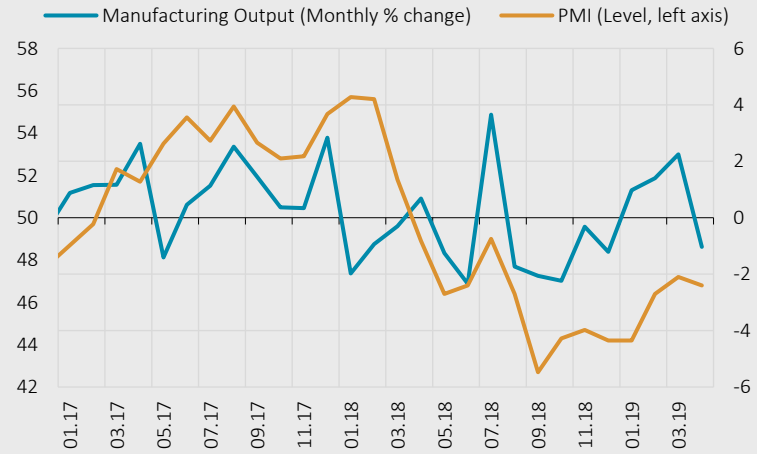
Box 4.1

The Relation Between Manufacturing Output and PMI Indicators

The Purchasing Managers Index (PMI) is one of the key indicators monitored for the course of economic activity.[1] The PMI reveals the previous month's developments on the first business day of each month, which increases the importance of the survey in terms of timely information. Responses of survey participants define the direction of activity in comparison with the previous month. Then, the aggregated responses are transformed into a diffusion index. The index has a threshold value of 50, and a reading below (above) this threshold refers to a contraction (expansion) in manufacturing output.

When we examine recent developments, we see that the headline value of the index has remained below the threshold of 50 since April 2018. This has led to market comments that manufacturing output is set to contract. However, since manufacturing output has recorded monthly expansions in certain months during this period, most visibly in 2019, one should be careful when extracting information from the index (Chart 1).

Chart 1: Manufacturing Output and the PMI (Seasonally Adjusted)



Sources: IHS Markit - Istanbul Chamber of Industry, TURKSTAT.

In this box, following Koenig (2002), we seek answers to these questions:

- Does the threshold value differ from value of 50 in practice?
- Do the monthly changes of the index matter as much as the PMI level?
- Do these relations change over time?

There are a number of factors that call for a close investigation of the information content of the index.[2] For one, the PMI survey is conducted with large-scale firms and only information related to direction is pursued - in other words, there is no information with respect to the magnitude of the change. Additionally it is possible that participants may tend to be more pessimistic during times of financial turbulence. To assist with such an investigation, the following equation, in which the quarterly change of manufacturing output is explained by the PMI level and the

[1] PMI Survey in Turkey is co-organized by the Istanbul Chamber of Industry and IHS Markit.

[2] Eren (2014) studies the threshold value for Turkey. In this study, GDP is used as the dependent variable.

quarterly change of the index, is estimated for the 2005Q2-2019Q1 period. In order to observe whether the relations have changed over time, we repeated the estimation for the sub-periods of 2005-09, 2010-14 and 2015-19. We conducted the same analysis for the production sub-index in addition to PMI headline data, and reported the findings. All the data used in the analysis are seasonally adjusted.

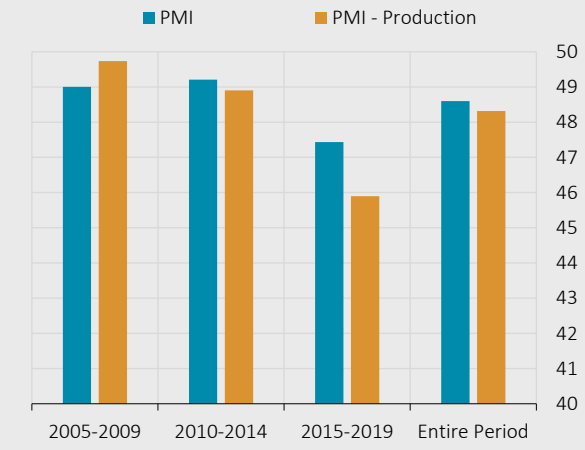
$$(\Delta mnfp_t/mnfp_{t-1}) * 100 = c(1) * \big(pmi_t - c(2)\big) + c(3) * \Delta pmi_t + \varepsilon_t$$

In the equation, the c(2) coefficient refers to the threshold value while the c(1) coefficient measures the effect of the gap between the PMI level and the threshold, and c(3) measures the effect of the quarterly change in the PMI on the quarterly change in manufacturing output.

