



RESEARCH

Tool to simulate the impact of the coronavirus shock on potential output

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RES Economic Modeling (RESEM)

Potential output estimation in the IMF

- There is no rule imposed on country desks on how to estimate potential output.
- So, sometimes desks use simple statistical filters or other methods for their projections.
- Research provides 2 tools for country desks to choose when formulating their projections: 1) The simple multivariate filter (MVF); 2) the tool discussed in this presentation.
- The tool presented today has been developed and it has been favored in the context of the pandemic.

Approach: Use semi-structural model impulse response functions to stylized shocks.

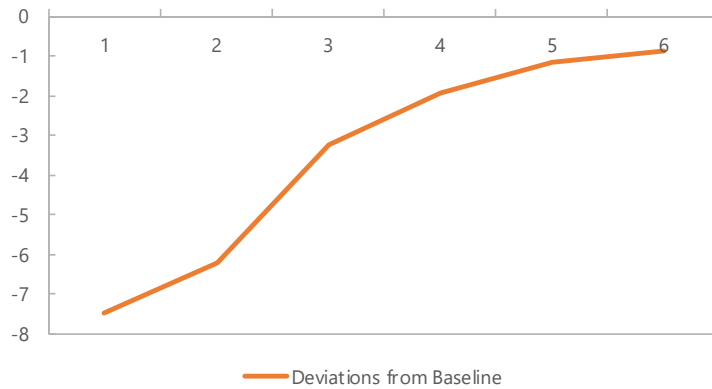
- I. This is an application of the Model-Updated Projection Framework developed by the IMF. That framework is an excel tool to produce IRF's for any model given a combination of shocks.**
- II. Some stylized shocks defined:**
 - Supply shocks**
 - A. TFP
 - B. NAIRU
 - C. Capital
 - Demand shocks**
 - A. Stylized domestic demand
 - B. Stylized foreign demand
 - C. Global financial

The background

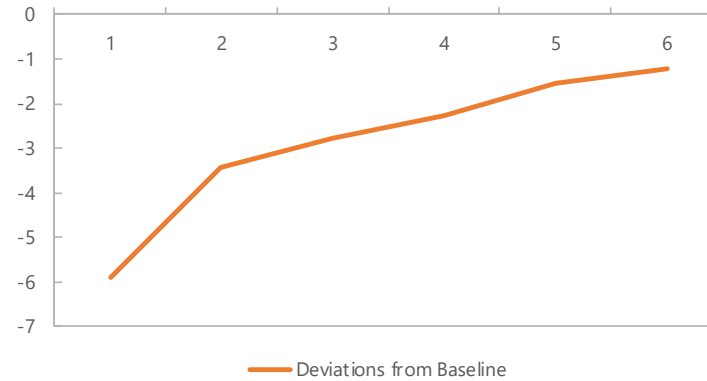
- I. Potential output is measured using G20MOD's production function (Cobb Douglas) ;**
- II. Given a structural shock, G20MOD is simulated and produces IRF's for several variables, including potential output and its components; For example, a demand shock (lower investment) translates in lower capital stock and potential output;**
- III. We provide an example, but each desk can choose the composition and size of the shocks (fiscal; financial; domestic and foreign demand; TFP; Capital; NAIRU). Given any choice of the shocks, the tool produces a path, based on FSGM's IRFs, for potential output, its main components and real GDP and shows how their dynamics is driven by the different shocks;**
- IV. The main idea was to provide a tool so that country desks could choose their own shocks in formulating their potential output projections.**

Final output is a path for potential output and other variables that reflects the combination of chosen shocks.

