A Leading Indicator of Austrian Exports Based on Truck Mileage

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The close correlation between economic activity and freight performance is emphasized in numerous international studies. With regard to Austria, timely information on truck mileage has been available since 2004 when Austria introduced road pricing. In this study, truck road pricing data compiled by the Austrian highway authority (ASFINAG) are analyzed for the first time with respect to their adequacy as a leading indicator for various macroeconomic indicators. The results show that truck mileage is a good leading indicator above all for goods exports. The timely availability provides an information advantage in analyzing economic developments of two to three months relative to the first release of export data by Statistics Austria.

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Meaningful analysis of the latest economic developments depends on the timely availability of economic data – even more so in today's turbulent times. However, most economic data are subject to significant publication lags – for instance delays of around 65 days following the end of the reporting month for external statistics and trade sales data for Austria, and delays of 55 days for data on industrial production.

Since the production and distribution of goods is highly dependent on freight services, freight data might be a good short-term indicator. To assess the validity of this assumption, we have analyzed the data on truck road pricing that Austria's highway authority ASFINAG collects. These data have the advantage of being available within just a few days after the end of each month.

The goal of this study is to analyze the truck mileage data with respect to their adequacy as a proxy for various macroeconomic indicators. The results show a close correlation between truck mileage and goods exports and imports, retail sales, and industrial production. This correlation provides an information advantage of two to three months over data published by Statistics Austria.

1 Correlation between Transport and Economic Activity

Business activity in an economy is closely related with freight performance. The high correlation between freight growth and economic growth has been emphasized in numerous international studies (OECD, 2003) and exists both in the short and long term. The dominant factors in the long term include globalization, changes in production structures (outsourcing, offshoring), the formation of regional trade blocs (EU, NAFTA, etc.), changes in consumer preferences, increases in efficiency, and investments in transportation infrastructure, whereas short-term changes basically reflect fluctuations in production and demand.

Brunel (2005) offers a good overview of the international literature on the correlation between economic activity and transport, differentiating between two bodies of literature. The first deals with long-term changes in transport intensity and whether there is a decoupling between freight perfor-

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Table 1

Freight Performance in Austria in 2005

	Road	Rail	Pipelines	Inland waterway	Total
	Freight performance in million ton kilometers				
Inland transport	13,876	4,200	160	37	18,273
Exports and imports	10,760	8,428	3,807	1,275	24,270
Transit trade	10,707	5,162	11,517	1,284	28,670
Total	35,343	17,790	15,484	2,596	71,213
	Share in % (total freight performance per type of transport = 100)				
Inland transport	75.9	23.0	0.9	0.2	100.0
Exports and imports	44.3	34.7	15.7	5.3	100.0
Transit trade	37.3	18.0	40.2	4.5	100.0
Total	49.6	25.0	21.7	3.6	100.0
	Share in % (total freight performance per means of transport = 100)				
Inland transport	39.3	23.6	1.0	1.4	25.7
Exports and imports	30.4	47.4	24.6	49.1	34.1
Transit trade	30.3	29.0	74.4	49.5	40.3
Total	100.0	100.0	100.0	100.0	100.0

Source: Herry Consult GmbH (2007).

