The Monthly Index of Economic Activity

The Economic Activity Index is a monthly indicator produced by the Bank of Israel to describe the pace of economic growth in recent months. Its purpose is to provide real-time insights into changes in the growth environment, prior to the official quarterly release of the National Accounts. The indicator is based on processing data from about 30 economic time series, most of which are monthly, using a statistical model developed at the Bank of Israel (TETA). The full model is detailed in the paper by Ginker and Suhoy (2022).[1] It was designed to forecast quarterly GDP growth based on indicators that become available earlier, as well as to produce a monthly GDP estimate—data not included in the official figures published by the Central Bureau of Statistics (CBS). The Economic Activity Index is the average of the monthly growth estimates for the three most recent months (for example, the index for August reflects the average growth rate for June through August).[2] The index is calculated and published about two weeks after the end of the reference month (on the first Tuesday following the publication of foreign trade data by the CBS).

1. Explanatory Variables

The primary input series used in constructing the index are summarized in Table 1. These series are grouped into nine thematic clusters, which are also employed in the presentation of model outputs. The choice of series was made on an empirical basis—that is, series with demonstrated real-time predictive power for GDP. The underlying data arrive with heterogeneous publication lags. For example, financial series, credit card purchases (based on data from SHVA, reported to the Bank of Israel), and import/export and tax revenue data are available contemporaneously or shortly after the reference month. In contrast, other series such as industry-level revenues, wages, and salaried positions are published with a longer lag. Therefore, at the time the Economic Activity Index is released, actual data for these series are typically available only up to two months prior to the reference month. The model is explicitly designed to accommodate this unbalanced data structure. For some of these series, forecasts are generated based on external information—such as the CBS Business Tendency Survey—to mitigate the impact of publication lags.

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[1] T. Ginker and T. Suhoy (2022). "Nowcasting and Monitoring Real Economic Activity in Israel", Discussion Paper Series 2022.07, Bank of Israel Research Department.
https://boi.org.il/media/typa1sbo/dp202207en.pdf
For a more accessible, less technical version, see T. Ginker and T. Suhoy (2021), "A New Model for Estimating GDP Growth in Real Time", Bank of Israel, *Statistical Bulletin,* 2021.
https://www.boi.org.il/boi_files/Statistics/Nowcasting_model_for_forecasting_economic_activity.pdf
[2] The monthly growth rate estimate tends to be volatile and should be interpreted carefully regarding the growth environment. Therefore, the Economic Activity Index is based on a three-month average.

Table 1 | Variables Included in the Monthly Economic Activity Index, by Group

Group	Series
Credit card purchases	Index of credit card purchases by private consumers[1]
Industry indices[2]	Index of revenue in the services industries[3]
	Index of revenue in the trade industries
	Index of retail trade - total, except fuel, fertilizers, and natural gas
	Residential building starts - total
	Index of employees' actual work hours - manufacturing, mining and quarrying
	Index of number of employees - manufacturing
	Industrial production index - total (excl. mining and quarrying)
	Industrial production index - construction inputs
	Industrial production index - mixed-high technology
Export indices	Net goods exports - total (excl. ships, aircraft, and diamonds)
	Goods exports - total manufacturing (excl. diamonds)
	Goods exports - manufacturing - mixed-high technology
	Receipts in respect of total goods exports[4]
	Exports of other services (excl. startups) and tourism services
	Exports of other services
	Receipts in respect of exports of other services (excl. tourism, transportation, and insurance)[4]
Import indices	Goods imports - consumption goods
	Goods imports - durable consumption goods
	Goods imports - investment assets other than ships and aircraft
	Goods imports - production inputs
Labor market	Employees minus absentees
	Employee posts - total - Israelis
	Job vacancies
	Total wage payments (real)
Tax data	VAT - gross[5]
	VAT - net, excl. VAT on defense imports - minus legislative changes[5]
	Income tax - net[5]
	Indirect taxes - as defined by the Tax Authority - minus legislative changes[5]
Financial indices	NASDAQ 100 index[6]
	Price of a barrel of oil on the London Exchange[6]
	General equities and convertibles index
Purchasing managers index	Purchasing managers index - US[6]
Gasoline consumption	Gasoline consumption[7]

[1] Central Bureau of Statistics data complemented by most recent data from the Bank of Israel based on SHVA.

