The Role of GHG Mitigation in Land Use and Forestry to Indonesia Economy

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LoCARNet 7th Annual Meeting Program
November 21-22, 2018
Arya Duta Hotel- Jakarta

Introduction

Indonesia Economy depend on Forestry and Commercial Plantation even since 1960 until now

VS

- Fastest Deforestation rate (Reuters, 2007, The Guardian, 2014)
- Top 5 GHG emitters → Mostly because AFOLU sector

Paris Agreement → National Determined Contribution

Emission reduction 29% (41%) from BaU in 2030

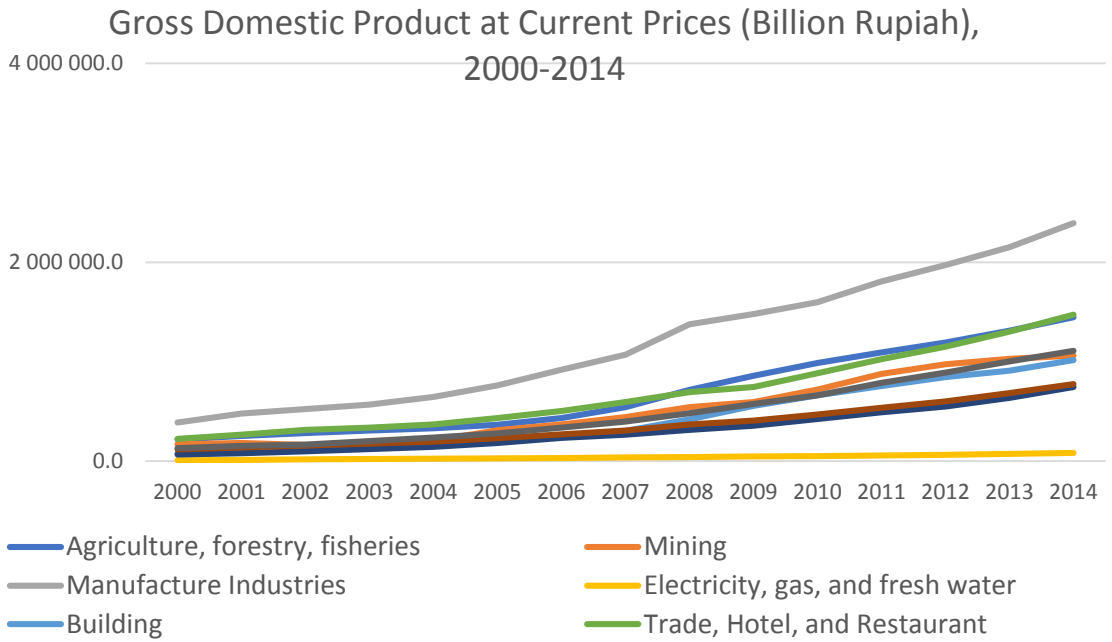
Objectives

- **How mitigation may affect economy and environment?**
- **How much the GDP loss by doing mitigation action?**

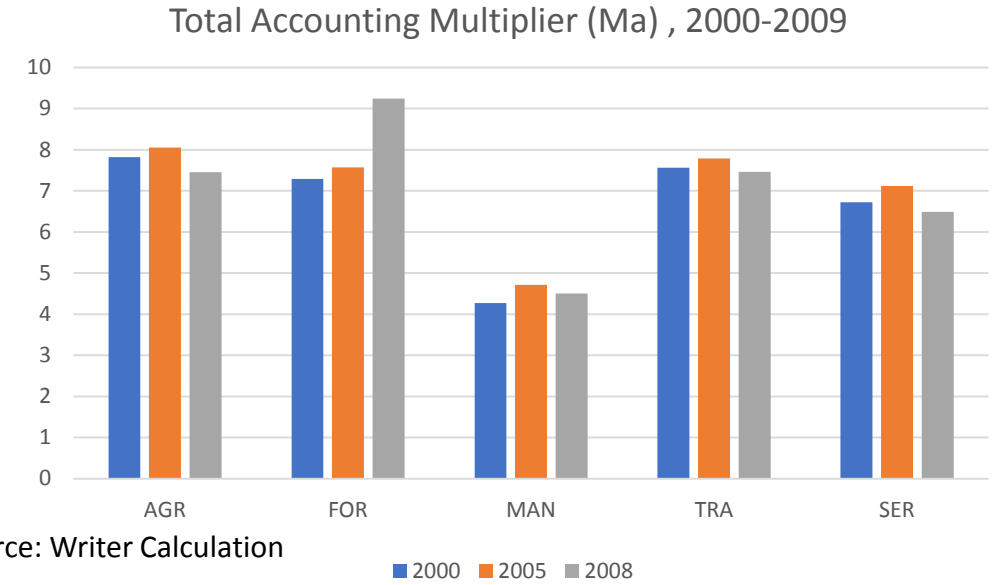
Computer General Equilibrium + Land Allocation Matrices

