The impacts of covid-19 on Indonesian poverty and unemployment

Bahri, Muhamad[1]

Abstract

This study estimates the negative impacts of the COVID-19 on poverty and unemployment in Indonesia. In doing so, this study develops and uses the SD model that reproduced similar patterns in terms of GDP, poverty, and unemployment. Estimated unemployment and estimated poverty under the COVID-19 are calculated for three different economic scenarios: the optimistic, the mid, and the pessimistic scenarios. This study concludes that Indonesia will experience rising unemployment and poverty in ranges (9-10) and (25-26) million people respectively by the end of this year – depending on projected economy growths. This study suggests that existing financial aids are sufficient to support rising unemployment and rising poverty level. However, if the Indonesia government cannot carefully slow the COVID-19 flow, higher financial supports are required to curb the negative impacts of the COVID-19.

Keywords: COVID-19, Indonesia, socioeconomic impacts, unemployment, poverty, coronavirus impacts

[1] The Graduate Programme of Development Studies (Jurusan Pascasarjana Studi Pembangunan)
Bandung Institute of Technology
Jl Ganesha 10, Bandung, West Java, Indonesia
Email: databahri@yahoo.com

Introduction

The COVID-19 has affected almost all countries in all continents across the world. Despite low fatality rates, the negative impacts have reached large-scale socioeconomic impacts such as low employment and possible economic recessions. In reality, regardless of country income, all countries have struggled to escape from the COVID-19 impacts. Recently, despite lower infection rates upon preparedness of more open social and economic activities, the possible second waves have shadowed policymakers. Although some countries have slowed the COVID-19 flow, those affected countries have struggled to curb the negative impacts of the COVID-19.

As one of the emerging markets, Indonesia has attempted to properly handle the pandemic through some policies such as the social restriction policy, restricted travels, and relaxed policies relate to taxes and consumer credits. However, Indonesia has still struggled to sustain its positive economic growths.

Statistics show that the COVID-19 cases were firstly identified on March 1st, 2020 after two female Indonesians returned from the International dance festival (Wijaya, 2020; https://covid19.go.id). Following the first two identified cases, the Indonesian COVID-19 cases have increased rapidly, despite the social distancing policy. Up to date, there are about 50,000 cases, 2,000 recoveries, and 3,000 fatalities due to the COVID-19 (https://covid19.go.id).

The dynamics, the possible impacts, and the government responses relate to the COVID-19 have attracted Indonesian scholars to investigate several issues. Some studies (Muhyiddin, 2020; Nurhalimah, 2020) discussed the impacts of the pandemic on social, economic, and education aspects respectively. Other studies (Almuttaqi, 2020; Djalante et al., 2020; Kumala, 2020; Saleh & Mujahiddin, 2020) explained the government and people's responses on the COVID-19. Few studies (Anawar & Sukardi, 2020; Setyawan & Lestari, 2020) focused on possible impacts of policies in eradicating the pandemic spread and correlations between weather and the COVID-19 (Tosepu et al., 2010).

Despite beneficial findings of those studies, there is no available study in investigating the impacts of the COVID-19 on employment, and poverty. Some studies noticed the impacts of the pandemic on unemployment and economic growth (Boissay et al., 2020; Caracciolo et al., 2020; Fornaro, & Wolf, 2020; Gumede et al., 2020; Loayza, & Pennings, 2020; McKibbin, & Fernando, 2020). Even, the IMF itself has offered financial support to affected countries in minimizing the negative impacts (https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#I). The IMF has also provided a link - explaining possible policies tackling the negative impacts in affected countries (https://www.imf.org/en/Topics/imf-and-covid19/COVID-Lending-Tracker#APD). The aforementioned studies enhance our awareness of understanding the negative impacts of the COVID-19 on socioeconomic factors, especially on employment and poverty. This study aims to fill this gap, focusing the negative impacts of the COVID-19 on unemployment and poverty in Indonesia.

Data and Methods

Socioeconomic data were collected from the Indonesian statistics bureau (www.bps.go.id). For instance, Gross Domestic Product (GDP), poverty, and employment were collected in the period 2000-2019. This study uses the 2000 constant price's GDPs which are also available in the BPS website. The poverty definition used in this study follows the BPS definition, stating that disadvantaged people who cannot fulfill their daily calorie intake about 2,100 per daily capita (https://www.bps.go.id/subject/23/kemiskinan-dan-ketimpangan.html).

To estimate the impacts of the COVID-19 on poverty and unemployment, this study assumes that the economic downturn starts from reduced consumption. This study takes this way as Indonesia GDP has been mainly dominated by consumption about 61% of the total GDP (BPS, 2018; Soemartini, 2007; Wiranthi, 2014). So when the Indonesian economy is under pressure, consumption is expected to experience a significant loss (Suryahadi et al., 2020).

The application of the system dynamics (SD) approach has been applied in some subjects such as macro economy and health issues (Sterman, 2001). Furthermore, Sterman (1991) affirmed that one benefit of the SD approach is enabling policymakers to solve critically complex issues through the system-thinking concept. The concept captures important features such as stock-flow, time delays, non-linearity, and feedback – which are also underlying features of the real world. Owing to this, this study applies the SD approach in understanding the impacts of the COVID-19 on poverty and unemployment in Indonesia.

Discussion and results

The Indonesia economy

Indonesia has experienced significant economic growths since the Asian monetary crisis of 1998. Since an economic contraction about 13% in 1998, Indonesia has experienced promising economic growths about 5-7 % per year as seen in figure 1. Consumption has dominated Indonesian Gross Domestic Product (GDP) about 60% of the total GDP (Bahri, 2008, BPS, 2018). Owing to dominance of household consumption, Indonesia has still led a positive economic growth during the economic crisis of 2008.
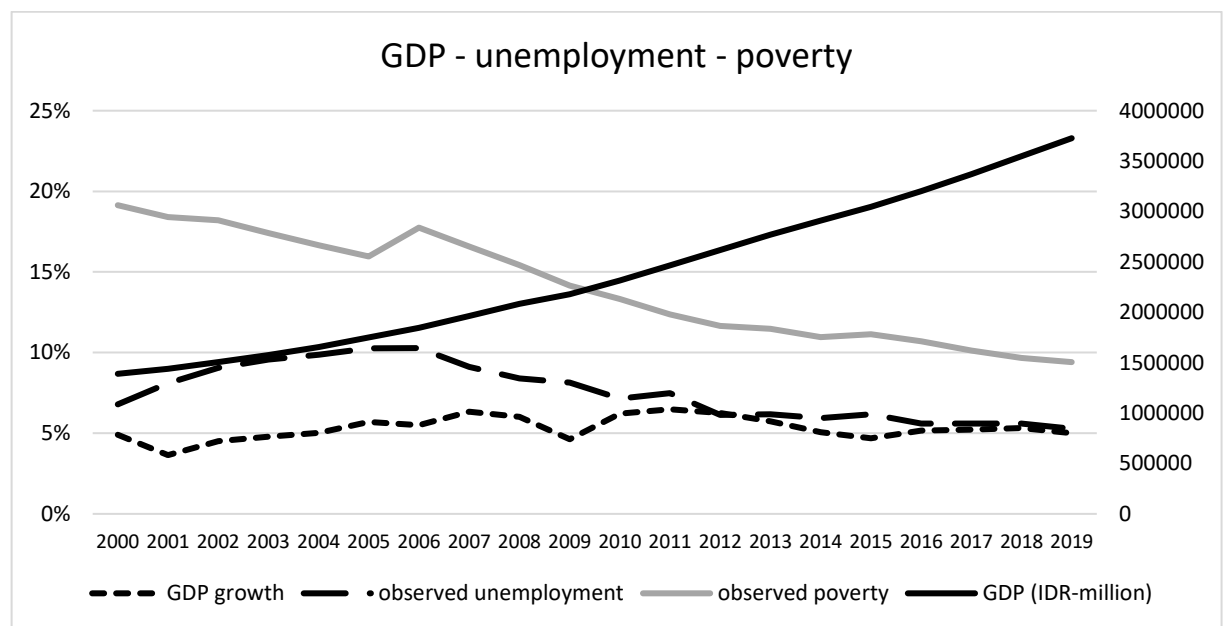
Figure 1. Indonesian GDP – unemployment and poverty (2000-2019)

Some studies (Suryahadi et al., 2006; Van Leeuwen, & Földvári, 2016; Yusuf, & Sumner, 2017) confirmed the positive impacts of Indonesian economic growth on poverty reduction. It was found that every 1 percent economic growth has led to 0.5 percent of poverty reduction in Indonesia. As seen in figure 1, the number of poor has reduced subject to positive economic growths.

