BAB V

PENUTUP

5.1. Kesimpulan

Berdasarkan hasil analisis data dan pembahasan yang telah dilakukan mengenai pengaruh Produk Domestik Bruto (PDB) per Kapita, Jumlah Penduduk, dan *Foreign Direct Investment* (FDI) terhadap Emisi Karbon Dioksida (CO_2) di 4 Negara Kawasan ASEAN (Indonesia, Malaysia, Filipina, dan Thailand) pada tahun 1997 – 2024 dengan menggunakan metode terbaik yaitu *System* GMM didapatkan kesimpulan bahwa:

1) Produk Domestik Bruto (PDB) per Kapita berpengaruh positif dan signifikan terhadap Emisi Karbon Dioksida (CO_2) di negara kawasan ASEAN-4 (Indonesia, Malaysia, Filipina, dan Thailand) tahun 1997 – 2024.
2) Jumlah Penduduk berpengaruh positif dan signifikan terhadap Emisi Karbon Dioksida (CO_2) di negara kawasan ASEAN-4 (Indonesia, Malaysia, Filipina, dan Thailand) tahun 1997 – 2024.
3) *Foreign Direct Investment* (FDI) berpengaruh positif dan signifikan terhadap Emisi Karbon Dioksida (CO_2) di negara kawasan ASEAN-4 (Indonesia, Malaysia, Filipina, dan Thailand) tahun 1997 – 2024.

5.2. Saran

Berdasarkan hasil penelitian yang telah dilakukan, maka diperoleh saran yang diberikan untuk para pemangku kebijakan terkait, masyarakat, dan peneliti selanjutnya adalah sebagai berikut:

1) Pemerintah di Negara Indonesia, Malaysia, Filipina, dan Thailand diharapkan menerapkan kebijakan pembangunan ekonomi yang berkelanjutan. Peningkatan PDB per Kapita dapat diiringi dengan penerapan teknologi ramah lingkungan, efisiensi energi, dan penguatan kebijakan dalam pengendalian Emisi CO_2. Para pemangku kebijakan terkait dapat mendorong transisi menuju energi terbarukan untuk menekan dampak degradasi lingkungan yang disebabkan oleh peningkatan PDB per Kapita.
2) Penduduk atau masyarakat perlu mendapatkan edukasi terkait dengan perilaku ramah lingkungan seperti: program rumah tangga ramah lingkungan dan meminimalisir transportasi pribadi dengan menggunakan transportasi umum.
3) Pemerintah lebih selektif dalam menerima investasi asing dengan mengutamakan sektor-sektor yang ramah lingkungan (*green investment*). Selain itu, perlu adanya regulasi dan standar ketat bagi investor asing, seperti kewajiban penggunaan teknologi bersih (*clean technology*) dan penerapan prinsip *Environmental*, *Social*, dan *Governance* (ESG).
4) Peneliti selanjutnya diharapkan dapat mengembangkan variabel-variabel lain seperti penggunaan energi terbarukan dan menyesuaikan kondisi aktivitas ekonomi di masa mendatang. Selain itu, dapat menggunakan

metode atau alat analisis lain serta memperluas cakupan wilayah di ASEAN untuk memperoleh hasil yang lebih komperhensif.

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LAMPIRAN

Arellano-Bond dynamic panel-data estimation — Number of obs = 104
Group variable: **country** — Number of groups = 4
Time variable: **tahun**

Obs per group:
min = 26
avg = 26
max = 26

Number of instruments = 102 — Wald chi2(3) = 5794.18
Prob > chi2 = 0.0000

One-step results

(Std. err. adjusted for clustering on **country**)

lco2	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
lco2						
L1.	.7026285	.0200772	35.00	0.000	.663278	.7419791
lgdp	.2799299	.0536249	5.22	0.000	.174827	.3850329
lpop	.0889742	.0811946	1.10	0.273	-.0701642	.2481126
fdi	.0083673	.0036909	2.27	0.023	.0011332	.0156014
_cons	-2.660058	1.014181	-2.62	0.009	-4.647817	-.6722994