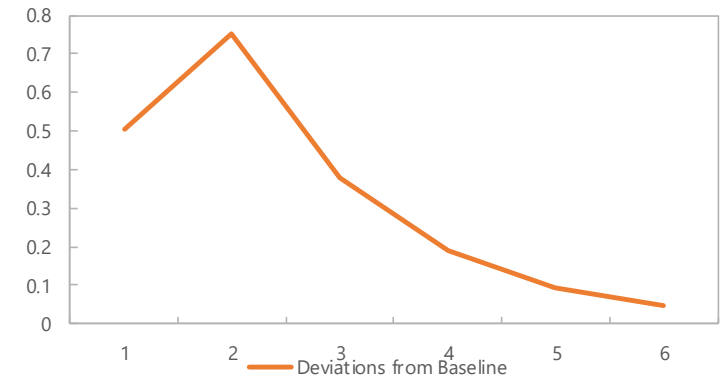
Real GDP



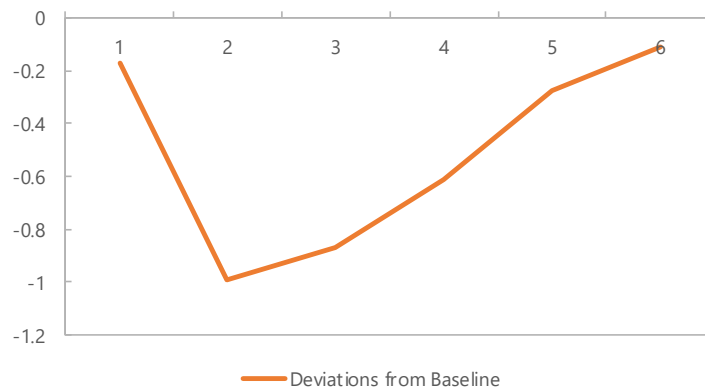
Potential output



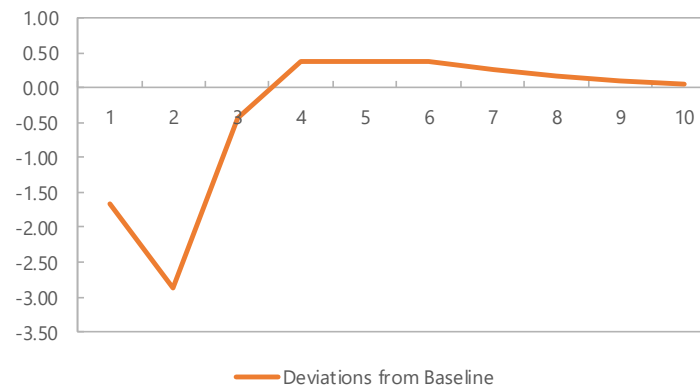
NAIRU



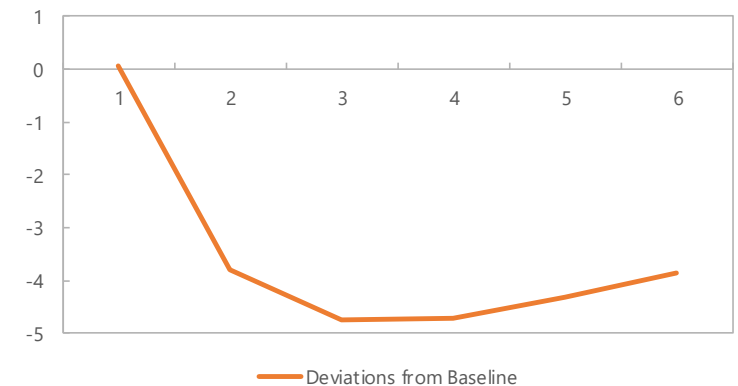
Trend TFP



Output Gap



Capital stock



Approach for scenario

- **The first step is to figure out how much of the Covid shock is driven by supply or demand components.**
- **The supply component of the Covid shock just shifts potential output temporarily.**
- **The method we propose here uses the Pandemic Impact Framework (min max approach for demand and supply shocks).**
- **We assume that most of the supply component corresponds to the output losses from government mandated lockdowns. We also assume some additional supply component depending on the country.**

Approach: Separate Severity & Timing

1. Three events defined:

- A. Baseline Shutdown (mix of supply and demand)
- B. Severe Lockdown/Shutdown (mostly supply restrictions)
- C. Post-Shutdown (mostly demand)

2. Assess impact on value added at sectoral level

3. Combine the weeks of each measure for each month

e.g.: March: 2 weeks of shutdown + 2 weeks of severe lockdown

Events Defined

- **Baseline Shutdown**

- Curtailment of economic activity, many people still go to work, some plants closed, restaurants & hotels severely impacted

- **Severe lockdown**

- Only **essential** production and services, most people at home, stay-at-home orders, more plants closed.