To add information of land

The importance of FOLU sectors for Indonesia



Source: BPS



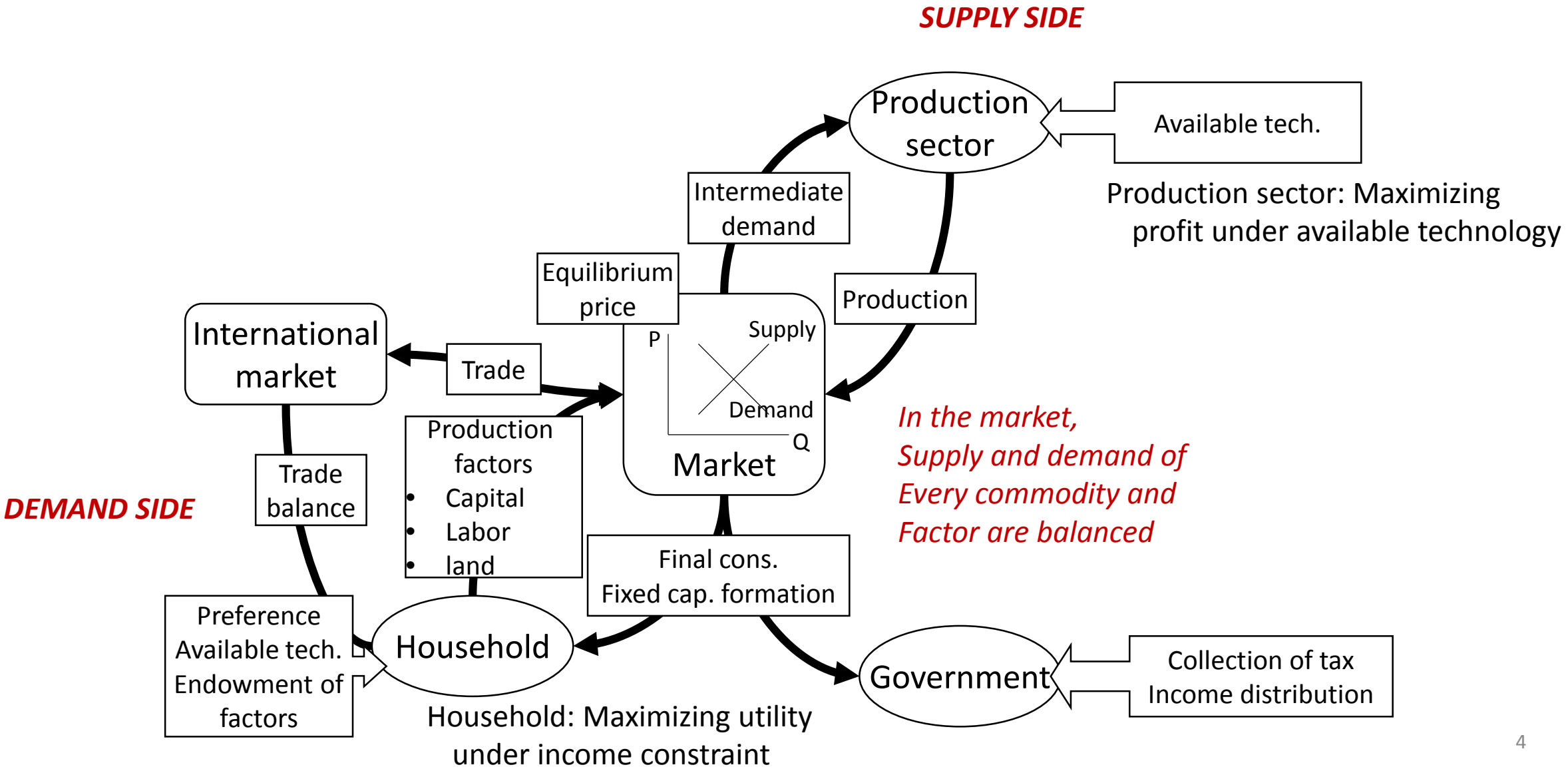
Source: Writer Calculation

- GDP shared of AFOLU sectors is the third largest in Indonesia.
- However, if multiplier effect is considered, the multiplier effect of forestry and plantation sector are the highest
