

COVID-19; The Great Compression; Square-Root and Swoosh- Shaped Roadmaps for Recovery

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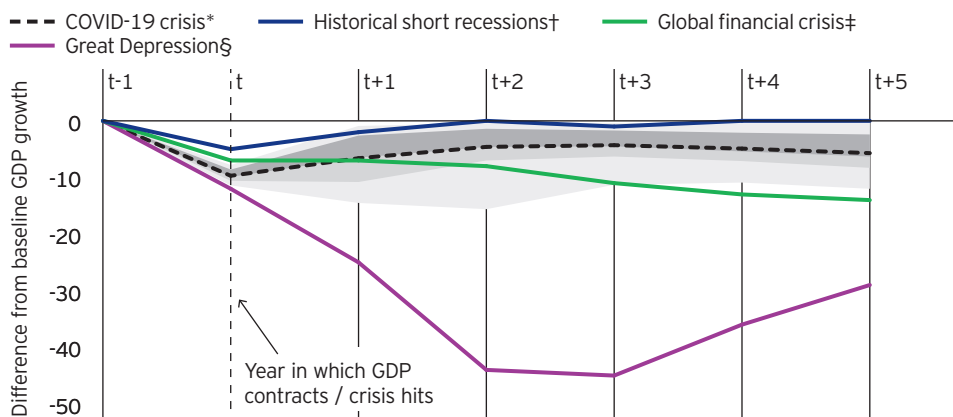
The Great Compression in Historical Context and a Simple Model to Map GDP Scenarios and Roadways to Recovery



- **Rapid, widespread COVID-19 lockdowns were imposed in Q1-2, precipitating a global Great Compression**, the most abrupt, deliberate downturn on record - very different from past recessions or depressions.
- **We expect continued diversity and unevenness in economic recovery** across countries, regions, sectors, due to variations in economic features, policy support, lockdown successes or premature re-opening.
- **Further outbreaks, lockdowns and confidence, labour market or financial challenges could slow the recovery**, unless a vaccine or cure becomes widely available, or general immunity is achieved.
- **Any major domestic or international policy change would affect both cyclical and trend growth**, via spending on public health, social safety nets, trade/investment rules, capex and consumption.
- **We devise a simple model to flesh out three scenarios with five roadmaps to recovery**, reflecting interplay among the pandemic; public health and macro policies; and private behaviour on domestic spending:
 - **Bull - two rapid routes**: a best-case V, rapid vaccine development and hence better than usual recovery; a good-case U with a somewhat slower return to normality;
 - **Bear - two treacherous routes**: a bad-case, L-shaped, a long recession with weak confidence holding back recovery; and worst-case, a W with secondary waves, extensive lockdowns and double-dip depression, even financial crises;
 - **Mid-way with a swoosh**: recovery is slow but steady and sustained;
 - **An assigned probability-weighted "square-root" path**: a sharp fall, a re-opening rebound that levels off due to debt and demand constraints, and long-run change in major economies and the international system.
- **The road ahead as well as potential roadblocks or accidents will matter** - new lockdowns or financial crises? - and likely affect bond yields, currencies, commodity prices, labour income and corporate earnings.
- **We expect regional and sectoral diversity to increase the value of country, sector and asset selection**. We would expect even greater dispersion across asset classes if more bullish or bearish scenarios materialize.

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Figure 1: Recovery Roadmap: Better than the Great Recession or Depression, worse than "Normal" Recessions



Note: All GDP paths are relative to a baseline of the pre-downturn GDP trend, incorporating both the level and growth of GDP.

* Shade represents the range of five Global Market Strategy Office scenarios; COVID-19 dotted line is the path based on probabilities we assign across our five scenarios as described in the text.

† Classical "V-Shape" recession/recovery - the median of 410 short recessions over the last 200 years - GDP declining in the year t-1 to t, then recovering to or above trend growth the following year.

‡ Median across developed market economies which experienced systemic banking crises in 2007-08.

§ Great Depression is the path of US GDP during the first five years of the Great Depression, 1929-1934.

Source: Oxford Economics, Haver Analytics, Maddison Project Database; Macrobond; Invesco. Data through calendar 2018.

Introduction: Putting the Great Compression and Potential Roads to Recovery in Context

We believe the Great Compression is unique, as the sharpest and deepest in recorded economic history, precipitated by a deliberate decision to lockdown entire swaths of society and economic activity. So, historical precedents are not good templates for the downturn or recovery yet offer a historical atlas to help navigate routes through the uncharted territory ahead. Figure 1 shows GDP through distinct downturns and recoveries. The blue line is a median of cycles spanning hundreds of short recessions over centuries in scores of countries; the green line is median of major western economies in the Great Recession; the purple line is US GDP during Great Depression; the COVID-19 Great Compression and probability-weighted scenario (dashed line), within our range of recovery scenarios (grey shade)¹. All incorporate the effects of contraction, recovery and growth on the path of GDP relative to the baseline prior to the downturn.