System Dynamics Model

The system dynamics model was derived from other studies (Bahri, 2008; Forrester, 1985). In understanding the Indonesian macroeconomic model, the SD model is separated into three sub-models as seen in figures 2-4. The first sub-model is the potential output (PTY) and output (Y or GDP) sub-model that determines relationships between PTY and GDP. Please note that the model documentation is available in appendix A.
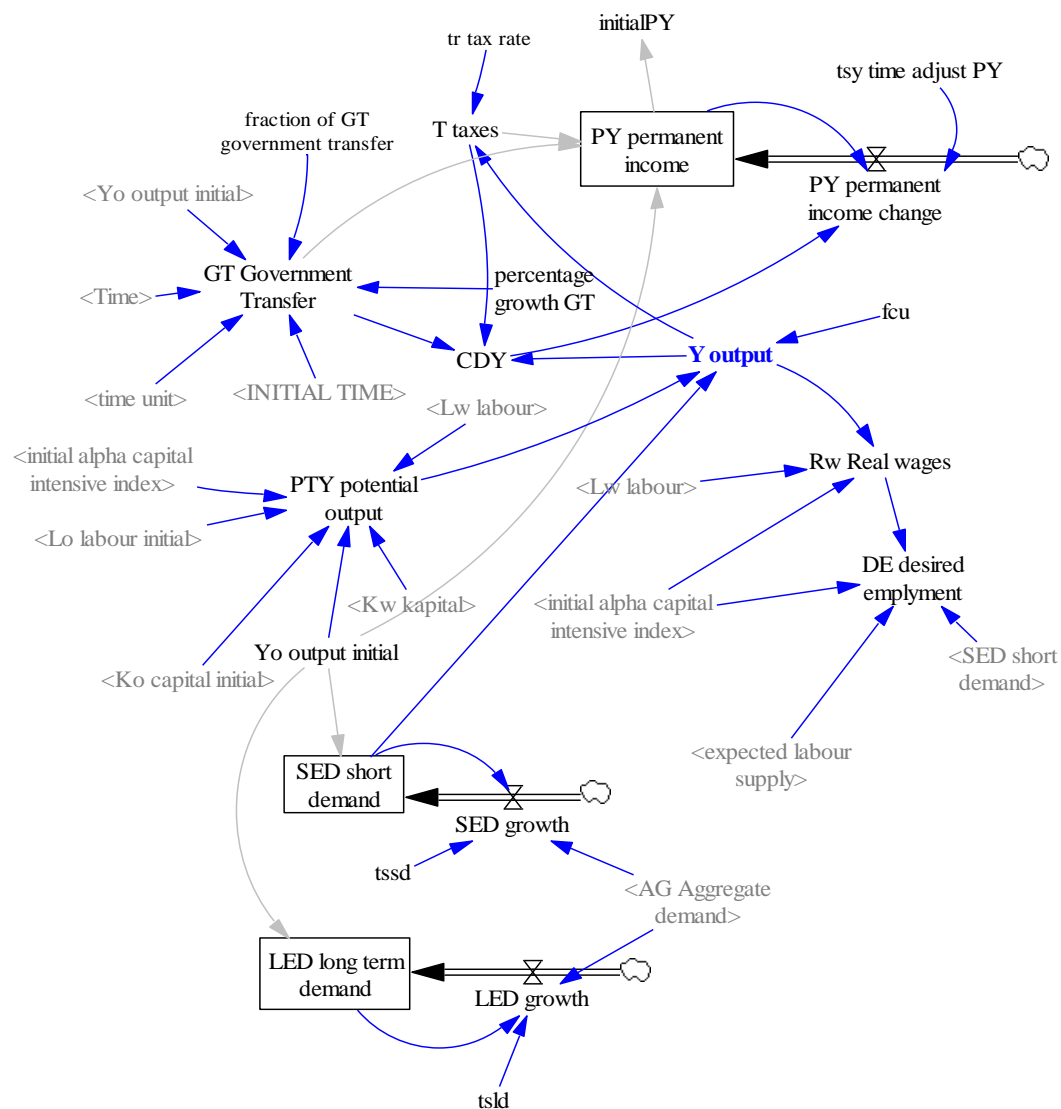
Figure 2. The sub-model of the potential output (PTY) and output (Y = GDP)

The second sub-model is called the capital and labor (CL) sub-model that describes relationships between population, labor, and capital. In this sub-model, a relationship between GDP, poverty, and employment is defined based on historical data. The last sub-model is called the Aggregate Demand (AG) sub-model, explaining relationships between GDP, AG, and poverty level.
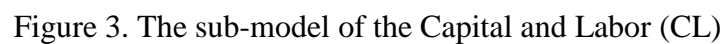
Figure 3. The sub-model of the Capital and Labor (CL)
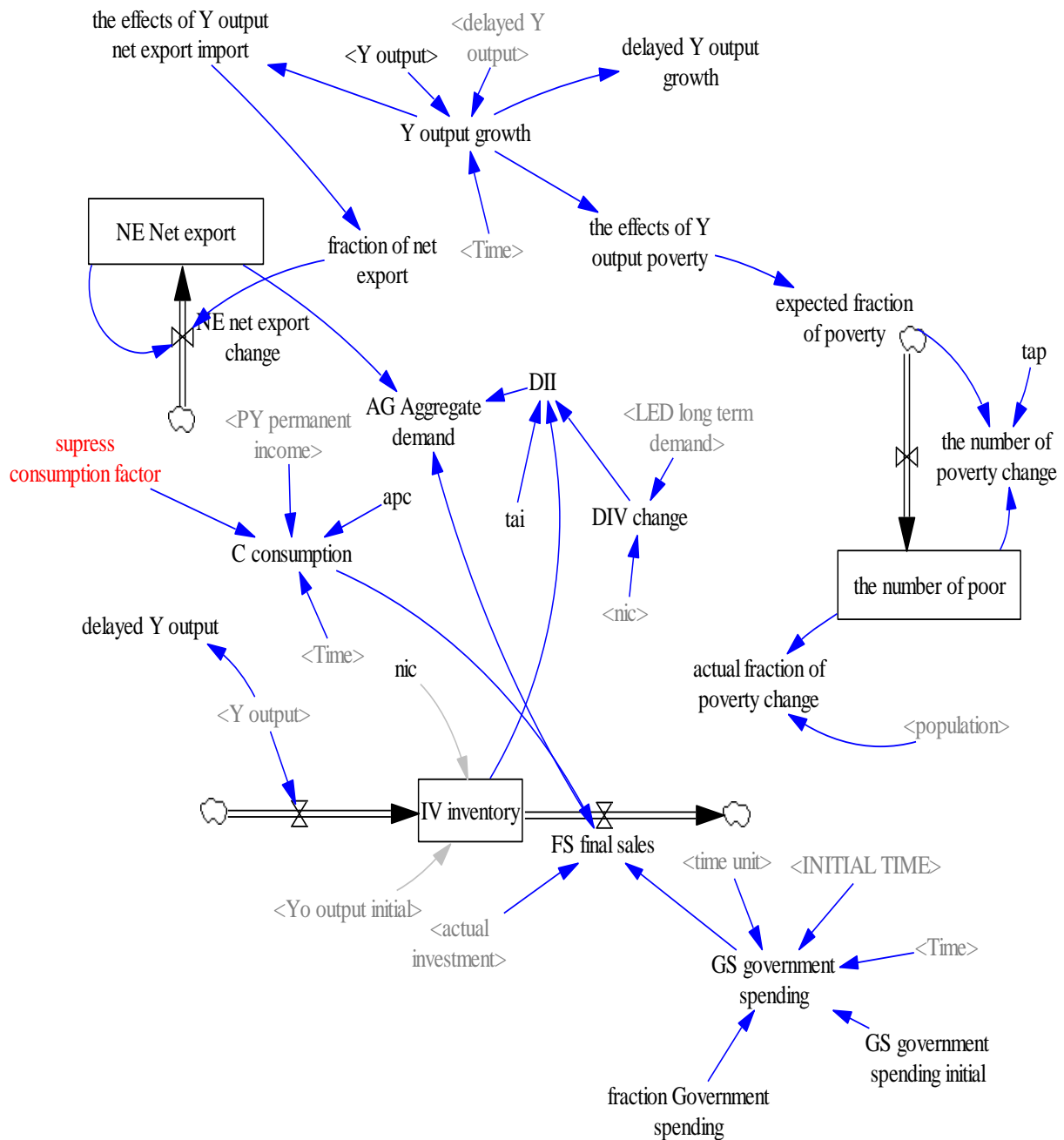
Figure 4. The sub-model of the Aggregate Demand (AG)

