Forecasting Revisions of German Industrial Production

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Abstract

Macroeconomic variables, such as industrial production or GDP, are regularly and sometimes substantially revised by the official statistical offices. Nevertheless, there are only few attempts in the previous literature to investigate whether it is possible to forecast these revisions systematically. In this paper it is illustrated how revisions of German industrial production can be forecasted with respect both to the direction as well as to the level of the revision. We are the first that use a large data for this purpose.

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1 Introduction

In recent years a growing interest in real-time data for business cycles indicators such as GDP or industrial production has been observed. Researchers and policy-makers alike rely on such figures while facing the problem of subsequent monthly or quarterly revisions of those figures. It is therefore of vital importance to examine to what extent various indicators that are potentially correlated with the business cycle allow observers to predict such revisions or the actual "true" value of the business cycle, respectively. In this paper we deal with this issue by forecasting revisions of German Industrial production using a large data set. Our forecasts refer both to the level as well as to the direction of the revision. We contribute to a small literature that dealt with revisions in macroeconomic time series. Jacobs and Sturm (2004), Faust, Rogers, and Wright (2005), Jacobs and Sturm (2008) and Boysen-Hogrefe and Neuwirth (2012) addressed the problem of forecasting revisions. However, these papers always used only a small set of indicators. We follow closely the ideas and set up of Jacobs and Sturm

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(2004). We are the first to use a large data set with 114 indicators and to employ forecast combination schemes.

2 Data

2.1 The IP vintage data

We use vintage data of German industrial production (IP) which is provided by the real-time database from the Deutsche Bundesbank. The data was obtained in August 2015. The IP series range from from 6 February 2004 to 8 May 2015; by implication, the latest IP figure, which refers to March 2015, was released on 8 May 2015 as the preliminary announcement. We confine ourselves to vintages of at least twenty-four releases.[1] In our case, this holds for April 2014. Let y_t^{FR} denote the *first release* of monthly growth rate of IP in month t. We define the revisions as

$$R_t^i = y_t^{FR} - y_t^j, \quad \text{with } i = 1, \ldots, N; j = 2, \ldots, M \tag{1}$$

where i denotes the i^{th} revision and j the corresponding releases of IP. Although IP figures in the initial data set refer to three different base years (2000, 2005, 2010), no rebasement is needed since the proportionality of growth rates should not to be linked to overall level shifts.[2]

2.2 The indicator set

Our starting point is the data set as in Henzel, Lehmann, and Wohlrabe (2015) with 257 indicators. We dropped all indicators which refer to the future (e.g. survey expectations) or which are also subject to revisions. This leaves us with only 16 indicators. Then, we enriched

[1] There are some peculiarities with the industrial production release data set worth to be mentioned here. First, industrial production figures released before 22 November 2005 were derived manually and not by automatic systems. It does not surprise that the revision frequency and intensity differs during this period appraising to 21 release dates in total. Second, releases belonging to release dates in the transition phase to automation (from 22 November 2005 to 24 January 2006) have been published twice per month with occasional differences between them. The authors assume that the statistical agency regards the second release per month as the definite one, hence the first one has been ruled out from the data set.

[2] The aspect of benchmark revisions is intensively discussed in Knetsch and Reimers (2009).

the data set by including all indicators from the Ifo industry survey on the two-digit level. This includes sectors like machinery, chemical industry or car manufacturing. We use the questions from the survey which are related both to the current business situation as well as to the development of the production in the previous month. This idea builds upon Jacobs and Sturm (2004) who use both indicators on the aggregate industry level in order to forecast German IP revisions. The survey indicators are employed both in levels and first differences. Finally, we end up with 104 indicators. All of them are transformed appropriately to ensure stationarity. The full data set can be found in the appendix.