Lampiran 1.1 Hasil Uji FDGMM

```
. estat sargan
Sargan test of overidentifying restrictions
H0: Overidentifying restrictions are valid

        chi2(97)     =  122.1959
        Prob > chi2  =    0.0428
```

Lampiran 1.2 Hasil Uji Sargan

```
. estat abond

Arellano-Bond test for zero autocorrelation in first-differenced errors
H0: No autocorrelation

Order         z    Prob > z
-----------------------------
    1    -1.8185      0.0690
    2    -.19619      0.8445
-----------------------------
```

Lampiran 1.3 Hasil Uji Arellano-Bond

```
. estimates table fem fdgmm pls, star stats(N)
```

Variable	fem	fdgmm	pls
lco2			
L1.	.71801071***	.70262855***	.9621786***
lgdp	.24325128***	.27992995***	.04902394
lpop	.14114224	.08897417	.0427078*
fdi	.00702414*	.00836731*	.00380352
_cons	-3.3444348*	-2.6600584**	-1.0169653
N	108	104	108

Lampiran 1.4 Hasil Uji Ketidakbiasan FDGMM

```
System dynamic panel-data estimation          Number of obs      =       108
Group variable: country                       Number of groups   =         4
Time variable: tahun
                                              Obs per group:
                                                           min =        27
                                                           avg =        27
                                                           max =        27

Number of instruments =    128                Wald chi2(3)       =  98199.35
                                              Prob > chi2        =    0.0000
One-step results
```

lco2	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
lco2						
L1.	.8814336	.0250983	35.12	0.000	.8322419	.9306254
lgdp	.1039117	.0346427	3.00	0.003	.0360132	.1718102
lpop	.0814685	.0189655	4.30	0.000	.0442968	.1186402
fdi	.0080519	.0033317	2.42	0.016	.001522	.0145818
_cons	-1.818932	.5284101	-3.44	0.001	-2.854597	-.783267

Lampiran 1.5 Hasil Uji SYSGMM

```
Sargan test of overidentifying restrictions
H0: Overidentifying restrictions are valid

        chi2(123)     =  141.3179
        Prob > chi2   =    0.1237
```

Lampiran 1.6 Hasil Uji Sargan

```
. estat abond

Arellano-Bond test for zero autocorrelation in first-differenced errors
H0: No autocorrelation

Order         z    Prob > z
-----------------------------
    1    -1.8599      0.0629
    2    -.27931      0.7800
-----------------------------
```

Lampiran 1.7 Uji Arellano-Bond

```
. estimates table fem sysgmm pls, star stats(N)
```

Variable	fem	sysgmm	pls
lco2			
L1.	.71801071***	.88143362***	.9621786***
lgdp	.24325128***	.10391168**	.04902394
lpop	.14114224	.0814685***	.0427078*
fdi	.00702414*	.0080519*	.00380352
_cons	-3.3444348*	-1.8189319***	-1.0169653
N	108	108	108

Lampiran 1.8 Hasil Uji Ketidakbiasan SYSGMM

```
S
Group variable: country                         Number of groups  =         4
Time variable: tahun
                                                Obs per group:
                                                              min =        27
                                                              avg =        27
                                                              max =        27

Number of instruments =    128                  Wald chi2(3)      =  98199.35
                                                Prob > chi2       =    0.0000
One-step results
```

lco2	Coefficient	Robust std. err.	z	P>|z|	[95% conf.	interval]
lco2						
L1.	.8814336	.0250983	35.12	0.000	.8322419	.9306254
lgdp	.1039117	.0346427	3.00	0.003	.0360132	.1718102
lpop	.0814685	.0189655	4.30	0.000	.0442968	.1186402
fdi	.0080519	.0033317	2.42	0.016	.001522	.0145818
_cons	-1.818932	.5284101	-3.44	0.001	-2.854597	-.783267