The model performance in estimating observed GDP, observed poverty, and observed employment can be seen in figures 5-7. Figures 5-7 show that the SD model can reproduce similar observed GDP and observed poverty. For unemployment, the SD model can reproduce similar unemployment patterns in the last decade (2010-2019). As seen in table 1, MAPEs of the SD model are less than 20% which mean the SD model can predict the observed system relatively accurate (Hanke et al., 2001; Hoshmand, 2009).
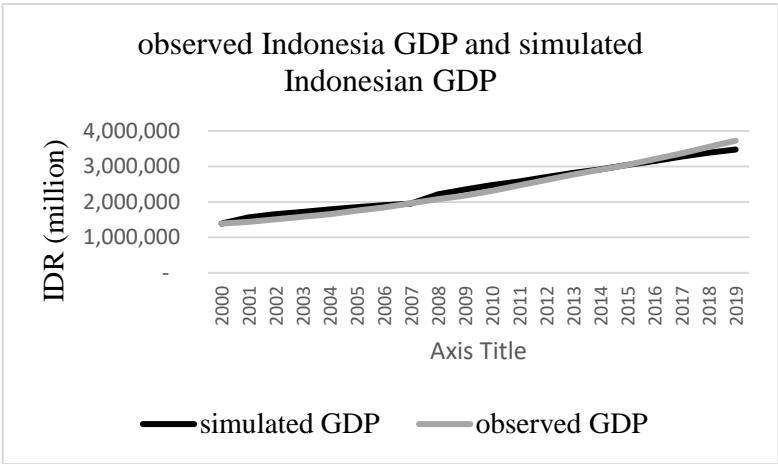
Figure 5. Simulated and observed GDP in Indonesia
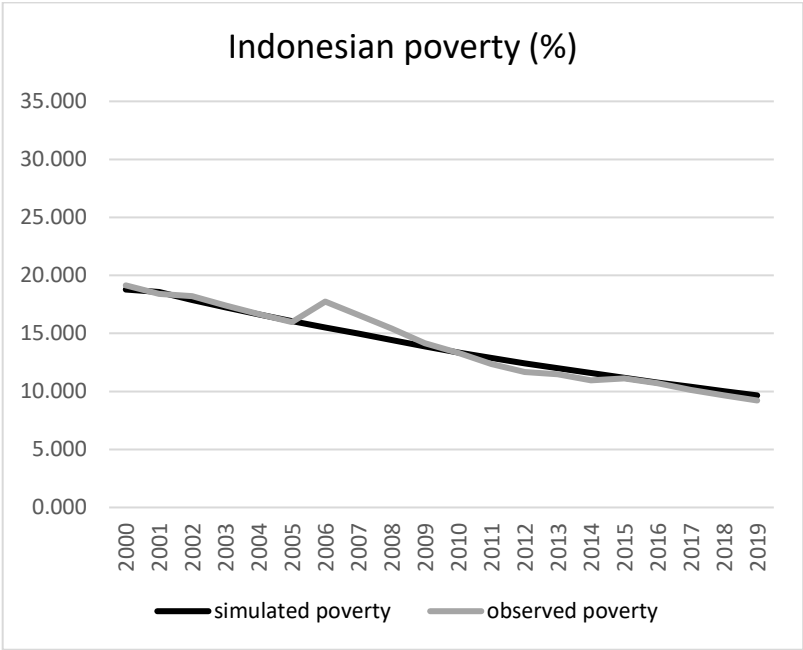
Figure 6. Simulated and observed poverty in Indonesia
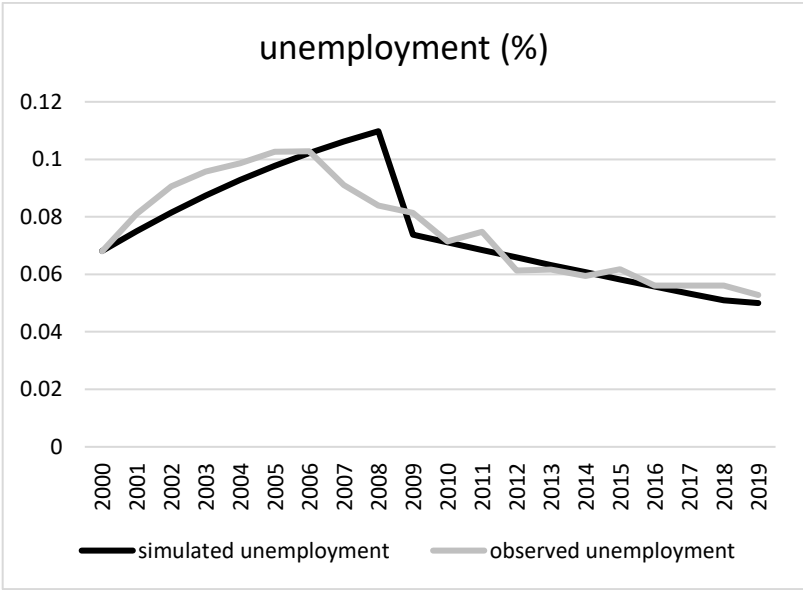
Figure 7. Simulated and observed employment in Indonesia

Figure 8. A completed stock-flow model (Please appendix A for the model documentation)
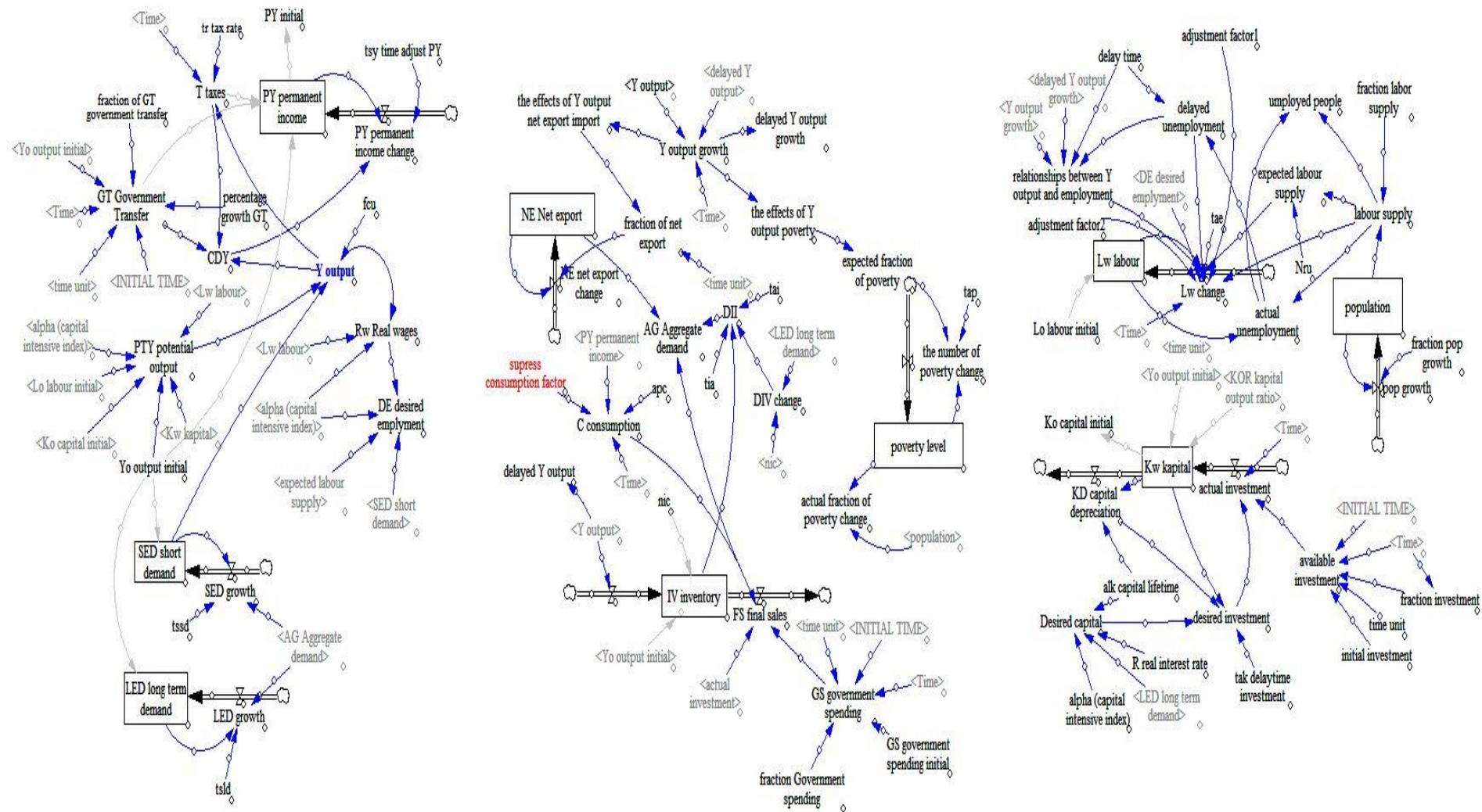
No	Variables	MAPE
1	Simulated GDP	3.5%
2	Simulated poverty level	4.5%
3	Simulated unemployment	7%

Table 1. MAPE for important variables

Estimated unemployment and poverty level

To estimate the poverty level and unemployment during the COVID-19, this study evaluates three different scenarios. The first scenario is the optimistic scenario where Indonesian economic growth will be about 2.5% by the end of this year (Wardhana et al., 2020). The second one is the mid scenario where Indonesia will experience an economic growth of about 0.5% (Wardhana et al., 2020). The last one is the pessimistic scenario in which Indonesia will experience a negative GDP growth of about -3.5% (Wardhana et al., 2020).