- Mitigation in land-based sector will have impact on environment and economics

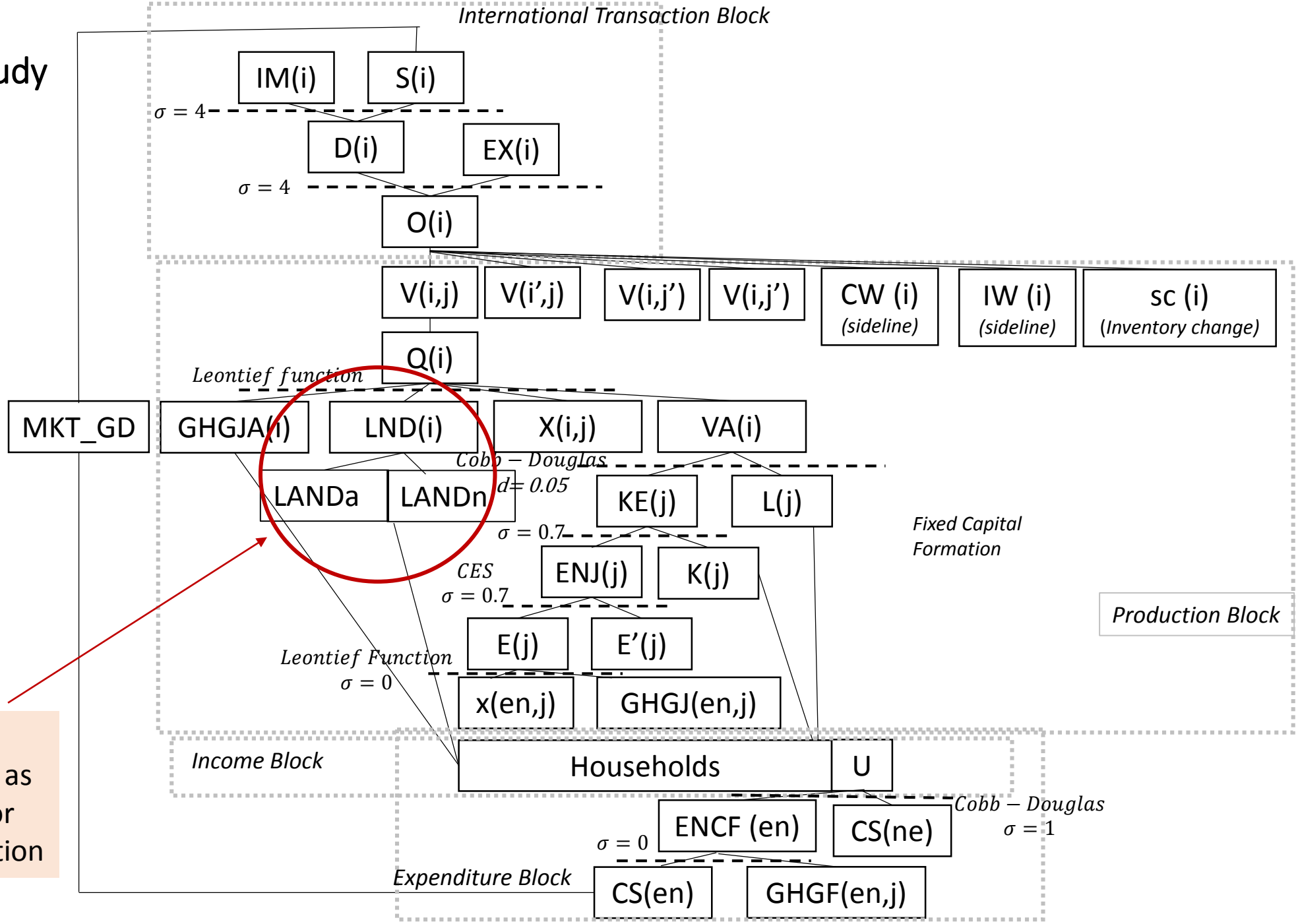
Sector	29%	38%
Forestry and peatland	**59.3**	**60.2**
Waste	1.31	2.61
Energy and Transportation	**37.9**	**36.61**
Agriculture	1.1	0.34
Industry	0.34	0.29

