Supplementary materials: Contents

Background commentary

Sources. Moody's Analytics provides the Division of Financial Management with forecast data, primarily at the national level. These forecasts are produced monthly by the firm.[1]

The **Federal Open Market Committee (FOMC)**, as defined on their website "consists of twelve members — the seven members of the Board of Governors of the Federal Reserve System; the president of the Federal Reserve Bank of New York; and four of the remaining eleven Reserve Bank presidents, who serve one-year terms on a rotating basis." The FOMC meets eight scheduled times per year. Part of their charge is to make projections for major economic indicators including: real GDP, the headline[2] unemployment rate, core personal consumption expenditures (core CPE), and the federal funds rate. The federal funds rate is the rate that the FOMC influences through its decisions. March saw the first release of their projections during 2025. The prior projection was released in December 2024.

As described on their website: "The **Bureau of Labor Statistics (BLS)** is an agency of the United States Department of Labor. It is the principal fact-finding agency in the broad field of labor economics and statistics and serves as part of the US Federal Statistical System. BLS collects, calculates, analyzes, and publishes data essential to the public, employers, researchers, and government organizations." Among the statistics the BLS publishes are the monthly consumer price index (CPI) report, the monthly jobs openings and labor turnover-survey (JOLTS), the unemployment rate (U-3); the agency also works with state departments of labor to produce quarterly census of employment and wages (CEW) data. CEW data for Idaho is the backbone of the historical data used to produce this *IEF* publication.

The **Bureau of Economic Analysis** produces statistics including gross domestic product and personal income. They also produce personal consumption expenditures (PCE) inflation measures.

The **Organization for Economic Co-Operation and Development (OECD)**, with the US as a member, released their Economic Outlook publication in March 2025. They indicate that business and individual activities, along with economic policy uncertainty, are pointing towards a global softening of the economy. The OECD is looking at trade policies as causing significant changes to the economy by affecting growth and rising inflation. In the upside, adoption of artificial intelligence is expected to increase productivity.

The **International Monetary Fund (IMF)** is another economic coordination group of which the US is a member. In fact, the IMF is a broad organization encompassing most countries of the world. As explained on their website: "The International Monetary Fund, or IMF, works

[1] They are forecast at a quarterly frequency, meaning that a data point forecast pertains to, say 2025q3, i.e., the third quarter of 2025. Smooth interpolations of those quarterly frequency forecasts are then projected down to the monthly forecast frequency by Moody's, and that is employed by DFM. Some state level forecasts are also integrated with the forecast produced internally at DFM. Blending of the two allows for additional input from Moody's, while preserving the variation inherent in non-smoothed data gathered from other sources either at the national level (e.g., the consumer price index also known as the CPI) or the state level (monthly housing starts, both in terms of units for individual household occupation as well as the monetary values associated with those permits).

[2] The headline unemployment rate is the U-3 rate released monthly by the Bureau of Labor Statistics from its monthly jobs surveys.

to achieve sustainable growth and prosperity for all of its 191 member countries. It does so by supporting economic policies that promote financial stability and monetary cooperation, which are essential to increase productivity, job creation, and economic well-being."

Modeling. DFM continues blending three month's worth of analysis to produce a quarterly forecast, in this case the '2025q4' forecast. Partly this is a response to the volatility in the model outputs. The three forecasts being blended are the baseline outputs for the *IEM* (Idaho Economic Model) for August, September, and October, with the greatest weight (over 60%) resting on the most recent forecast.

The BEA ceased publication of is table SAINC45 as of September 2024, which dealt with the details of farm proprietors' income. This annual table was traditionally released in September. Hence this 2025q4 *IEF* is the first which must model farm proprietors' income without the additional detail. The forecast for this particular portion of Idaho personal income is likely to continue to evolve across the next year.

We have been able to augment some of the housing data that we have collected. Permits (Idaho and Western US) and starts and completions (Western US) data are now more complete, and the modeling of the transition from permits to starts and onto completions now uses this extra data.

DFM benefited from an intern's work[3] this and the past summer. His work is leading to another modeling technique for Idaho's economy. It focused upon connecting the jobs data from the Idaho Department of Labor with the tax data from the Idaho State Tax Commission in a parsimonious model using what are called Vector Autoregression Models (VARs). These have the advantage of linking two or more variables into a forecast procedure. We have been employing a VAR between construction employment and sales tax using housing permit values (a new data usage by DFM) to aid in the forecasting. The construction employment portion of the VAR model forecast has been incorporated in the *IEF* since October 2024, and continues to be so today.

We are working to more broadly employ VAR forecasts and use them for both the economic and tax forecasts.

[3] The intern has been Sean Murphy, a Skyview HS graduate coming to us from Grinnell College in Iowa.

Look ahead. The 2025q4 *IEF* is a precursor forecast for the January 2026 revenue projection which accompanies the 2026q1 *IEF*; the *IEF* forecast is the economic forecast whereas the revenue projection is (largely) the tax forecast. This edition has historical employment and wage data through 2025q2. That is the extent of data which will be available for that January *IEF* publication. Changes to the economic forecast for January are consequently attributable to changes in the national forecast. As the month of October closes, the US administration is engaged in several changes in tariff policy (reputed deals with South Korea and China) which could affect that national forecast.

The US federal shutdown may constrain the limited amount of additional data that this office collects on the Idaho economy: it would normally be possible to have another month or two of housing permit data. As that is processed through the US Census Bureau, it is unclear if that additional data will become available in a timely manner.