- **Post-shutdown**

- People worried reducing voluntarily the demand for certain goods with high contact exposure.

Each Event Quantified (A)

- For each event, define the value-added LOSS for each of the 56 sectors, giving a total **“GDP loss per instant”**
- Countries differ by their GDP structure, which matters (more car production, etc.)
- Coefficients can be country-specific or follow the “master” setup

A01	Crop and animal production, hunting and related service activities	1
A02	Forestry and logging	1
A03	Fishing and aquaculture	1
B	Mining and quarrying	0.75
C10-C12	Manufacture of food products, beverages and tobacco products	0.75
C13-C15	Manufacture of textiles, wearing apparel and leather products	0.75
C16	Manufacture of wood and of products of wood and cork, except paper	0.75
C17	Manufacture of paper and paper products	0.75
C18	Printing and reproduction of recorded media	1
C19	Manufacture of coke and refined petroleum products	0.75
C20	Manufacture of chemicals and chemical products	0.75
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	1.2
C22	Manufacture of rubber and plastic products	0.75
C23	Manufacture of other non-metallic mineral products	0.75
C24	Manufacture of basic metals	0.75
C25	Manufacture of fabricated metal products, except machinery and equipment	0.75
C26	Manufacture of computer, electronic and optical products	0.75
C27	Manufacture of electrical equipment	0.75
C28	Manufacture of machinery and equipment n.e.c.	0.75
C29	Manufacture of motor vehicles, trailers and semi-trailers	0.3
C30	Manufacture of other transport equipment	0.3
C31_C32	Manufacture of furniture; other manufacturing	0.3
C33	Repair and installation of machinery and equipment	0.8
D35	Electricity, gas, steam and air conditioning supply	1
E36	Water collection, treatment and supply	1
E37-E39	Sewerage; waste collection, treatment and disposal activities	1.1
F	Construction	0.5
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles	0.3
G46	Wholesale trade, except of motor vehicles and motorcycles	0.75
G47	Retail trade, except of motor vehicles and motorcycles	0.3
H49	Land transport and transport via pipelines	0.75
H50	Water transport	1
H51	Air transport	0.8
H52	Warehousing and support activities for transportation	0.8
H53	Postal and courier activities	1
I	Accommodation and food service activities	0.2
J58	Publishing activities	1
J59_J60	Motion picture, video and television programme production, sound recording and publishing activities	0.75
J61	Telecommunications	1
J62_J63	Computer programming, consultancy and related activities; information and communication	1
K64	Financial service activities, except insurance and pension funding	0.8
K65	Insurance, reinsurance and pension funding, except compulsory social security	1
K66	Activities auxiliary to financial services and insurance activities	1
L68	Real estate activities	0.85
M69_M70	Legal and accounting activities; activities of head offices; management consulting and activities	1
M71	Architectural and engineering activities; technical testing and analysis	0.75
M72	Scientific research and development	1
M73	Advertising and market research	0.5
M74_M75	Other professional, scientific and technical activities; veterinary activities	0.75
N	Administrative and support service activities	1
O84	Public administration and defence; compulsory social security	1.3
P85	Education	1
Q	Human health and social work activities	1.4
R_S	Other service activities	0.75
T	Activities of households as employers; undifferentiated goods and services activities	0.75
U	Activities of extraterritorial organizations and bodies	0.75

Approach: two main shocks defined

- The two main shocks (demand and “other supply”) are then aggregated in the sector and simulated over time.