- Ambitious emission reduction from the forestry and peatland, although there is the reality that predicting the emission from these sectors aren't easy because it should predict the land conversion.

Concept of AIM/CGE (Computable General Equilibrium)- General Picture



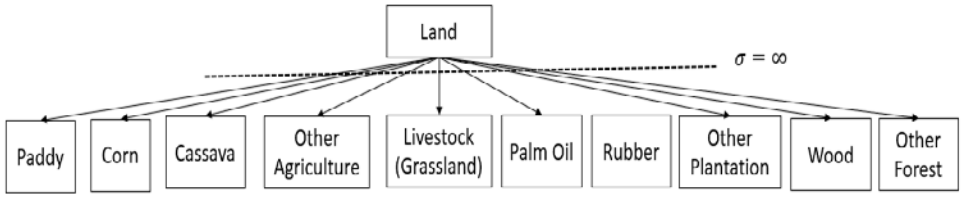
CGE in this study



Land is treated as input for production

Land Allocation Matrix (in ha)

- To fit the model specification, we aggregated the Land Allocation Matrix so it fits the sector in the CGE.
- The CGE then combined with the land matrix.
- For Land→ land will converted into another land use that more profitable by considering the resource they use.



- Limitation→ cost and/or additional input (capital/labor) for the land use change between one sector to another.

	PAD	COR	CAS	OAG	RUB	PAL	OPL	LIV	WOO	OFO
PAD	**6,881,200**	4,855	2,662	23,142	739	1,491	985	0	420	105
COR	13,432	**2,603,034**	35,224	305,663	35,448	71,534	47,261	45	26,540	6,555
CAS	7,365	35,238	**1,424,478**	168,133	19,627	39,608	26,168	25	14,695	3,630
OAG	64,018	305,711	168,090	**13,568,596**	169,587	342,227	226,102	213	126,969	31,363
RUB	1,933	39,141	22,115	186,087	**3,845,311**	269,302	177,745	22	44,859	11,109
PAL	3,901	78,987	44,629	375,527	269,302	**8,033,000**	358,630	45	90,525	22,418
OPL	2,576	52,187	29,485	248,114	177,747	358,633	**5,181,575**	30	59,809	14,812
LIV	400	512	282	2,443	517	1,043	689	**3,247,000**	252	63
WOO	3,741	30,678	16,965	146,697	45,239	91,292	60,316	17	**5,583,731**	10,899
OFO	1,035	13,275	7,339	63,470	35,854	72,343	47,756	204	23,377	**87,777,641**
	Note	**Text**	: Own sector							
		text	: highest converted land							

Based on Bappenas, 2013

	PAD	COR	CAS	OAG	RUB	PAL	OPL	LIV	WOO	OFO
PAD										
COR										
CAS										
OAG										
RUB										
PAL										
OPL										
LIV										
WOO										
OFO										
CAPITAL										
LABOR										
LAND1										
LAND2										
LAND2										
LANDN										

IO TABLE

LAND MATRIX

Scenarios

No	Scenario	reduce deforestation	reforestation	energy efficiency	
1	BaU	no	no	no	
2	DDPP_1	yes	no	no	
3	DDPP_2	yes	yes	no	
4	INDC1	yes	no	yes	29% of CO2 reduction in 2030
5	INDC2	yes	yes	yes	