Distinguishing Downturns: Recessions; Great Depression; Great Recession

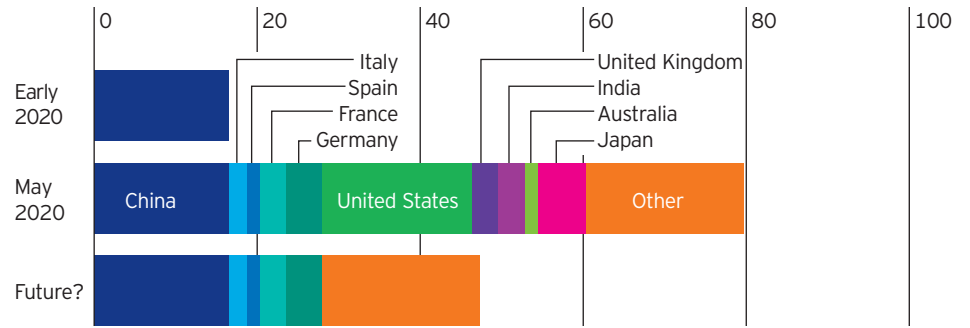
Normal recession/V-shaped recovery: Central banks are serial killers and effective revivers of growth in normal recessions and recoveries, much of the time. Recessions with V-shaped recoveries typically occur when central banks tighten to squeeze inflation out of an overheating economy without major structural or balance sheet problems. Financial conditions tighten, growth falls, inflation follows. Policy eases; investment and consumption recover strongly; rapid growth resumes, often rising above trend. Policy then normalizes, bringing growth back to trend. The blue line in Figure 1 shows median performance around 400 short recessions over two centuries in many countries. In such recessions, there are no permanent losses in output; GDP returns to its prior path as if there had been no downturn over about half the cycle.

The Great Depression: We believe depressions, multi-year recessions with year on year GDP contractions usually with deflation, owe to policy failures: Monetary or fiscal policies are not loosened enough in a downturn. Unmanaged financial stress or crises contribute to year-on-year declines in employment, consumption, investment, and permanent losses in output, productivity and potential growth. In the Great Depression, US policy was tightened at times and the gold standard kept longer than many other large economies. Deflationary pressures, bank runs and falling credit and money supply followed. The purple line in Figure 1 shows the severe, protracted US GDP collapse in the Great Depression.

The Great Recession: The Great Recession in 2008-09 and the Eurozone Financial Crisis in 2010-12 followed the Global Financial Crisis in 2007-08. These crises were likely severe enough to cause a global depression, but monetary and fiscal support stabilized and recapitalized banks, and huge, coordinated fiscal stimulus restored growth. The green line in Figure 1 shows the median GDP path of economies hit by systemic banking crises in 2007-08. There was no depression, but permanent output losses have prevented GDP from recovering its pre-crisis trendline. Neither output nor growth returned to the status quo ante.

Figure 2: Potential Share of Economic Activity in Lockdown during Q2 - 40-60% of Global GDP

Share of global GDP (level terms, %, PPP-basis)



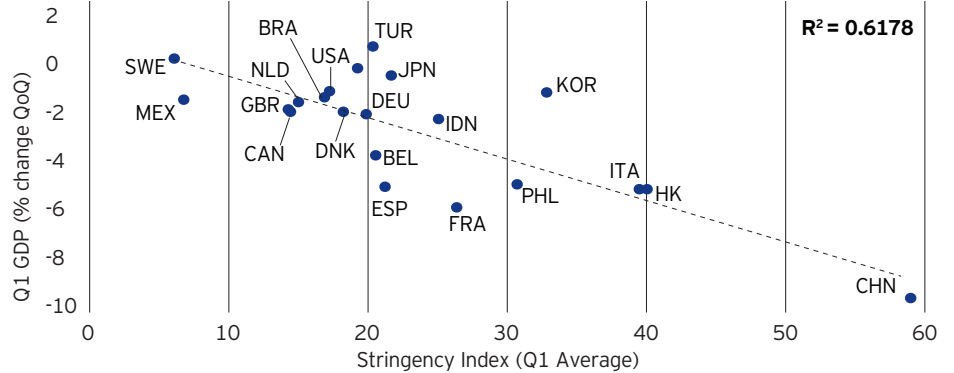
Source: IMF, Oxford Economics, Haver Analytics, Invesco. Data for calendar 2020, PPP-basis

Conceptualizing the Great Compression: The Steepest, Deepest Downturn on Record

Lockdowns intended to suppress the pandemic abruptly compressed swaths of domestic economic activity all at once, and across the world in rapid sequence. Some 20% of global economic activity was locked down in Q1, rising to 40-60% in Q2 (Figure 2). We see this as a “Great Compression” - a deliberate decision to press the “pause” button on economic activity, which makes this COVID-19 downturn very different than historical recessions or depressions, which reflect the relatively gradual effects of macro policies rather than abrupt effect of lockdowns. Indeed, Q1 GDP data points to an almost linear relationship between the depth of the downturn and the duration and stringency of national lockdowns (Figure. 3),² despite major structural differences between large, closed economies and those that are smaller and more open to trade.

Figure 3: The Great Compression: Q1 GDP had a linear relationship with lockdown stringency

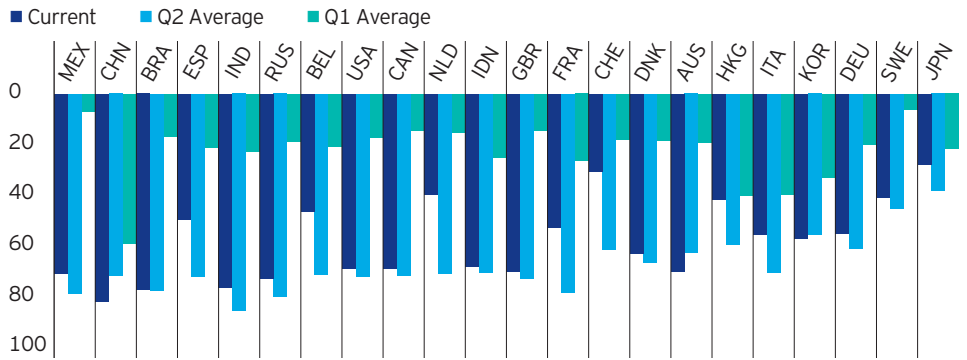
Selected countries GDP growth Q1 2020 vs. Stringency of Lockdown measures



Source: Blavatnik School of Government, University of Oxford, national statistical agencies, various dates. Bloomberg L.P. and Invesco.