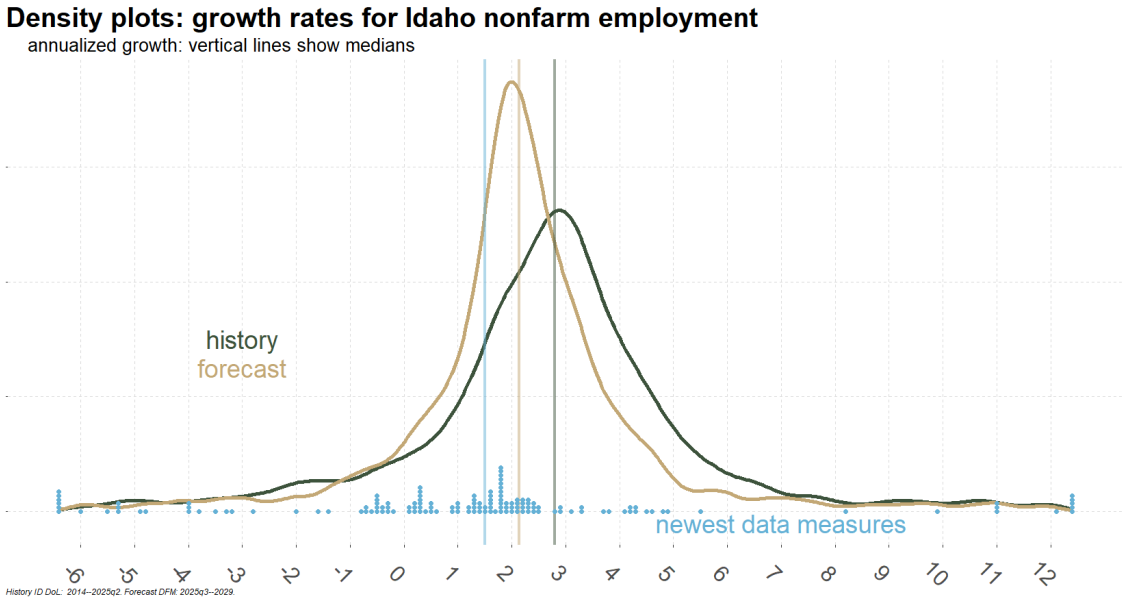
The tax forecast will, however, rest upon a bit more local data. Collections for October will be finalized and initial impressions for November data will be available before the revenue forecast is set. The fiscal year totals generally have to be adhered to prior to Thanksgiving, with month-to-month flexibility between the individual income tax stream and the corporate income tax stream. There is usually an adjustment between the months of December, January, and April regarding what is termed the SALT[4] workaround. This is often a shift (between these months, and among the two revenue streams) of \$200–300 million dollars. The SALT workaround was a consequence of the 2017 Tax Cuts and Jobs Act, and it was implemented in Idaho via HB 317 of 2021. Consequently history on the SALT workaround is not sufficient for the model to fully pick up on the pattern. The 2025 One Big Beautiful Bill Act altered the SALT cap from \$10 k per year to \$40 k per year for 2025–2030. This would be one aspect of this year's conformity bill which the Idaho legislature may address.

Finally, it is worth emphasizing that the October baseline forecast from Moody's had a two-week federal government shutdown forecast. As of the close of October, the shutdown has lasted four weeks. The longer duration shutdown is likely to result in a weaker GDP outlook for 2025 in subsequent baseline forecasts from Moody's.

Idaho economy via three density plots. Total nonfarm employment, total wages paid, and total personal income trajectories have been given the main body of this *IEF*. Attention now turns to the density plots for these, which help to put into context the expected future trajectories in terms of the already realized historical trajectories. For these density plots, the annualized growth rate is depicted. Each month of data (whether historical or forecast) produces thirty-six such measurements; that helps to smooth the density since the forecast is using data that is not seasonally adjusted. It also helps to recognize the growth rates that the overall trajectories (historical and forecast) are conveying, rather than the one-month-to-another zigs-and-zags which are inherent in data that is not seasonally smoothed.

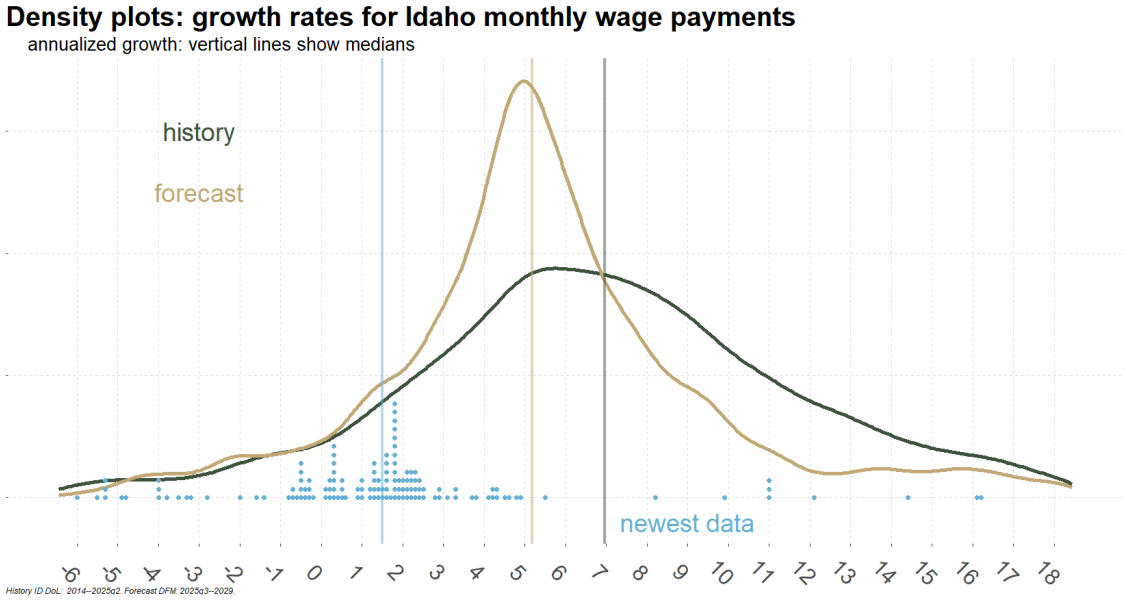
➜ The order of presentation of these moves towards establishing: Idaho's economy is growing; the pace has slowed.