[2] All of the industrial indices exclude diamond processing.

[3] Including the following industries: Real estate activity (L); Professional, scientific, and technical services (M); Administrative and support services (N); Education (P); Health and welfare services (Q); Art, recreation and leisure ®; and other service activities (S).

[4] Bank of Israel data - Receipts and payments system

[5] Based on Ministry of Finance data.

[6] Bloomberg data.
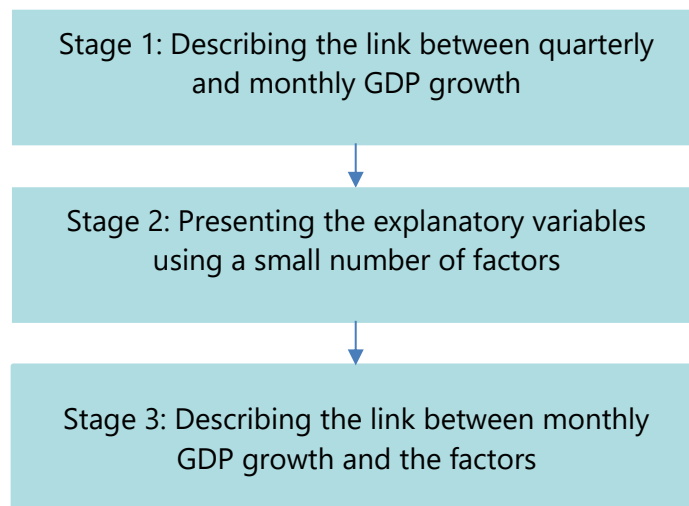
[7] Fuel Administration data.

2. Structure of the Model

The goal of this model is to forecast quarterly growth in gross domestic product (GDP) and, in addition, to produce an estimate of monthly GDP growth—a metric not currently measured by the Central Bureau of Statistics. Consequently, the model treats monthly GDP growth as an unobserved variable. There are three main challenges when estimating models of this type:
• First, the integration of data observed at different frequencies (GDP is observed quarterly, while all other variables in the model are observed monthly);
• Second, the high number of monthly variables relative to the limited historical data available;
• Third, the asynchronous arrival of data, as the various indicators become available with differing publication lags.

The following is a flowchart illustrating the model's stages, designed to address these challenges:

Chart 1 – Stages of the model

Stage 1: Describing the link between quarterly and monthly GDP growth

Stage 2: Presenting the explanatory variables using a small number of factors

Stage 3: Describing the link between monthly GDP growth and the factors

Stage 1 – Describing the link between quarterly and monthly GDP growth

The first stage addresses the integration of monthly indicators with quarterly GDP by expressing observed quarterly GDP as a function of unobserved monthly GDP. For this purpose, the observed quarterly GDP is presented in terms of the unobserved monthly GDP. We label the (level of) quarterly GDP using the variable GDP_t^Q and the (level of) monthly GDP using the variable GDP_t^M.

The first equation in the model links quarterly GDP to its latent monthly counterpart by aggregating the three monthly observations that comprise each quarter. Specifically, quarterly GDP is expressed as the sum of monthly GDP over the quarter:

$$(1)\ GDP_t^Q = GDP_t^M + GDP_{t-1}^M + GDP_{t-2}^M,$$

where t refers to the final month of the reference quarter. We use Y^Q to indicate quarterly GDP growth, which is the rate of change in the level of quarterly GDP.[3] For instance, the change in GDP that took place between two quarters is given by:

$$(2) \; Y_t^Q = \ln\left(GDP_t^Q\right) - ln\left(GDP_{t-3}^Q\right)$$

To relate this to monthly dynamics, the rate of change in quarterly GDP can be approximated by a weighted average of monthly GDP growth rates. Specifically[4]:

$$(3) \; Y_t^Q = \frac{1}{3}Y_t^M + \frac{2}{3}Y_{t-1}^M + Y_{t-2}^M + \frac{2}{3}Y_{t-3}^M + \frac{1}{3}Y_{t-4}^M,$$

where Y_t^M denotes the monthly growth rate of GDP, defined as the log change in GDP between month t and $t-1$. Equation (3) thus provides an approximate mapping between quarterly and monthly GDP growth.

