Digital process data from the truck toll collection –

a new building block in official short-term statistics

# Keywords: big data, digital process data, nowcasting, production index, business cycle

# 1. Introduction

Economic activity generates and requires transport services - there is a close connection between the economic development in Germany and the freight traffic on German roads. Since the beginning of 2005, a toll has been charged on heavy goods vehicles on federal motorways and later on trunk roads in Germany. As part of toll collection, digital process data is generated, among other things, on the mileage of trucks subject to toll. The data is generated in a combination of mobile technology and satellite positioning system (GPS). A German authority which is responsible for freight traffic has used this data to develop a truck-toll-mileage index, which indicates the mileage for comparable basic characteristics and excludes structural changes as far as possible. Due to its early availability and economic meaningfulness, this index has been included in the publication program of official statistics. This article describes the truck-toll-mileage index as a new element in business cycle statistics and explains its relation to existing short-term statistics. Further, the question is discussed whether the truck-toll-mileage-index can be used as nowcast for the German Industrial Production Index.

# 2. Methods

## 2.1 Computation of the truck-toll-mileage-index

Using the toll data, a challenge is that the coverage of the truck toll has been gradually expanded since its introduction. In order to exclude these structural changes evolving from the extension of the toll in the observed mileage, the above mentioned authority has developed the "truck-toll-mileage index" (TTMI). This indicates the mileage as an index for a subpopulation, which is unchanged over time. On the one hand, only the mileage of trucks on federal motorways is included in the truck-toll-mileage index, since the distance-related extensions of the toll duty had always been related to the includion of trunk roads. On the other hand, only trucks with at least four axles are included, as in most cases they are not affected by toll extension on trucks with a gross vehicle weight of less than 12 tons.

## 2.2 German industrial production index

The aim of the industrial production index (IPI) is to measure the developments in the volume of industrial output at monthly intervals. It is a reference indicator for economic research and is used in particular to identify turning points in economic development at an early stage. It is furthermore an important input statistic used in national accounts for the quarterly extrapolation of the gross national product. The IPI is one of the earliest business cycle indicators in official statistics but it is still issued with a time lag of 37 days to the reporting month.

# 3. Results

**3.1 Publication of the TTMI**

With the truck-toll-mileage index, an indicator is provided that reflects truck traffic on German motorways and is available within 10 days. Truck traffic on federal motorways is in turn a comparatively good indicator of total inland freight traffic, since the share of road freight transport in the total transport volume of all modes of transport is very high and comparatively constant. Therefore, and because of its early availability, the truck-toll-mileage index is to be used as an additional economic indicator. In order to offer the index where data users regularly retrieve economic information, the index of the above mentioned authority has been included in the statistical program of official statistics.

**3.2 Using the TTMI to generate a nowcast for the Industrial Production Index?**

Due to the statistical relationship between mileage and industrial production, the question arises whether the data from the truck toll survey could be used to shorten the publication lags of short-term statistics. Such a nowcast would have to refer to the seasonally adjusted results, as these are in the foreground of the publications of official statistics. As a first step, the relationship between the truck-toll-mileage index and the results of short-term statistics was examined descriptively using the IPI for the manufacturing sector as an example. The following shows selected results.

*Non-seasonally adjusted figures from TTMI and IPI*

In Figure 1 on the left side, the y-axis shows the monthly rates of change of the non-seasonally adjusted IPI for the manufacturing sector and the corresponding change in the TTMI on the x-axis. For a simple outline of the relationships, the coefficient of determination of a linear single regression is given as a measure for the strength of the statistical relationship.

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| --- | --- | --- |
| Production Index for Manufacturing | Non-seasonally adjusted | Seasonally adjusted |
|  |  |
| Truck-toll-mileage index | |

Figure 1. Scatterplot of month-on-month rates of change, Feb 2015 – Aug 2018

The coefficient of determination of 0.74 indicates a clear statistical relationship between production and mileage. On the one hand, raw materials and intermediates have to be transported to the production sites, and on the other hand, industrial products have to be delivered to customers. The freight services can thus occur before, during or after production, but in many sectors of the industry supply, production and transport are very closely linked in time through just-in-time supply chains. The analysis of temporal shifts in the time series has shown that the relationship between the production and mileage of the same period is the strongest – when comparing the IPI with the TTMI in previous months or successive months, statistical cross-correlation is significantly weaker.

*Seasonally adjusted results from TTMI and IPI*

The seasonal adjustment procedure X13 in JDemetra +, which is widely used in the European statistical system for calculating the seasonally adjusted data of most short-term statistics, was also applied to the truck-toll-mileage index with the same parameter setting. The seasonal components of IPI and TTMI show a very close match. The coincidence of the seasonal pattern of mileage and goods production implies, conversely, that the application of seasonal adjustment excludes a significant portion of the covariance that exists between the two time series.

On the right side of Figure 1 the calendar and seasonally adjusted previous month rates are displayed in a scatter plot. The development of IPI for the manufacturing sector is displayed on the y-axis and the corresponding changes in the TTMI are shown on the x-axis. The seasonally adjusted times series contains movements of the trend-cyclical and the irregular component. The coefficient of determination is 0.15, which is significantly lower than the non-seasonally adjusted time series. The trend-cycle components of the two adjusted times series are correlated, whereas the irregular components are not. Hence the irregular component is mainly responsible for the low correlation of the seasonally adjusted time series.

*Business cycles of TTMI and IPI*

Figure 2 shows the cyclical developments of the IPI for the manufacturing sector and of the TTMI. The cyclical movements are computed as the deviation of the medium from long-term trends. In this representation, there are some exact matches in the economic turning points, but in other places deviating developments. The beginning of the downward movement at the time of the economic and financial crisis occurs for both time series simultaneously on February 2008 and its bottom on July 2009. In the years 2015 and 2016, the course of the index seems to have decoupled from the production development. At this time the IPI is characterized by little pronounced cyclical movements. At the turn of the year 2017/2018, another common turning point can be observed, which is only displayed one month earlier in the TTMI.

**Figure 2. Business Cycles as deviations of medium from long-term trends**

*Econometric modelling of the relationship between mileage and production*

Studies on the generation of nowcasts of seasonally adjusted production development based on truck toll data were carried out, for example, by the Deutsche Bundesbank [1], Askitas / Zimmermann [2] and Döhrn [3]. The studies tested different estimates using regressions and RegARIMA modeling. While Askitas / Zimmermann optimistically assessed the potential of toll data, Döhrn's preliminary assessment was rather sobering.

Similar investigations are carried out in the framework of the above mentioned cooperation project with the now available longer time series of almost 13 years. The newly introduced data, which has been adjusted for structural changes, is used in this project.

# 4. Conclusions

The truck-toll-mileage index developed by an authority responsible for freight traffic was included in the program of official statistics. Whether it can be used to produce a nowcast for seasonally adjusted industrial production index results is under investigation. The time series component of irregular movements, which is included in seasonally adjusted results, strongly influences seasonally adjusted results. The analysis of the cyclical trend movements, however, indicates that economic developments are certainly reflected in the performance of the mileage, partly with a clear coincidence in the economic turning points. In the further course of the project, it must be examined how this information content could be utilized.

references

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