Many lockdowns are now being gradually released, following wide variation in the duration and stringency of lockdowns, as well as success in “flattening the curve” (e.g., Europe) but arguably prematurely, because of the social, political and economic costs of extensive lockdowns (e.g., the US or India). Despite being reluctant to consider a trade-off between health and wealth, many governments may now fear that societies and economies can no longer tolerate extensive, extended lockdowns.

Figure 4: Lockdown stringency may have peaked in Q2, and now seems to be undergoing gradual release



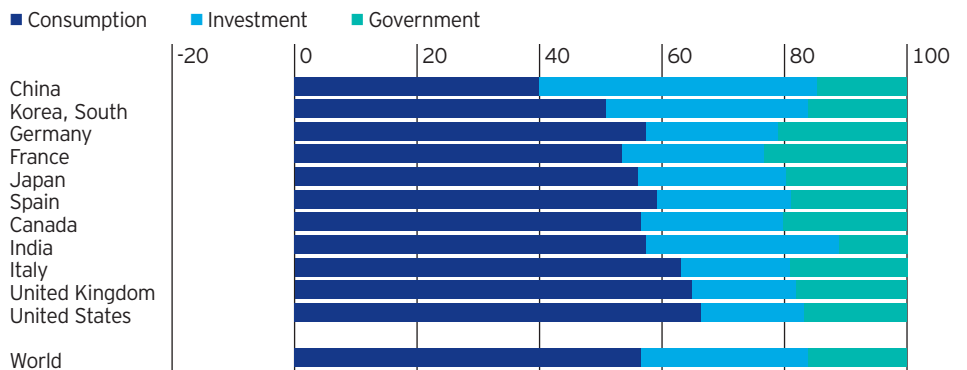
Source: Blavatnik School of Government, University of Oxford, Bloomberg and Invesco. Data as at 1 June 2020.

As lockdowns are relaxed (Figure 4) we may well see a re-opening rebound as well as a resurgence in the virus. Soft data like PMIs point to elements of a V-shaped recovery, suggesting that re-opening will take countries up the chain from the lower right in Figure 3 towards the upper left. The underlying dynamics are likely to be more nuanced. Academic research shows that choices had greater impact on economic activity than lockdown rules. Hence, economies may rebound on re-opening, yet still be constrained by corporate and consumer confidence and willingness to return to business as usual, even if the rules permit it; by the direct effects of regional or sectoral lockdowns or by any spill-over confidence effects to other regions or sectors.³

Conceiving a Framework: Sketching Roadmaps of the Great Compression and Recovery

All these issues suggest that devising a framework for guesstimating the extent of the Great Compression and roadways to recovery should ideally emphasize unique aspects of this downturn. The stringency index appears to be a good summary indicator for the way down in the Great Compression across countries (Figure 3), even in federal, devolved or a laissez-faire lockdowns as in the US, Brazil or the UK, and led by private choices as much as public policy. As such, conventional models based on historical sensitivities of specific economic sectors to each other or leading indicators may not be a reliable compass for navigating the Great Compression or a re-opening rebound. By the same token, the exit might be very divergent, since structural and behavioural differences are clearly less amenable to modification by simple rule changes or lockdown release. Furthermore, where private decisions rather than public policy choices are in the driver's seat, the diversity of national economic structures (Figure.5), of lockdown stringency (Figure. 4) and of success in containing COVID-19 points to more diversity in the recovery than the downturn. But as economies normalise, normal economic relationships seem likely to resume, so conventional models should come back into their own.

Figure 5: The Structure of GDP by End-Use



Source: Index Mundi, CIA World Factbook, 2019; Invesco

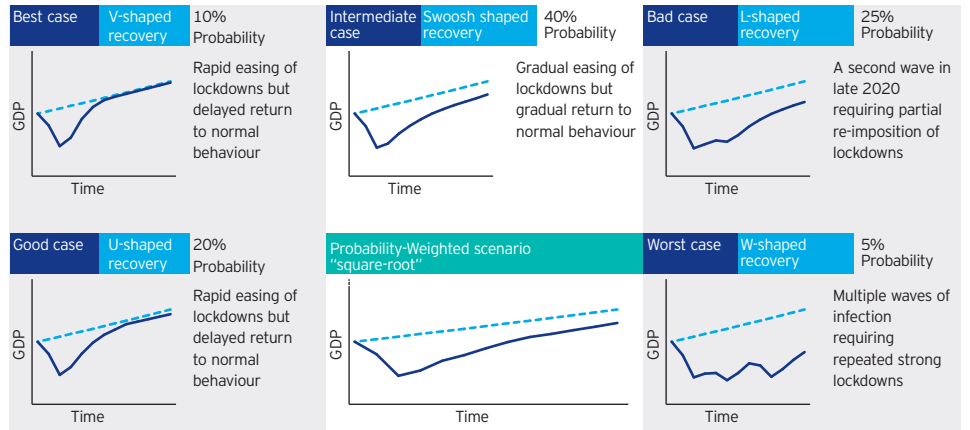
For all these reasons, we devised a “toy model” to imagine the impact of different scenarios, time frames and degrees of lockdown stringency based on the composition of GDP by end use. Unbundling GDP this way is more useful in our view than using conventional components of aggregate demand in the national accounts⁴ among other things by re-apportioning public spending on investment as well as the consumption of public employees. Figure. 5 shows the important differences across major economies in spending and end-use of GDP. Some are consistent with conventional wisdom (e.g., the US has the highest share of consumption; India the smallest share of public spending). But France's share of government spending is not nearly as large as by conventional metrics; France's conventional G is 56% of GDP, but government accounts for about 25% of GDP in end-use terms. This reapportioning, we feel, distinguishes the components of GDP more appropriately for the massive, across-the-board shock implied by locking down swaths of the economy, which has never been done before in modern times.

