One way to clearly communicate the phase signals is by using colours, where different colours correspond to different states. This technique is also used in the Statistics Netherlands' business cycle tracer[2] (van Ruth et al., 2005). Here red indicates 'weak demand', yellow indicates 'recovering', orange indicates 'weakening' and green indicates 'strong demand'. In this section we will present a visualisation, in which we produce the signal by (2) and use the parameter values we derived in section 4.1, i.e.: $\overline{X}_{it}^{ST} = \sum_{k=t-3}^{t-1} \frac{X_{ik}}{3}$ and $\overline{X}_{it}^{LT} = \sum_{k=t-60}^{t-1} \frac{X_{ik}}{60}$.

[2] http://www.cbs.nl/en-GB/menu/themas/dossiers/conjunctuur/publicaties/conjunctuurbericht/inhoud/conjunctuurklok/conjunctuurklok2.htm

Figure 9: Visualisation of the ESDM data[3]



Ideally figure 9 should explain itsself. In it we see 16 coloured circles that represent the 16 ESDM indicators and their state phases for October 2011. On top we see a graph in which the colours represent the summarizing phase statistics over time (as determined by (3)) together with the black line that represents the YoY Dutch export growth realisations. As we can see, the summarising phase statistic for October 2011 is 'weak demand'. Moreover, we can immediately answer the question 'why?' Because the circles representing the economic sectors show us that there are also signs of weakness in German industry, Belgian consumers, Belgian manufacturers of basic metals, French manufacturers of chemicals, UK consumers, UK industry and UK manufacturers of chemicals. Furthermore we can see that the summarising phase statistic provides us with early warning signals. For instance, already in October 2007 we encounter a negative signal that becomes consistently negative from February 2008 until February 2009. However, it was not until November 2008 that The Netherlands encountered the first case of actual negative growth in Dutch exports. Finally we should note that figure 9 represents a snapshot of a dynamic visualisation tool where a user should be able to scroll back to any moment in time. This would allow a user of the visualisation to see which end-users of Dutch exports were doing good or bad at any time. A dynamic version of the ES visualisation tool for The Netherlands will be available on the Statistics Netherlands website soon.

[3] See the Statistics Netherlands website for a colored and more up-to-date version.

5. Conclusions

For trade-oriented economies like The Netherlands, timely and preferably early information on developments influencing exports is of great value. For this reason, Statistics Netherlands has developed the Export Scan, a tool for detecting and analysing early signals of developments influencing Dutch exports. Traditionally, there are two ways to achieve this: quantitative forecasts and leading indicators. This paper presents a novel way of constructing leading indicators, sacrificing some lead profile for informational content. Traditional leading indicators have a certain amount of "black box" character. Component indicators are selected on their lead properties, less so on their economic content. As a result, it is often somewhat unclear why a positive or negative development is signalled. To remedy this, but still retain a leading character, we use the export scan detection method. The idea is that the export of one country is the result of demand in other countries. By monitoring developments in major export markets, it is shown here that early signals of developments in Dutch exports can be detected. The analysis is actually taken one step further, as we propose to monitor developments in the major receiving sectors of the main trading partners. By analysing trade flows and using structural economic data from the receiving countries' National Accounts, we identified the most important destinations, i.e. country-sector combinations, for the Dutch exports of goods. These were linked to relevant sentiment indicators from business and consumer surveys, thus resulting in a highly structured monitoring system. We found that production expectations performed better than general confidence indicators and order book information. In the aggregate, the system has a high degree of correlation with the development of Dutch exports, with an actual lead of two months. In practice, the lead will be greater, as sentiment indicators suffer neither from publication lags nor from revisions. The system was designed to give an optimal combination of early warning, stability and information. Disaggregated, the system is more useful still. It communicates important structural information on the composition and destinations of Dutch exports. But this also shows whether, and how, certain developments diffuse among trading partners and industries. This presentation of the individual signals can further enhance the lead profile of the Export Scan tool, as it allows the first signals of a coming change to be seen.