3 Empirical Approach and Results

Generally, all revisions of IP could be forecasted using our data set. For illustrative purposes and to save space we focus on the first and the final revision (after the 24th release). Our simple forecasting model is given by

$$R_t^i = \alpha + \beta y_t^1 + \gamma x_t^k. \tag{2}$$

The IP revision (R_t^i) is explained by a constant, the first release of IP (y_t^1) and an indicator (x_t^k). Our initial estimation sample runs from June 2001 to December 2006. Our first forecast is the first and the final revision for the growth rate of IP for January 2006. We do not have to take care of any real-time data issues as all of our indicators are available before the first IP release and are not subject to any revisions. Then we increase our estimation sample by one observation (recursive scheme), re-estimate the model and calculate the forecast for February 2006. We continue in this fashion up to April 2013. Given that we have a large data set, it is natural to employ forecast combination schemes, which proved to be quite successful in the forecasting literature.[3] We focus on the two most simple ones: the mean and the median. As a benchmark we use the zero forecast, i.e. the first release is not revised as in Jacobs and Sturm (2004). Besides the point forecasts we also consider directional forecasts. These

[3]See Timmermann (2006) for an overview and further details.

could be important for market participants, indicating whether the current release of IP will be revised down- or upwards. In order to test whether the hit ratio (percentage share of correct directional forecasts) is statistically different from "flipping a coin", we follow Jacobs and Sturm (2004) and employ bootstrap techniques to simulate the corresponding p-values.

In Table 1, we lists the results. Panels A and B report the best five indicators plus forecast combination in terms of the relative mean squared forecast error (MSFE). A value smaller than one implies that the indicator model is better then the zero forecast benchmark. Panels C and D state the best five indicators in terms of the relative percentage share of correct directional forecasts.[4] The results can be summarized as follows:

1. Indicator-based forecasts improve upon zero-revision forecasts up to 30% in terms of MSFE.

2. The improvement is slightly better for the final revisions than for the first ones.

3. The ifo survey indicators are the dominant predictors.

4. Indicator forecasts can deliver correct directional forecasts up to 75% of all cases.

5. As with respect to point forecasts, our model is slightly better for the final revision compared to the first one.

6. In contrast to many applications in the literature, forecast combinations do not outperform the best single indicator forecasts.

4 Conclusion

In this paper we show that it is possible to forecast revisions of German industrial production. Using a large data set, mainly consisting of Ifo survey data, we demonstrate that we can systematically outperform simple benchmarks. Our setup allows us to forecast the direction of the revision in up to 75% of all cases. Our results might be useful for future research, which

[4]The full list of results are listed in the appendix.

incorporates the real-time information of revisions with respect to forecasting the releases of industrial production or other macroeconomic variables which are subject to revisions.

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Appendix

Table 1: Forecasting Results

Panel A: Point forecasts - first release		
Rank	Indicator	MSE ratio
1	Ifo Production - Wooden Goods (fd)	0.796
2	Ifo Production - Textiles (fd)	0.822
3	Ifo Production - Textiles	0.822
4	Ifo Production - Metals (fd)	0.832
5	Ifo Production - Engineering (fd)	0.836
19	Forecast Combination	0.854
Panel B: Point forecasts - final release		
Rank	Indicator	MSE ratio
1	Ifo Production - Metals (fd)	0.688
2	Ifo Production - Metals	0.720
3	Oil Price (Euro/barrel)	0.731
4	HWWA Index of World Market Price of Raw Materials (Eurozone), incl. Energy	0.733
5	employment - wholesale voln	0.740
25	Forecast Combination	0.773
Panel C: Directional forecasts - first release		
Rank	Indicator	Hit ratio	p-value
1	New Registrations - Cars	0.679	0.002
2	New Registrations - All Vehicles	0.654	0.008
3	Ifo Production - Industry (fd)	0.628	0.029
4	Nominal Effective Exchange Rate	0.603	0.073
5	Ifo Business Situation - Rubber and Plasticware (fd)	0.603	0.075
53	Forecast Combination	0.564	0.211
Panel D: Directional forecasts - final release		
Rank	Indicator	Hit ratio	p-value
1	Ifo Business Situation - Electronic Devices (fd)	0.731	0.000
2	Ifo Production - Metals (fd)	0.718	0.000
3	Ifo Business Situation - Furniture (fd)	0.718	0.000
4	Ifo Business Situation - Other Wares (fd)	0.718	0.000
5	Ifo Production - Metals	0.718	0.000
35	Forecast Combination	0.692	0.001

This table reports the MSE ratios relative to the benchmark model (zero forecast). Additionally, it states the hit ratio (share of correct direction forecasts of the revision) and its corresponding p-value. A value of small than 0.05 indicates that the hit ratio is statistically significant better than the coin flip.

