Open Economy Model

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Introduction

$$X_t = AX_{t-1} + \epsilon_t$$

We have model (A).

We have initial condition (X_0).

What do we get when we run a simulation into future? More or less smooth convergence to steady-state. That's not a forecast, because it doesn't incorporate all available information.

We can (need to) add shocks that will add dynamics. The shocks represent all future expected events that will meaningfully impact macroeconomic variables - tax increases, commodity price changes, fiscal policy, ...

Because QPM is reduced-form model, often one real life event is represented by a combination of several shocks.

But: shocks are exogenous to the model, so the model cannot help us choose the right shocks and the right size of the shocks.

Out of Model Calculations

Model doesn't tell us the size of the shocks. Often we have to do calculations outside of the model. Takes usually (far) more time than the work with model itself.

Example: Biden stimulus package, analysis by the Global Projection Model Network

American Rescue Plan Act (ARPA) multipliers

- ARP Act includes large number of various policies. For our analysis we used **a simplified version**, where we group some of these policies into larger categories, to which we then assign fiscal multipliers.
- Sizes of multipliers are always subject to large uncertainty and can have wide ranges for some categories. Given the research studies we went over, we think that multipliers used in this analysis are somewhere below mean multipliers.
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- The categories are as follows:

❑ **Direct transfers for households**
- ($465bn) to provide individual rebates (stimulus checks or Economic Impact Payments) to households.
  - Even though individual rebates tend to have relatively low multipliers, Senate's changes to the package made the transfers more targeted, which should lower the chance that households will save received money.

❑ **State/local funding**
- ($350bn) to support state and local funding and ($170bn) reopening of schools

❑ **Unemployment benefits**
- ($350bn) to extend and increase unemployment checks
  - Unemployment benefits are targeted and focused to specific category of those with liquidity constraints, which should make the spending effect high.

❑ **Healthcare funding**
- ($160bn) to provide for a vaccination program

❑ **Child tax credit (CTC)**
- ($120bn) to expand child tax credit (mostly for low and middle income households)

❑ **Other policies**
- ($250bn) to use for a combination of other policies

- Our resulting overall average multiplier for ARP Act is 0.8.
- *Of course, super-precise version would be to have multipliers for each policy and also have different size of multipliers per year as they have tendency to decay over time. But we are simplifying in these aspects.*

ARPA multipliers per category

- **Direct transfers for households**
  - 0.9
- **State/local funding**
  - 0.8
- **Unemployment benefits**
  - 0.9
- **Healthcare funding**
  - 0.6
- **Child tax credit**
  - 0.9
- **Other policies**
  - 0.5

These multipliers are not estimated! We inspired by various studies, which investigated multipliers for the US economy more closely, found similar categories of policies with ARP Act and imposed judgement on size of resulting multiplier used for purposes of our analysis.

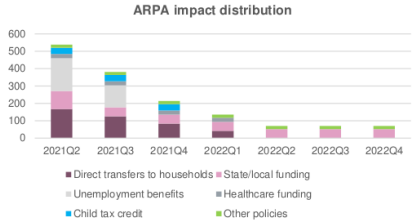
American Rescue Plan Act (ARPA) impact on demand

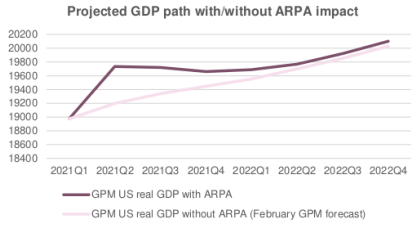
- **Simplified calculation** of ARPA impact would go as follows:

STEP 1.
- Multiplying each category of ARP Act by assigned multiplier results in roughly $1500bn impact on US demand

STEP 2.
- Based on our "timing analysis" we redistribute impact for each category on 2Y horizon per quarter.

STEP 3.
- In each quarter we add expected ARPA impact on top of our projected GDP path from February forecast.





American Rescue Plan Act (ARPA) impact on potential

- Let's have a look if ARP Act has some policies, which could affect potential output. Is there something:
- **in education?**
  - The ARP Act has roughly $170bn allocated for "education" category, but the largest part of this money aims at re-opening of school, which have been closed due to pandemic. That means improving ventilations, reducing class sized (due to social distancing), purchase of protective equipment etc.
  - Few millions devoted to training programs, especially in healthcare.
- **for investment in infrastructure or transport?**
  - There are few billions in this category but its primary purpose of use is to help airlines and public transport agencies handle that enormous fall in ridership due to drop in movement related to lockdowns and prevent furloughs.
- **in R&D?**
  - There is (less than $10bn) devoted to research and development of vaccines.
- **to affect labor supply?**
  - There are some child-care benefits, health-insurance subsidies and (emergency) paid leaves (for over 100 millions of people).
- Some of the policies will effect supply-side of the economy, however, **ARPA's impact on demand is absolutely prevailing.**

Level or growth shock?