No	Institutions	The world	Indonesia
1	Asian Development Bank	(-2.3 – 4.8) %	2.5% (3,819,998.9)
2	IMF (https://www.imf.org/external/datamapper/ NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD)	-3%	0.5% (3,745,462.4)
3	World Bank	n.a.	(-3.5 – 2.1) % (3,596,389.2)

Table 2. Projected economic growth in 2020 (estimated GDP in IDR million)

To simulate each scenario, the SD model is embedded by a variable namely "suppress consumption factor" as seen in figure 4. This variable represents a consumption drop in 2020. Consumption is projected to decrease about 11.5%, 19%, and 33.5%. Reduced consumptions correspond with the economic growth of the first, the second, and the third scenario respectively.

As seen in figure 9, the number of poverty and unemployment tends to increase for the first, the second, and the third scenario. As expected, the number of unemployed and poverty are the highest ones in the third scenario.
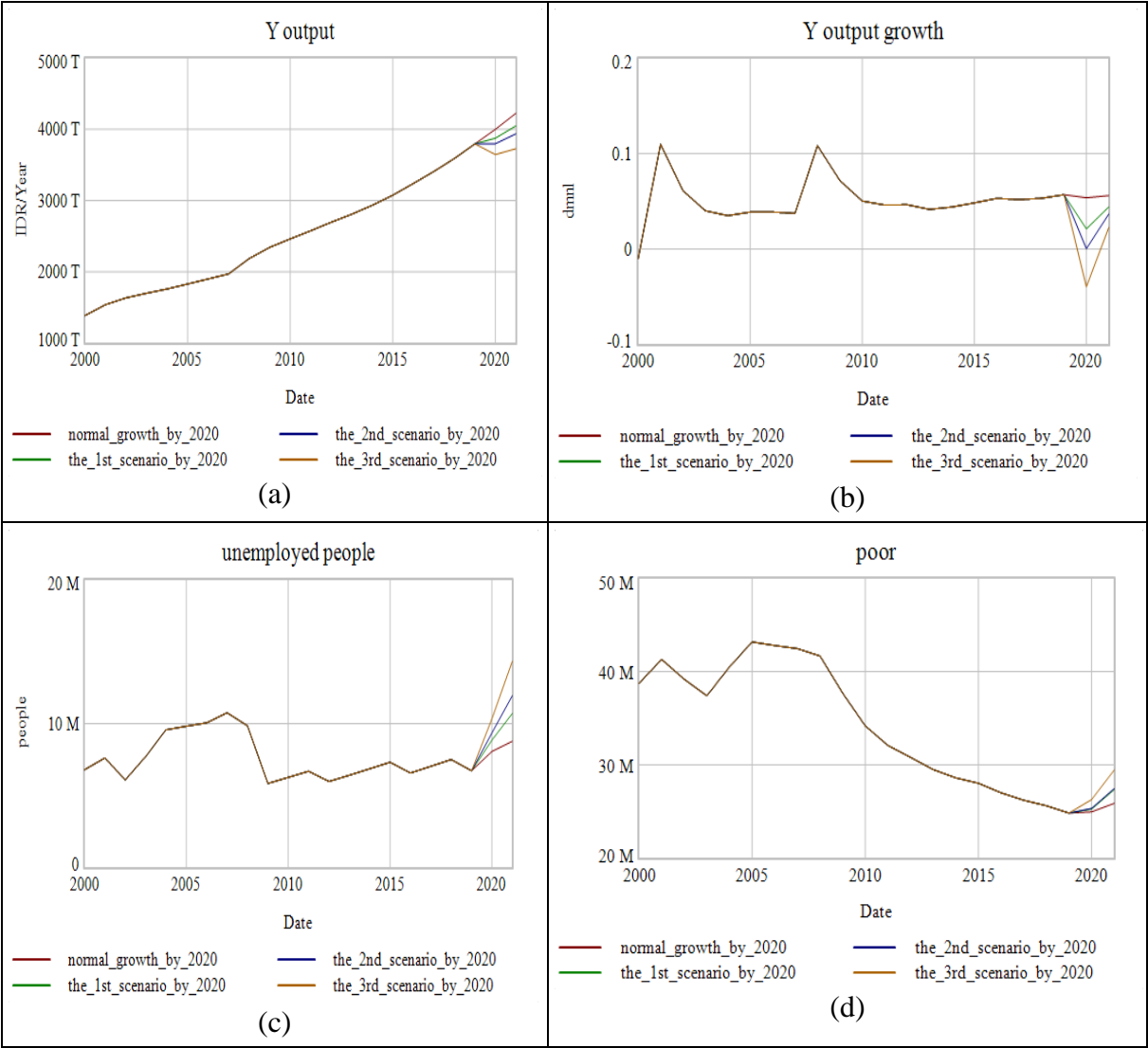
Figure 9. Comparison outputs for different scenarios by 2020

Figure 9 displays the estimated unemployment and poverty for each scenario by 2100. It is estimated that unemployment will be about 6.76% to 7.89% for the first to the third scenarios by 2100. This corresponds with 8.9 million and 10.3 million unemployed people respectively. This study also estimated rising poverty about 8.79% to 9.46% depending on the scenarios by 2100. This means that rising poverty will be about 23.75 million to 25.56 million by 2020.

Estimated unemployment and poverty by 2020
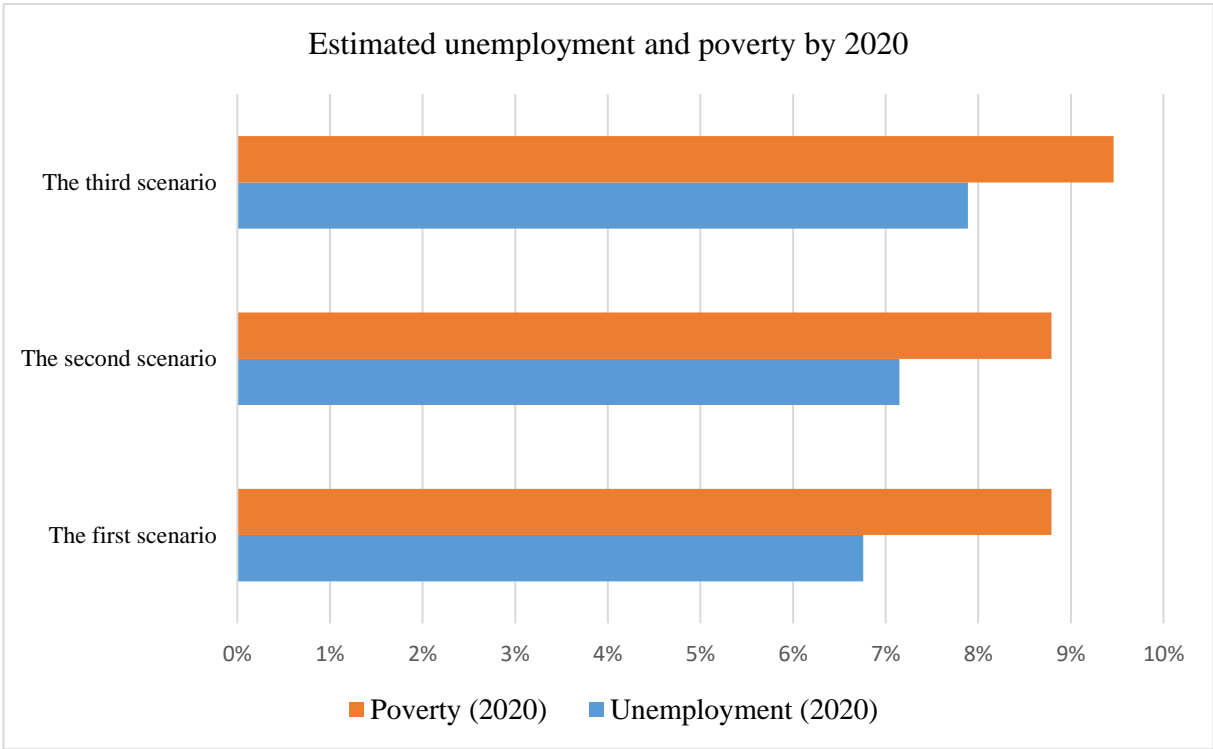
Figure 10. Estimated unemployment and poverty by 2020