Table 2: Full results

	MSE-Ratio		Hit-Ratio		p-values	
	1st Rev.	Final Rev.	1st Rev.	Final Rev	1st Rev.	Final Rev
New Registrations - All Vehicles	0.927	0.771	0.654	0.679	0.008	0.002
New Registrations - Cars	0.937	0.782	0.679	0.667	0.002	0.004
New Registrations - Heavy Trucks	0.851	0.761	0.577	0.679	0.158	0.002
Unemployment	0.858	0.769	0.564	0.679	0.198	0.002
Employed persons (residence concept)	0.854	0.777	0.577	0.692	0.161	0.001
Employed persons (work-place concept)	0.856	0.777	0.577	0.679	0.154	0.002
employment - wholesale voln	0.863	0.740	0.538	0.679	0.309	0.002
Working Days	1.063	0.780	0.538	0.692	0.316	0.001
vacancies (dec 1999 onwards new definition) vola	0.878	0.761	0.551	0.705	0.262	0.000
DAX Share Price Index ep nadj	0.863	0.779	0.564	0.718	0.208	0.000
nominal effective exchange rate 39 sadj	0.851	0.777	0.603	0.679	0.073	0.002
HWWA Index of World Market Price of Raw Materials (Eurozone), incl. Energy	0.845	0.733	0.564	0.679	0.215	0.002
HWWA Index of World Market Price of Raw Materials (Eurozone), excl.energy	0.880	0.782	0.551	0.692	0.259	0.001
Oil Price (â,¬/*barrel*)	0.845	0.731	0.590	0.692	0.111	0.001
ZEW Present Economic Sit.	0.871	0.791	0.564	0.692	0.212	0.001
ZEW Present Economic Sit. (fd)	0.858	0.742	0.551	0.679	0.263	0.002
Ifo Results - Level Data						
Ifo Business Sit. - Industry	0.877	0.794	0.577	0.667	0.158	0.004
Ifo Production - Industry	0.877	0.770	0.577	0.692	0.154	0.001
Ifo Business Sit. - Food	0.866	0.783	0.551	0.679	0.264	0.002
Ifo Production - Food	0.854	0.778	0.564	0.692	0.212	0.001
Ifo Business Sit. - Beverage	0.856	0.778	0.577	0.679	0.156	0.002
Ifo Production - Beverage Industry	0.872	0.777	0.538	0.692	0.313	0.001
Ifo Business Sit. - Textiles	0.861	0.790	0.590	0.692	0.113	0.001
Ifo Production - Textiles	0.822	0.770	0.577	0.692	0.160	0.001
Ifo Business Sit. - Clothing	0.891	0.789	0.513	0.692	0.389	0.001
Ifo Production - Clothing	0.875	0.779	0.551	0.692	0.255	0.001
Ifo Business Sit. - Leatherwork and Shoes	0.868	0.780	0.564	0.679	0.208	0.002
Ifo Production - Leatherwork and Shoes	0.863	0.774	0.564	0.705	0.213	0.000
Ifo Business Sit. - Wooden Goods	0.861	0.785	0.564	0.705	0.206	0.000
Ifo Production - Wooden Goods	0.860	0.775	0.577	0.679	0.160	0.002
Ifo Business Sit. - Paper	0.892	0.799	0.551	0.654	0.263	0.009
Ifo Production - Paper	0.907	0.757	0.513	0.667	0.388	0.004
Ifo Business Sit. - Data Carriers	0.858	0.782	0.577	0.692	0.159	0.001
Ifo Production - Data Carriers	0.868	0.786	0.577	0.667	0.160	0.004
Ifo Business Sit. - Mineral Oil Processing	0.869	0.788	0.564	0.654	0.207	0.009
Ifo Production - Mineral Oil Processing	0.893	0.776	0.590	0.667	0.114	0.004
Ifo Business Sit. - Chemicals	0.885	0.792	0.551	0.654	0.265	0.008
Ifo Production - Chemicals	0.901	0.773	0.564	0.692	0.204	0.001
Ifo Business Sit. - Rubber and Plasticware	0.880	0.794	0.551	0.667	0.261	0.004
Ifo Production - Rubber and Plasticware	0.872	0.771	0.551	0.679	0.264	0.002
Ifo Business Sit. - Glass, Ceramics, Stone, Earth Elements	0.868	0.784	0.564	0.679	0.204	0.002
Ifo Production - Glass, Ceramics, Stone, Earth Elements	0.893	0.790	0.564	0.679	0.211	0.002
Ifo Business Sit. - Metals	0.874	0.793	0.564	0.654	0.207	0.008
Ifo Production - Metals	0.860	0.720	0.564	0.718	0.212	0.000
Ifo Business Sit. - Metals	0.879	0.795	0.551	0.679	0.265	0.002
Ifo Production - Metals	0.878	0.767	0.564	0.667	0.214	0.004