[4] SALT stands for state and local tax



This indicates that employment growth, by-and-large, is expected to be slightly weaker than the historical record, though well within the range of growth rates typically seen. The dots represent the finalized data for 2025q1. Each month of data gives rise to multiple historical measures. To keep the clutter down, rather than looking back across 36 months from each datum to compute average annual growth rates, the look back is curtailed to 24 months. In this picture, we see that the latest finalized measurements are supportive of the forecast being less aggressive than recent historical growth.

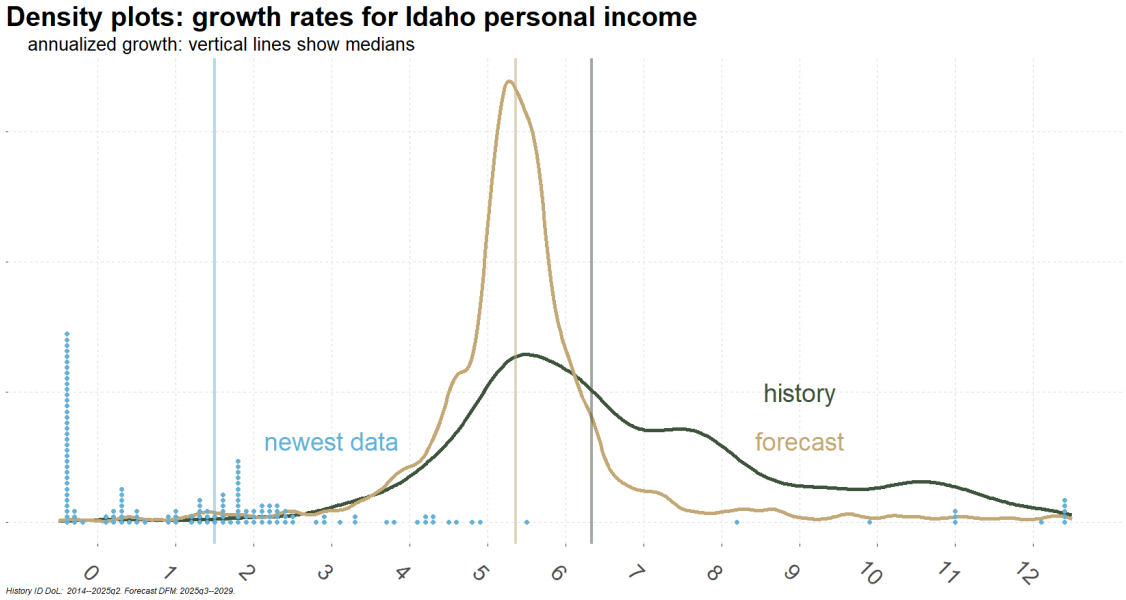
The small pile-up of dots at -6.4 and 12.4 represent data truncation. In this case, the truncated data are somewhat balanced, and outweighed by the data near the median lines.



A large component of personal income is the (monthly) wage bill paid to Idaho employees. First quarter data shows evidence that the forecast density peak should be left of the historical density

peak. Data does indicate that the typical full range of observations continues, if skewed more to the 2–5% range than the 2–10% range seen in history.

On the monthly wage payments graph, truncation was not needed for the dots to display.



In this personal income density plot, the newest data was truncated at -0.4% and at 12.4%. These are the reasons for the pile-ups at those particular markers. This indicates that personal income is showing more substantial signs of a slowdown in the economy than the jobs data.

In this personal income density plot, the most recent data shows a significant amount of truncation at the -0.4% level, and that is not balanced at the 12.4% level. This differs from the results seen in the prior two densities.

Forecast analysis

Forecast comparison. The forecast from Moody's continues to evolve. Tables give the most recent forecast summaries.

US forecasts. DFM provides an interactive opportunity to see the evolution of a few key indicators of the US forecast across recent months due to revisions in the baseline outlook of Moody's. These are available HERE.[5]

Here is a table summarizing changes to the forecast across 2024–2025.

Oct. 25 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
GDP	b (2017) $	22,724	23,359	23,813	24,216	24,638	25,161	25,789
P. income	b $	23,585	24,906	26,161	27,330	28,494	29,614	30,865
Population	m	337	340	343	344	345	345	346
Nonfarm	m ct.	156	158	159	160	160	161	162
Wages	b $	11,733	12,388	13,009	13,574	14,098	14,559	15,091
Jul. 25 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
GDP	b (2017) $	22,671	23,305	23,666	23,966	24,384	24,933	25,529
P. income	b $	23,403	24,670	25,957	27,164	28,339	29,434	30,623
Population	m	337	340	343	344	345	345	346
Nonfarm	m ct.	156	158	160	160	160	161	162
Wages	b $	11,725	12,401	13,002	13,563	14,066	14,507	15,009
Apr. '25 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
GDP	b (2017) $	22,671	23,305	23,611	23,949	24,493	25,079	25,692
P. income	b $	23,403	24,659	25,779	26,912	28,088	29,192	30,417
Population	m	337	340	343	344	345	346	346
Nonfarm	m ct.	156	158	159	159	160	161	162
Wages	b $	11,725	12,390	12,884	13,392	13,864	14,289	14,814
Dec. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
GDP	b (2017) $	22,671	23,300	23,821	24,201	24,634	25,150	25,721
P. income	b $	23,403	24,684	25,774	26,926	28,062	29,196	30,480
Population	m	339	342	345	346	347	348	348
Nonfarm	m ct.	156	159	160	161	161	162	162
Wages	b $	11,725	12,421	12,994	13,582	14,111	14,575	15,116
Oct. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
GDP	b (2017) $	22,671	23,278	23,804	24,296	24,818	25,384	25,958
P. income	b $	23,010	24,080	25,070	26,170	27,360	28,610	29,890
Population	m	335	337	338	339	341	342	343
Nonfarm	m ct.	156	157	158	158	159	160	160
Wages	b $	11,830	12,480	13,010	13,530	14,070	14,630	15,210