The Indonesia government has provided support to rising poverty and rising unemployment under the pandemic. The proposed funding is about IDR 677.2 trillion that is about IDR 87.55 trillion to support medical facilities, and IDR 385.75 trillion to relief industries – please see table 4 for details. For the safety net, the government provides about IDR 203.9 trillion. Table 2 shows that the potential poverty level is about 25.56 million people or 5.6 million households – assuming a family size is about 4.58 people (BPS, 2019). This means that the social safety net can support affected families about IDR 700,000.monthly for three months in the worst-case scenario.

Funding support in health, economy, and social safety nets (IDR trillion)
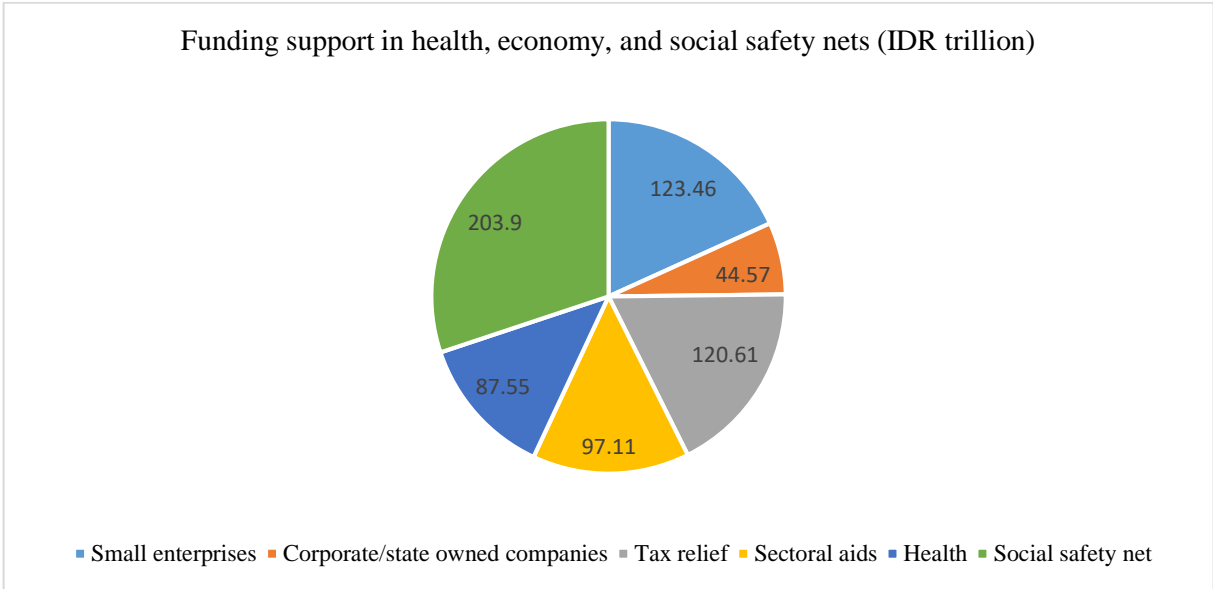
Figure 11. The government support for the Covid-19 (Kementerian Keuangan RI, 2020)

The Indonesian poverty line is about IDR 440,500/person/month or about 2 million/family/month (BPS, 2019). Assuming that a consumption drop is similar to an income loss (33.3%), the safety net of IDR 700,000 per family could relatively curb the income loss during the COVID-19 time.

As this support is only available for about 3 months, this study also suggests that the government should consider and monitor the impacts of the COVID-19 regularly to anticipate rising unemployment and rising poverty. The most importantly, the government should work together with other stakeholders to hamper the COVID-19 spread across the country.

Conclusion

This study applied the SD approach to estimate the impacts of the COVID-19 on Indonesian unemployment and poverty. The SD model can reproduce similar GPD, unemployment, and poverty in the period 2000-2019. As such, the model can be used to forecast projected unemployment and poverty owing to the COVID-19.

This study also suggests that available funding for the safety net is sufficient to support affected households for about three months. In that case, the government should monitor and handle the COVID-19 flow properly so that the society and the industries can return to their normal activities at the expected time. If the impacts of the COVID-19 is longer than expectation, the government should prepare higher financial aids to support rising unemployment and poverty level.

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Appendix A.

Documentation of macroeconomic_models_covid-19_2020
Model Assessment Results

Model Information	Number
Total Number of Variables	92
Total Number of State Variables (Level+Smooth+Delay Variables)	13 (14.1%)
Total Number of Stocks (Stocks in Level+Smooth+Delay Variables) †	15 (16.3%)
Total Number of Macros	0
Time Unit	Year
Initial Time	0
Final Time	21
Reported Time Interval	1
Time Step	0.0078125
Model Is Fully Formulated	Yes

TOP	Default		
Module	*Group*	Type	*Variable Name* and Description
Default	Control	#23 C	**FINAL TIME** (Year) = 21 **Description:** *The final time for the simulation.* **Not Present In Any View**
Default	Control	#37 C	**INITIAL TIME** (Year) = 0 **Description:** *The initial time for the simulation.* **Present in 1 view:** • View 1 **Used by:** • available investment - available investment • GS government spending - government spending • GT Government Transfer - the government transfer • Time - Internally defined simulation time.
Default	Control	#64 C	**SAVEPER** (Year [0,?]) = 1 **Description:** *The frequency with which output is stored.* **Not Present In Any View**
Default	Control	#79 C	**TIME STEP** (Year [0,?]) = 0.0078125 **Description:** *The time step for the simulation.* **Not Present In Any View**
Default	macroeconomic models covid-19 2020 (Default)	#1 C	**A TPF** (dmnl) = 1 **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#2 A	**actual fraction of poverty change** (dmnl) = the number of poor/population **Description:** *poverty percentage* **Present in 1 view:** • View 1
Default	macroeconomic models covid-19	#3 F,A	**actual investment** (IDR/Year) = IF THEN ELSE(Time>7 , (MAX(available investment,desired investment)) , available investment)

	2020 (Default)		**Description:** *actual investment* **Present in 1 view:** • View 1 **Used by:** • FS final sales - the final sales • Kw kapital - the number of capital
Default	macroeconomic models covid-19 2020 (Default)	#4 A	**actual unemployment** (dmnl) = (labour supply-Lw labour)/labour supply **Description:** *actual unemployment* **Present in 1 view:** • View 1 **Used by:** • delayed unemployment - one year lagged unemployment • umployed people - unemployed people
Default	macroeconomic models covid-19 2020 (Default)	#5 A	**AG Aggregate demand** (IDR/(Year)) = DII+FS final sales+NE Net export **Description:** *the aggregate demand* **Present in 1 view:** • View 1 **Used by:** • LED growth - changes in long expected demand • SED growth - changes in short expected demand
Default	macroeconomic models covid-19 2020 (Default)	#6 C	**alk capital lifetime** (Year) = 10 **Description:** *average capital lifetime* **Present in 1 view:** • View 1 **Used by:** • Desired capital - desired capital • KD capital depreciation - capital depreciation
Default	macroeconomic models covid-19 2020 (Default)	#7 C	**"alpha (capital intensive index)"** (dmnl) = 0.241 **Description:** *initial capital intensive index* **Present in 1 view:** • View 1