Stage 2 – Presenting the explanatory variables using a small number of factors

We use n to denote the number of monthly explanatory variables included in the model, represented as $X_1^m, X_2^m, \dots, X_n^m$. Given the high dimensionality of these inputs, the variables do not enter the model individually. Instead, they are summarized using a small set of orthogonal latent factors. Each factor is constructed as a weighted average of the original series, capturing common variation across the data. We denote the factors by $F_1, F_2, \dots, F_r$, where r is the number of retained factors.

Stage 3 – Describing the link between monthly GDP growth and the factors

The following equation in the model links monthly GDP growth to the common factors extracted from the explanatory variables:

$$(4) \; Y^M = \alpha + \beta_1 F_1 + \beta_2 F_2 + \cdots + \beta_r F_r + \varepsilon$$

This specification implies that monthly GDP growth is modeled as a linear function of a small number of latent factors, which themselves summarize the information contained in the broader set of monthly indicators. The residual term ε captures the idiosyncratic component of monthly growth not explained by the factors.

Together, Equations (1)–(4) establish the link between the high-dimensional set of monthly explanatory variables (via the extracted factors) and quarterly GDP growth (through the latent monthly GDP series).

The Economic Activity Index for month t is defined as the three-month moving average of estimated monthly GDP growth:
$$MADAD_t = (Y_t^M + Y_{t-1}^M + Y_{t-2}^M)/3$$

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[3] The rate of change in GDP that is proximately equal to the change (difference) in the natural log of GDP, and not the change in GDP that is brought in this work for simplicity.
[4] For a more full explanation of the transition from Equation (2) to Equation (3), see Ginker and Suhoy (2021) (Footnote 1).

Analyzing short-term economic trends using a three-month average of monthly GDP growth estimates offers several advantages for tracking real activity. First, it smooths out high-frequency noise in the monthly data, producing a more stable and interpretable signal. Second, by focusing on a broader time window, it mitigates the effects of the unbalanced data structure, as some indicators are released with a lag. Third, it reduces sensitivity to revisions in individual monthly estimates, making the index more robust for real-time monitoring. Finally, the three-month average aligns more closely with the statistical properties of quarterly GDP growth, enhancing its comparability and interpretive value.

Model Estimation

The model parameters are estimated using maximum likelihood methods. The unobserved monthly GDP growth series, Y_t^M, is extracted using a Kalman filter. The Kalman filter is a recursive algorithm designed to estimate the underlying state of a dynamic system—in this case, a state-space model that includes both observed and unobserved components. It optimally combines information from observed variables (such as quarterly GDP and the set of monthly indicators) to infer the unobserved states (such as monthly GDP growth).

3. Outputs of the Economic Activity Index

The results of the monthly Economic Activity Index are summarized in a monthly announcement using a number of graphs and charts.

Figure 1 presents the monthly Economic Activity Index (which reflects the growth rate in the past three months). In addition, the chart presents the long-term average of the Index, along with the 25th and 75th percentiles of its distribution, based on data from 2000 through the current publication date. These benchmarks help to evaluate the current growth estimate relative to historical norms.

Table 1 details the contribution of each group of indicators to the monthly Economic Activity Index. Since the model is linear, we can provide an algebraic expression of each rate of GDP change derived from the model as the weighted sum of the changes in the variables feeding the model (contemporaneously and for previous periods). The sum of each column, plus the "long-term trend" component, therefore equals the total Economic Activity Index. It is important to note that this is not a structural effect (such as how much a change in taxation causes higher growth), but a statistical effect—to what extent does a change in taxation cause the model to derive that actual growth was higher.