Including yield improvement and reducing the rate of deforestation

In 2030, it is assumed that all the energy-related mitigation technology able to reduce emission by 38%

Study Limitation:

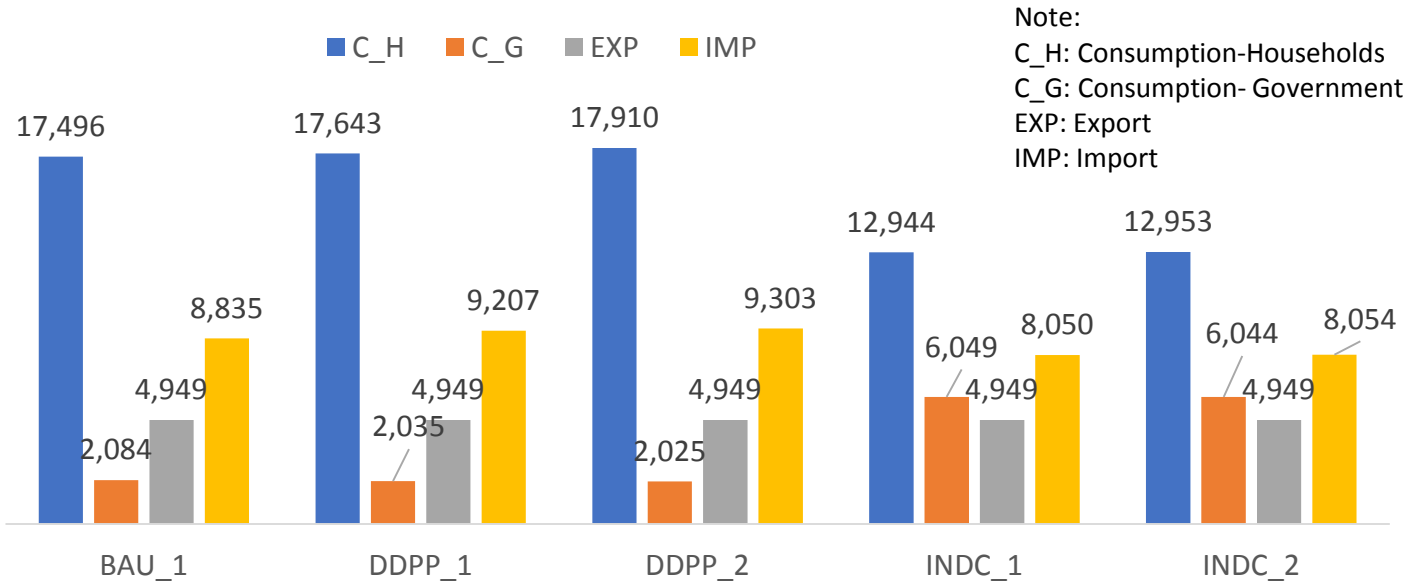
- Still haven't introduce details of mitigation technologies and its cost from another sectors.
- In the case of forestry, there are no "conservation function" introduced yet on the model. The implication of this policy is although the land is already reforested/afforested, those land still able to be converted into another land function.
- For the land→ only mineral land is treated yet.

Economic Impact

GDP and GDP Loss 2015-2030 (Trillion IDR)

Year	BAU_1	DDPP_1		DDPP_2		INDC_1		INDC_2	
	GDP	GDP	GDP gain/loss	GDP	GDP gain/loss	GDP	GDP gain/loss	GDP	GDP gain/loss
2015	8941.0	8928.4	-0.14%	8929.4	-0.13%	8928.4	-0.14%	8929.4	-0.13%
2020	12887.3	12955.6	0.53%	12848.8	-0.30%	12849.2	-0.30%	12853.6	-0.26%
2025	18192.2	18618.5	2.34%	18320.9	0.71%	17868.9	-1.78%	17872.2	-1.76%
2030	26649.75	26748.09	0.37%	27005.09	1.33%	26062.91	-2.20%	26067.47	-2.18%

Some macroeconomic indicator in 2030 (Trillion IDR)



Under INDC, other indicator are reduced, except the C_G due to income from the tax

Carbon Price (USD/tCO2eq)