			Used by: • DE desired emplyment - desired employment • Desired capital - desired capital • PTY potential output - the potential output • Rw Real wages - real wages
Default	macroeconomic models covid-19 2020 (Default)	#8 C VAB	**apc** (dmnl) = 0.6 **Description:** *average propensity to consume* **Present in 1 view:** • View 1 **Used by:** • C consumption - household consumption
Default	macroeconomic models covid-19 2020 (Default)	#9 A VAB	**available investment** (IDR/(Year)) = initial investment*((1+fraction investment)^(Time/time unit-INITIAL TIME/time unit)) **Description:** *available investment* **Present in 1 view:** • View 1 **Used by:** • actual investment - actual investment
Default	macroeconomic models covid-19 2020 (Default)	#10 A VAB	**C consumption** (IDR/Year) = IF THEN ELSE(Time<19, apc*PY permanent income, apc*PY permanent income*(1-supress consumption factor)) **Description:** *household consumption* **Present in 1 view:** • View 1 **Used by:** • FS final sales - the final sales
Default	macroeconomic models covid-19 2020 (Default)	#11 A VAB	**CDY** (IDR/Year) = Y output-T taxes+GT Government Transfer **Description:** *Current Disposible Income* **Present in 1 view:** • View 1 **Used by:** • PY permanent income change - the permanent income changes

Default	macroeconomic models covid-19 2020 (Default)	#12 A VAB	**DE desired emplyment** (people) = MIN((SED short demand*(1-"alpha (capital intensive index)")/Rw Real wages),expected labour supply) **Description:** *desired employment* **Present in 1 view:** • View 1 **Used by:** • Lw change - changes in employment
Default	macroeconomic models covid-19 2020 (Default)	#13 DE	**delayed unemployment** = DELAY1I(actual unemployment, 1 , actual unemployment) **Description:** *one year lagged unemployment* **Present in 1 view:** • View 1 **Used by:** • Lw change - changes in employment • the actual effects of Y output employment - the effects of GDP on umployment
Default	macroeconomic models covid-19 2020 (Default)	#14 DE	**delayed Y output** (IDR/Year) = DELAY FIXED (Y output, 1, 0.049) **Description:** *delayed output (GDP) - one year lagged GDP* **Present in 1 view:** • View 1 **Used by:** • Y output growth - output Y growth - (GDP growth)
Default	macroeconomic models covid-19 2020 (Default)	#15 DE	**delayed Y output growth** (dmnl) = DELAY FIXED (Y output growth, 1 ,-0.01) **Description:** *one-year output growth - (one-year lagged GDP growth)* **Present in 1 view:** • View 1 **Used by:** • the actual effects of Y output employment - the effects of GDP on umployment
Default	macroeconomic models covid-19 2020 (Default)	#16 A VAB	**Desired capital** (IDR) = ("alpha (capital intensive index)")*LED long term demand/((1/alk capital lifetime)+R real interest rate) **Description:** *desired capital* **Present in 1 view:** • View 1 **Used by:**

|			
			• desired investment - desired investment
Default	macroeconomic models covid-19 2020 (Default)	#17 A VAB	**desired investment** (IDR/Year) = KD capital depreciation+(Desired capital-Kw kapital)/tak delaytime investment **Description:** *desired investment* **Present in 1 view:** • View 1 **Used by:** • actual investment - actual investment
Default	macroeconomic models covid-19 2020 (Default)	#18 A VAB	**DII** (IDR/Year) = MAX(DIV change,(DIV change-IV inventory)/tai) **Description:** *desired inventory investment* **Present in 1 view:** • View 1 **Used by:** • AG Aggregate demand - the aggregate demand
Default	macroeconomic models covid-19 2020 (Default)	#19 A VAB	**DIV change** (IDR) = LED long term demand*nic **Description:** *desired inventory change* **Present in 1 view:** • View 1 **Used by:** • DII - desired inventory investment
Default	macroeconomic models covid-19 2020 (Default)	#20 A VAB	**expected fraction of poverty** (dmnl) = -the effects of Y output poverty **Description:** *expected poverty level* **Present in 1 view:** • View 1 **Used by:** • the number of poverty change
Default	macroeconomic models covid-19 2020 (Default)	#21 A VAB	**expected labour supply** (people) = labour supply*(1-Nru) **Description:** *available labour supply after NRU (natural unemployment)* **Present in 1 view:** • View 1 **Used by:**

			• DE desired emplyment - desired employment • Lw change - changes in employment
Default	macroeconomic models covid-19 2020 (Default)	#22 C VAB	**fcu** (dmnl) = 0.5 **Description:** *Flexibility of Capacity Utilization* **Present in 1 view:** • View 1 **Used by:** • Y output - output Y - (GDP)
Default	macroeconomic models covid-19 2020 (Default)	#24 C VAB	**fraction Government spending** (dmnl) = 0.0847 **Description:** *fraction of government spending* **Present in 1 view:** • View 1 **Used by:** • GS government spending - government spending
Default	macroeconomic models covid-19 2020 (Default)	#25 A VAB	**fraction investment** (dmnl) = IF THEN ELSE(Time<10, 0.07 , 0.09) **Description:** *fraction of investment growth* **Present in 1 view:** • View 1 **Used by:** • available investment - available investment
Default	macroeconomic models covid-19 2020 (Default)	#26 C VAB	**fraction labor supply** (dmnl) = 0.485 **Description:** *fraction of labour supply - share of labour and population* **Present in 1 view:** • View 1 **Used by:** • labour supply
Default	macroeconomic models covid-19 2020 (Default)	#27 C VAB	**fraction of GT government transfer** (dmnl) = 0.03 **Description:** *a fraction of the government transfer* **Present in 1 view:** • View 1

			Used by: • GT Government Transfer - the government transfer
Default	macroeconomic models covid-19 2020 (Default)	#28 A VAB	**fraction of net export** (1/Year) = the effects of Y output net export import **Description:** *fraction of export-import* **Present in 1 view:** • View 1 **Used by:** • NE net export change - net export-import change
Default	macroeconomic models covid-19 2020 (Default)	#29 C VAB	**fraction pop growth** (1/Year) = 0.0135 **Description:** *fraction of population growth* **Present in 1 view:** • View 1 **Used by:** • pop growth - population change
Default	macroeconomic models covid-19 2020 (Default)	#30 F,A VAB	**FS final sales** (IDR/Year) = actual investment+C consumption+GS government spending **Description:** *the final sales* **Present in 1 view:** • View 1 **Used by:** • AG Aggregate demand - the aggregate demand • IV inventory
Default	macroeconomic models covid-19 2020 (Default)	#31 C VAB	**growth fraction** (dmnl) = 0.04 **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#32 A VAB	**GS government spending** (IDR/Year) = GS government spending initial*((1+fraction Government spending)^(Time/time unit-INITIAL TIME/time unit)) **Description:** *government spending* **Present in 1 view:** • View 1 **Used by:** • FS final sales - the final sales

Default	macroeconomic models covid-19 2020 (Default)	#33 C	**GS government spending initial** (IDR/Year) = 9.08e+13 **Description:** *initial government spending* **Present in 1 view:** • View 1 **Used by:** • GS government spending - government spending
Default	macroeconomic models covid-19 2020 (Default)	#34 LI,A	**GT Government Transfer** (IDR/Year) = IF THEN ELSE(Time>=20 ,0 , ((Yo output initial*fraction of GT government transfer)*((1+percentage growth GT)^(Time/time unit-INITIAL TIME/time unit)))) **Description:** *the government transfer* **Present in 1 view:** • View 1 **Used by:** • CDY - Current Disposible Income • PY permanent income - the permanent income
Default	macroeconomic models covid-19 2020 (Default)	#35 C	**household financial assets** (IDR) = 6.99e+14 **Present in 1 view:** • View 1 **Used by:** • permanent income from financial assets
Default	macroeconomic models covid-19 2020 (Default)	#36 C	**initial investment** (IDR/Year) = 2.759e+14 **Description:** *initial investment (2000)* **Present in 1 view:** • View 1 **Used by:** • available investment - available investment
Default	macroeconomic models covid-19 2020 (Default)	#38 L	**IV inventory** (IDR) = ∫Y output-FS final sales *dt* + [nic*Yo output initial] **Present in 1 view:** • View 1 **Used by:** • DII - desired inventory investment

Default	macroeconomic models covid-19 2020 (Default)	#39 F,A	**KD capital depreciation** (IDR/Year) = Kw kapital/alk capital lifetime **Description:** *capital depreciation* **Present in 1 view:** • View 1 **Used by:** • desired investment - desired investment • Kw kapital - the number of capital
Default	macroeconomic models covid-19 2020 (Default)	#40 I	**Ko capital initial** (IDR) = INITIAL(Kw kapital) **Description:** *initial capital* **Present in 1 view:** • View 1 **Used by:** • PTY potential output - the potential output
Default	macroeconomic models covid-19 2020 (Default)	#41 LI,C	**KOR kapital output ratio** (IDR/(IDR/Year)) = 1.45 **Present in 1 view:** • View 1 **Used by:** • Kw kapital - the number of capital
Default	macroeconomic models covid-19 2020 (Default)	#42 L	**Kw kapital** (IDR) = ∫actual investment-KD capital depreciation *dt* + [Yo output initial*KOR kapital output ratio] **Description:** *the number of capital* **Present in 1 view:** • View 1 **Used by:** • desired investment - desired investment • KD capital depreciation - capital depreciation • Ko capital initial - initial capital • PTY potential output - the potential output
Default	macroeconomic models covid-19 2020 (Default)	#43 A	**labour supply** (people) = population*fraction labor supply **Present in 1 view:** • View 1