Table 2 details the actual development in recent months of the detailed variables that feed the model. The Table also shows the development of the variables (such as how high the most recent release of revenue data was), as well as what set of information was available in that month (empty cells reflect a lack of data for that variable in a given month).

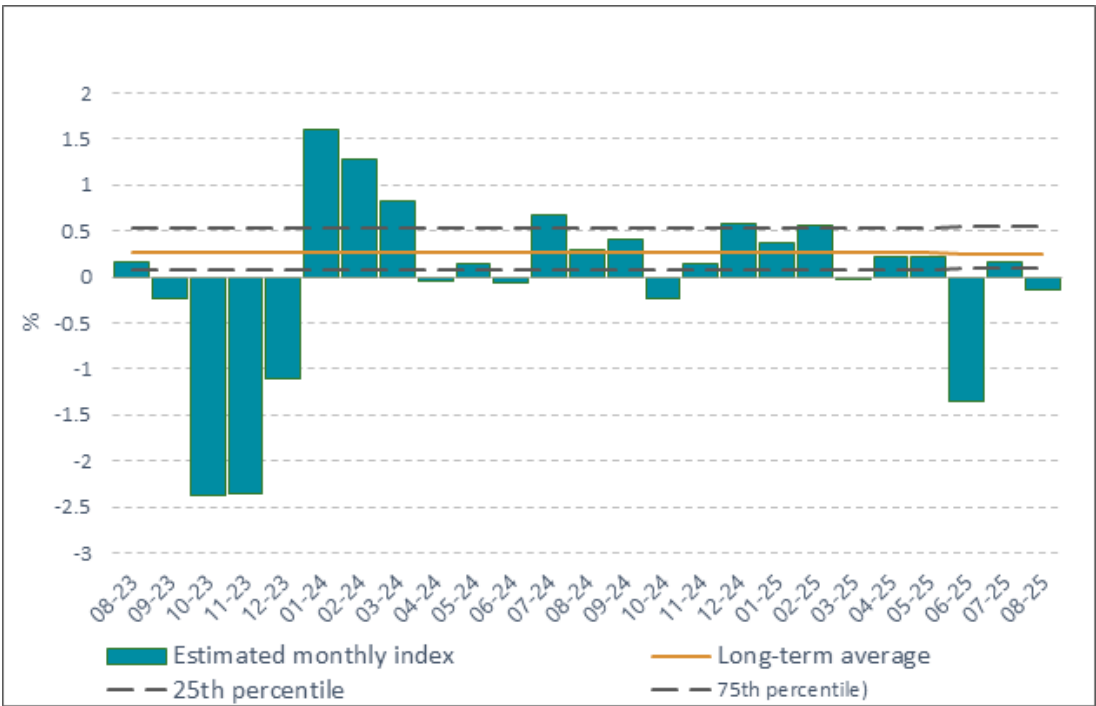**FIGURE 1 | The Monthly Index of Economic Activity**

Table 1 | Contribution of the Index Components to the Total Estimate in Recent Months, by Group
(percentage points, unless otherwise specified)

Group	March	April	May	June	July	August
Credit card purchases	-0.002	0.050	0.066	-0.117	0.126	0.103
Industry indices	-0.081	0.369	0.169	-0.538	-0.138	-0.294
Export indices	0.011	0.034	0.057	-0.091	0.119	-0.032
Import indices	0.032	0.061	0.055	-0.116	0.070	0.023
Labor market	-0.026	0.069	0.085	-0.154	-0.033	-0.075
Tax data	-0.019	-0.039	0.032	0.007	-0.011	-0.004
Financial indices	-0.044	-0.082	-0.009	0.090	0.164	0.097
Purchasing managers indices	0.001	0.002	0.000	-0.002	-0.008	-0.012
Gasoline consumption	0.002	0.024	0.060	-0.084	-0.090	-0.119
Actual GDP data	-0.137	-0.534	-0.695	-0.620	-0.310	-0.103
Long-term trend	0.278	0.278	0.278	0.278	0.278	0.278
Total estimate	**-0.032**	**0.226**	**0.226**	**-1.346**	**0.166**	**-0.139**