We emphasize that this is a “toy model” – a simple, even naïve model of major economies aggregated through historical GDP weights to tot up the world economy in response to brute-force shocks imposed on the broad components of GDP (along with residuals for the rest of the world and the rest of the eurozone, which we did not incorporate into our toy model). The approach is mechanical, relying on scenarios based on judgement, rather than a rigorous theory or an historically accurate model affirmed by back testing.⁵

Playing with our Toy Model of the World Economy, the Major Economies and the Pandemic

Using this GDP structure, and based on the trajectory implied by the Q1 GDP data per country, we constructed five roadmaps for growth, based on a bull case, a bear case and a middle case, to which we then assigned probabilities based on internal discussion and debate, to generate a probability weighted scenario. We are using these roadmaps to recovery as a collective atlas to guide us - not a formal forecast based on a proper model. As sequential GDP data emerge, we will update and revise the model and the scenarios; and as activity increasingly normalizes, we will revert to using more conventional models based on normal economic relationships - both based on the structure of activity and historical relationships.

Figure 6: Linking epidemiology, lockdowns and economic behaviour across our scenarios

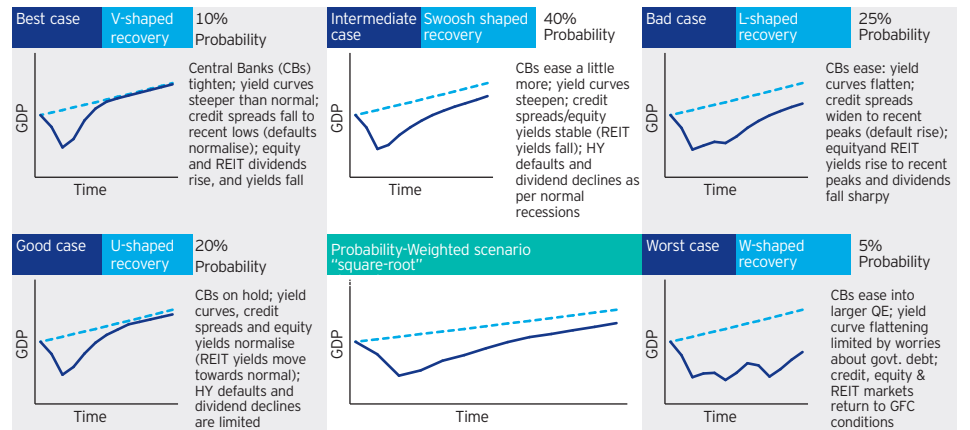


Source: Invesco for illustrative purposes only. There is no guarantee these scenarios will be realized.

Mapping Roadways to Recovery: Still too Early to Rule Out a Wide Range of Pathways

The shapes of the Great Compression and exit scenarios should help investors to gauge the recovery as well as changes in health, monetary, fiscal or international economic policies. The path of the global and major national economies may also drive inflation expectations and growth-gearred assets.

Figure 7: Linking epidemiological and economic scenarios with capital markets



Source: Invesco for illustrative purposes only. There is no guarantee these scenarios will be realized.

The scale, speed and nature of this global economic shock has created a cottage industry around historical metaphors and models for the shape of the recession and recovery, with many resorting to an alphabet soup of recession and recovery shapes, from a V-shape to a U, a W-shaped double dip or even an L. We believe it is too early to definitively forecast a particular recovery path: substantial second waves; the hope of vaccination, effective cures or therapies; or worse, economic or financial crises in the event of renewed lockdowns or cascading defaults could alter the path of GDP. Furthermore, such scenarios are not mutually exclusive, since progress or setbacks could shift the world or any economy from one track to another, for example in the event of a financial crisis; or, alternatively if second waves and lockdowns were reversed by a vaccine. So we have taken a probabilistic approach to programming these scenarios in our toy model based on what we expect from governments, firms and households in each scenario.

V-shaped, best-case recovery is a vaccine-driven narrative with a sharp, sustainable rebound, supported by fiscal and monetary policy that comes soon enough that there are no systemic balance sheet problems in major economies. We assign a 10% probability because no human coronavirus vaccine has ever been developed, and only one vaccine has ever been devised among the many known animal coronavirus - but because there is so much effort in this area, we think there is a meaningful chance of a positive scenario, with a strong rebound, boosted by enormous monetary and fiscal support.

U-shaped, good-case recovery is a similar, delayed and more gradual upside scenario in which economic behaviour returns to normal without the rapid benefit of a full vaccine therapy, perhaps because of effective treatment or cure, and because we begin to live with the virus. Again in the absence of significant balance sheet stresses, monetary and fiscal stimulus can propel a sustained recovery forward with permanent but only moderate losses in output and potential growth. We assign a 20% probability because we think this has a decent chance, but we do not believe that governments or the private sector will bank on a treatment or cure, but wait to see one before animal spirits return in full.

L-shaped, bad-case GDP path involves sustained weakness in economic activity due to persistent concerns about the pandemic, incorporating difficulty for monetary and fiscal support to gain traction in boosting recovery. New, extensive lockdowns might be imposed in a second wave if infections and illnesses overwhelm hospital capacity. Though there are no financial or economic crises - and hence no further major legs down in GDP, lack of progress and confidence leads to permanent output, employment and potential growth losses. We assign a 25% probability, because this scenario seems an important threat.

W-shaped worst case entails multiple dips in economic activity due to multiple pandemic waves and renewed extensive lockdowns, with significant risks of financial or economic crises. This is closest to a depression scenario. We assign only a 5% probability because we cannot rule out any of these very bad outcomes, but we feel that the commitment of both fiscal and monetary authorities around the world can help avoid a depression-like outcome even if the pandemic cannot be contained or multiple waves cannot be prevented, because we believe policy credibility exists.

Intermediate, swoosh-shaped recovery places the emphasis more on economic re-opening and a gradual return to business as usual with no conclusive success in dealing with the pandemic. Fiscal and monetary support are effective in avoiding systemic financial crises, and in sustaining recovery once re-opening gets underway, even though growth levels off gradually. We assign a 40% probability, because it feels to us as if this is roughly where we are now, with a high but not conclusive chance of remaining here.