HOMEGROWN EFFEC with scaling coefs																					
	RowIndex	SR	MR	V3	rho_M	2019/12	2020/1	2020/2	2020/3	2020/4	2020/5	2020/6	2020/7	2020/8	2020/9	2020/10	2020/11	2020/12	Supply side	% total	
AUS	1.0	-20.8			-33.5	0.94	0.0	0.0	0.0	-5.6	-33.5	-24.0	-15.6	0.0	0.0	0.0	0.0	0.0	0.0	-6.6	0.6
BRA	5.0	-18.0			-38.6	0.94	0.0	0.0	0.0	-4.5	-33.5	-25.9	-6.8	-6.4	-6.0	-5.7	-5.4	-5.1	-4.8	-8.7	0.8
CAN	6.0	-14.5			-23.2	0.94	0.0	0.0	0.0	-18.8	-23.2	-21.0	-14.5	0.0	0.0	0.0	0.0	0.0	0.0	-6.5	0.7
CHE	7.0	-12.4			-34.2	0.94	0.0	0.0	0.0	-23.3	-17.1	-1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.5	0.4
CHN	8.0	-17.0			-43.1	0.85	0.0	-5.4	-24.5	-2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.7	0.5
DEU	11.0	-15.6			-37.4	0.94	0.0	0.0	0.0	-7.8	-15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.0	0.3
ESP	13.0	-19.0			-37.5	0.94	0.0	0.0	0.0	-16.0	-37.5	-19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.0	0.6
FRA	16.0	-11.9			-30.0	0.94	0.0	0.0	0.0	-18.0	-30.0	-13.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.1	0.6
GBR	17.0	-16.3			-35.5	0.94	0.0	0.0	0.0	-9.4	-35.5	-17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.2	0.5
IDN	21.0	-23.8			-49.3	0.94	0.0	0.0	0.0	-5.9	-17.8	-17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.5	0.5
IND	22.0	-20.8			-28.8	0.94	0.0	0.0	0.0	-7.2	-28.8	-17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.5	0.5
ITA	24.0	-16.5			-37.4	0.94	0.0	0.0	-4.1	-27.0	-37.4	-27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-8.0	0.6
JPN	25.0	-7.1			-15.5	0.95	0.0	0.0	0.0	-7.1	-15.5	-11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.8	0.4
KOR	26.0	-19.1			-41.9	0.94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEX	30.0	-13.2			-32.7	0.94	0.0	0.0	0.0	-3.3	-13.2	-27.8	-5.8	-5.5	-5.2	-4.9	-4.6	-4.3	-4.1	-6.6	0.7
RUS	37.0	-19.3			-32.4	0.94	0.0	0.0	0.0	-3.2	-32.4	-25.8	-19.3	-9.6	0.0	0.0	0.0	0.0	0.0	-7.5	0.7
TUR	41.0	-22.7			-36.9	0.94	0.0	0.0	0.0	0.0	-33.3	-29.8	-11.3	0.0	0.0	0.0	0.0	0.0	0.0	-6.2	0.6
TWN	42.0	-19.5			-44.3	0.94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA	43.0	-10.5			-30.1	0.94	0.0	0.0	0.0	-5.2	-30.1	-20.3	-7.8	0.0	0.0	0.0	0.0	0.0	0.0	-5.3	0.6
ROW	44.0	-18.8			-44.1	0.94	0.0	0.0	0.0	-31.4	-31.4	-4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.6	0.6
THA	46.0	-17.5			-40.7	0.95	0.0	0.0	0.0	-4.4	-17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.8	0.3
ARG	50.0	-16.8			-39.1	0.94	0.0	0.0	0.0	-15.6	-39.1	-23.5	-4.2	-4.0	-3.7	-3.5	-3.3	-3.1	-3.0	-8.6	0.8
CHL	51.0	-16.9			-40.3	0.94	0.0	0.0	0.0	0.0	-28.6	-28.6	-4.2	-4.0	-3.8	-3.5	-3.3	-3.2	-3.0	-6.8	0.8
COL	52.0	-18.5			-39.3	0.94	0.0	0.0	0.0	-9.3	-39.3	-24.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	0.6
PER	53.0	-20.6			-47.2	0.94	0.0	0.0	0.0	-23.6	-47.2	-22.1	-2.6	-1.9	-1.8	-1.7	-1.6	-1.5	-1.5	-8.8	0.8
ZAF	54.0	-29.1			-8.8	0.94	0.0	0.0	0.0	-1.5	-8.8	-18.9	-29.1	-14.5	0.0	0.0	0.0	0.0	0.0	-6.1	0.6