[5] the url is https://dfm.idaho.gov/about-dfm/about-the-economic-analysis-bureau/key-indicators-dashboard/

Jul. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
GDP	b (2017) $	22,377	22,896	23,286	23,719	24,239	24,813	25,388
P. income	b $	22,961	24,043	25,072	26,150	27,316	28,582	29,887
Population	m	335	337	338	339	340	342	343
Nonfarm	m ct.	156	159	160	160	161	161	162
Wages	b $	11,798	12,388	12,956	13,469	14,001	14,559	15,136
Apr. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
GDP	b (2017) $	22,380	22,960	23,340	23,780	24,300	24,870	25,440
P. income	b $	22,980	24,110	25,130	26,210	27,380	28,630	29,920
Population	m	335	337	338	339	340	342	343
Nonfarm	m ct.	156	158	159	160	161	161	162
Wages	b $	11,820	12,470	13,030	13,550	14,090	14,650	15,230
Jan. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
GDP	b (2017) $	22,340	22,710	23,100	23,620	24,180	24,770	25,340
P. income	b $	23,010	24,080	25,070	26,170	27,360	28,610	29,890
Population	m	335	337	338	339	341	342	343
Nonfarm	m ct.	156	157	158	158	159	160	160
Wages	b $	11,830	12,480	13,010	13,530	14,070	14,630	15,210

ID forecasts. The wage and personal income data available in this edition of the *IEF* is complete through calendar year 2025m6. See the next page for a comparison table across various historical forecasts.

Interactive plots for Idaho scenarios (optimistic, baseline, and pessimistic cases) are available: HERE.[6]

[6] the url is https://dfm.idaho.gov/about-dfm/about-the-economic-analysis-bureau/key-indicators-dashboard/

Oct. 25 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
P. income	$ m	116,693	124,748	131,614	137,959	144,969	152,799	161,263
Wages	$ m	12,064	12,740	13,339	13,901	14,411	14,868	15,396
Population	ct	1,971,122	2,001,619	2,043,156	2,080,986	2,119,997	2,160,974	2,203,485
Nonfarm	jobs	818,518	834,132	851,913	865,798	881,431	901,495	924,452
Jul. 25 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
P. income	$ m	115,509	122,833	130,339	137,370	145,322	153,750	162,872
Wages	$ m	50,513	55,141	58,349	61,571	64,942	68,435	72,296
Population	ct	1,971,122	2,001,619	2,029,588	2,064,862	2,101,439	2,139,693	2,179,412
Nonfarm	jobs	818,518	834,132	852,072	865,858	881,039	899,915	921,323
Apr. '25 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
P. income	$ m	116,676	123,773	132,600	140,290	147,643	155,262	163,610
Wages	$ m	50,513	54,189	56,633	59,059	61,592	64,093	67,027
Population	ct	1,971,122	2,001,619	2,058,079	2,094,334	2,132,143	2,171,225	2,211,901
Nonfarm	jobs	818,518	834,077	852,134	859,793	870,505	883,215	898,938
Dec. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
P. income	$ m	116,676	124,665	134,234	142,182	150,349	159,992	170,651
Wages	$ m	50,513	54,340	58,792	62,858	67,058	71,457	76,226
Population	ct	1,971,122	2,001,619	2,034,195	2,064,203	2,094,737	2,126,478	2,159,336
Nonfarm	jobs	818,518	841,982	870,557	887,699	904,283	922,678	942,519
Oct. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
P. income	$ m	116,676	124,832	133,868	141,921	150,097	159,283	169,290
Wages	$ m	50,513	54,076	58,025	61,838	65,825	70,094	74,668
Population	ct	1,964,726	1,991,348	2,019,872	2,047,359	2,075,422	2,104,274	2,133,907
Nonfarm	jobs	818,518	840,033	867,123	886,606	905,587	924,950	944,596
Jul. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
P. income	$ m	115,750	120,575	126,639	134,344	142,160	150,626	159,616
Wages	$ m	50,843	54,349	58,040	61,309	64,526	67,761	71,207
Population	ct	1,964,726	1,991,425	2,018,403	2,044,996	2,072,399	2,100,652	2,129,620
Nonfarm	jobs	818,518	840,373	860,568	876,062	892,089	908,773	925,438
Apr. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
P. income	$ m	115,989	119,352	127,203	134,696	142,130	150,133	158,693
Wages	$ m	51,051	54,567	58,339	61,798	65,347	69,056	73,105
Population	ct	1,964,726	1,992,911	2,019,231	2,045,836	2,073,301	2,101,656	2,130,765
Nonfarm	jobs	818,458	846,999	864,081	879,665	896,095	913,435	931,017
Jan. '24 forecast		**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	
P. income	$ m	114,900	122,776	129,867	137,495	145,156	153,868	
Wages	$ m	51,170	55,026	58,604	61,994	65,546	69,379	
Population	ct	1,988,810	2,008,714	2,038,713	2,062,648	2,081,655	2,098,946	
Nonfarm	jobs	843,117	877,558	901,856	920,909	936,845	952,591	

Appendix

US Macroeconomic model by Moody's Analytics

Moody's model is a structural model based upon the IS-LM demand model and the Phillips curve for supply. It has about 2,300 variables forecast in their macroeconomic model, with more than 9 in 10 determined within the model (i.e., endogenously, rather than exogenously, or external to the model.) The firm also characterizes the model as a Keynesian model, with short-term fluctuations largely driven by demand. The firm indicates that substantial shocks can take up to two years to unwind back to an equilibrium path.

There are some particular variables which are central in the model. Moody's says:

> The federal funds rate's effect in the model is systemic. It affects the yield curve, which is critical to consumer spending and business investment. Therefore, it affects real GDP growth, the labor market, and inflation.