Probability-weighted, "square-root" shaped recovery. A reopening rebound is constrained by the persistence of the pandemic; uncertainty amid hope for vaccine, cure or treatment; ongoing fear of financial crises or balance sheet stresses that bite despite fiscal and monetary policy support; overarching international tensions that prevent a return to business as usual, affecting both consumption and investment and now. As a result, the rebound levels off, leaving behind sustained losses in output, employment and trend growth. The silver lining is that monetary and fiscal policy remain exceptionally accommodative, supporting incomes, holding up consumption as well as financial asset prices.

Imagining Long-Run Effects on Potential Growth

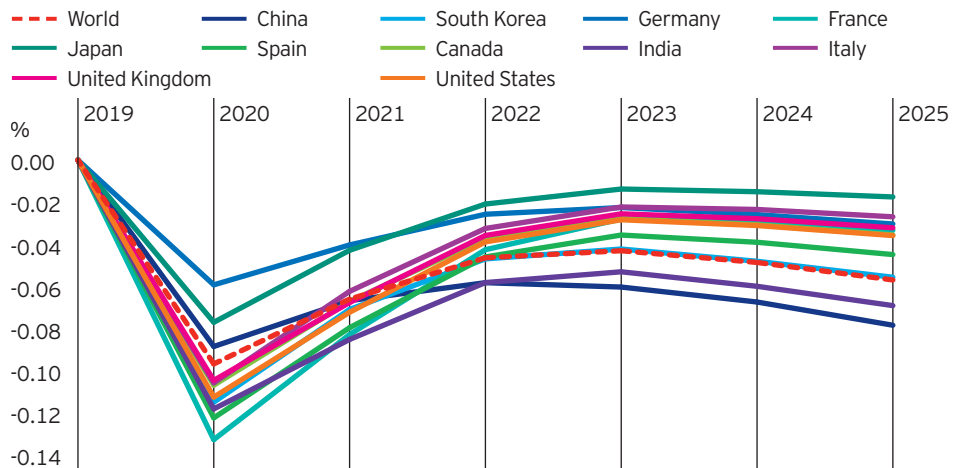
The Great Compression is worse than modern, non-economic precedents in being much faster and much more widespread within the major economies and globally, but arguably better in other respects. The effects of natural disasters, for example, may be as immediate - even instantaneous, but tend to be geographically much more concentrated. Major wars tend to be much more destructive of both supply and demand, but often move more slowly across national and international territories, though the confidence shocks in the real economy and financial markets have sometimes been extreme and widespread.

In the Great Compression, the economic consequences of the pandemic arguably have been much more comprehensive and rapid than in wars or natural disasters, because lockdowns were imposed all at once on almost everyone, except essential workers, and work that could be done from home; and because lockdowns spread rapidly across the West and Emerging Markets in Q2.

More favourably, lockdowns are not responsible for anywhere near the permanent destruction in supply capacity common in major natural disasters or wars. Furthermore, the massive monetary and fiscal support have kept financial systems functioning and liquid in general, and many households and firms solvent, which should help sustain demand. Plus, these policies should also have more traction in major wars or national natural disasters (given the physical destruction) or in financial crises (since banks in many major economies are better capitalized than they were going into most banking collapses).

All these distinctive features of the Great Compression are in our view good reasons why the downturn may be as severe as a systemic crisis or even a depression, but also why the recovery ought to be better. Against that, the challenges to confidence posed by the ongoing spread of the pandemic, its incomplete containment and arguably premature re-opening in the United States and many major EMs including India and Brazil, as well as secondary outbreaks in many other countries with successful containment all point to confidence constraints in consumption, production and investment.

Figure 8: Simultaneous Great Compression likely to give way to diverging recovery



Source: Invesco for illustrative purposes only. GDP scenario analysis as at 16 June 2020. There is no guarantee these scenarios will be realized.

Conclusion

Conclusion: Economies and Asset Classes to Diverge in Recovery, Despite Declining Almost All Together

A crucial macro investment theme emerging even now, as the world progresses through the pandemic and supported by policy, emerges into recovery, is increasing variety and variability in performance – even though the world economy suffered a nearly global, shared Great Compression due to lockdowns. There is already evidence of differentiation within the market recovery, following the sharp across-the-board and the world sell-off in March, with technology tending to outperform other sectors, and China and the US leading global equity performance, with the rest of EM and the rest of DM recovering less lost ground.

We believe there is more differentiation to come across countries and asset classes. How countries, sectors and asset classes will perform may vary further still according to the type of recovery we have. Our toy model scenarios show significant divergence from the pre-COVID baseline GDP trend country by country (Figure. 8). The fastest growing countries, mechanically, would suffer the most relative to their baseline, while the slowest growing would suffer the least.