Lampiran 1.9 Hasil Uji Parsial dan Uji Wald

		Mt CO_2	USD PPP	Jiwa	Persen
Negara	**Tahun**	**CO2**	**PDB**	**POP**	**FDI**
Indonesia	1997	275.5207	6897.002	206536095	2.167797
Indonesia	1998	278.2434	5897.685	209826788	-0.25229
Indonesia	1999	295.25	5855.658	213004668	-1.33257
Indonesia	2000	299.0702	6056.382	216077790	-2.75744
Indonesia	2001	319.562	6190.52	219097902	-1.85569
Indonesia	2002	324.9389	6381.95	222088495	0.074152
Indonesia	2003	353.623	6599.092	225048008	-0.25426
Indonesia	2004	360.1513	6843.547	227926649	0.738244
Indonesia	2005	362.597	7140.855	230871650	2.916115
Indonesia	2006	383.4194	7434.488	233951652	1.347943
Indonesia	2007	401.7934	7802.464	237062337	1.603011
Indonesia	2008	397.2554	8165.062	240157903	1.826329
Indonesia	2009	411.3491	8435.456	243220028	0.903919
Indonesia	2010	443.682	8848.225	246305322	2.025179
Indonesia	2011	499.9362	9274.97	249470032	2.302984
Indonesia	2012	504.2572	9708.612	252698525	2.30978
Indonesia	2013	474.9651	10121.81	255852467	2.551356
Indonesia	2014	505.0762	10504.39	258877399	2.819973
Indonesia	2015	512.3973	10893.66	261799249	2.297616
Indonesia	2016	507.0965	11319.66	264627418	0.487372
Indonesia	2017	535.7474	11772.57	267346658	2.019489
Indonesia	2018	596.4692	12262.23	269951846	1.81429
Indonesia	2019	637.5692	12757.79	272489381	2.233362
Indonesia	2020	596.2839	12388.54	274814866	1.810584
Indonesia	2021	622.6868	12757.07	276758053	1.787856
Indonesia	2022	722.6996	13334.27	278830529	1.872641
Indonesia	2023	772.5618	13889.97	281190067	1.571167
Indonesia	2024	812.2042	14470.44	283487931	1.736511

		Mt CO_2	USD PPP	Jiwa	Persen
Negara	**Tahun**	**CO2**	**PDB**	**POP**	**FDI**
Malaysia	1997	113.2477	18604.51	21375218	5.136241
Malaysia	1998	110.6521	16817.17	21906713	2.997751
Malaysia	1999	119.6769	17428.63	22435531	4.921467
Malaysia	2000	130.7612	18532.91	22967816	4.038429
Malaysia	2001	138.4076	18186.44	23526538	0.597029
Malaysia	2002	146.5505	18708.87	24102477	3.166124
Malaysia	2003	156.5469	19329.01	24679602	2.920942
Malaysia	2004	169.5908	20168.51	25256772	3.507873
Malaysia	2005	181.1171	20767.59	25836071	2.734387
Malaysia	2006	187.727	21444.49	26417909	4.727165
Malaysia	2007	204.8805	22305.12	26998389	4.686846
Malaysia	2008	216.128	22898	27570059	3.280819
Malaysia	2009	197.9123	22106.64	28124778	0.056692
Malaysia	2010	215.5014	23307.97	28655776	4.268647
Malaysia	2011	218.2727	24115.82	29162039	5.07446
Malaysia	2012	219.7969	25006.36	29662831	2.829057
Malaysia	2013	237.1554	25736.35	30174265	3.494312
Malaysia	2014	251.3897	26818.43	30696137	3.141229
Malaysia	2015	252.8595	27699.63	31232798	3.270944
Malaysia	2016	247.4841	28425.37	31789685	4.47131
Malaysia	2017	237.8324	29551.55	32355644	2.93582
Malaysia	2018	254.2848	30459.97	32910967	2.314587
Malaysia	2019	255.1651	31300.51	33440596	2.506977
Malaysia	2020	253.08	29200.45	33889558	1.202755
Malaysia	2021	257.9155	29822.85	34282399	5.416264
Malaysia	2022	276.9845	32129.22	34695493	3.684862
Malaysia	2023	282.3786	32857.67	35126298	1.979901
Malaysia	2024	295.9542	34116.23	35557673	3.693095