To illustrate why shocks may take time to dissipate in the model, Moody's also indicates:

> Monetary policy operates with a lag in the model. Eventually the model's inflation and unemployment rate forecasts return to equilibrium, and the federal funds rate follows.

Monetary policy includes setting and adjusting the federal funds rate, but it also includes other tools that the Federal Reserve has. A recent example of this has been both Quantitative Easing (during the acute phase of the pandemic), and its opposite, Quantitative Tightening (during 2022–present).

Moody's organizes its model into blocks: These include

(1) Consumption through consumer spending
(2) Investment
(3) International trade[7]
(4) Fiscal policy
(5) Supply (labor force potential, for example)
(6) Inflation
(7) Monetary policy and its transmittal
(8) Personal Income
(9) Corporate income
(10) Labor markets (actual employment by sector)
(11) Housing

Moody's provides a detailed look at parts of each of these blocks in their model. Doing so takes the firm 25+ pages. To not extend the length of this publication, we will take only a couple of these for further discussion. The few we do are quite parallel to the Idaho economic model.

Moody's indicates that their model is anything but static, much as the US economy.

[7] Moody's emphasises trade in their model.

> Rarely does a month go by when no changes are made to the model. Equations that are no longer performing well are re-specified, and variables are occasionally added to the model as more data become available or the dynamics of the economy change.

Their wording here also applies to the Idaho economic model.

"(5) Supply" means the long-term economic potential of the US. It is governed by innate parts of the economy, including population forecasts. As we have learned, it is difficult to find labor without having a population of workers appropriate for the labor, in location, age, skill, and desire to work. Moody's says:

> Labor force supply is a key determinant of potential GDP, which largely depends on demographics. Population is estimated based on Census Bureau birth and death rates and immigration rates that are determined by the economic performance of the U.S. relative to the rest of the world.

Here we see a couple of potential exogenous variables in the Moody's model, namely the data coming from Census Bureau estimates. We also see that each block can and does interact with other blocks in the Moody's model: here international trade interacts with the population portion of the supply block through the strength of the immigration draw that the US economy represent, or will represent in the future.

Another input in the potential labor force is an estimate of what is called the Non-Accelerating Inflation Rate of Unemployment (NAIRU). This concept is a Phillips curve one: if unemployment rates are too low, inflation is expected to not only be present, but to increase in rate. Such a situation is one that the Federal Reserve works to prevent. One of its two charges by Congress is stable prices; that is, the Fed must not allow accelerating inflation to persist. Thus the NAIRU is important for understanding potential labor force; it is not as simple as computing the 16–64 year-olds in the US. NAIRU is another example of an exogenous variable. In this case:

> We use the [Congressional Budget Office] CBO's long-term NAIRU forecast and make that variable exogenous in our model. We then specify an error correction model to predict the value of short-term NAIRU.

This also indicates that parts of Moody's model may have equations of varying types. We have already seen that Moody's employs demographic models to estimate population. These are different from the Ordinary Least Squares (OLS) equations, which dominate the Labor block 10 of Moody's model.

"(8) The Personal Income" block is illustrative of the pervasiveness of Bureau of Economic Analysis data organization across almost all economic forecasts. Principal parts are wage and salaries, supplements to wages and salaries (that is the BEA name; largely these are benefits such as health insurance), dividends, interest, and rent (modeled separately), and proprietors' income.

> Individual wage and salary categories are modeled as functions of industry employment, industry average hourly earnings, and a broad measure of hours worked.

The personal income block certainly interacts with the labor market block 10. Another interaction is present with the Inflation block 6. While industry average hourly earnings are used for each industry, behind the scenes is average hourly earnings in all private industries. Forecasting that broad measure is "the most important wage equation in the macroeconomic model," though Moody's makes this statement within their discussion of the Employment Cost Index, in order to understand CPI inflation.

Idaho economic model. The Idaho Economic Model (IEM) is an income and employment-based model of Idaho's economy. The Model consists of a simultaneous system of linear regression equations.

These have historically been estimated at the quarterly frequency as that is the frequency of data provided by IHS Markit (our prior provider of the US forecast) as well as Moody's (our current provider of the US forecast). Some of the source data is available at the monthly frequency. Examples of this include personal income for the US (source: BEA), inflation as measured by the Consumer Price Index (CPI inflation, source: BLS), and local employment (source: Idaho Department of Labor — available in quarterly batches of monthly measurement). Where source data is available at the monthly level, it is used[8] and where it is not readily available for our own collection, the monthly version from Moody's is used.

The primary exogenous variables are obtained from the national forecast provider (now Moody's). Endogenous variables are forecast at the state level.

The focal point of the IEM is Idaho personal income, which is given by the identity:

> **personal income = wage and salary payments + other labor income + farm proprietors' income + nonfarm proprietors' income + property income + transfer payments - contributions for social insurance + residence adjustment.**

Except for farm proprietors' income and wage and salary payments, each of the components of personal income is estimated stochastically by a single equation. Farm proprietors' income and wage and salary payments each comprise sub-models containing a system of stochastic equations and identities.

The farm proprietor sector is estimated using a sub-model[9][10] consisting of equations for crop marketing receipts, livestock marketing receipts, production expenses, inventory changes, imputed rent income, corporate farm income, and government payments to farmers. Farm proprietors' income includes inventory changes and imputed rent, but this component is netted out of the tax base.

At the heart of the IEM is the wage and salary sector, which includes stochastic employment equations for North American Industry Classification System employment categories (NAICS). Conceptually, the employment equations are divided into basic and domestic activities. The basic employment equations are specified primarily as functions of national demand and supply variables. Domestic employment equations are specified primarily as functions of state-specific

[8] the quarterly values recorded by the US forecast provider have always been the average values for the corresponding months

[9] As the exogenous variables for the farm model are only available at the annual frequency, the farm model is now computed at that frequency, and monthly values are interpolated from these. The source for the exogenous regressors in the farm model is the FAPRI institute of the University of Missouri, Columbia.