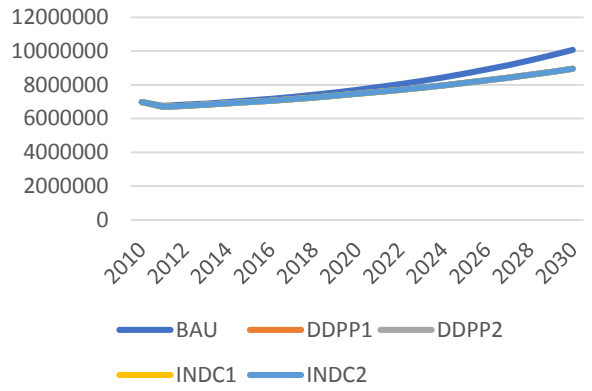
Carbon Price	INDC-1	INDC-2
2010	0.000	0.000
2015	0.000	0.000
2020	0.005	0.007
2025	0.702	0.700
2030	1.507	1.505

This result might be “too-optimist”

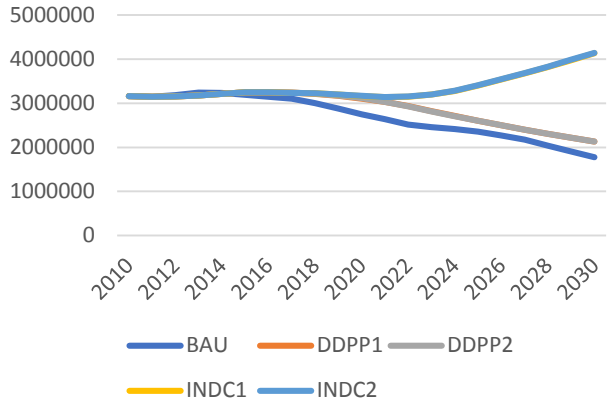
- The FOLU scenario is highest one (DDPP).
- Haven’t introduce the very detail of mitigation technology in each sector

Total Area (ha)