			Used by: • actual unemployment - actual unemployment • expected labour supply - available labour supply after NRU (natural unemployment) • Lw change - changes in employment • umployed people - unemployed people
Default	macroeconomic models covid-19 2020 (Default)	#44 F,A	**LED growth** ((IDR/Year)/Year) = (AG Aggregate demand-LED long term demand)/tsld **Description:** *changes in long expected demand* **Present in 1 view:** • View 1 **Used by:** • LED long term demand - long expected demand
Default	macroeconomic models covid-19 2020 (Default)	#45 L	**LED long term demand** (IDR/Year) = ∫LED growth *dt* + [Yo output initial] **Description:** *long expected demand* **Present in 1 view:** • View 1 **Used by:** • Desired capital - desired capital • DIV change - desired inventory change • LED growth - changes in long expected demand
Default	macroeconomic models covid-19 2020 (Default)	#46 LI,C	**Lo labour initial** (people) = 9.323e+07 **Description:** *initial labour* **Present in 1 view:** • View 1 **Used by:** • Lw labour - the number of labour • PTY potential output - the potential output
Default	macroeconomic models covid-19 2020 (Default)	#47 F,A	**Lw change** (people/Year) = (IF THEN ELSE(Lw labour<expected labour supply :AND: Time >8, max(DE desired emplyment/tae*adjustment factor2,(labour supply/expected labour supply *((delayed unemployment-relationships between Y output and employment)*labour supply/tae))) ,MIN(DE desired emplyment/tae*adjustment factor1,(labour supply/expected labour supply*adjustment factor1*((delayed unemployment-relationships between Y output and employment

			*adjustment factor1)*labour supply/tae)))))**Description:** *changes in employment* **Present in 1 view:** • View 1 **Used by:** • Lw labour - the number of labour
Default	macroeconomic models covid-19 2020 (Default)	#48 L	**Lw labour** (people) = ∫Lw change *dt* + [Lo labour initial] **Description:** *the number of labour* **Present in 1 view:** • View 1 **Used by:** • actual unemployment - actual unemployment • Lw change - changes in employment • PTY potential output - the potential output • Rw Real wages - real wages
Default	macroeconomic models covid-19 2020 (Default)	#49 L	**NE Net export** (IDR/Year) = ∫NE net export change *dt* + [1.462e+14] **Description:** *net export import* **Present in 1 view:** • View 1 **Used by:** • AG Aggregate demand - the aggregate demand • NE net export change - net export-import change
Default	macroeconomic models covid-19 2020 (Default)	#50 F,A	**NE net export change** (IDR/(Year*Year)) = fraction of net export*NE Net export **Description:** *net export-import change* **Present in 1 view:** • View 1 **Used by:** • NE Net export - net export import
Default	macroeconomic models covid-19 2020 (Default)	#51 LI,C	**nic** (Year) = 0.3 **Description:** *Normal Inventory Coverage* **Present in 1 view:** • View 1

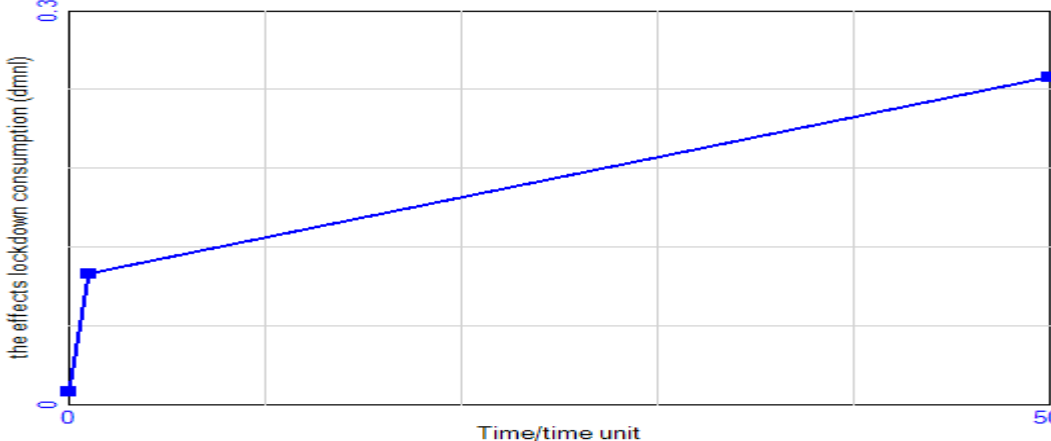|			
			Used by: • DIV change - desired inventory change • IV inventory
Default	macroeconomic models covid-19 2020 (Default)	#52 C VAB	**Nru** (dmnl) = 0.05 **Description:** *NRU (natural unemployment)* **Present in 1 view:** • View 1 **Used by:** • expected labour supply - available labour supply after NRU (natural unemployment)
Default	macroeconomic models covid-19 2020 (Default)	#53 C VAB	**percentage growth GT** (dmnl) = 0.1 **Description:** *the government transfer growth* **Present in 1 view:** • View 1 **Used by:** • GT Government Transfer - the government transfer
Default	macroeconomic models covid-19 2020 (Default)	#54 A VAB	**permanent income from financial assets** (IDR) = household financial assets **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#55 F,A VAB	**pop growth** (people/Year) = fraction pop growth*population **Description:** *population change* **Present in 1 view:** • View 1 **Used by:** • population - population
Default	macroeconomic models covid-19 2020 (Default)	#56 L	**population** (people) = $\int$ pop growth dt + [2.06265e+08] **Description:** *population* **Present in 1 view:** • View 1 **Used by:** • actual fraction of poverty change - poverty percentage

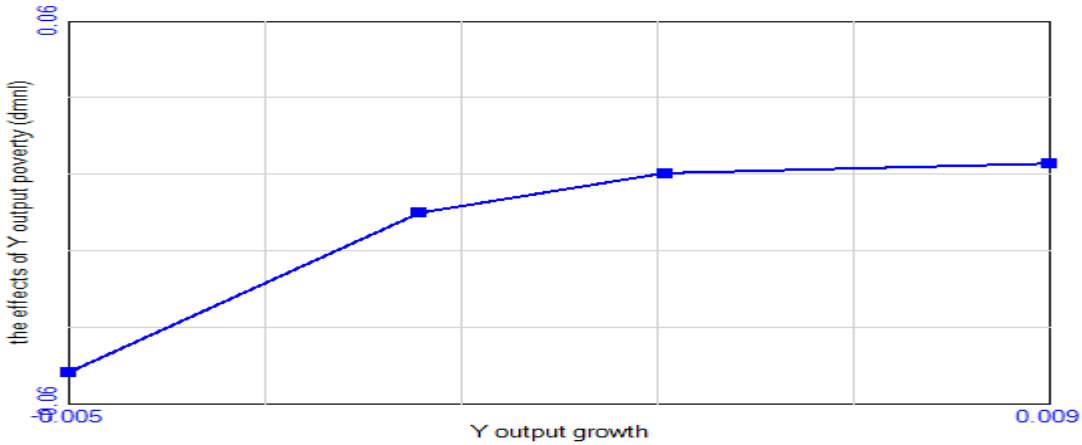|			
			• labour supply • pop growth - population change
Default	macroeconomic models covid-19 2020 (Default)	#57 A VAB	**PTY potential output** (IDR/Year) = Yo output initial*((Lw labour/Lo labour initial)^(1-"alpha (capital intensive index)"))*((Kw kapital/(Ko capital initial))^("alpha (capital intensive index)")) **Description:** *the potential output* **Present in 1 view:** • View 1 **Used by:** • Y output - output Y - (GDP)
Default	macroeconomic models covid-19 2020 (Default)	#58 I VAB	**PY initial** (IDR/Year) = INITIAL(PY permanent income) **Description:** *initial permanent income in 2000* **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#59 L 	**PY permanent income** (IDR/Year) = ∫PY permanent income change *dt* + [Yo output initial-T taxes-GT Government Transfer] **Description:** *the permanent income* **Present in 1 view:** • View 1 **Used by:** • C consumption - household consumption • PY initial - initial permanent income in 2000 • PY permanent income change - the permanent income changes
Default	macroeconomic models covid-19 2020 (Default)	#60 F,A VAB 	**PY permanent income change** ((IDR/Year)/Year) = (CDY-PY permanent income)/tsy time adjust PY **Description:** *the permanent income changes* **Present in 1 view:** • View 1 **Used by:** • PY permanent income - the permanent income
Default	macroeconomic models covid-19 2020 (Default)	#61 C VAB	**R real interest rate** (1/Year) = 0.02 **Description:** *real interest rate* **Present in 1 view:**