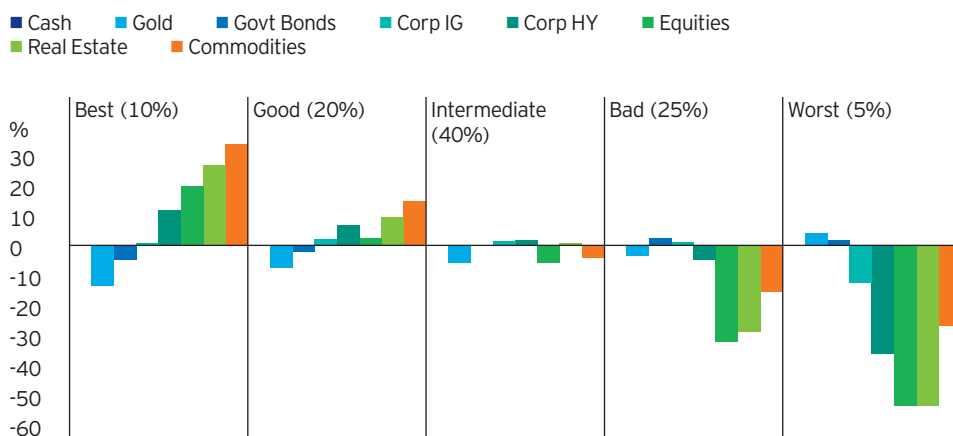
By way of example, in a V-shaped recovery based say on rapid deployment of an effective vaccine, the EZ South could well outperform the EZ Core (see Appendix 2), because leisure, hospitality, travel and tourism might well stage a strong comeback. This prospect is probably not priced into the relative valuations of EZ Periphery bonds and equities, given the lower risk premiums in manufacturing heavy north. In such a V-shaped rebound, the South would require much less fiscal and monetary support than in the more negative scenarios as tourism, leisure and hospitality industries as well as smaller scale businesses and services – a hall mark of the Italian economy, for example, would probably recover more strongly.

Conversely, in a W-shaped multiple dip scenario with repeat waves and regional / targeted lockdowns – all the more so if there were extensive lockdowns, the South might suffer a more severe double dip than the North, as well as requiring more fiscal support to sustain household incomes and hold unemployment in check. The North would likely outperform the South in growth as well as in financial market performance – including government bonds of the South, which would probably perform as a risky financial asset in the form of sovereign credit rather than outperforming as a risk-free safe haven.

We continuously monitor high-frequency data, including mobility data, online activity, etc.⁶ as well as more traditional data like PMIs and confidence indicators, along with pretty much everyone. However, we note that the link among such data and GDP, household income and corporate cashflow is probably uncertain and changeable, given even temporary shifts in behaviour – on both the way down and the way up. For example, people may prefer to drive rather than take public transport, including furloughed workers returning to work as well as those who worked from home through the lockdowns. The NY Fed's index of weekly economic activity may be the best available near real-time indicator but is not a useful guide to global activity, nor is it able to capture shifts in behaviour in response to confidence shocks or shifts in lockdown rules. We will therefore revise our scenarios as new GDP data and pandemic-related information emerge, refine the toy model and revisit our views on probabilities and potential asset class performance.

Our global asset allocation team has generated a wide variety of prospective returns across asset classes across our range of scenarios for the path of global GDP (Figure. 9). We believe this exercise points to high value in combining diversification with active asset allocation with country and asset selection, reflecting the diversity we expect in recoveries, based on variations and emerging information in the progression of the pandemic; lockdown success; re-openings and new lockdowns; and policy support.

Figure 9: Asset Allocation Model Suggests Diversification, Given Wide Range of Potential GDP Roadways



Source: Invesco for illustrative purposes only. GDP scenario analysis as at 16 June 2020; returns based on market data as at 29 May 2020. Notes: based on local currency returns. Figures in parenthesis are our subjective probabilities. GDP data shows projected global GDP growth in 2020. Cash is an equally weighted mix of USD, EUR, GBP and JPY. As of 29 May 2020. There is no guarantee these views will come to pass. Diversification does not guarantee a profit or eliminate the risk of loss. See Appendix 2 for definitions, methodology and disclaimers. Source: BAML, MSCI, GSCI, FTSE, Refinitiv Datastream and Invesco.

- 1 The US has had six generally recognized depressions, although there have been more recessions with multi-year declines in GDP. Many occurred in the absence of a central bank and all without active monetary or fiscal policies (the Federal Reserve is the third central bank in US history).
- 2 The "Blavatnik Stringency Index" is the Oxford Covid-19 Government Response Stringency Index from the Blavatnik School of Government, Oxford. It measures the stringency of government responses to Covid-19, including the extent of school, business and travel shut-downs but also includes policy measures (both monetary and fiscal) and healthcare actions (testing etc.). The index ranges from 0 to 100, with higher scores indicating a more stringent response. The current value is as of 1 June 2020 and the Q2 average is calculated up to that date. GDP is calculated as the seasonally adjusted quarter on quarter change during 2020 Q1 (not annualised).
- 3 Chicago Booth School Professor Austan Goolsbee, who served as chair of President Obama's Council of Economic Advisors, has argued that data across commuting zones, state and county lines and footfall show that shelter-in-place and shutdown orders account for only a modest share of the economic damage. Austan Goolsbee and Chad Syverson, Fear, Lockdown and Diversion: Comparing Drivers of Pandemic Economic Decline 2020, Preliminary Version, Working Paper No. 2020-80, Becker Friedman Institute, University of Chicago, 17 June 2020
- 4 The general definition of GDP is given by the simple accounting identity, $GDP = Y = C + I + G + X - M$ in any given accounting period. By way of a simple clarification, GDP is a "national accounts" based estimate of economic value added within a country (or multinational economy, such as the Eurozone). There are three major approaches to estimating GDP, which should normally yield very similar results:
 - a In the product approach, GDP is calculated as the economic value added. The value of inputs is subtracted from the market value of the outputs. This is known as "GDP at factor cost" incorporating the cost of the factors of production and for all inputs. "GDP at market prices" incorporates indirect taxes such as excise duties, tariffs and sales tax or VAT.
 - b In the incomes approach, GDP is measured as the total of all income received by economic agents, including people, firms and the public sector.
 - c In the expenditure approach, GDP is measured as the sum of all final spending in the economy.

We have used the expenditure approach here, and chosen the expenditure approach as the simplest way to get a handle on unprecedently abrupt shifts in national and global economic activity; and have resorted to GDP by end-use because the use of lockdowns has directly impacted both final and intermediate spending, probably more intensely and quickly than might be reflected in the other approaches.