Fiscal Policy shock. Several assumptions, mostly not affecting potential directly

- Large component of fiscal packages worldwide aimed at maintain income. These measures prevented even larger drop in consumption
- In some countries, large below-the-line measures to avoid financial crisis

Main assumptions:

- Above the line measures imputed as transfers, gov't cons., or tax measures.
- The impact of below-the-line measures is subsumed in the homegrown layer and in the “policies to lower financial stress” layer

Financial Layer: Increased Risk & Policy Actions

- Sovereign and credit spreads spiked early in the year, following the covid-19 shock.
- Historical relationships would have implied substantially larger change in risk premiums (financial accelerator).
- Several policies (direct lending by CBs, business grants, treasury loan guarantees, CBs asset purchases) have acted to mute these premiums *globally*.

Main assumptions:

- Consistently with the persistence in the home-grown layer, the change in spreads was projected forward for 2020 and 2021, assuming continued policy support
- The observed premiums thus are interpreted as the difference between a no-policy counterfactual and the **effects of policies to lower the spreads**.

Scarring layer

- The scarring layer constitutes other source of supply shocks to the economy. It includes shocks to the labor supply, capital stock (from bankruptcies) and TFP.
- We initially calibrated the shock so that the scarring after 3 years corresponds to the experiences observed in previous recessions.
- The scarring effect on potential increases over time.

The tool in practice

GOAL

- Provide platform/framework for updating potential output projections

HOW

- One excel file
- Simulations/projections: done using (impulse responses)
- User-friendly interface

TARGET: all area teams



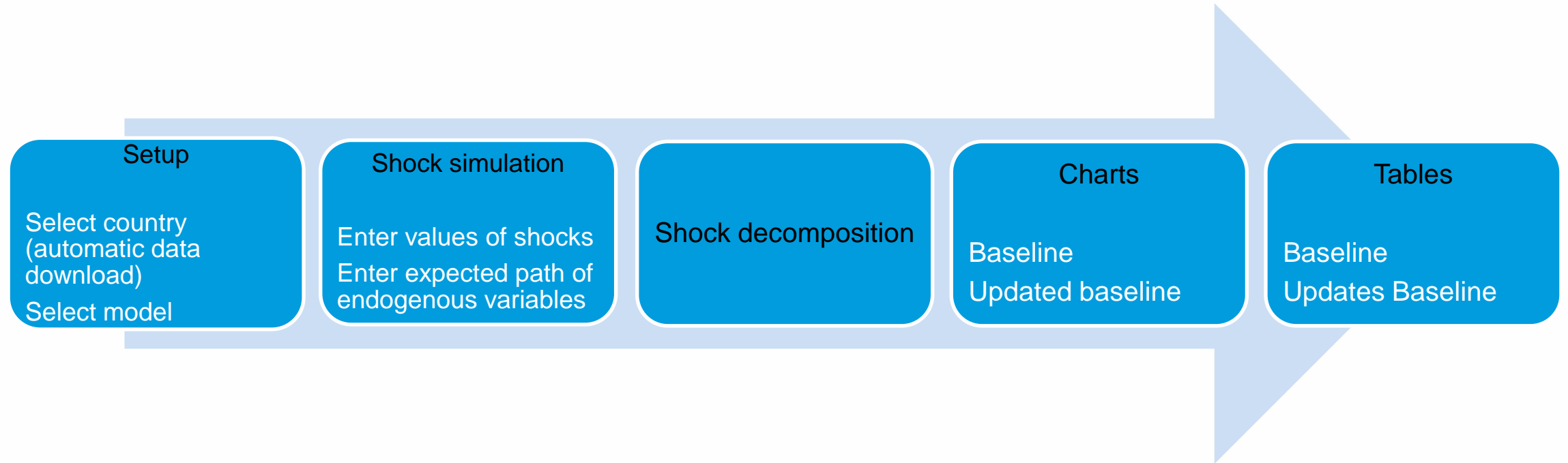
This is not about THE model...