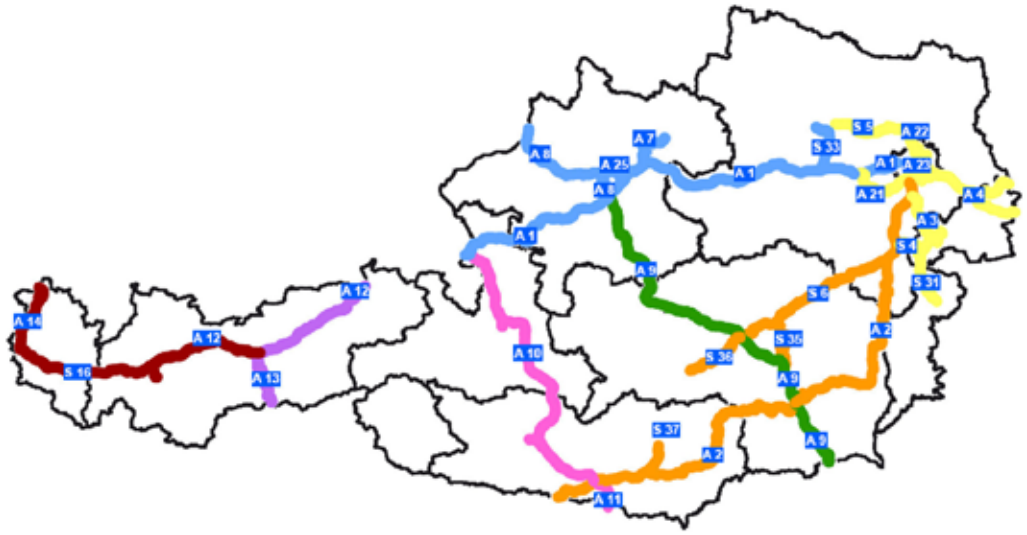
mance and economic growth (Baum and Kurte, 2002; Ahman, 2004). This is highly relevant in particular for environmental policy issues. The second strand, which is relevant for this study, analyzes the elasticity between freight performance and economic growth. Examples that document the close correlation between freight performance and economic growth based on error correction models include Meersman and Van de Voorde (1999) for Belgium, Lenormand (2002) for France, and Ramanathan (2001) for India. Lahiri and Yao (2004) and Lahiri et al. (2003) construct a transport index for the U.S.A. and show that it leads the economic turning points of the National Bureau of Economic Research (NBER) by five to six months. Andersson and Elger (2007) come to a similar conclusion in a study for Sweden. They differentiate between short-, medium-, and long-term fluctuations and find that medium-term fluctuations in freight performance precede the business cycle, i.e. they foreshadow the medium-term fluctuations in economic growth. However, the highest correlation to be found is in the short term. Of the economic indicators used by Andersson and Elger (2007), export activity exhibits the highest correlation with freight performance in the short term. With 0.64, the correlation coefficient is significantly higher than the coefficient for GDP (0.41). Finally, Yao (2005) examines the correlation between freight performance and inventories, verifying the significant feedback effect between both variables using Granger causality tests. From an economic standpoint, even the value added through transport services is relevant. The transport sector contributes around 4% to overall value added in Austria.

2 Freight Performance in Austria

Goods are transported through Austria by road, rail, and water, through pipelines, and by air, but roads are the single most important means of transport by far. Roads accounted for 49.6% of total freight performance (measured in million ton kilometers – tkm) in 2005. Rails ranked second with a 25.0% share. A breakdown of trans-

Chart 1

Key Routes within the ASFINAG Network



- Route 1 – Arlberg (A14, S16, A12 Zams exit to Innsbruck intersection)
- Route 2 – Brenner (A12 Kiefersfelden to Innsbruck intersection, A13)
- Route 3 – Tauern (A10, A11)
- Route 4 – Phyrn (A9)
- Route 5 – Danube (A1, A7, A25, S33)
- Route 6 – South (A2, S6, S35, S36)
- Route 7 – Vienna area (A3, A4, A6, A21, A22, S1, S4, S5, S31)

Source: ASFINAG.

Note: A = Highway; S = Expressway.

port performance by means of transport shows a rather balanced relationship between intra-Austrian transport (39.3%), exports and imports (30.4%), and pure transit trade (30.3%).

Highways and expressways dominate within the category of roads. In 2006, they accounted for 63.9% of total trucking performance over 3.5 tons (Herry Consult GmbH, 2007). In total, one-third of all goods are transported by truck on highways and expressways in Austria.