[10] The US Bureau of Economic Analysis has a note indicating that farm income data at the state level has been discontinued; see BEA discontinuation of SAINC45. In the coming publications, DFM will re-model this portion of the computation.

demand variables. Average wage rates are estimated for each of these employment categories and are combined with employment to arrive at aggregate wage and salary payments.

The demographic component of the model is used to forecast components of population change and housing starts. Resident population, births, and deaths are modeled stochastically. Net migration is calculated residually from the estimates for those variables. Housing starts are divided into single and multiple units. We model housing starts on permits based upon equations estimated for the Western US, and for completions upon starts in a similar manner. These are then used to forecast housing stock, which is also estimated by the US Census Bureau. In this last step, we have a check on our housing model.

The output of the IEM (i.e., the forecast values of the endogenous variables) is determined by the parameters of the equations and the values of exogenous variables over the forecast period. The values of equation parameters are determined by the historic values of both the exogenous and endogenous variables. IEM equation parameters are estimated using the technique of ordinary least squares. Model equations are occasionally re-specified in response to the dynamic nature of the Idaho and national economies. Parameter values for a particular equation (given the same specification) may change as a result of revisions in the historic data or a change in the time interval of the estimation. In general, parameter values should remain relatively constant over time, with changes reflecting changing structural relationships.

Like in Moody's US economic model, most equations are specified in log form. This is generically

$$\log(y) = c_0 + c_1 \cdot \log(x_1) + \cdots + c_n \cdot \log(x_n)$$

which means that

$$y = e^{c_0} \cdot x_1^{c_1} \cdots x_n^{c_n} .$$

These mathematical forms are sufficient to enable good fits of the data without overly complicated equations. This helps to avoid "over-fit", which can precipitate small changes of the inputs redirecting the output in unreasonable directions.

While the equation parameters are determined by structural relationships and remain relatively fixed, the forecast period exogenous variable values are more volatile determinants of the forecast values of endogenous variables. They are more often subject to change as expectations regarding future economic behavior change, and they are more likely to give rise to debate over appropriate values. As mentioned above, the forecast period values of exogenous variables are primarily obtained from Moody's US macroeconomic models.

Since the output of the IEM depends in large part upon the output of the US model, an understanding of the US model, its input assumptions, and its output is useful in evaluating the results of the IEM's forecast. The assumptions and output of the US model are discussed in the National Forecast section, and a discussion of the details of the IEM build and of the Moody's follows.

Idaho time series model. The Idaho Time Series Model (ITS)[11] is a new numeric model of Idaho's economic activity. The model consists of sequential equations solved in modules with dependencies such that downstream modules can rely on data forecasted in earlier modules. The regression equations are estimated using time series forecasting techniques covered by the R 'seasonal' package. The package uses the X-13 ARIMA-SEATS method to understand the typical monthly or quarterly trend from data before creating a forecast. The method is a joint development by the US Census Bureau, Stats Canada, and the Bank of Spain. ARIMA models are time-series models, which means they look to prior measurements of a variable in order to understand subsequent measurements of that *same* variable.[12]

The guiding principal of the time series model is to let the data speak for itself and involve exogenous regressors sparingly. Several equations in the model, such as the adult share of the population, are computed exclusively as ARIMAs with no exogenous regressors. Fewer than five equations in the model use more than two exogenous regressors. Time series models tend to produce accurate forecasts, but without the linkages of multiple regression models like the IEM. For time series forecasts it can be difficult to explain why a forecast is evolving in a particular way.

The first module estimates monthly values for Idaho births, deaths, and net migration and combines these to get a measure for monthly change in population. This contrasts with the IEM which treats migration as a residual. The only exogenous regressors used in this portion of the ITS model are mortgage rates, the US unemployment rate, a dummy for COVID-19, and Idaho housing completions, which are provided by Moody's.

The population estimate feeds into the second module, which then estimates values for the monthly adult population, labor force, and employed persons before estimating monthly levels of employment across the standard employment sectors into which the BEA divides the US economy. To do so, this second module begins by using the population number to create forecasts of the total number of adults, the size of the labor force, and then the number of employed persons.[13] These forecasts rely on Local Area Unemployment Statistics (LAUS, a BLS program) numbers.

Once the labor force is understood, the second module continues by using separate regressions for each major NAICS sector, this time using data from the quarterly Current Employment and Wages (QCEW, another BLS program). An "other" category trues these values up to the total number of employed (since LAUS and QCEW use different definitions). This portion of the

[11] The ITS was pioneered by Matthew Hurt; it has been used for the past year+ in forecasting revenue in a blended model with the IEM. Further integration with this report is the next aim.

[12] An example may be illustrative: an ARIMA forecast of housing would look at prior housing permit activity to predict future housing permit activity; a general regression analysis might look towards population trends to predict future housing permit activity. Both can have merits, and a combination of the methods is often used, though one or the other may be the dominant driver in any particular equation analysis, say the equation analysis of housing permits. The population trends in the second approach are an example of an exogenous regressor for housing starts — they are variables which can be supplied externally from the internal computations of the housing permit equation.

[13] Once the employed number and the labor force number are known, the unemployment rate is easily found: the difference between these gives the unemployed count, and dividing by the labor force number gives the unemployment rate.

second module, focusing on employment categories, uses mortgage rates, the US unemployment rate, the US labor force participation rate, the federal funds rate, and CPI as exogenous regressors. However, each individual regression relies at most on two of these exogenous regressors.

The third model estimates wage rates and wagebills for each of the NAICS categories. The IEM and ITS dis-aggregate labor markets in a similar manner, although the ITS has a finer breakdown. One example is the commonly grouped categories such as 22, 48, and 49 (utilities, and transportation sectors), which the ITS keeps fully separate. The principal data for employment and wages come from the Quarterly Census of Employment and Wages (QCEW). The total QCEW wagebill is the ultimate target, as it is a vital exogenous regressor used in the subsequent personal income and GDP modules.