- **Any model can be used in the framework;** but we use FSGM as the model in the background.

This is about...

- **The user-friendly framework for making consistent projections.** Calculations done in the background (VBA)

What does the file do



How is it used in practice?

- The size of the relative shocks is chosen by a desk economist in the SIM_DESIGN sheet.
- There they can choose the shock size and decomposition for each country.
- Below is an example of one shock decomposition

Shock Name	(Variable Name)	1	2	3	4	5	6	7	8	9	10
Demand shock impact in potential through in		-9.3									
Demand shock ARG		-11.1									
Demand shock AUS		-11.1									
Demand shock BRA		-10.8									
Demand shock CAN		-9.6									
Demand shock CHN		-6.3									
Demand shock DEU		-7.7									
Demand shock FRA		-8.3									
Demand shock IND		-8.7									
Demand shock IDN		-6.9									
Demand shock ITA		-12.4									
Demand shock JPN		-6.4									
Demand shock KOR		-3.8									
Demand shock MEX		-9.1									
Demand shock RUS		-8.3									
Demand shock SAU		-10.1									
Demand shock ZAF		-10.1									
Demand shock ESP		-11.1									
Demand shock TUR		-10.9									
Demand shock GBR		-9.9									
Fiscal shock		5.8									
Global Financial shock		1.0									
NAIRU		0.5	0.5								
trend TFP1		-0.1	-0.3	-0.1	-0.1						
Capital shock		1.0									
Other supply		-5.3	-0.9	-0.5	-0.3						

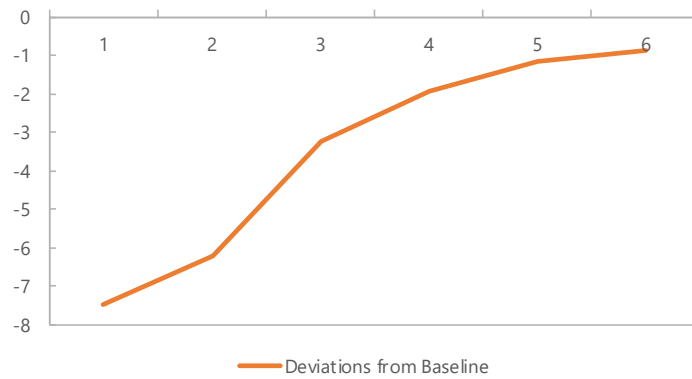
Results are presented for many variables

- After “running the model”, the results of simulations are available for dozen of variables in a table and charts formats.
- All results are presented as level percent deviations from your baseline. So, it is important that the baseline correctly reflected country conditions. We use the Dec 2019 WEO update as our baseline