- 5 Granting that ours is a relatively mechanical and naïve construct, a toy model is not necessarily as childish as it may sound. In the famous words of noted statistician George Box, which have been resurrected in the context of the epidemiology of this pandemic, all models are wrong, but some are useful. Toy models can be very useful, especially for dealing with complex, entirely new problems. Some of the most influential economic models began as toy models. Indeed, the idea comes from physics, and is used to take a first pass at major, new cosmic questions, by simply trying to describe an observed relationship and apply it to new data or instances of similar events.

In this case, the reasonably good relationship between lockdown stringency / duration and activity is consistent with at least cross-country Q1 GDP data seems intuitively reasonable. It also informs the view that re-openings, renewed lockdowns or self-directed household behaviour that resembles lockdowns could have effects on GDP of a similar magnitude.

This view and approach are consistent with the available economic history in general terms. In many past pandemics, it was "non-pharmaceutical interventions" - social distancing and lockdowns - rather than the direct economic impact of disease (i.e., death or illness, hospitalization, absence from working, producing and consuming) that caused most of the economic costs. Past pandemics, especially when there were extensive NPIs, suggest that recoveries are affected not just by the relaxation of the lockdowns, but also by the effects on consumer and corporate confidence. Indeed, research suggests that lockdowns are actually more effective at supporting growth over the entire course of a pandemic; the New York Federal Reserve economists have shown that US cities that practiced social distancing during the Great Influenza Pandemic of 1918-1921 had better overall performance than those that did not.

- 6 Harvard Professor Raj Chetty and colleagues have aggregated private sector data of various kinds, such as consumer spending, to gauge the effect of COVID-19, lockdowns and re-openings in the United States - see www.tracktherecovery.org.

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Kristina has 25 years of investment industry experience. Prior to joining Invesco, she was the US investment strategist at Allianz Global Investors. Prior to Allianz, she held positions at PIMCO Funds, UBS (formerly PaineWebber) and MetLife. She has a BA degree cum laude from Wellesley College; a J.D. from Pace University School of Law; an MBA in finance from New York University, Leonard N. Stern School of Business, where she was a teaching fellow in macroeconomics and organizational behavior; and a master's degree from the Cornell University School of Industrial and Labor Relations, where she focused on labor economics. She holds the Certified Financial Planner, Chartered Alternative Investment Analyst, Certified Investment Management Analyst and Chartered Financial Consultant designations.



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Arnab has 28 years of investment industry experience. He is a member of Invesco's Global Investor Forum Advisory Council with a focus on global macro and emerging markets, and previously served as Head of emerging markets macro research for Invesco Fixed Income. Prior to joining Invesco, he served as Co-head of Economic Research & Strategy at Roubini Global Economics; Co-head of Global Economics & Strategy, Head of Global FX Research, and Head of EM Economics & Strategy at Dresdner Kleinwort; and Head of EMEA Research at JP Morgan. He has also been a private consultant in global and emerging markets, as well as consulting with Trusted Sources, a specialist EM research boutique. Arnab's studies were in macroeconomics, economic history and international political economy. He received an AB from Princeton University and completed his postgraduate and doctoral work at the London School of Economics.



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Brian has 20 years of investment industry experience in the asset management industry. In April 2000, he joined the firm, starting in fixed income product management and then transitioning into the macro and investment strategy group in 2005. He earned a BA degree in economics from the University of Michigan and an MBA with honors in finance and international business from Fordham University.



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Paul has 34 years of investment industry experience. Prior to joining Invesco, Paul worked at Société Générale in both Paris and London, holding positions as Macro Specialist Sales, Equity Strategist and Head of Research.

He started his career at Morgan Stanley in London where he worked in Corporate Finance and Equity Research before transferring to New York where he joined Morgan Stanley Asset Management as portfolio manager. He holds a BSc in Economics from the London School of Economics and a Master of Philosophy in Economics from Oxford.



Talley Léger
Investment Strategist

Talley has 19 years of investment industry experience. Prior to joining Invesco, he was the founder of Macro Vision Research and held strategist roles at Barclays Capital, ISI, Merrill Lynch, RBC Capital Markets, and Brown Brothers Harriman. He is the co-author of the revised second edition of the book, From Bear to Bull with ETFs. He earned an MS degree in financial economics and a Bachelor of Music from Boston University. He is a member of the Global Interdependence Center (GIC) and holds the Series 7 registration.



Ashley Oerth
Investment Strategy
Analyst

Ashley is an Investment Strategy Analyst. In this role, she develops and communicates economic outlooks and investment insights, with a particular focus on macroeconomic concepts and modeling. Additionally, she researches and creates thought leadership pieces to help articulate the firm's thematic viewpoints.

Ms. Oerth joined Invesco when the firm combined with OppenheimerFunds in 2019. She began her career with OppenheimerFunds in 2016 and worked with the investment strategy team. Previously, she worked at High Frequency Economics as Research Coordinator.

Ms. Oerth earned a BA degree in economics and political studies from Bard College at Simon's Rock in Great Barrington, Massachusetts. She also completed the Bard Globalization and International Affairs program (BGIA) as part of her studies. She holds the Series 7 registration.

This 5-way roadmap draws heavily on Invesco investment teams' three-scenario analysis bull, bear and base-case approach. We thank Invesco Fixed Income, Invesco Solutions and all the investment and analyst teams for their insights and thought provoking research. We also thank key Invesco individuals for their work which we draw upon even more heavily than usual during the COVID-19 pandemic:

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Appendices

Appendix 1: Eurozone Core Definition

The term, Eurozone Core is generally applied to member-states that are net creditors to “EZ “Periphery” member states, notably Portugal, Italy, Greece and Spain. The Core is generally considered to center on Germany, Netherlands, Finland, Austria, but can also include Belgium, Luxembourg and conceivably even Ireland, which was a crisis-stricken member of the EZ Periphery. In some formulations Belgium and France are considered “Semi-Core” because they are net creditor countries within the Eurozone, but France usually runs a current account deficit, and Belgium has very high public debt ratios as well as sizeable current account surpluses.