To get to that total QCEW wagebill, separate wagebills for each NAICS category are computed. These wagebills come about as the product of wage rates and employment numbers. Wage rates are estimated via time-series regression for each NAICS category using the unemployment rate in Idaho and the corresponding national wagerates for each NAICS sector.

The first modules all run on monthly data. If exogenous data come from Moody's on a quarterly basis, the ITS first smooths these data to monthly values and then performs the forecast. The personal income and GDP modules rely on quarterly data. When data is imported from earlier modules in the ITS, these data are monthly, so both the personal income and the GDP modules average the monthly data to obtain quarterly data, and these two modules are run. Currently the GDP module is only for state-level real GDP and only uses the total wagebill as an exogenous regressor. The personal income module forecasts many components of personal income and uses the total wagebill in addition to some of the previously described exogenous regressors.

Variables. It is likely that the choice of variables will change slightly across the next two years. Partly, this may reflect removal of what amount to essentially duplications. Partly, this may reflect better integration of the components of the model; like Moody's US model, the Idaho economic model is structured in modules or blocks.

Endogenous variables: These are computed within the Idaho economic model.

id_pi	Idaho personal income
id_supp	Idaho supplementary income
id_dir	Idaho dividends, interest, and rent
id_nonfarm_prop	Idaho nonfarm proprietors' income
id_transfer	Idaho transfer payments
id_ra	Idaho residence adjustment
id_si	Idaho social insurance
id_e1133	Idaho employment in wood products industries
id_mwr1133	Idaho monthly wage rates in wood products industries
id_mwb1133	Idaho monthly wage bill in wood products industries
id_e21	Idaho employment in mining
id_mwr21	Idaho monthly wage rates in mining
id_mwb21	Idaho monthly wage bill in mining
id_e22	Idaho employment in utilities
id_mwr22	Idaho monthly wage rates in utilities
id_mwb22	Idaho monthly wage bill in utilities
id_e23	Idaho employment in construction
id_mwr23	Idaho monthly wage rates in construction
id_mwb23	Idaho monthly wage bill in construction
id_e31	Idaho employment in food manufacturing
id_mwr31	Idaho monthly wage rates in food manufacturing
id_mwb31	Idaho monthly wage bill in food manufacturing
id_e32	Idaho employment in other nondurable manufacturing
id_mwr32	Idaho monthly wage rates in other nondurable manufacturing
id_mwb32	Idaho monthly wage bill in other nondurable manufacturing
id_e33	Idaho employment in durable manufacturing
id_mwr33	Idaho monthly wage rates in durable manufacturing
id_mwb33	Idaho monthly wage bill in durable manufacturing
id_e42	Idaho employment in wholesale trade
id_mwr42	Idaho monthly wage rates in wholesale trade
id_mwb42	Idaho monthly wage bill in wholesale trade
id_e44	Idaho employment in retail trade
id_mwr44	Idaho monthly wage rates in retail trade
id_mwb44	Idaho monthly wage bill in retail trade

id_e45	Idaho employment in other retail trade
id_mwr45	Idaho monthly wage rates in other retail trade
id_mwb45	Idaho monthly wage bill in other retail trade
id_e48	Idaho employment in transportation
id_mwr48	Idaho monthly wage rates in transportation
id_mwb48	Idaho monthly wage bill in transportation
id_e49	Idaho employment in delivery and warehousing
id_mwr49	Idaho monthly wage rates in delivery and warehousing
id_mwb49	Idaho monthly wage bill in delivery and warehousing
id_e51	Idaho employment in information
id_mwr51	Idaho monthly wage rates in information
id_mwb51	Idaho monthly wage bill in information
id_e52	Idaho employment in finance and insurance
id_mwr52	Idaho monthly wage rates in finance and insurance
id_mwb52	Idaho monthly wage bill in finance and insurance
id_e53	Idaho employment in real-estate
id_mwr53	Idaho monthly wage rates in real-estate
id_mwb53	Idaho monthly wage bill in real-estate
id_e54	Idaho employment in professional services
id_mwr54	Idaho monthly wage rates in professional services
id_mwb54	Idaho monthly wage bill in professional services
id_e55	Idaho employment in management
id_mwr55	Idaho monthly wage rates in management
id_mwb55	Idaho monthly wage bill in management
id_e56	Idaho employment in administrative services
id_mwr56	Idaho monthly wage rates in administrative services
id_mwb56	Idaho monthly wage bill in administrative services
id_e61	Idaho employment in private education
id_mwr61	Idaho monthly wage rates in private education
id_mwb61	Idaho monthly wage bill in private education
id_e61gsed	Idaho employment in state education
id_mwr61gsed	Idaho monthly wage rates in state education
id_mwb61gsed	Idaho monthly wage bill in state education
id_e61gled	Idaho employment in local education
id_mwr61gled	Idaho monthly wage rates in local education
id_mwb61gled	Idaho monthly wage bill in local education