3 Truck Road Pricing Data for Austria

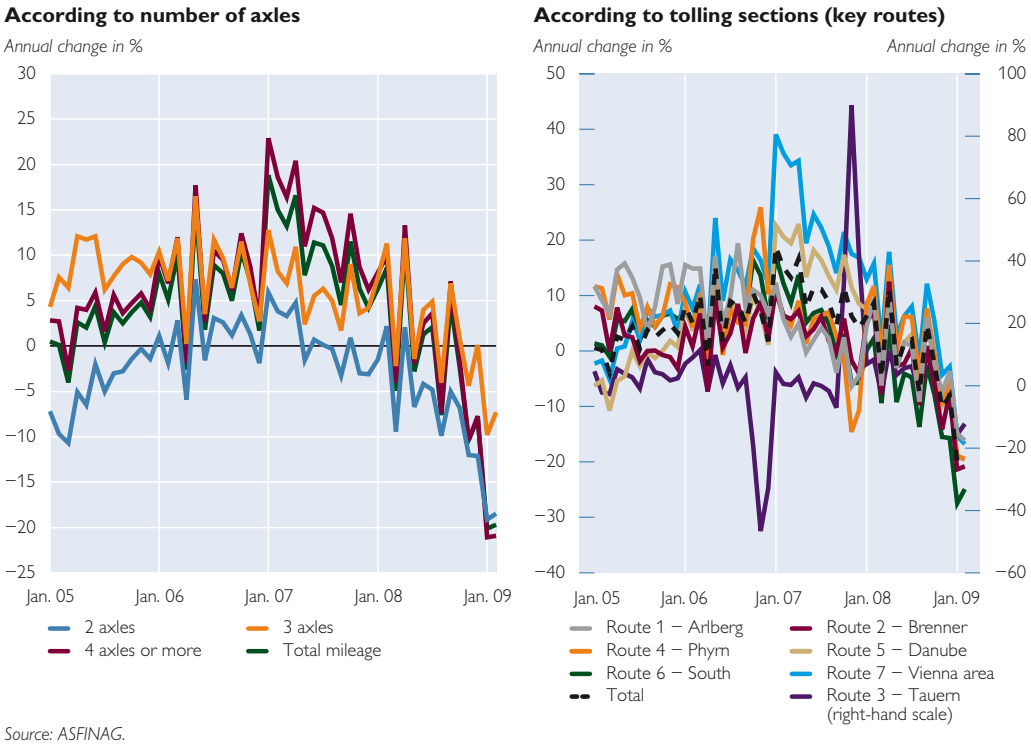
As the road toll operator in Austria, the highway authority ASFINAG can provide timely data on truck traffic.[2] Austria implemented an electronic road pricing scheme for trucks, buses and motorhomes maximum permissible weight of more than 3.5 tons on January 1, 2004. The appropriate charges are automatically deducted from vehicles entering restricted zones via in-vehicle units, with tolls amounts reflecting mileage as well as the number of axles. Trucks account for the overwhelming majority of tolling transactions (96%); buses and other vehicles over 3.5 tons, such as motorhomes, for the residual amount.

ASFINAG collects road-pricing data for a total of 855 tolling sections. To facilitate analysis, the data are aggregated to seven key routes (Route 1 – Arlberg; Route 2 – Brenner; Route 3 – Tauern; Route 4 – Phyrn; Route 5 – Danube; Route 6 – South; Route 7 –

[2] *The ASFINAG traffic data are not generally available at this time, but ASFINAG has kindly agreed to make the data available to the OeNB shortly after the end of each month for the purpose of short-term economic analysis.*

Chart 2

Total Truck Mileage on the ASFINAG Network



Source: ASFINAG.

Vienna area). Furthermore, data breakdowns are available for different numbers of axles – two, three, and four or more axles – and for tolling transactions at border crossings.

When analyzing the traffic data, it is important to remember that they can be distorted by special factors. These include temporary shifts in traffic between key routes, for instance as a result of roadblocks. For example, A10 was blocked for reconstruction work on the Altersberg bridge from October to December 2006, forcing through traffic between Germany and Italy to detour to other routes. In addition, highway expansions can cause traffic to shift between key routes and/or result in a general increase in traffic volume.[3] Finally, (temporary) shifts in traffic can occur as a result of developments abroad. For example, Germany also introduced a road pricing scheme on January 1, 2005, and the Czech Republic did so for trucks weighing more than 12 tons on since January 1, 2007.

4 Explanatory Value of Truck Mileage for Macroeconomic Variables

The explanatory value of data on truck mileage is analyzed using single equation models, since the length of the available time series does not permit the use of an error correction model, which is customary in international studies.

The analysis of the explanatory value for various macroeconomic variables is subject to a number of constraints, starting with the relatively short time span for which data are available. Monthly data on truck mileage have only been available since January

[3] *ASFINAG's network grows by an average of 2% annually.*

2004, which adds up to 63 separate observations until March 2009. Since 12 observations are lost through the construction of annual growth rates, and since the corresponding macroeconomic series are only available up to December 2008 or January 2009, only 48 or 49 observations remain for the econometric estimates. Owing to the relatively short data sample, none of the otherwise common out-of-sample tests for assessing their predictive quality can be performed; neither can the tests for robustness of estimated parameters. In light of this, the estimation and forecast results must be interpreted with the requisite caution.

