Modeling Challenges:

Economic forecasts in times of unexpected shocks

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The COVID-19 pandemic has caused a sudden shock to economic activity, reducing business activity and consumer spending significantly. This has created much uncertainty about the economic environment over the next year. Forecasting the economic environment is the first step to quantifying how it affects businesses in key metrics such as NIM, credit reserves, and capital. This briefing calculates key economic variables from past recessions and displays some uses of the information to guide forecasts of these variables.

As a leader in Model Risk Management, Montana Analytics has been active in developing models and utilizing rigorous analytical methods for examining models since 2002.

Overview

The COVID-19 virus that started in December 2019 has spread to nearly all countries worldwide as of early April 2020, with cases across the US increasing daily. This outbreak was officially classified as a pandemic by the WHO in early March and certainly qualifies as a "black swan" event. Governments and businesses have responded with various tactics to slow the virus' spread. Social distancing guidelines from public health authorities has forced the closure of most social venues across the country, many schools, and shelter- in-place orders are in effect for a significant part of the US population and the world at large. This is clearly an unprecedented event for just about all living people (the 1918 flu pandemic is the closest analog but records from then aren't complete) so the uncertainty dominates all potential thoughts and events. It's all but certain the US (and likely many countries) has entered a recession with the typical questions of how bad will it be and how long it will last even more uncertain given this sudden, exogenous shock that differs greatly from recessions occurring typical business cycles.

Many industries are badly affected during these times with the hospitality industry most directly affected. There are broadly four segments of the hospitality industry: Food and beverages, Travel and Tourism, lodging, and recreation. Restaurants that remain open offer no dine-in services so revenues have significantly declined for most. Recreation options including theaters, concert venues, movie theaters, and sporting events are all postponed, temporarily closed, or canceled. International travel to and from the US is near zero. Domestic travel isn't faring much better with approximate capacity rates of 10-20%. Most of the typical tourist attractions are closed so tourism revenues are effectively zero. Hotels that remain open, the list of which dwindles weekly, have similar occupancy rates to the airlines' capacity rates. These affects filter through to the record high unemployment claims witnessed in mid-April, leading to stress on all debts. rents and mortgage payments for residential and commercial buildings. Many other US industries are clearly affected in this connected economy.

Most recessions are classified as caused by a demand shock (9/11 for example) or a supply shock (sudden oil price increases) in economics. These are the classic forces in economics and there is both a theoretical understanding and historical data on how such shocks broadly affect an economy, along with more granular data for many industries, so classifying the recession shock type helps to quantify the estimated impact. However, the COVID-19 pandemic delivers both shocks at once, though it is dominated by the demand side. The demand shock is most obvious given a significant portion of the US in some type of quarantine as discussed above, leading to a significant decline in consumer spending that typically comprises around 70% of GDP. The supply shock is likely widespread but more difficult to estimate. It is known that supply chains are long and complex and a few examples illustrate this: Apple Supplier List details the top 200 suppliers that represented 98 percent of procurement expenditures for fiscal year 2018[1], GE bought directly from over 30,000 suppliers from multiple locations around the world[2], various meat processing plants are shutting down across the country that could significantly affect meat supply and farmers down the chain[3]. It is therefore more difficult to quantify the supply impact for these unknown potential disruptions since mapping supply chains is opaque.

[1] https://www.apple.com/supplier-responsibility/pdf/Apple-Supplier-List.pdf
[2] https://www.genewsroom.com/press-releases/ge-aims-increase-its-procurement-cee-smes
[3] https://www.npr.org/sections/coronavirus-live-updates/2020/04/13/833110486/u-s-meat-supply-is-perilously-close-to-a-shortage-ceo-warns

Filing quarter 1 financial statements is necessary soon and will necessitate large adjustments from the inputs and outputs used just in the recent quarter. Likewise, short-term business plans require new and significant updates also given this shock.

Montana Analytics analyzes various economic data points in the most recent 3 recessions classified by the NBER[4] to assist companies in forecasting inputs for budget planning and financial statements. This will be helpful for forecasting economic inputs or benchmarking forecasts and applies to business planning, CECL forecasting, and ALLL adjustments (through q-factors) directly.

Estimates from a single scenario are most common for figures published in financial statements; this typically means any common variables used in processes (e.g., GDP, unemployment) are the same across an organization. Selecting a common scenario is always more difficult at such economic inflection points, particularly the suddenness in the current environment. Montana Analytics recommends generating several scenarios for all material portfolios (at least, all portfolios if possible) to determine the best one to use across the organization for institutions utilizing a single scenario in accounting estimates given the uncertain outlook. Remaining scenarios can be used as evidence to support the chosen scenario given the large amount of uncertainty and also to determine any adjustments.

The next few sections briefly describe some characteristics of the past few recessions, followed by calculations of GDP and unemployment rate that can be used to determine short-term paths (approximately 1 year) for these variables.

1990 Oil Price Shock

Timeline: July 1990-March 91 (9 months)

The Republic of Iraq invaded the State of Kuwait on August 2, 1990, leading to a seven-month occupation of Kuwait and a huge military alliance with the U.S. forces comprising the largest portion of the coalition. The average monthly price of oil per barrel doubled from July to October in 1990 as a result. The immediate cause of the recession was a result of the oil price shock, coupled with an already weak economy that had been growing slowly in the past year. Although the recession was relatively mild, it was characterized by a slow employment recovery, most commonly referred to as a jobless recovery. Unemployment rose through June 1992, even though GDP growth returned in late 1991.