			• View 1 **Used by:** • Desired capital - desired capital
Default	macroeconomic models covid-19 2020 (Default)	#62 A VAB	**Rw Real wages** (IDR/people/Year) = (1-"alpha (capital intensive index)")*Y output/Lw labour **Description:** *real wages* **Present in 1 view:** • View 1 **Used by:** • DE desired emplyment - desired employment
Default	macroeconomic models covid-19 2020 (Default)	#63 C VAB	**RWo** (IDR/Person/years) = 8.44564e+06 **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#65 F,A VAB	**SED growth** ((IDR/Year)/Year) = (AG Aggregate demand-SED short demand)/tssd **Description:** *changes in short expected demand* **Present in 1 view:** • View 1 **Used by:** • SED short demand - short expected demand
Default	macroeconomic models covid-19 2020 (Default)	#66 L	**SED short demand** (IDR/Year) = ∫SED growth *dt* + [Yo output initial] **Description:** *short expected demand* **Present in 1 view:** • View 1 **Used by:** • DE desired emplyment - desired employment • SED growth - changes in short expected demand • Y output - output Y - (GDP)
Default	macroeconomic models covid-19 2020 (Default)	#67 C VAB	**supress consumption factor** (dmnl) = 0 **Description:** *0.115;0.189;0.333* **Present in 1 view:** • View 1

			Used by: • C consumption - household consumption
Default	macroeconomic models covid-19 2020 (Default)	#68 LI,A VAB	**T taxes** (IDR/Year) = IF THEN ELSE(Time>=20 , 0, ((Y output*tr tax rate))) **Present in 1 view:** • View 1 **Used by:** • CDY - Current Disposible Income • PY permanent income - the permanent income
Default	macroeconomic models covid-19 2020 (Default)	#69 C VAB	**tae** (Year) = 0.5 **Description:** *delay time of employment changes* **Present in 1 view:** • View 1 **Used by:** • Lw change - changes in employment
Default	macroeconomic models covid-19 2020 (Default)	#70 C VAB	**tai** (Year) = 0.4 **Description:** *delay time of desired inventory* **Present in 1 view:** • View 1 **Used by:** • DII - desired inventory investment
Default	macroeconomic models covid-19 2020 (Default)	#71 C VAB	**tak delaytime investment** (Year) = 3 **Description:** *delay time of investment* **Present in 1 view:** • View 1 **Used by:** • desired investment - desired investment
Default	macroeconomic models covid-19 2020 (Default)	#72 C VAB	**tap** (Year) = 0.5 **Description:** *delay time of poverty change* **Present in 1 view:** • View 1

			Used by: • the number of poverty change
Default	macroeconomic models covid-19 2020 (Default)	#73 DE	**the actual effects of Y output employment** (dmnl) = DELAY3I(delayed unemployment-((Y output growth-delayed Y output growth)),1 , delayed unemployment-((Y output growth-delayed Y output growth))) **Description:** *the effects of GDP on umployment* **Present in 1 view:** • View 1 **Used by:** • Lw change - changes in employment
Default	macroeconomic models covid-19 2020 (Default)	#74 T,A	**the effects lockdown consumption** (dmnl) = WITH LOOKUP (Time/time unit,([(0,0)-(50,0.3)],(0,0.01),(1,0.1),(50,0.25))) **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#75 T,A	**the effects of Y output net export import** (dmnl) = WITH LOOKUP (Y output growth,([(-0.05,-0.02)-(0.07,0.02)],(-0.05,-0.02),(0,0),(0.07,0.02))) **Description:** *the effects of output on export import (2000-2019)* **Present in 1 view:** • View 1

			Used by:
			• fraction of net export - fraction of export-import
Default	macroeconomic models covid-19 2020 (Default)	#76 T,A	**the effects of Y output poverty** (dmnl) = WITH LOOKUP (<u>Y output growth</u>,([(-0.005,-0.06)-(0.009,0.06)],(-0.005,-0.05),(0,0),(0.0035,0.0125),(0.009,0.0155))) **Description:** *the effects of GDP on poverty* **Present in 1 view:** • <u>View 1</u> **Used by:** • expected fraction of poverty - expected poverty level

Default	macroeconomic models covid-19 2020 (Default)	#77 L	**the number of poor** $= \int \underline{\text{the number of poverty change}}\ dt + [3.8741\text{e}+07]$ **Description:** *the poverty level* **Present in 1 view:** • View 1 **Used by:** • actual fraction of poverty change - poverty percentage • the number of poverty change
Default	macroeconomic models covid-19 2020 (Default)	#78 F,A	**the number of poverty change** (people/Year) $= \underline{\text{expected fraction of poverty}} * \underline{\text{the number of poor}} / \underline{\text{tap}}$ **Present in 1 view:** • View 1 **Used by:** • the number of poor - the poverty level
Default	macroeconomic models covid-19 2020 (Default)	#80 C	**time unit** (Year) $= 1$ **Description:** *unit time* **Present in 1 view:** • View 1 **Used by:**

			• available investment - available investment • GS government spending - government spending • GT Government Transfer - the government transfer • the effects lockdown consumption
Default	macroeconomic models covid-19 2020 (Default)	#81 C VAB	**tr tax rate** (dmnl) = 0.11 **Description:** *a fraction of the government tax* **Present in 1 view:** • View 1 **Used by:** • T taxes
Default	macroeconomic models covid-19 2020 (Default)	#82 C VAB	**TSAY Time to Smooth Average Output** (Year) = 3 **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#83 C VAB	**tsld** (Year) = 4 **Description:** *delay time of long expected demand* **Present in 1 view:** • View 1 **Used by:** • LED growth - changes in long expected demand
Default	macroeconomic models covid-19 2020 (Default)	#84 C VAB	**tssd** (Year) = 0.5 **Description:** *delay time of short expected demand* **Present in 1 view:** • View 1 **Used by:** • SED growth - changes in short expected demand
Default	macroeconomic models covid-19 2020 (Default)	#85 C VAB	**tsy time adjust PY** (Year) = 1 **Present in 1 view:** • View 1 **Used by:** • PY permanent income change - the permanent income changes

Default	macroeconomic models covid-19 2020 (Default)	#86 A ⌦VAB	**umployed people** (people) = actual unemployment*labour supply **Description:** *unemployed people* **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#87 C ⌦VAB	**unit KLR** (IDR/people) = 1 **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#88 C ⌦VAB	**unit measure** (dmnl) = 1 **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#89 C ⌦VAB	**Uo** (dmnl) = 0.061 **Present in 1 view:** • View 1
Default	macroeconomic models covid-19 2020 (Default)	#90 F,A ⌦VAB ⤲	**Y output** (IDR/Year) = (SED short demand*(fcu)+(PTY potential output*(1-fcu))) **Description:** *output Y - (GDP)* **Present in 1 view:** • View 1 **Used by:** • CDY - Current Disposible Income • delayed Y output - delayed output (GDP) - one year lagged GDP • IV inventory • Rw Real wages - real wages • T taxes • Y output growth - output Y growth - (GDP growth)
Default	macroeconomic models covid-19 2020 (Default)	#91 A ⌦VAB	**Y output growth** (dmnl) = IF THEN ELSE(Time<1, -0.01 , ((Y output-delayed Y output)/delayed Y output)) **Description:** *output Y growth - (GDP growth)* **Present in 1 view:** • View 1 **Used by:**

			• delayed Y output growth - one-year output growth - (one-year lagged GDP growth) • the actual effects of Y output employment - the effects of GDP on umployment • the effects of Y output net export import - the effects of output on export import (2000-2019) • the effects of Y output poverty - the effects of GDP on poverty
Default	macroeconomic models covid-19 2020 (Default)	#92 LI,C VAB	**Yo output initial** (IDR/Year) = 1.38977e+15 **Description:** *initial output (GDP)* **Present in 1 view:** • View 1 **Used by:** • GT Government Transfer - the government transfer • IV inventory • Kw kapital - the number of capital • LED long term demand - long expected demand • PTY potential output - the potential output • PY permanent income - the permanent income • SED short demand - short expected demand