While the time series on truck mileage and macroeconomic variables can be controlled for seasonal fluctuations by using annual changes, working-day effects may produce spurious correlations, since both truck mileage and the dependent macroeconomic variables are influenced by the number of working days per month. Therefore, the series are adjusted for working-day effects.[4] The intensity of the working-day effect can be seen in the last row of table 2. A 1% increase in working days in one month leads to a 0.75% increase in truck mileage.[5] The working-day effects are similarly high for exported and imported goods. Business-day effects (i.e. the effect of the various number of Monday-through-Saturday business days per month) were calculated for retail sales. These turned out to be considerably weaker than the working-day effects. This suggests that demand-side factors dominate in the retail industry, whereas supply-side factors are more likely to affect freight performance and exports. Industrial production figures

Table 2

Explanatory Value of Truck Mileage for Macroeconomic Variables

	Total truck mileage	Goods exports, real		Goods imports, real		Retail sales, real		Industrial production, NACE C–E, real	
Data adjusted for working days									
Constants		1.42		1.60		–0.19		3.78	
Total truck mileage		0.86	[0.000]	0.63	[0.000]				
Total truck mileage, 3 axles						0.09	[0.018]		
Total truck mileage, 3 axles (–1)						0.12	[0.005]		
Truck mileage, key southern route								0.30	[0.000]
Dummy December 2007		–15.10	[0.000]						
Adjusted R^2		0.74		0.51		0.44		0.76	
Durbin-Watson statistic		1.53		1.70		1.19		1.74	
Working-day effect[1]	0.75	0.85		0.70		0.30		x[2]	

Source: Authors' calculations.

Note: Endogenous variables and regressors are annual growth rates (adjusted for working days). Values in square brackets are error probabilities (p-values).

[1] *Calculated for January 2000 to December 2008, except for truck mileage figures, which have been available only since January 2004. Retail sales were adjusted for business days (incl. Saturdays).*

[2] *Series is already adjusted by Statistics Austria.*

[4] *As a general rule, Eurostat recommends not to adjust series shorter than three years for seasonal and/or working-day effects, whereas it recommends to adjust time series that are three to seven years long, but to inform users that the estimated parameter values can exhibit instability if there are too many regressors (Eurostat, 2008). The time series adjusted in this study pass all Tramo/Seats tests. Please refer to Scheiblecker (2003) for more on adjusting Austria's quarterly GDP for working-day effects.*

[5] *This econometric result coincides well with ASFINAG's data, according to which the average number of daily tolling transactions on Saturdays, Sundays, and holidays corresponds respectively to 35.8%, 15.4%, and 13.6% of the average number of weekday transactions.*