Finally we developed an export scan visualisation tool (see figure 9) that comprises and presents the indicatorset we constructed in an easy to interpret and economically meaningful way. It aims to provide us with general tendencies in export conditions and it seems to do this with high accuracy. For instance, when the visualisation provides us with a signal such as 'weak demand' or 'recovering', within 2 to 4 months this phase also occurs in real Dutch exports growth, in over 90% of the time. Moreover, it tells us the statistical story on why Dutch export growth is as it is and acts as it acts.

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Appendix A

Short methodology Export Scan production

Step 1: Download the sub-sector sentiment data at:

http://ec.europa.eu/economy_finance/db_indicators/surveys/sub-sectors/index_en.htm

Step 2: Select the following time series.

Country	End-user	Business survey question	DG-ECFIN code
Germany	*Consumers*	*Major purchases at present*	CONS.DE.TOT.8.BS.M
Germany	*Total industry*	*Production expectations for the months ahead*	INDU.DE.TOT.5.BS.M
Germany	*Manufacture of motor vehicles, trailers and semi-trailers*	*Production expectations for the months ahead*	INDU.DE.29.5.BS.M
Germany	*Manufacture of machinery and equipment n.e.c.*	*Production expectations for the months ahead*	INDU.DE.28.5.BS.M
Belgium	*Consumers*	*Major purchases at present*	CONS.BE.TOT.8.BS.M
Belgium	*Total industry*	*Production expectations for the months ahead*	INDU.BE.TOT.5.BS.M
Belgium	*Manufacture of coke and refined petroleum products*	*Production expectations for the months ahead*	INDU.BE.19.5.BS.M
Belgium	*Manufacture of basic metals*	*Production expectations for the months ahead*	INDU.BE.24.5.BS.M
France	*Consumers*	*Major purchases at present*	CONS.FR.TOT.8.BS.M
France	*Total industry*	*Production expectations for the months ahead*	INDU.FR.TOT.5.BS.M
France	*Manufacture of motor vehicles, trailers and semi-trailers*	*Production expectations for the months ahead*	INDU.FR.29.5.BS.M
France	*Manufacture of chemicals and chemical products*	*Production expectations for the months ahead*	INDU.FR.20.5.BS.M
United Kingdom	*Consumers*	*Major purchases at present*	CONS.UK.TOT.8.BS.M
United Kingdom	*Land transport and transport via pipelines*	*Expectation of the demand over the next 3 months*	SERV.UK.49.3.BS.M
United Kingdom	*Total industry*	*Production expectations for the months ahead*	INDU.UK.TOT.5.BS.M
United Kingdom	*Manufacture of chemicals and chemical products*	*Production expectations for the months ahead*	INDU.UK.20.5.BS.M

Step 3: Calculate, for each series and for every moment in time (X_{it}), the average over both the last 3 and the last 60 months. These are the short term ($\overline{X}_{it}^{ST}$) and long term ($\overline{X}_{it}^{LT}$) averages.

Step 4: Use the equations below to determine, for each series and every moment in time, the series` phase and color.

P_{it} = Weak demand = Red if $X_{it} < \overline{X}_{it}^{ST}$ & $X_{it} < \overline{X}_{it}^{LT}$

P_{it} = Recovering = Yellow if $X_{it} < \overline{X}_{it}^{ST}$ & $X_{it} > \overline{X}_{it}^{LT}$

P_{it} = Weakening = Orange if $X_{it} > \overline{X}_{it}^{ST}$ & $X_{it} < \overline{X}_{it}^{LT}$

P_{it} = Strong demand = Green if $X_{it} > \overline{X}_{it}^{ST}$ & $X_{it} > \overline{X}_{it}^{LT}$

Step 5: Determine the general phase by counting which of the four possible phases has the highest prevalence (so not necessarily the majority) among the sixteen indicators:

$P_t = Modus(P_{1t}, P_{2t}, ..., P_{16t})$. However, when this is inconclusive because two or more phases occur equally often, see if one of them is equal to P_{t-1}. If so, set $P_t = P_{t-1}$. If not (which is unlikely), look for a "logical" current phase.

Step 6: Download the monthly export volume growth series (the relative year-on-year growth rate in the index of the volume of export of goods (corrected for working day effects)) at:

Step 7: Plot the all the P_{it}'s, the P_t and the monthly export series in the visualisation.