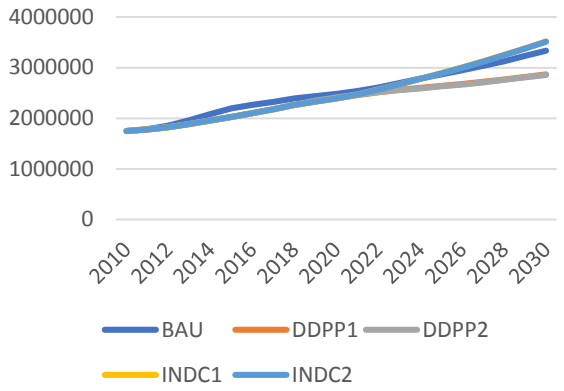
Paddy



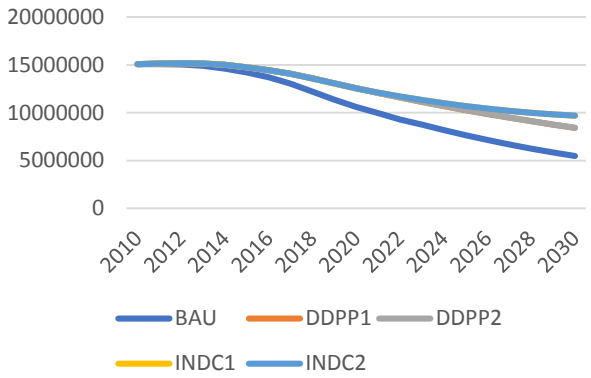
Corn



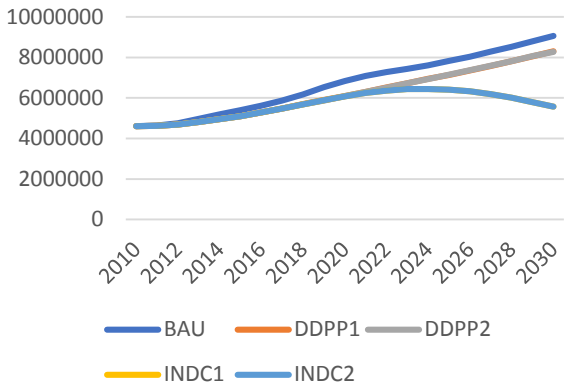
Cassava



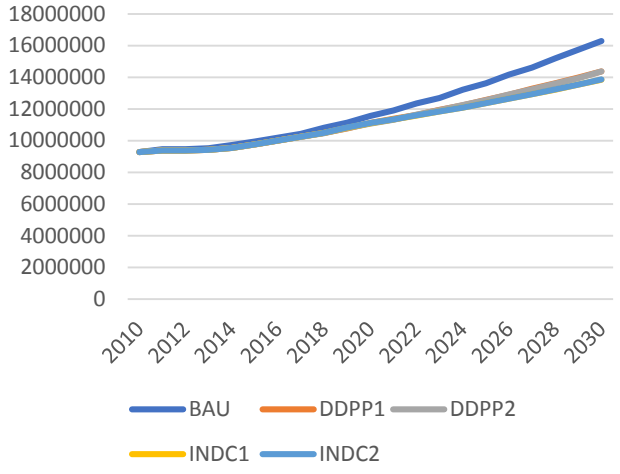
Other Annual Crops



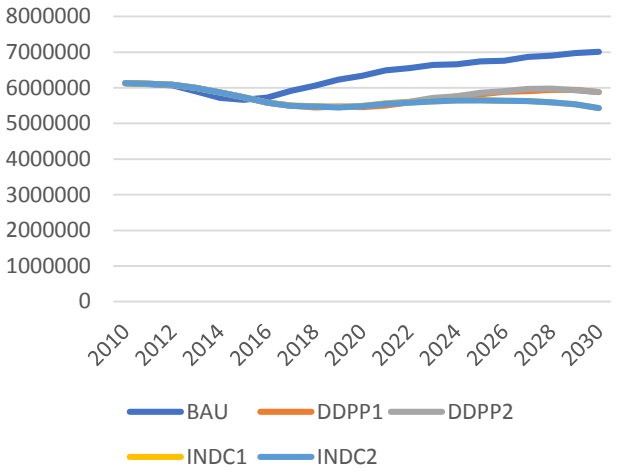
Rubber



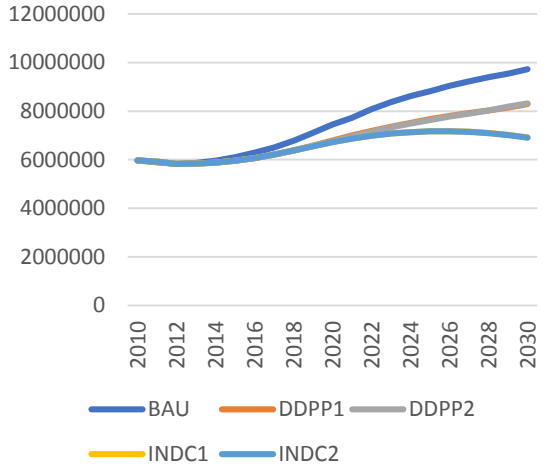
Palm Oil



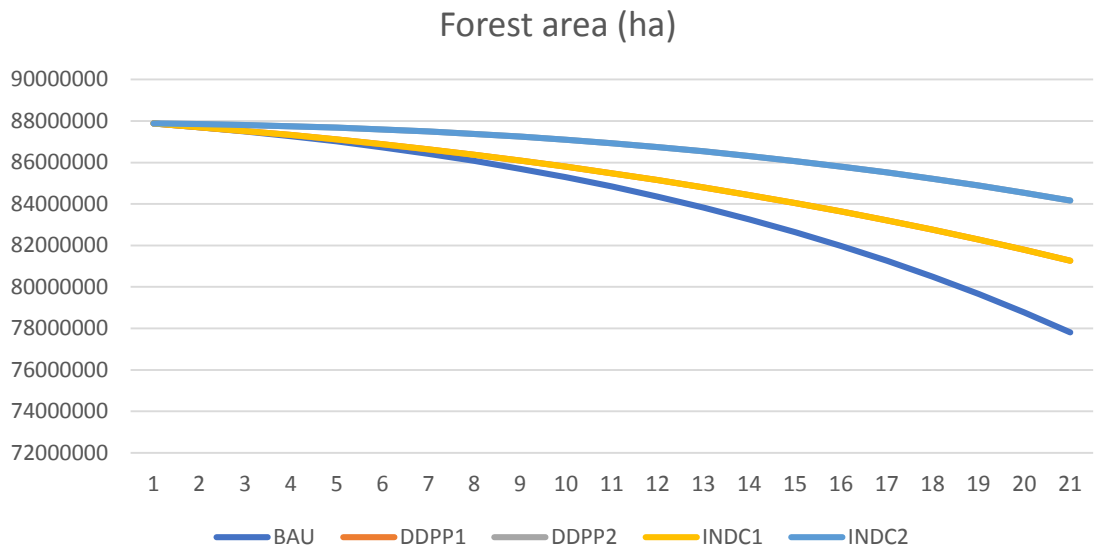
Other Perennial Crops

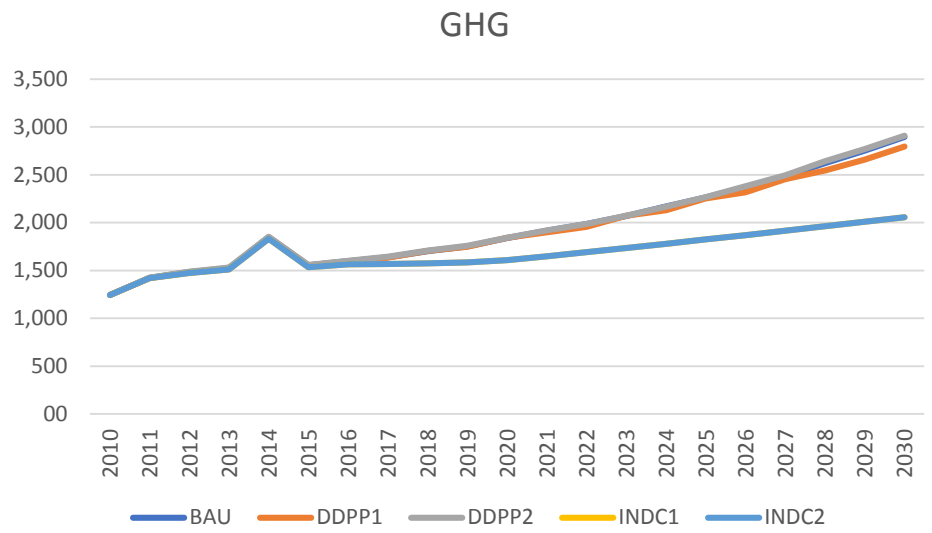


Timber



Under all scenarios, we predict that the area for paddy, palm oil, and timber will keep increasing. Mitigation policy will only reduce its growth rate.





Scenario	2015	2020	2025	2030
BAU	86729237.5	84836360.2	81973994.5	77815013.4
DDPP1	86876035.2	85481768.7	83635604.9	81267300.8
DDPP2	87596101.8	86925057.0	85805733.8	84167896.8
INDC1	86876035.2	85481769.0	83635605.7	81267301.7
INDC2	87596101.8	86925057.2	85805646.8	84165670.7

Although we didn't introduce the conservation function, however, we found that the reforestation still the best way if the government want to maintain the forest area.

However, we found, at least in 2030, if the conservation not introduced. The reforestation policy (DDPP2) will still cause a high GHG emission because the are still a high probability of land conversion.

Under the INDC (IND1 and INDC2) the emissions are set to 29% reduction from BAU level in 2030.

Conclusion

- The INDC might causing around 2% of GDP loss in 2030. However it should be noted that the land productivity improvement is under the DDPP scheme. Moreover, the reforestation can help to maintain the forest area.
- The mitigation action in Indonesia will not effective if the policy is done partially. At least, the FOLU sector should increase the crops yield and lower the deforestation rate.
- As long as the economy still highly rely on land based sector, the land conversion, especially in the mineral land, will keep remaining although the mitigation already introduced
- We predict the land-use change will keep increasing as long as this sector is promising for the economy. Indonesia needs another promising alternative beside from the land-based sectors. However, we also admit that the result might be over-estimated due to the lack of introduction of mitigation cost and details of mitigation technology from other sectors.

Thank You