Appendix 2: Methodology for asset allocation, expected returns and optimal portfolios

Portfolio construction process

The optimal portfolios are theoretical and not real. We use optimisation processes to guide our allocations around “neutral” and within prescribed policy ranges based on our estimations of expected returns and using historical covariance information. This guides the allocation to global asset groups (equities, government bonds etc.), which is the most important level of decision. For the purposes of this document the optimal portfolios are constructed with a one-year horizon.

Which asset classes?

We look for investibility, size and liquidity. We have chosen to include: equities, bonds (government, corporate investment grade and corporate high-yield), REITs to represent real estate, commodities and cash (all across a range of geographies). We use crossasset correlations to determine which decisions are the most important.

Neutral allocations and policy ranges

We use market capitalisation in USD for major benchmark indices to calculate neutral allocations. For commodities, we use industry estimates for total ETP market cap + assets under management in hedge funds + direct investments. We use an arbitrary 5% for the combination of cash and gold. We impose diversification by using policy ranges for each asset category (the range is usually symmetric around neutral).

Expected/projected returns

The process for estimating expected returns is based upon yield (except commodities, of course). After analysing how yields vary with the economic cycle, and where they are situated within historical ranges, we forecast the direction and amplitude of moves over the next year. Cash returns are calculated assuming a straight-line move in short term rates towards our targets (with, of course, no capital gain or loss). Bond returns assume a straight-line progression in yields, with capital gains/losses predicated upon constant maturity (effectively supposing constant turnover to achieve that). Forecasts of corporate investment-grade and high-yield spreads are based upon our view of the economic cycle (as are forecasts of credit losses). Coupon payments are added to give total returns. Equity and REIT returns are based on dividend growth assumptions. We calculate total returns by applying those growth assumptions and adding the forecast dividend yield. No such metrics exist for commodities; therefore, we base our projections on US CPI-adjusted real prices relative to their long-term averages and views on the economic cycle. All expected returns are first calculated in local currency and then, where necessary, converted into other currency bases using our exchange rate forecasts.

Optimising the portfolio

Using a covariance matrix based on monthly local currency total returns for the last 5 years and we run an optimisation process that maximises the Sharpe Ratio. Another version maximises Return subject to volatility not exceeding that of our Neutral Portfolio. The optimiser is based on the Markowitz model.

Currency hedging

We adopt a cautious approach when it comes to currency hedging as currency movements are notoriously difficult to accurately predict and sometimes hedging can be costly. Also, some of our asset allocation choices are based on currency forecasts. We use an amalgam of central bank rate forecasts, policy expectations and real exchange rates relative to their historical averages to predict the direction and amplitude of currency moves.

Cash: returns are based on a proprietary index calculated using the Intercontinental Exchange Benchmark Administration overnight LIBOR (London Interbank Offer Rate). The global rate is the average of the euro, British pound, US dollar and Japanese yen rates. The series started on 1st January 2001 with a value of 100. The same data is used to construct historical comparisons (yields within historical ranges, say).

Gold: London bullion market spot price in USD/troy ounce.

Government bonds: Current values chart uses Datastream benchmark 10-year yields for the US, Eurozone, Japan and the UK and the Thomson Reuters China benchmark 10-year yield for China. Historical and projected yields and returns are based on Bank of America Merrill Lynch government bond indices with historical ranges starting on 31st December 1985 for the Global, Europe ex-UK, UK and Japanese indices and 30th January 1978 for the US. The emerging markets yields and returns are based on the Bloomberg Barclays emerging markets sovereign US dollar bond index with the historical range starting on 28th February 2003. The same indices are used to construct historical comparisons (yields within historical ranges, say).

Corporate investment grade (IG) bonds: Bank of America Merrill Lynch investment grade corporate bond indices with historical ranges starting on 31st December 1996 for the Global, 31st January 1973 for the US dollar, 1st January 1996 for the euro, 31st December 1996 for the British pound, and 6th September 2001 for the Japanese yen indices. The emerging markets yields and returns are based on the Barclays Bloomberg emerging markets corporate US dollar bond index with the historical range starting on 28th February 2003.

Corporate high-yield (HY) bonds: Bank of America Merrill Lynch High-Yield indices with historical ranges starting on 29th August 1986 for the US dollar, and 31st December 1997 for the Global and euro indices. The same indices are used to construct historical comparisons (yields within historical ranges, say).

Equities: We use MSCI benchmark indices to calculate projected returns and calculate long-term total returns with historical ranges starting on 31st December 1969 for the Global, US, Europe ex-UK, UK and Japanese indices, and 31st December 1987 for the emerging markets index. Equity index valuations (such as yields within historical ranges) are based on dividend yields using Datastream benchmark indices with historical ranges starting on 1st January 1973 for the Global, US, Europe ex-UK and Japanese indices, on 31st December 1969 for the UK index and 2nd January 1995 for the Emerging Markets index. The same indices are used to construct historical comparisons (yields within historical ranges, say).

Real estate: We use FTSE EPRA/NAREIT indices with historical ranges starting on 29th December 1989 for the US, Europe ex-UK, UK and Japanese indices, 18th February 2005 for the Global index, and 31st October 2008 for the Emerging Markets index. The same indices are used to construct historical comparisons (yields within historical ranges, say).

Commodities: Standard and Poor's Goldman Sachs Commodity Total Return Indices with historical ranges starting on 31st December 1969 for the All Commodities and Agriculture indices, 31st December 1982 for the Energy index, 3rd January 1977 for the Industrial Metals index, and 2nd January 1973 for the Precious Metals index. We refer to oil & gas and industrial metals as industrial commodities.

Investment risks

The value of investments and any income will fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested.

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