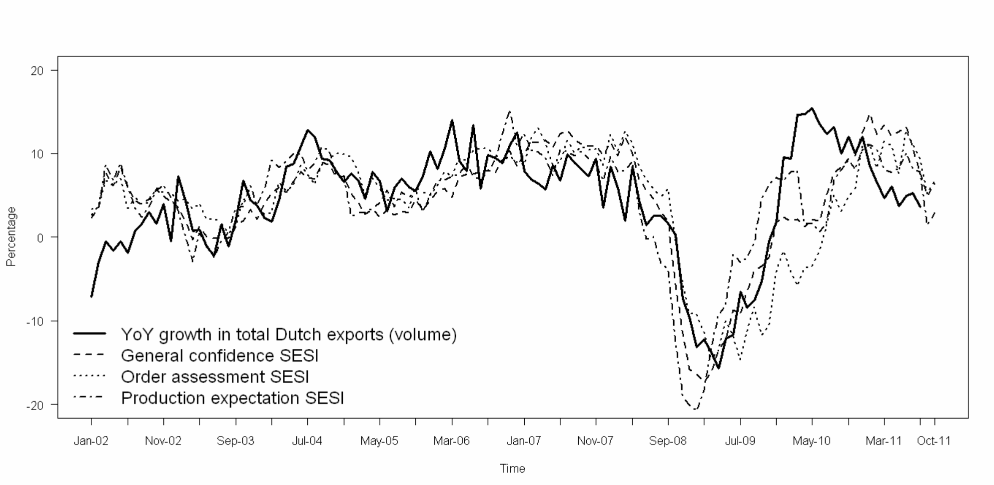
Appendix B

Table 11: Desciption of CPA codes

CPA code	Description
01	Products of agriculture, hunting and related services
02	Products of forestry, logging and related services
05	Fish and other fishing products; services incidental of fishing
10	Coal and lignite; peat
11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying
12	Uranium and thorium ores
13	Metal ores
14	Other mining and quarrying products
15	Food products and beverages
16	Tobacco products
17	Textiles
18	Wearing apparel; furs
19	Leather and leather products
20	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials
21	Pulp, paper and paper products
22	Printed matter and recorded media
23	Coke, refined petroleum products and nuclear fuels
24	Chemicals, chemical products and man-made fibres
25	Rubber and plastic products
26	Other non-metallic mineral products
27	Basic metals
28	Fabricated metal products, except machinery and equipment
29	Machinery and equipment n.e.c.
30	Office machinery and computers
31	Electrical machinery and apparatus n.e.c.
32	Radio, television and communication equipment and apparatus
33	Medical, precision and optical instruments, watches and clocks
34	Motor vehicles, trailers and semi-trailers
35	Other transport equipment
36	Furniture; other manufactured goods n.e.c.
37	Secondary raw materials
40	Electrical energy, gas, steam and hot water
41	Collected and purified water, distribution services of water
45	Construction work
50	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of automotive fuel
51	Wholesale trade and commission trade services, except of motor vehicles and motorcycles
52	Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods
55	Hotel and restaurant services
60	Land transport; transport via pipeline services
61	Water transport services
62	Air transport services
63	Supporting and auxiliary transport services; travel agency services
64	Post and telecommunication services
65	Financial intermediation services, except insurance and pension funding services
66	Insurance and pension funding services, except compulsory social security services
67	Services auxiliary to financial intermediation
70	Real estate services
71	Renting services of machinery and equipment without operator and of personal and household goods
72	Computer and related services
73	Research and development services
74	Other business services
75	Public administration and defence services; compulsory social security services
80	Education services
85	Health and social work services
90	Sewage and refuse disposal services, sanitation and similar services
91	Membership organisation services n.e.c.
92	Recreational, cultural and sporting services
93	Other services
95	Private households with employed persons

Appendix C

Figure 10a and 10b: Indicator series and correlation spectrum for 3 countries and 3 industries