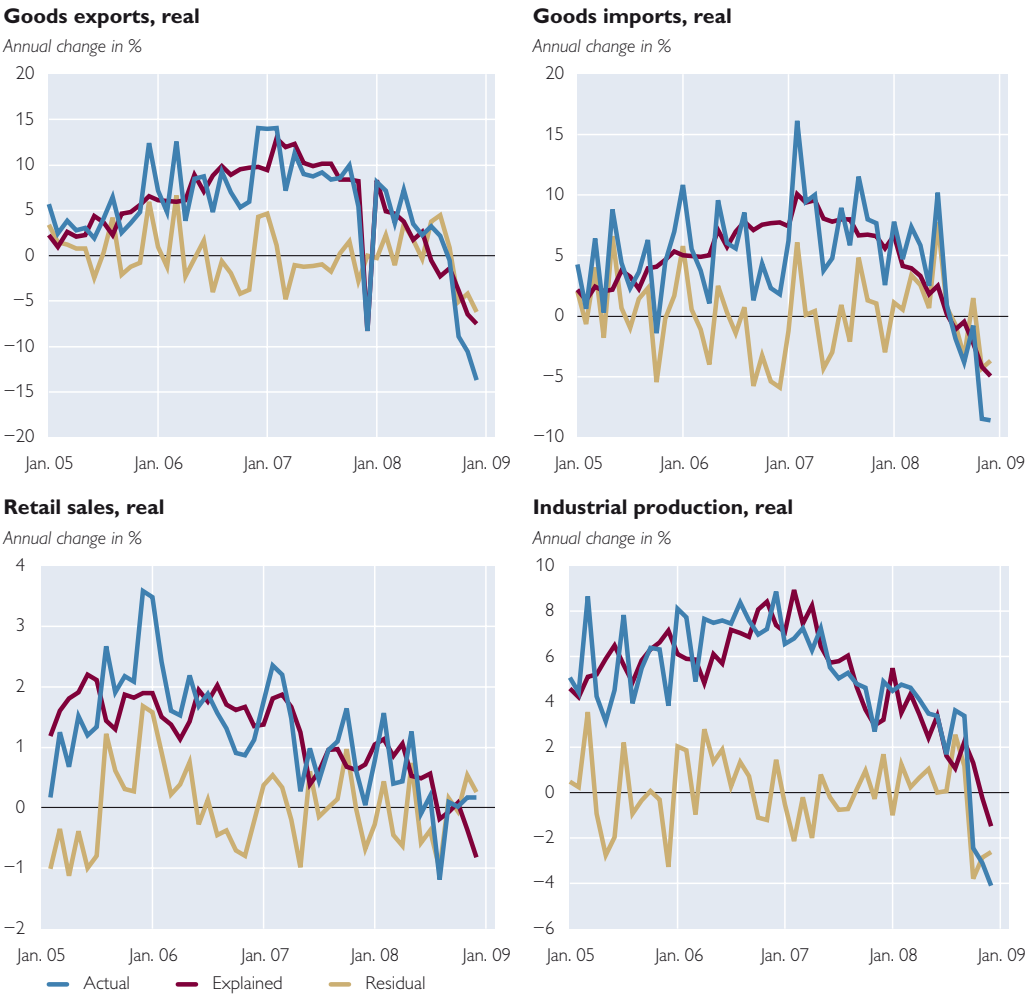
as published by Statistics Austria are already adjusted for working days.

Whereas retail sales and industrial production are available in real terms, Statistics Austria publishes figures on exports and imports in nominal terms only. Export and import deflators are only available on a quarterly basis. Therefore, we estimated the monthly deflator series necessary to adjust for inflation with a state space model. For explanatory monthly variables, the HICP and bilateral exchange rate of the euro to the U.S. dollar were chosen on the export side, while the commodity price index of the Hamburg Institute of International Economics (HWWI) was used additionally on the import side.

The dependent variables were regressed either on total truck mileage or on the mileage attributable to selected key routes or the number of axles. The estimation horizon runs from January 2005 to November/December 2008. The results all appear plausible; the respective equations all have high explanatory value and significant coefficients (table 2). With the exception of the equation for retail sales, the Durbin-Watson statistic shows only low serial

Chart 3

Actual and Explained Behavior of Macroeconomic Variables (adjusted for working days)



Source: Statistics Austria and authors' calculations.

correlation in the residuals. Exports and imports of goods are best explained by truck mileage across the entire network, with exports exhibiting both a higher explanatory value as well as a higher coefficient on truck mileage. The coefficient of determination of 0.7 for goods exports coincides with other results found in the empirical literature (Andersson and Elger, 2007). Retail sales are best explained by the aggregated mileage of trucks with three axles. This makes sense, because trucks with more than three axles are mostly used for long-distance transport. Truck mileage on the key southern route, finally, provides the best explanatory value for industrial production (NACE C–E). This result appears to be plausible, considering the concentration of important industries in Styria and the area's below-average share of through traffic.[6]

5 Decrease in Truck Mileage Implies Further Worsening of the Economic Downturn

Austrian economic output already declined in the fourth quarter of 2008 according to the flash estimate by the Austrian Institute of Economic Research (WIFO). The 0.2% quarter-on-quarter decrease in real GDP (adjusted for seasonal and working-day effects) was relatively moderate compared to other countries, though. In the same period, GDP fell by 1.5% in the euro area, while the decline in Germany was even worse (–2.1%). In particular, the decrease in exports and capital expenditures in Austria was considerably lower than expected. GDP was supported mainly by consumer spending (+0.4%) as well as government spending (+0.2%). In contrast, exports (–1.0%) and capital expenditures (–0.2%) continued to decline as in the previous quarters.