The first significant finding is that the threshold value (c(2) coefficient) differs from the 50 mark and changes over time. While the threshold value was found to be at 48.6 when the analysis was conducted for the entire period, it declined to 47.4 for the 2015-2019 period. When the analysis is repeated for the production sub-index, the estimate for the threshold value declines to 45.9 from 48.3 for the same periods (Chart 2).

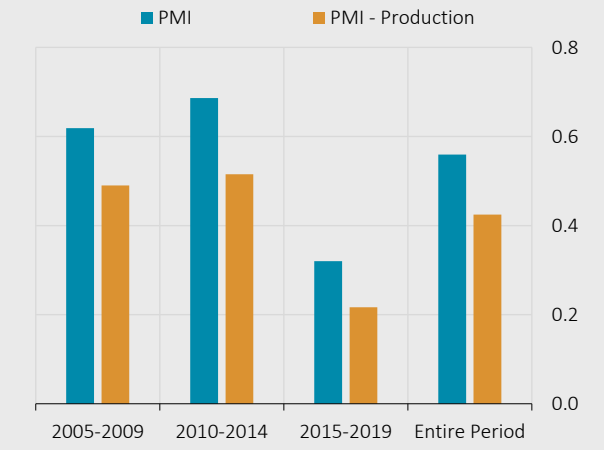
The coefficient of c(1), which shows the effect of a deviation from the threshold value on the change in manufacturing output, is estimated to be 0.56 for the entire period. This implies that when the PMI exceeds the threshold value by one point, manufacturing output increases by about 0.6%. This coefficient takes a lower value (0.32) in the estimation conducted for the 2015-19 period. Repeating the analysis for the sub-index yields a similar outlook (Chart 3).

Chart 2: Threshold Value Estimate - $c(2)$



Source: Authors' calculations.

Chart 3: The Estimated Coefficient of the Deviation from the Threshold Value - $c(1)$



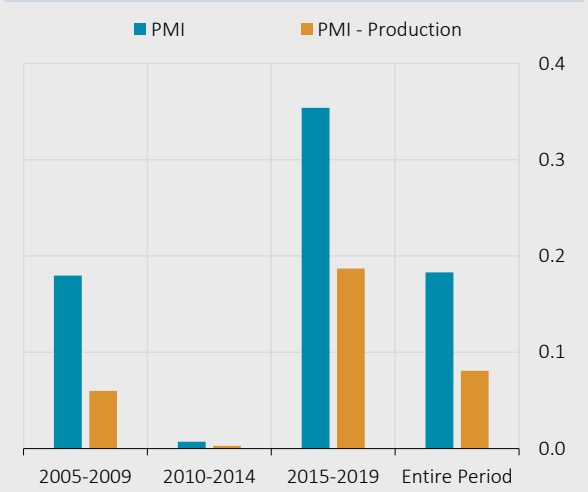
Source: Authors' calculations.

When the impact of the quarterly change in the PMI on manufacturing output, c(3), is examined for the entire period, it is found that the coefficient is statistically significant at the 0.18 value[3]. This observation indicates that during recovery periods following a contraction (for instance during the first half of 2009), even though the index remains below the threshold value, an increase in the index may imply a rise in manufacturing output. The estimated coefficient of the PMI change obtained from the regression for the 2015-19 period increases to 0.35, suggesting a rise in the importance attributed to the change in the index. When the analysis is repeated for the production sub-index, the coefficient estimate increases over time, and the t-value, which expresses the statistical significance, rises as well (Charts 4 and 5).

[3] The horizontal line in Chart 5 indicates the critical value.

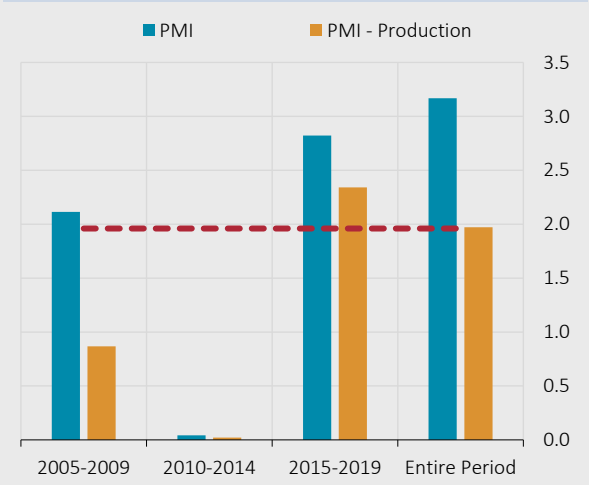
When the explanatory power of the estimated equation is examined, it is observed that the adjusted coefficient of determination (R^2) assumes a high value in the analysis conducted for the entire period. Yet, the estimations conducted for the five-year periods reveal that the adjusted coefficients of determination tend to decrease, and their explanatory power weakens considerably for the 2015-19 period (Chart 6). On the other hand, the inclusion of the PMI change in the equations increases the adjusted coefficients of determination in the analyses carried out for sub-periods (except for the 2010-14 period) and for the entire period.