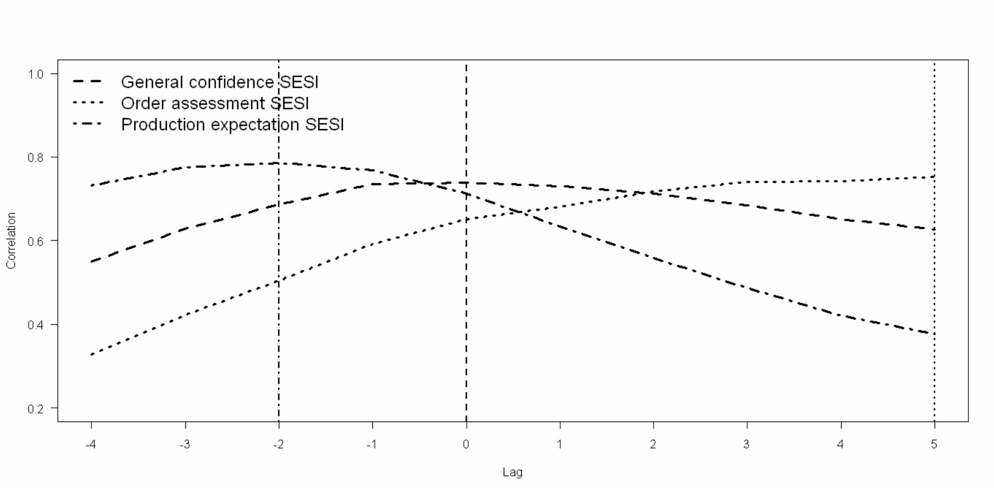
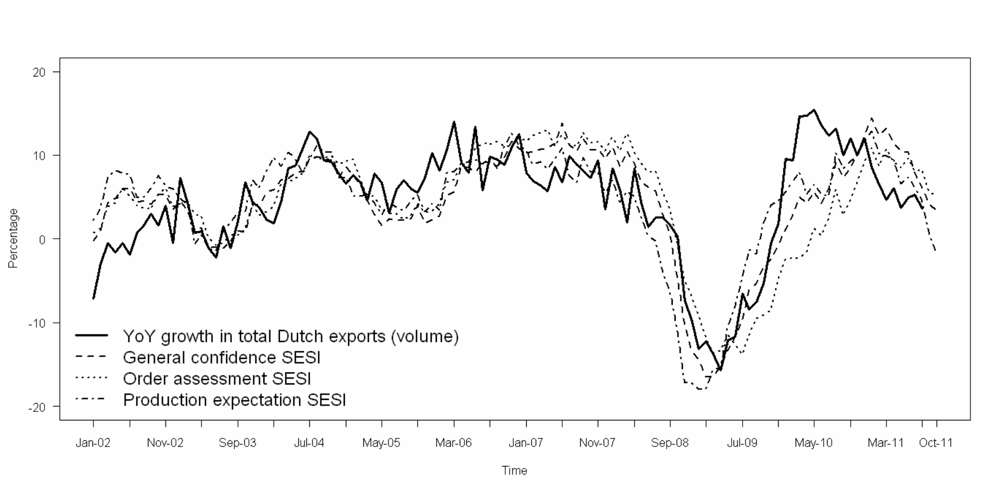


Figure 11a and 11b: Indicator series and correlation spectrum for 4 countries and 4 industries