2001 Recession

March to November 2001 (9 months)

The economy shrank in the first quarter of 2001, increased in the second quarter, and then decreased again in the third quarter 2001. Four terrorist attacks occurred on September 11, 2001 without warning to the general public. This crisis threw the US back into the 2001 recession, with positive GDP growth starting again fairly

[4] https://admin.nber.org/cycles/cyclesmain.html

quickly in Q4 2001. Unemployment continued to rise though in fits and starts after the recession, peaking in June 2003.

2007 Recession

December 2007 to June 2009 (19 months)

The Great Recession in the United States was a severe financial crisis combined with a deep recession. The timeline for the recession is atypically long, as was the recovery. Real GDP growth did not regain its pre-crisis level until Q3 2011 while the unemployment rate did not return to the pre-crisis level until May 2016.

GDP, Unemployment Rates

Table 1[5] displays GDP growth 1 and 2 quarters after the start of the recession and the same periods after the end of the recession. Table 2 displays unemployment rate changes 3 months and 6 months after the start of the recession and the same periods after the end of the recession. These calculations represent a fairly typical length of downturns in many post-WWII recessions caused by an exogenous shock, supplemented with 2 quarters of an initial recovery. This constitutes an estimate of one-year path if so desired.

Table 1: Selected GDP growth rates in past recessions

	Start of Recession		Start of Recovery	
Recession	1-quarter	2-quarter	1-quarter	2-quarter
1990	-5.2%	-1.1%	3.4%	4.1%
2001	-1.7%	-0.3%	5.9%	3.9%
2007	-0.2%	-1.2%	1.5%	2.9%
Average	-2.4%	-0.9%	3.6%	3.6%

Table 2: Selected Unemployment rate changes in past recessions

	Start of Recession		Start of Recovery	
Recession	1-quarter	2-quarter	1-quarter	2-quarter
1990	0.7	1.1	0.1	0.1
2001	0.1	0.7	0.2	0.3
2007	0.2	0.7	0.3	0.4
Average	0.3	0.8	0.2	0.3

Montana Analytics does not forecast the expected shape but estimates based on historical experience are 2 to 3 quarters of negative growth, followed by a recovery of some sort of similar length. Given the US economy was fairly strong and stable before this exogenous shock, economic/financial theory would expect the shape of the recession and recovery generally to be one of the following:

- V-shaped: Characterized by a sharp downturn and equally sharp almost immediate upturn
- U-Shaped: sharp downturn, followed by moderate growth, then a fast recovery

[5] Data Source: https://fred.stlouisfed.org/, Montana Analytics calculations

The data points chosen show the first few quarters of a recession and initial points of a recovery. It is observed that the GDP is negative for the first 2 quarters as that coincides with the typical criteria to set a recession. GDP growth after the recession is moderate. Unemployment falls during the recession as expected but also continues to fall in the initial part of the recovery. This is expected, though it may be counterintuitive. The reason for this is typically explained as unemployment is a lagging indicator of economic conditions so employers want certainty on future economic growth prior to hiring (or re-hiring as it were) workers again. This phenomenon is observed in many recessions and the text above describes how slowly the job gains have been to recover following these recessions.

Using these examples, one can construct some rates of change for a forecast. Some simplistic ways to use the data are to assume the historical numbers calculated each sequentially constitute the next four quarters to construct two simple paths:

- Average path: Average value for the variable in each quarterly historically (i.e. -2.4% is first quarterly GDP estimate)
- Worst path: Lowest value for the variable in each quarterly historically (i.e. 0.1% is third quarterly unemployment change estimate as observed in 1990 recession)

Table 3 shows the average and worst paths of the GDP variable for the next four quarters and directly uses the GDP figures calculated above. Table 4 displays the paths for the unemployment rates using the rates of change above added to the unemployment rate that stood at 4.4% in March 2020.

Table 3: Example forecasted GDP growth rates

Quarter	Average Path	Worst Path
Q2 2020	-2.4%	-5.2%
Q3 2020	-0.9%	-1.2%
Q4 2020	3.6%	1.5%
Q1 2021	3.6%	2.9%

Table 4: Example forecasted unemployment rates

Quarter	Average Path	Worst Path
Q2 2020	4.73	5.10
Q3 2020	5.57	6.20
Q4 2020	5.77	6.50
Q1 2021	6.03	6.90

It is again noted that these paths are formed by applying figures calculated from prior recessions to the latest observed actual number (Q1 for GDP, March 2020 for unemployment rate) so they do not account for the specific facts and circumstances of the current economic environment. These are not intended to be forecasting projections to use directly without considering such information and creating several scenarios for analysis is

recommended given the uncertainty. The above paths may be most useful as-is for considering the shape of the near-term forecasts rather than the absolute levels. Montana Analytics has considerable experience with stress testing, scenario development and modeling. We can assist institutions in creating scenarios, generating model results, measuring sensitivities and risk exposures based on forecasted results.

Montana Analytics is a quantitatively-focused risk management consulting firm delivering innovative solutions in model risk management, model validation, analytical development, asset valuation and risk analytics for all types of bank assets. We specialize in high-quality expert analysis coupled with an independent perspective that covers probabilistic risk exposure modeling, predictive models for performing and non-performing assets, competing-risks, CECL modeling, Stress Testing, Basel II PD, EAD, LGD models, economic capital, asset pricing and loan valuation techniques, default management and loss mitigation. We also analyze and develop consumer scoring solutions for origination decisions and behavioral analysis for community and regional banks. Additionally, since 2002, we have assisted in developing enterprise-level Model Risk Management programs and have conducted numerous independent validations of complex models using our industry-leading *Model Validation Program*.