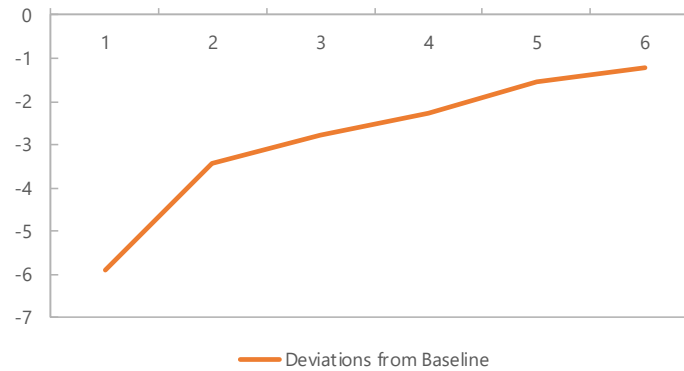
Variable Name	1	2	3	4	5	6	7	8	9	10
GDP_R_USA	-7.5	-6.2	-3.2	-1.9	-1.2	-0.9	-0.8	-0.7	-0.7	-0.6
GDP_FE_USA	-5.9	-3.4	-2.8	-2.3	-1.5	-1.2	-1.0	-0.9	-0.8	-0.7
UNR_FE_USA	0.5	0.8	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
K_USA	0.1	-3.8	-4.7	-4.7	-4.3	-3.9	-3.4	-3.1	-2.8	-2.5
TFP_FE_USA	-0.2	-1.0	-0.9	-0.6	-0.3	-0.1	0.0	0.0	0.0	0.0