ARPA includes policies, which could affect potential output. Are we talking growth or level shock?

- ❑ Investment into vaccination development could represent a type of technological (R&D) innovation, which could accelerate growth of potential.
- ❑ Policies that may affect level of potential output, are those, which aim to:
  - ❖ Provide financial incentives to work and protect the most vulnerable group from being excluded from labor force for a long time
  - ❖ Promote wage moderation and aim at reducing nominal wage rigidities (to reduce structural unemployment and boost competitiveness)
  - ❖ Assist with labor market transitions via training or job-search assistance (to smoothen the adjustment and reallocation of resources in the economy)
  - ❖ Invest in physical capital e.g. infrastructure
  - ❖ ➔ *elements of these policies are in the ARPA*

American Rescue Plan Act (ARPA) in GPM model – US economy

- ***ARPA impact will be implemented in GPM forecast in a following way:***

1. We estimated that ARPA will increase US GDP growth by around 1.5pp in 2021 (via demand effect)
   - Around 2/3 of this effect will be cumulated in 2021
2. Additionally, US output gap (as estimated by GPM Team) is around -3% in 2020Q4 and -2.4% in 2021Q1 (almost in line with the CBO calculations presented in their February 2021 report)
3. ➔ under these assumptions we assign distribution of US demand shocks between 2021-2022
   - We will differentiate between country-specific (SHK_L_GDP_GAP) and spillover (SHK_YY) shocks - This is judgement-based decision (no specific calculations to decide this)
4. Additionally, some policies are expected to have positive impact on potential output as well. We use combination of level and growth shocks (SHK_L_GDP_BAR and SHK_G_GDP_BAR)
   - This is again judgement-based decision (we do not have model to assess impact from these policies)
5. We do not expect the FED to increase funds rate in 2021. 2022-2023 are more difficult years to assess as we do not know how much and for how long the FED will allow inflation to overshoot the target in order to meet the "to achieve inflation that averages 2 percent over time" goal. Let's wait for March FED meeting for some hints. Or we can inspire by current US yield curve, which implies 2Y yield at 0.15% and 3Y at 0.35%.
6. **However, this is only US economy --- we will expand this scenario by additional assumptions (e.g. reaction of other central banks, commodity markets etc.)**

Tunes / Expert Judgment

Tunes are shocks we impose on the forecast. Also called expert judgment.

Consider model:

$$X_t = 0.5X_{t-1} + (1-0.5)X_{ss} + \epsilon_t^1 + \epsilon_t^2$$

where $X_{ss} = 1$, $X_0 = 1$.

Soft Tunes

Simply set value of the shock directly.

$\epsilon_1^1 = 1,\ \epsilon_1^2 = 0$

$$X_1 = 0.5 \cdot 1 + (1 - 0.5) \cdot 1 + 1 + 0 = 2$$

We know the size of the shock, but we don't know what the resulting value of the variable will be.

Hard Tunes

We set the value of a variable and ask Matlab/IRIS to calculate shock consistent with that value. We need to specify which shock will explain the tune. Let's say we choose ϵ^2.

$X_1 = 0.75 => \epsilon_1^2 = ?$

Because $\epsilon_1^1 = 0$ => $\epsilon_1^2 = -0.25$.

Consider e.g. expected increase in policy rate. We know that policy rate will go up by 50 bp. We could calculate the shock needed to give us precisely the value, but it's pain. Hard tuning the policy rate is much easier.

Note that choice of the shock matters. Policy rate can go up because of:

- policy error (policy shock)
- expected inflation increase (inflation shock)
- expected tightening in foreign economy (foreign rate shock)
- ...

External Assumptions

There are variables in the model related to the foreign economy: foreign output gap, foreign interest rate, oil price, food price, ... We will impose values for these variables over the forecast horizon as hard tunes. Our model is not supposed to forecast the foreign variables.

We need to get forecast for these variables from a reliable source. The GPMN, Consensus Forecast, Bloomberg Consensus, ...