		Mt CO_2	USD PPP	Jiwa	Persen
Negara	**Tahun**	**CO2**	**PDB**	**POP**	**FDI**
Filipina	1997	76.8658	4758.708	73908810	1.298531
Filipina	1998	75.5809	4616.673	75791024	3.070111
Filipina	1999	73.993	4650.759	77753257	2.13568
Filipina	2000	74.2644	4740.439	79625397	1.777225
Filipina	2001	71.6919	4778.401	81401488	0.962985
Filipina	2002	72.9411	4856.499	83068889	2.098275
Filipina	2003	74.7742	5003.383	84731835	0.565263
Filipina	2004	75.6877	5229.451	86394504	0.623145
Filipina	2005	78.8843	5386.817	88015962	1.54906
Filipina	2006	70.973	5578.572	89508986	2.120919
Filipina	2007	76.9611	5840.068	91075184	1.871212
Filipina	2008	77.7622	5987.038	92699095	0.737801
Filipina	2009	78.6456	5965.307	94384250	1.173248
Filipina	2010	84.9688	6273.039	96337125	0.513698
Filipina	2011	84.5875	6388.313	98248614	0.856963
Filipina	2012	89.5021	6697.556	100175512	1.22763
Filipina	2013	97.4869	7016.538	102076336	1.316426
Filipina	2014	104.0134	7340.362	103767130	1.929375
Filipina	2015	113.1874	7691.763	105312992	1.84018
Filipina	2016	121.2972	8131.825	106735719	2.598508
Filipina	2017	135.646	8584.136	108119693	3.122388
Filipina	2018	141.3358	9016.287	109465287	2.868338
Filipina	2019	147.9244	9452.294	110804683	2.301175
Filipina	2020	136.3845	8455.185	112081264	1.885864
Filipina	2021	145.6114	8857.79	113100950	3.040789
Filipina	2022	151.7004	9457.104	113964338	2.34751
Filipina	2023	162.4527	9898.533	114891199	2.042104
Filipina	2024	174.1143	10375.94	115843670	2.044989

		Mt CO_2	USD PPP	Jiwa	Persen
Negara	**Tahun**	**CO2**	**PDB**	**POP**	**FDI**
Thailand	1997	187.4146	11952.85	60724584	2.593383
Thailand	1998	167.0286	10897.15	61522630	6.434807
Thailand	1999	174.5482	11253.39	62299043	4.817807
Thailand	2000	174.8428	11622.53	63007815	2.663129
Thailand	2001	183.5255	11901.32	63651141	4.212235
Thailand	2002	195.0715	12512.18	64266437	2.488153
Thailand	2003	202.9305	13287.3	64868166	3.43594
Thailand	2004	221.1427	13997	65452047	3.389475
Thailand	2005	229.2248	14458.26	66017420	4.339587
Thailand	2006	232.8491	15051.06	66567687	4.021257
Thailand	2007	237.863	15742.66	67102394	3.283569
Thailand	2008	238.9694	15891.78	67619830	2.938249
Thailand	2009	232.0176	15665.9	68121080	2.275902
Thailand	2010	246.3596	16730.37	68579447	4.323209
Thailand	2011	246.7462	16766.35	69007208	0.667088
Thailand	2012	264.8041	17869.64	69436098	3.244564
Thailand	2013	275.9576	18242.43	69845114	3.791265
Thailand	2014	272.5228	18324.61	70216367	1.221453
Thailand	2015	281.4677	18812	70540795	2.224685
Thailand	2016	277.7638	19370.61	70859841	0.843364
Thailand	2017	281.081	20094.68	71160187	1.815503
Thailand	2018	276.6537	20879.9	71376079	2.712798
Thailand	2019	286.4704	21277.84	71522271	1.017349
Thailand	2020	275.6334	19957.26	71641484	-0.85799
Thailand	2021	268.5767	20242.77	71727332	3.040253
Thailand	2022	284.314	20762.8	71735329	2.391798
Thailand	2023	275.0344	21191.45	71702435	2.001834
Thailand	2024	283.8091	21740.54	71668011	2.716368

Lampiran 1.10 Data Emisi Karbon Dioksida (CO2), PDB per Kapita, Jumlah Penduduk, dan FDI