Table 2 | Changes in the Index Components in Recent Months
(monthly rates of change, percent, seasonally adjusted)

Group	Series	March	April	May	June	July	August
Credit card purchases	Index of credit card purchases by private consumers	0.4	-0.5	0.5	-10.8	17.8	0.7
Industry indices	Index of revenue in the services industries	-1.8	-3.9	-1.3	-3.1		
	Index of revenue in the trade industries	-0.4	-0.4	2.3	-14.1		
	Index of retail trade - total, except fuel, fertilizers, and natural gas	-0.9	1.9	0.1	-7.9	9.1	
	Residential building starts - total	18.1					
	Index of employees' actual work hours - manufacturing, mining and quarrying	-0.9	0.3	-1.5	-4.6		
	Index of number of employees - manufacturing (excl. diamonds)	0.3	-0.1	-0.2	-0.3		
	Industrial production index - construction inputs	1.0	0.3	-0.6	-14.4		
	Industrial production index - total (excl. mining and quarrying)	-0.9	0.1	6.7	-11.3		
	Industrial production index - mixed-high technology	-4.4	-3.5	-2.2	0.0		
Export indices	Receipts in respect of total goods exports	9.3	-13.3	11.6	-10.4	3.3	
	Net goods exports - total (excl. ships, aircraft, and diamonds)	2.8	-14.7	6.6	-11.5	22.5	-11.4
	Goods exports - total manufacturing (excl. diamonds)	4.3	-14.5	5.3	-10.7	22.0	-11.9
	Goods exports - manufacturing - mixed-high technology	-2.4	0.4	-4.2	0.0	3.1	-14.4
	Receipts in respect of exports of other services (excl. tourism, transportation, and insurance)	-7.0	8.5	15.9	-9.2	-9.2	
	Exports of other services (excl. startups) and tourism services	2.4	0.8	-7.6	2.8		
	Exports of other services	3.1	-3.7	-3.8	0.3		
Import indices	Goods imports - consumption goods	7.0	1.5	-3.1	-14.5	29.3	-9.8
	Goods imports - durable consumption goods	17.0	1.0	2.5	-16.4	31.0	-15.8
	Goods imports - investment assets other than ships and aircraft	17.7	0.9	9.0	-18.1	23.6	
	Goods imports - production inputs	5.1	3.3	-7.2	-6.1	20.3	-7.5
Labor market	Employees minus absentees	-0.8	-0.1	2.0	-10.1	8.6	
	Employee posts - total - Israelis	-0.3	0.5	-0.4	-1.3	0.9	
	Job vacancies	1.8	-3.1	2.2	-4.8	5.1	
	Total wage payments (real)	0.2	0.2	-0.3	-2.3		
Tax data	VAT - gross	-0.2	2.8	0.7	-5.9	4.9	-0.3
	VAT - net, excl. VAT on defense imports - minus legislative changes	-2.7	0.9	4.5	-0.9	-6.7	10.9
	Income tax - net	-1.5	-0.5	-1.1	-4.6	13.4	
	Indirect taxes - as defined by the Tax Authority - minus legislative changes	-0.1	0.6	6.3	-4.2	-4.2	9.2
Financial indices	NASDAQ 100 index	-9.2	-6.7	11.1	5.4	5.5	2.8
	Price of a barrel of oil on the London Exchange	-4.8	-7.3	-3.8	8.7	-0.4	-3.4
	General equities and convertibles index	-1.7	-0.9	6.3	5.4	8.9	-1.3
Purchasing managers index	Purchasing managers index - US	49.0	48.7	48.5	49.0	48.0	48.7
Gasoline consumption	Gasoline consumption	4.0	-2.4	2.9	-18.1		