Chart 4: Estimated PMI Change Coefficient - $c(3)$



Source: Authors' calculations.

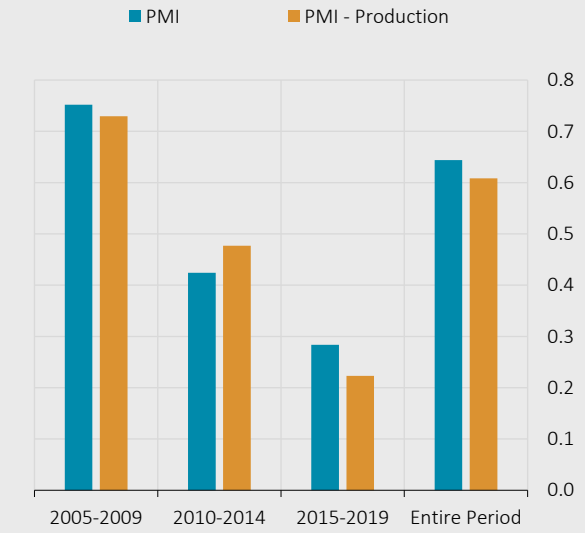
Chart 5: Statistical Significance of the PMI Change Coefficient (t-value)



Source: Authors' calculations.

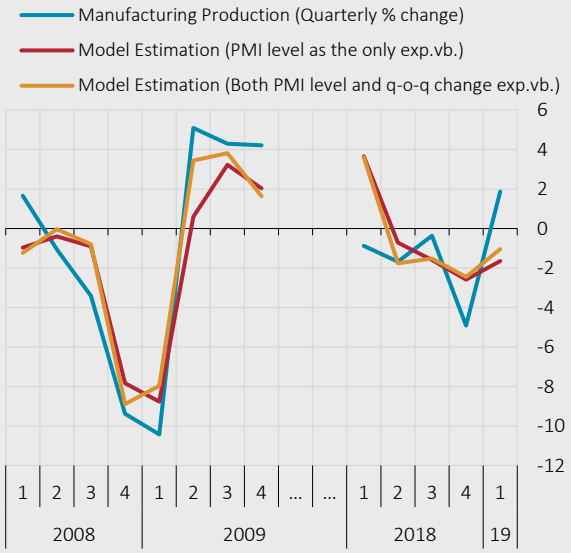
In this box, we examined the explanatory power of PMI indicators, which are frequently monitored to obtain information regarding the course of economic activity, to explain the quarterly percentage change of manufacturing output. Our findings reveal that the change in the index matters as much as the index level and that the threshold level differs from the 50 level. When the analysis is repeated for sub-periods, the coefficient estimates may vary and lose their statistical significance. Our estimations for the headline PMI and for the last 5-year sub-period suggest that both the threshold value and the explanatory power of a deviation from this level decreased while the importance attached to the change in the PMI rose. Therefore, we assess that drawing conclusions about manufacturing output by simply comparing the headline PMI value with the 50 threshold might be misleading. Nonetheless, even when the change in the index is factored in, the relation between the PMI and manufacturing output seems to have weakened in recent years (Chart 7). Sectoral contributions to the manufacturing industry change periodically, and therefore the relation between hard data and surveys, which have relatively fixed sampling, may weaken over time. For instance, despite the relatively positive recent performance of sectors such as other transport equipment and basic pharmaceutical products, the weakening in sectors linked to construction, motor vehicles and machinery-equipment might account for the fall in the information content of the index.

Chart 6: Adjusted Coefficient of Determination (R^2) Values



Source: Authors' calculations.

Chart 7: Manufacturing Output and Model Estimations



Source: Authors' calculations.

References

Eren, O. (2014). Forecasting the Relative Direction of Economic Growth by Using the Purchasing Managers` Index. İktisat, İşletme ve Finans, 29(344), pp. 55-72.

Koenig, E. (2002). Using the Purchasing Managers' Index to Assess the Economy's Strength and the Likely Direction of Monetary Policy. Federal Reserve Bank of Dallas Economic & Financial Policy Review, 1(6).