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Table 2 – *cont. from previous page.*

	MSE-Ratio		Hit-Ratio		p-values	
	1st Rev.	Final Rev.	1st Rev.	Final Rev	1st Rev.	Final Rev
Ifo Business Sit. - Electronic Devices	0.892	0.798	0.551	0.654	0.266	0.008
Ifo Production - Electronic Devices	0.890	0.788	0.564	0.667	0.217	0.004
Ifo Business Sit. - Electronic Equipment	0.865	0.787	0.577	0.679	0.156	0.002
Ifo Production - Electronic Equipment	0.870	0.776	0.577	0.692	0.161	0.001
Ifo Business Sit. - Engineering	0.869	0.788	0.577	0.705	0.151	0.000
Ifo Production - Engineering	0.881	0.789	0.577	0.654	0.160	0.008
Ifo Business Sit. - Cars	0.913	0.820	0.538	0.667	0.316	0.004
Ifo Production - Cars	0.861	0.757	0.551	0.705	0.262	0.000
Ifo Business Sit. - Other Vehicles	0.871	0.798	0.564	0.679	0.215	0.002
Ifo Production - Other Vehicles	0.872	0.831	0.564	0.641	0.215	0.017
Ifo Business Sit. - Furniture	0.862	0.783	0.577	0.679	0.157	0.002
Ifo Production - Furniture	0.865	0.780	0.577	0.692	0.160	0.001
Ifo Business Sit. - Other Wares	0.867	0.795	0.577	0.667	0.158	0.004
Ifo Production - Other Wares	0.882	0.798	0.564	0.679	0.214	0.002
Ifo Results - First differences						
Ifo Business Sit. - Industry	0.852	0.758	0.551	0.692	0.268	0.001
Ifo Production - Industry	0.857	0.782	0.628	0.705	0.029	0.000
Ifo Business Sit. - Food	0.881	0.770	0.551	0.705	0.265	0.000
Ifo Production - Food	0.865	0.776	0.564	0.679	0.213	0.002
Ifo Business Sit. - Beverage	0.865	0.782	0.590	0.705	0.111	0.000
Ifo Production - Beverage Industry	0.864	0.774	0.564	0.692	0.212	0.001
Ifo Business Sit. - Textiles	0.838	0.800	0.577	0.667	0.159	0.004
Ifo Production - Textiles	0.822	0.786	0.564	0.692	0.208	0.001
Ifo Business Sit. - Clothing	0.989	0.867	0.538	0.654	0.313	0.009
Ifo Production - Clothing	0.889	0.782	0.564	0.679	0.205	0.002
Ifo Business Sit. - Leatherwork and Shoes	0.871	0.782	0.603	0.679	0.073	0.002
Ifo Production - Leatherwork and Shoes	0.860	0.780	0.590	0.679	0.110	0.002
Ifo Business Sit. - Wooden Goods	0.850	0.771	0.577	0.705	0.157	0.000
Ifo Production - Wooden Goods	0.796	0.775	0.577	0.654	0.159	0.007
Ifo Business Sit. - Paper	0.895	0.783	0.538	0.705	0.314	0.000
Ifo Production - Paper	0.901	0.776	0.538	0.679	0.321	0.002
Ifo Business Sit. - Data Carriers	0.872	0.768	0.577	0.667	0.152	0.004
Ifo Production - Data Carriers	0.857	0.787	0.577	0.654	0.163	0.008