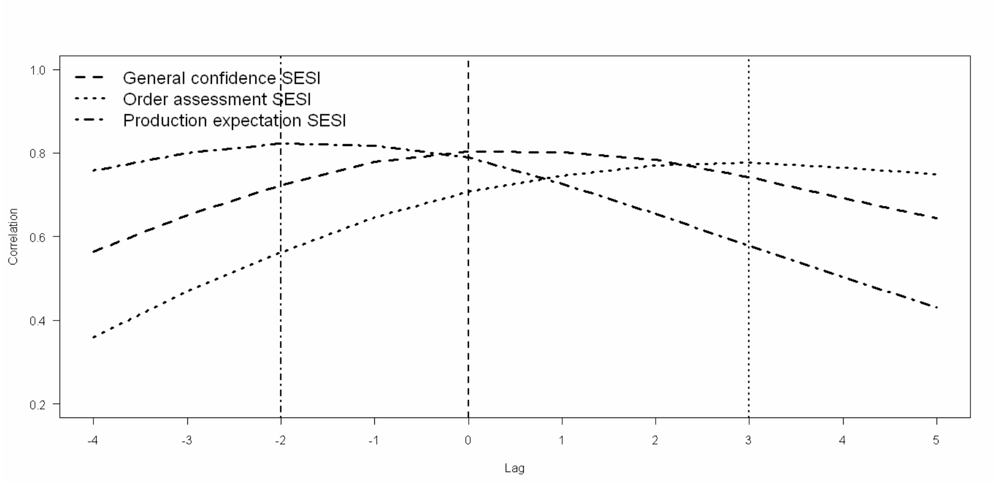
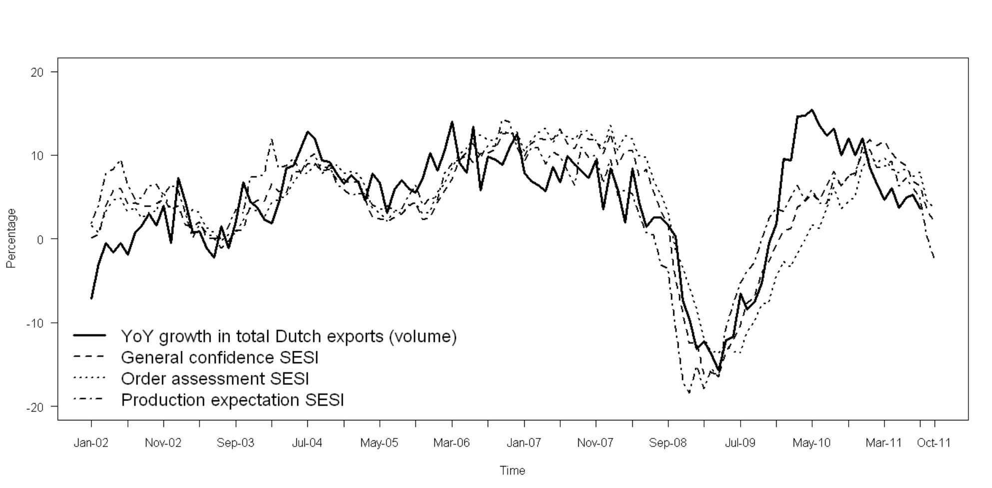
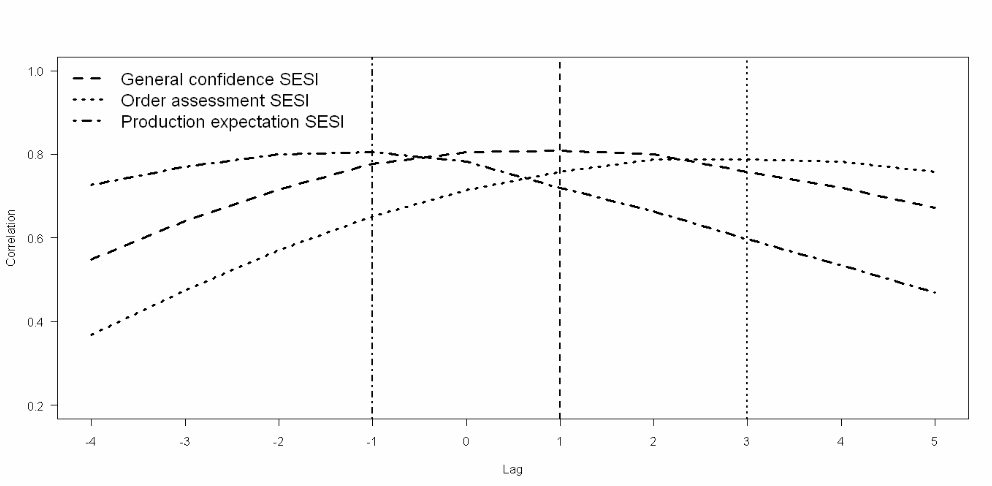


Figure 12a and 12b: Indicator series and correlation spectrum for 5 countries and 5 consuming sectors





Appendix D

Figure 13a, 13b and 13c: CF filtered export and indicator series for all size scenarios, together with their turning points.