Smart Business Cycle Statistics

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# Introduction

The Eurostat project ‘Smart Statistics’ started in February 2018 and will be finished in March 2019. At the end of January 2019, Eurostat will organise a workshop on ‘Trusted Smart Statistics: policymaking in the age of the IoT’ . The project includes three Proof of Concepts (PoCs): ‘Smart Mobility Statistics’ (PoC1), in ‘Smart Business Cycle Statistics’ (PoC2) and ‘Smart Labour Market Statistics’ (PoC3). The focus of this paper is the PoC2, which will explore how economic indicators can be derived from satellite imagery.

Business cycles are important economic phenomena. The Gross Domestic Product (GDP) for developed countries occurs in cycles around a positive trend. These cycles have an enormous influence on society’s welfare and well-being. Basically, business cycles are the workload of the economic production factors labour and capital. The workload of the production factor labour is highly correlated to the employment rate and with this to the income of most of the households. Fluctuations in using the factor capital have an influence on the investments or the income of the capital owners for example. All these effects are able to reinforce or to stabilize business cycles and with this to influence the growth of the GDP.

Because of the influence of business cycles for income and wealth, the economic parameters that are responsible for the cycles are of core interest to politicians. Their goal is to stabilize the growth of the GDP through economic policy. For this purpose they need information about the state of the business cycle. This can be done for example by forming indicators of the business cycle and combining them into a system [1]. Furthermore, it is important that this information is of high quality and up-to-date.

Traditional methods of reporting the GDP in official statistics work very well and have a high accuracy. However, the reporting process is complex and introduces a time lag of several weeks to publication. The goal of ‘Smart Statistics’ is to reduce this time lag by deriving indicators from economic activities, which are visible in satellite images. Satellite images are available with a short delay of only a few hours. The processing of the data and the detection of economic activities can also be done comparatively fast and thus allows a publication of economic indicators with a delay of only a few days. However, while these indicators are based on auxiliary data and cannot be expected to have the same accuracy as traditional methods of determining the GDP, these indicators can help to determine the state of the business cycle in almost real time.

# Methods

The economic activities need to be detectable from space, which means that they have to take place outdoors or leave traces outside. They have to be large enough to be captured by satellite imagery. High resolution satellite imagery can detect small images, but this resolution is very costly, therefor it has to be carefully decided which resolution is needed. The objects, which need to be detected, are of different sizes and thus the required minimal resolution varies. The freely available Sentinel-2 images with a spatial resolution of 10 m do not allow to detect some of the necessary objects, such as cars [2].

These objects can be detected with machine learning methods and quantified at different time points form a time series. These time series can then be combined and used to form single indicators of different economic activities. To distribute these indicators in a user friendly manner, a dashboard should be created similar to the Eurostat Business Cycle Clock [3] or the CBS Business Cycle Tracer. [4]

# Results

A lot of different objects can help to determine the state of the economic activity. For example while the revenue of supermarkets does not actually take place outdoors, the number of parked cars gives an indication and is traceable with very high resolution satellite images. Several enterprises such as ‘SpaceKnow’ , ‘Orbital Insight’ and ‘RS Metrics’ estimate the revenue of retailers by analysing the number of cars parked in front of their stores in combination with socioeconomic factors. By this, they are able to provide almost real time estimations to the stores.

The indicators that are investigated in the PoC are the following:

• Number of ships and containers in harbours

• Number of planes at airports

• Filling levels of fuel tanks

• Number of cars in front of supermarkets

• Number of ships on rivers and canals

• Length of traffic jams during rush hour

• Construction sites

# Discussion

One disadvantage of using optical satellite imagery are the clouds. Objects cannot be detected with clouds or shadows of clouds. On average 55% of the land is covered by clouds with seasonal and spatial variation [5].This means that all indicators are heavily affected by clouds, but the extent depends on the season. An alternative to optical remote sensing imagery are radar sensors which are independent of the weather, but can only detect certain objects such as ships.

# Conclusions

There are commercial satellites, which can provide a higher spatial resolution. At the moment, imagery with a very high resolution is very expensive. Furthermore Sentinel-2 has a temporal resolution of 5 days which is a problem when there are clouds in subsequent images which would mean that no observations can be reported in that time period. It would be possible to combine the images of different satellites to achieve a higher temporal coverage, however this would raise the cost and workload significantly.

While the calculation of indicators does not require the development of new methods, there is only limited scientific research on constructing economic indicators with remote sensing data. There are, however, several private enterprises, which are successfully using information derived from satellite images to detect the magnitude or change in economic activity. Unfortunately, their research is commercially valuable so that no details of their methods are publicly available.

The main obstacle at the moment is the high cost of very high resolution images and its infrequent coverage of areas. However, several private enterprises, such as BlackSky and Axelspace, plan on launching multiple small satellites, which can be used in combination to get a much better temporal resolution. Maybe in the middle run NSIs will have their own satellite. With more affordable prices for high resolution, both in spatial and temporal resolution, the economic activities needed to construct these indicators, will be more feasible to detect. Therefor, the smart business cycle statistics should become more accurate, affordable and reliable.

# References

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