Ifo Business Sit. - Mineral Oil Processing	0.852	0.784	0.577	0.692	0.159	0.001
Ifo Production - Mineral Oil Processing	0.895	0.790	0.564	0.654	0.208	0.008
Ifo Business Sit. - Chemicals	0.906	0.813	0.564	0.718	0.209	0.000
Ifo Production - Chemicals	0.911	0.804	0.564	0.705	0.215	0.000
Ifo Business Sit. - Rubber and Plasticware	0.841	0.780	0.603	0.692	0.075	0.001
Ifo Production - Rubber and Plasticware	0.912	0.797	0.551	0.679	0.258	0.002
Ifo Business Sit. - Glass, Ceramics, Stone, Earth Elements	0.892	0.777	0.564	0.692	0.212	0.001
Ifo Production - Glass, Ceramics, Stone, Earth Elements	0.932	0.782	0.590	0.679	0.107	0.002
Ifo Business Sit. - Metals	0.850	0.764	0.577	0.679	0.158	0.002
Ifo Production - Metals	0.832	0.688	0.590	0.718	0.113	0.000
Ifo Business Sit. - Metals	0.855	0.774	0.577	0.679	0.157	0.002
Ifo Production - Metals	1.002	0.787	0.513	0.692	0.388	0.001
Ifo Business Sit. - Electronic Devices	0.870	0.762	0.564	0.731	0.205	0.000
Ifo Production - Electronic Devices	0.873	0.780	0.564	0.705	0.204	0.000
Ifo Business Sit. - Electronic Equipment	0.858	0.797	0.590	0.705	0.115	0.000
Ifo Production - Electronic Equipment	0.847	0.779	0.590	0.692	0.115	0.001
Ifo Business Sit. - Engineering	0.868	0.798	0.577	0.705	0.161	0.000
Ifo Production - Engineering	0.836	0.788	0.590	0.692	0.110	0.001

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Table 2 – *cont. from previous page.*

	MSE-Ratio		Hit-Ratio		p-values	
	1st Rev.	Final Rev.	1st Rev.	Final Rev	1st Rev.	Final Rev
Ifo Business Sit. - Cars	0.858	0.777	0.551	0.654	0.260	0.009
Ifo Production - Cars	0.863	0.793	0.577	0.679	0.158	0.002
Ifo Business Sit. - Other Vehicles	0.851	0.797	0.551	0.641	0.265	0.015
Ifo Production - Other Vehicles	0.890	0.787	0.564	0.603	0.209	0.073
Ifo Business Sit. - Furniture	0.859	0.765	0.577	0.718	0.154	0.000
Ifo Production - Furniture	0.855	0.783	0.603	0.679	0.071	0.002
Ifo Business Sit. - Other Wares	0.854	0.778	0.577	0.718	0.160	0.000
Ifo Production - Other Wares	0.882	0.785	0.564	0.667	0.215	0.004
Forecast Combination (Mean)	0.854	0.773	0.564	0.692	0.211	0.001

This table reports the MSE ratios relative to the benchmark model (zero forecast). Additionally, it states the hit ratio (share of correct direction forecasts of the revision) and its corresponding p-value. A value of small than 0.05 indicates that the hit ratio is statistically significant better than the coin flip.