A forecast of real goods exports adjusted for seasonal effects based on truck mileage data up to March 2009 (table 3) shows that the slowdown in export activity that began when the financial crisis intensified in fall 2008 continued in February (–19.5%) and March 2009 (–20.2%). Controlled for the different amount of working days in February (–1) and March (+2) 2009 compared to 2008, real goods exports are expected to have, in fact, decreased by an even higher rate in February (–23.6%) and by a somewhat lesser rate in March (–11.8%).[7]

As a result of temporary special factors at the end of the estimation period in the fourth quarter of 2008, the growth in exports was overestimated by an average of 5 percentage points (chart 3). These special factors include, on the one hand, the number of empty trips, which increased during the financial crisis according to industry sources. On the other hand, the share of truck exports and imports in total traffic volume may also have fallen, because the current economic crisis was caused in large part by decreasing demand in Austrian export markets, while domestic demand – in particular consumer spending – remained comparatively stable. These special factors have been accounted for in the projections for February and March 2009.

The forecast decreases for trade sales and industrial production may be weaker than for foreign trade, but the figures at the same time imply that sharper decreases will follow, and that the eco-

[6] *Statistical tests regarding the effect of special factors, such as temporary roadblocks or highway expansions, were not significant.*

[7] *An evaluation of the number of tolling transactions according to border crossings suggests a regionally uniform decline in exports.*

Table 3

Forecasts of Macroeconomic Variables

	Total truck mileage	Goods exports, real	Goods imports, real	Retail sales, real	Industrial production, NACE C–E, real
	Annual change in %				
Adjusted for working days					
Sep. 08	–3.3	–2.0	–3.2	0.1	3.5
Oct. 08	–6.1	–9.6	–0.2	0.0	–1.9
Nov. 08	–8.9	–11.3	–9.1	0.1	–3.8
Dec. 08	–10.1	–14.0	–11.6	0.4	–4.1
Jan. 09	–12.9	–18.2	–14.4	**–0.3**	**–2.9**
Feb. 09	–14.5	**–19.5**	**–15.4**	**–1.0**	**–3.0**
Mar. 09	–15.3	**–20.2**	**–15.9**	**–0.6**	**–2.6**
Not adjusted for working days (historical data), or controlled for the number of working (business) days per month (forecast data)					
Sep. 08	4.7	8.1	1.7	1.3	×
Oct. 08	–2.4	–4.8	–0.1	1.2	×
Nov. 08	–10.3	–14.8	–9.4	–2.8	×
Dec. 08	–8.0	–9.3	–7.1	–2.1	×
Jan. 09	–20.1	–25.5	–18.7	**–1.5**	×
Feb. 09	–19.7	**–23.6**	**–18.7**	**–2.2**	×
Mar. 09	–11.0	**–11.8**	**–8.9**	**0.6**	×

Source: ASFINAG, Statistics Austria, and authors' calculations.

Note: values in bold print = forecast values.

nomic decline will be broad-based. The information currently available is inconclusive in determining whether these developments signal either a worsening or bottoming out of the recession in the first quarter of 2009.

However, the forecast results must be interpreted cautiously. As explained in section 4, the short time series preclude the application of otherwise common test methods. Thus, it is too early to provide a conclusive assessment of the forecast quality; this will not be possible until a correspondingly long time series of real time forecasts is available. Therefore, the early indicators for Austria on the basis of truck mileage can only supplement other methods and models of economic analysis and should by no means replace them.

6 Summary

The aggregate output of an economy is closely correlated with freight performance. Numerous international studies document that there is a close correlation both in the long and short term. Since short-term changes in freight performance essentially reflect fluctuations in production and demand, timely freight data are good leading indicators for economic developments.

With regard to Austria, timely information on truck mileage on highways and expressways, which accounts for one-third of freight mileage in Austria, has been available since 2004 when Austria introduced road pricing. Empirical analysis of the truck road pricing data compiled the Austrian highway authority (ASFINAG) shows that truck mileage has a high explanatory value for goods exports and imports as well as for industrial production, enabling the precise "nowcasting" of these key macroeconomic variables. Truck mileage data have the advantage of being available two to three months ahead of other data, which represents a substantial in-

formation advantage. However, the econometric results have to be interpreted with due caution in light of the small data sample. As a result of their positive leading indicator properties and their time availability, road pricing data will continue to play an important role in the analysis of current economic developments.

Precise and timely economic information is extremely important, in particular in economically difficult and uncertain times such as at the current juncture. The forecasts for foreign trade and industrial production prepared on the basis of road pricing data point to a further worsening of the economic downturn. Accordingly, an economic turnaround is not yet in sight.

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