id_e62	Idaho employment in private healthcare
id_mwr62	Idaho monthly wage rates in private healthcare
id_mwb62	Idaho monthly wage bill in private healthcare
id_e62gshl	Idaho employment in state healthcare
id_mwr62gshl	Idaho monthly wage rates in state healthcare
id_mwb62gshl	Idaho monthly wage bill in state healthcare
id_e62glhl	Idaho employment in local healthcare
id_mwr62glhl	Idaho monthly wage rates in local healthcare
id_mwb62glhl	Idaho monthly wage bill in local healthcare
id_e62gvfhl	Idaho employment in federal healthcare
id_mwr62gvfhl	Idaho monthly wage rates in federal healthcare
id_mwb62gvfh	Idaho monthly wage bill in federal healthcare
id_e71	Idaho employment in hospitality
id_mwr71	Idaho monthly wage rates in hospitality
id_mwb71	Idaho monthly wage bill in hospitality
id_e72	Idaho employment in arts
id_mwr72	Idaho monthly wage rates in arts
id_mwb72	Idaho monthly wage bill in arts
id_e81	Idaho employment in other services
id_mwr81	Idaho monthly wage rates in other services
id_mwb81	Idaho monthly wage bill in other services
id_e92gsad	Idaho employment in state administration
id_mwr92gsad	Idaho monthly wage rates in state administration
id_mwb92gsad	Idaho monthly wage bill in state administration
id_e92glad	Idaho employment in local administration
id_mwr92glad	Idaho monthly wage rates in local administration
id_mwb92glad	Idaho monthly wage bill in local administration
id_e92gvf	Idaho employment in federal administration
id_mwr92gvf	Idaho monthly wage rates in federal administration
id_mwb92gvf	Idaho monthly wage bill in federal administration
id_etribes	Idaho tribal employment
id_mwrtribes	Idaho monthly wage rates for tribal employment
id_mwbtribes	Idaho monthly wage bill for tribal employment
idp_sf	Idaho single-family housing permits
idp_mf	Idaho multi-family housing permits
ids_sf	Idaho single-family housing starts
ids_mf	Idaho multi-family housing starts
idc_sf	Idaho single-family housing completions
idc_mf	Idaho multi-family housing completions

wp_sf	western single-family housing permits
wp_mf	western multi-family housing permits
ws_sf	western single-family housing starts
ws_mf	western multi-family housing starts
wc_sf	western single-family housing completions
wc_mf	western multi-family housing completions
m_idhstk	monthly Idaho housing stock
id0npt	Idaho population
id0nb	Idaho births
id0nd	Idaho deaths
id0nmg	Idaho net migration
id_farm_prop	Idaho farm proprietors' income

Exogenous variables: These are imported into the Idaho economic model from outside sources.

cpi	consumer price index
dum_id_e1133_a	employment dummy for wood products
dum_id_e21	employment dummy for mining
dum_id_e23	employment dummy for construction
dum_id_e44	employment dummy for retail trade
dum_id_e45	employment dummy for other retail trade
dum_id_e48	employment dummy for transportation
dum_id_e49	employment dummy for delivery and warehousing
dum_id_e53	employment dummy for real-estate
dum_id_e56	employment dummy for administration
dum_id_e61gled	employment dummy for local education
dum_id_e61gsed	employment dummy for state education
dum_id_e62gshl	employment dummy for state healthcare
dum_id_e71	employment dummy for hospitality
dum_id_e72	employment dummy for arts
dum_id_mwr1133	employment dummy for woods products wage rates
dum_id_mwr23	employment dummy for construction wage rates
dum_id_mwr33	employment dummy for durable manufacturing wage rates
dum_id_mwr62	employment dummy for healthcare wage rates
dum_shift_id_farm_corp	employment dummy for corporate farm income
ffr	federal funds rate
gdp_farm	GDP from the US farm sector
gdpr	real US GDP
hhaf	household financial assets
hhao	other household assets
ip321	industrial production index for wood products
ip322	industrial production index for paper manufacturing
ip334	industrial production index for semi-conductor industry
ip335	industrial production index for electrical equipment
jpc	personal consumption expenditure inflation

lfpr	US labor force participation rate
ef_farm_pi_af	Moody's farm personal income from all products
ef_farm_pi_lp	Moody's farm personal income from livestock
ef_gdp_farm	Moody's farm GDP
ef_idp_sf	Moody's Idaho single-family permits
ef_idp_mf	Moody's Idaho multi-family permits
ef_ppi_farm	Moody's producer price index for farm products
ef_ppi_metals	Moody's producer price index for metals
ef_us_mwr23	Moody's monthly wage rates in construction
ef_us_mwr42	Moody's monthly wage rates in wholesale trade
ef_us_mwr44_45	Moody's monthly wage rates in retail trade
ef_us_mwr51	Moody's monthly wage rates in information
ef_us_mwr52	Moody's monthly wage rates in finance
ef_us_mwr53	Moody's monthly wage rates in real-estate
ef_us_mwr54	Moody's monthly wage rates in professional services
ef_us_mwr55	Moody's monthly wage rates in management
ef_us_mwr56	Moody's monthly wage rates in administration
ef_us_mwr61	Moody's monthly wage rates in private education
ef_us_mwr62	Moody's monthly wage rates in healthcare
ef_us_mwr71	Moody's monthly wage rates in hospitality
ef_us_mwr72	Moody's monthly wage rates in arts
ef_us_mwr81	Moody's monthly wage rates in other services
ef_us_mwrndmf	Moody's monthly wage rates in nondurable manufacturing
ef_us_mwrtw	Moody's monthly wage rates in transportation and warehousing
ef_us_mwrgvsl	Moody's monthly wage rates in state and local government
minwage	Moody's forecast for the minimum wage
month	1–12
pmms	average 30-year mortgage rates
productivity	Moody's index for productivity
trend	an increment increasing by 1 each month
u3_nsa	the US U-3 unemployment rate, not seasonally adjusted
us_div_int	US dividends, interest, and rent income
us_e1133	US employment in wood products
us_e22	US utilities employment
us_e23	US construction employment
us_e42	US wholesale trade employment
us_e44_45	US retail trade employment
us_e52	US finance employment
us_e53	US real-estate employment
us_e56	US management employment

us_e61	US private education employment
us_e62	US healthcare employment
us_edmf	US durable manufacturing employment
us_egvf	US federal government employment
us_egvsl	State and local government employment across the US
us_endmf	US non-durable manufacturing employment
us_etw	US employment in transportation and warehousing
us_nonfarm_prop_mf	Moody's forecast of US nonfarm proprietors' incomes
us_pop_tot	US population
us_rent	US income from rent
us_si	US social insurance
us_supp	US supplementary income
us_transfer	federal transfer payments
us_wb_tot	total wages in the US