Presentation of some results

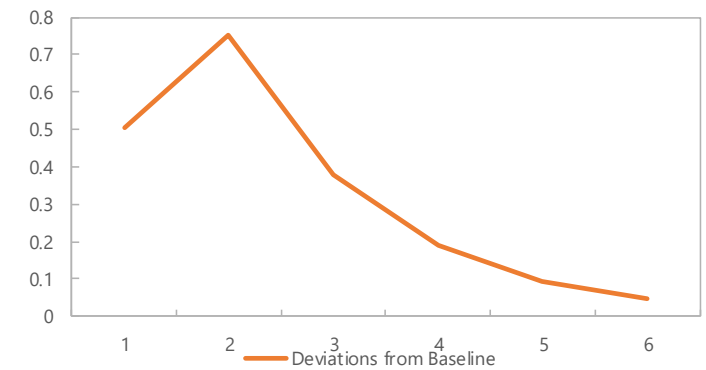
Real GDP



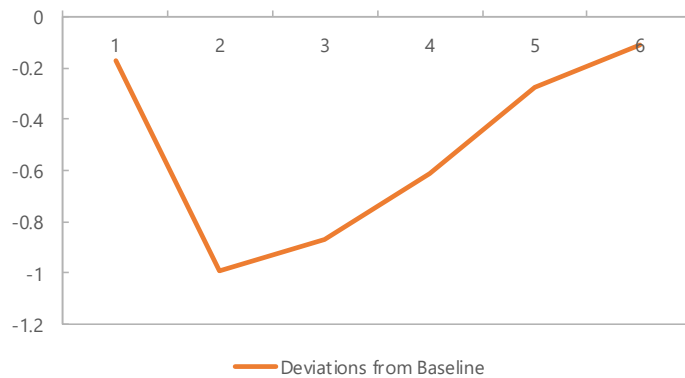
Potential output



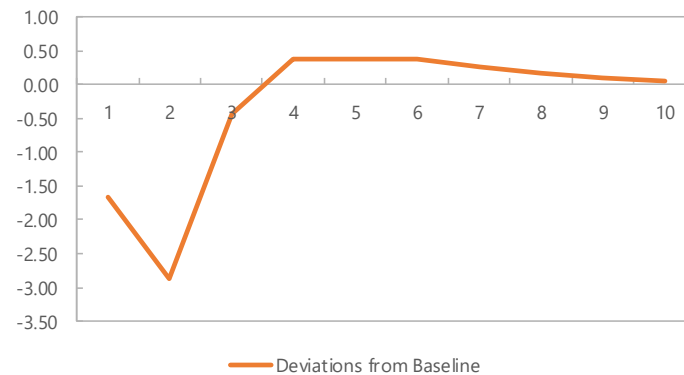
NAIRU



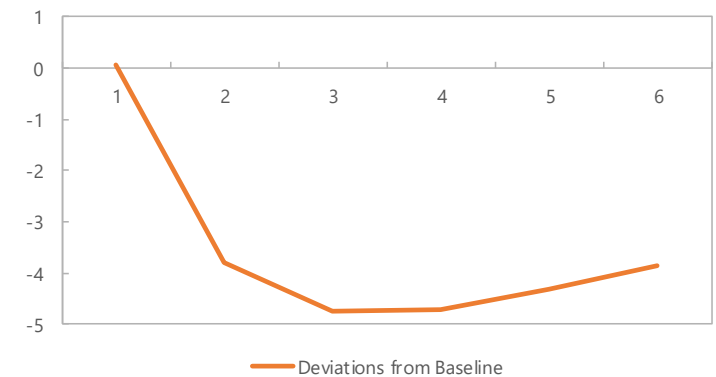
Trend TFP



Output Gap

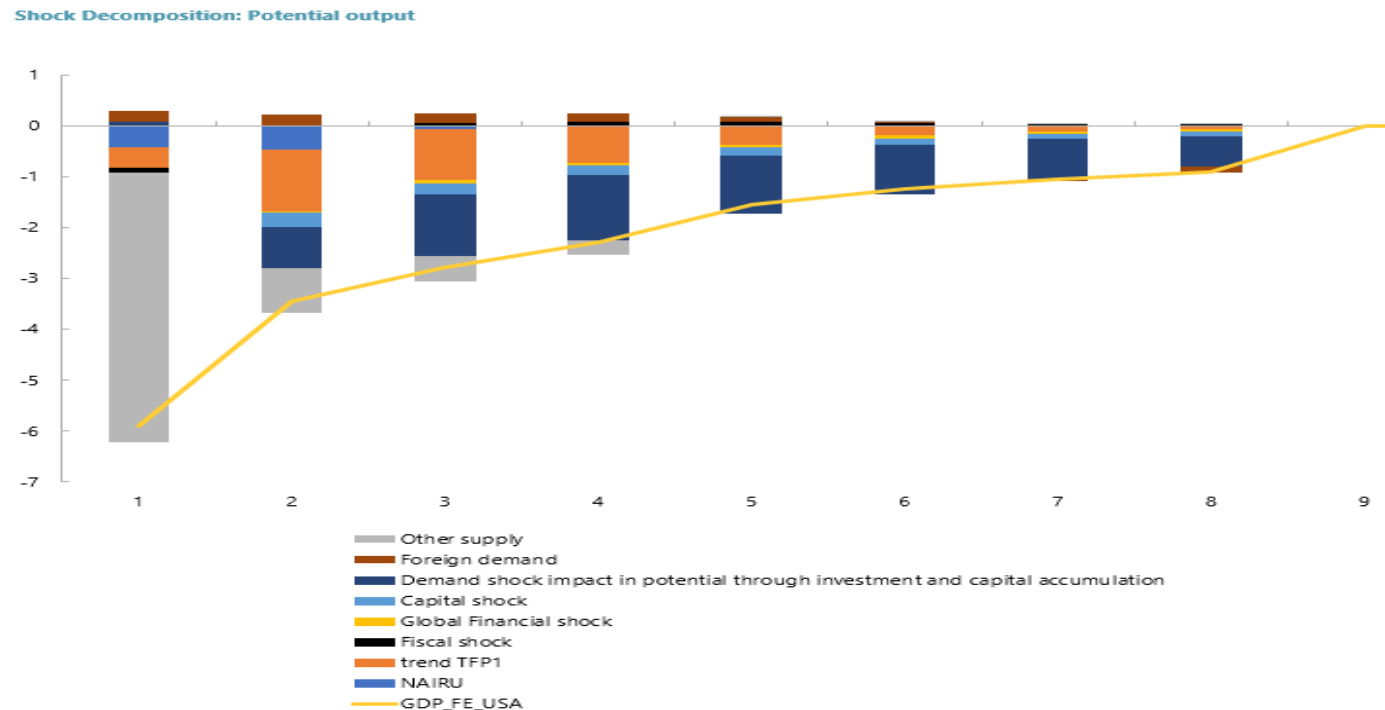


Capital stock



The combined shocks result in a shock decomposition to all variables

- Of particular interest, we show the decomposition to potential output.



Issues?

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