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The Food-Energy-Water-Nexus between Ecomodernism and Degrowth narrative – a welfare economics model approach

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Abstract—

The UN demands that the world community has to change the current unsustainable consumption and production patterns to achieve a green economy with significantly lower CO2 emissions to meet the Paris Agreement [1, 2]. For the transformation of the current unsustainable consumption and production patterns, currently two narratives are being discussed [3]: Ecomodernism and Degrowth. A dynamic 2-country Computable General Equilibrium (CGE) Model is used to analyze the two green economy approaches. Country A represents the Ecomodernism pathway to a green economy and country B is on a Degrowth path. To analyze these two approaches, a de-growth wedge is developed, which is based on the Harberger triangle [4-6]. The de-growth scenario can be seen as a distortion to the current market economy. The wedge measures the excess burden of welfare losses against the background of the traditional economic model represented by the Ecomodernism approach. The results of our stylized economic model for the Ecomodernism path of country A and for the Degrowth path of country B show a continuing spread of the economic development of the two countries. The results showed that especially the FEW-nexus has to deal with increasing challenges. An aggravating factor is that the cross-country FEW-Nexus has to be managed against the background of two different green economy approaches: Ecomodernism and Degrowth.

Keywords—Green economy, Ecomodernism, Degrowth, General Equilibrium Model, wedge equation system

I. INTRODUCTION

The global surface temperature has increased by around 1.01°C compared to 1880 mainly caused by the increase of the CO2 concentration in the atmosphere to 418 ppm in 2022. NASA wrote about this development: "Since the beginning of the industrialized era (1750), human activities have raised atmospheric concentrations of CO2 by about 50% [7]." Because of the raise of global temperature the arctic sea ice level left 13% per decade since 1979 and the Greenland ice lose 275 billion tons per year and Antarctica 152 billion metric tons [7, 8]. The UN demands that the world community has to change the current unsustainable consumption and production patterns to achieve a green economy with significantly lower CO2 emissions to meet the Paris Agreement [1, 2]. For achieving a green economy two models are currently being discussed: Ecomodernism and Degrowth [3]. Ecomodernism [9] tries to find technological solutions to "decouple GHG emissions and other environmental impacts from GDP growth [10]." The Degrowth approach [11] question the ability of the current linear economic system to decouple GHG emissions and resource consumption from economic growth to meet the SDGs and the Paris agreement goals [12]. Degrowth approaches [13-15] trying to decrease both GDP and GHG emissions [3], reduction of dependence on emission technologies and "aims to generate progress toward achieving the SDGs by prioritizing redistribution rather than GDP growth [10]." The Degrowth idea requires concepts such as "universal basic income, work-sharing, shifting taxation burdens from income to resource and energy extraction [3]." The new green economy approaches of Ecomodernism and Degrowth scenarios will have an impact on all economic sectors especially on the Food-Energy-Water Nexus (FEW-Nexus) sector - the key sectors for a sustainable development. A General Equilibrium Model is used to analyze the two green economy approaches consisting of two countries: An Ecomodernist country A and a Degrowth country B.

II. A TWO COUNTRY DYNAMIC MULTINATIONAL CGE MODEL

We use a dynamic multinational Computable General Equilibrium (CGE) model [16]. The consumption sector is represented by one consumer per country c=A,B and this consumer maximizes its utility as in the neoclassical consumption model [17]. Thus, the consumer maximizes an intertemporal utility function based on the periodical utility U_t, with t=1,.. 15.

$$U_c = \sum_{t=1}^{\infty}\left(\frac{1}{1+p_c}\right)^t \ln U_{t,c},\ \rho = \text{time preference rate, c = countries A + B , t = 1..15}$$

Periodical utility depends on the consumption $C_{t,c,i}$ of goods from the different production sectors i.

$$U_{t,c} = \prod_{i=1}^{3} C_{ti}^{\alpha_{c_i} Hi},$$

αH_i are the share parameters of both countries (c_i) in the Cobb-Douglas utility function whose sum is equal to 1

The shares α_{c_i} and $1-\alpha_{c_i}$ determine the consumption-per-period's share in utility $U_{t,c}$. Utility is maximized subject to the budget constraint:

$$\sum_{i=1}^{i=3} C_{t,i,c} + S_{c,t+1} = Y_{c,t}$$

A_t = asset at the beginning of period t, Y_t is the labor income in period t

r_t is the interest rate of the two countries (c).

Each period, the budget $Y_{t,c}$ is spend on consumption $C_{t,i,c}$ and savings $S_{t,c}$. From this optimization problem, the demand for goods can be calculated. Savings are assumed to finance investment. The production sector of each country consists of three sectors. Each sector is represented by a firm, which operates under perfect competition and a constant returns to scale Cobb-Douglas [18] production function using capital $K_{t,c,i}$ and labour $L_{t,c,i}$:

$$XD_{c,t,i} = f_{c,t,i}\left(K_{c,t,i} L_{c,t,i}\right) = a_{c,i}F_{c,i} \cdot K_{cti}^{\alpha_{c,i}F_{ic}} \cdot L_{cti}^{((1-\alpha_{c,i}F_{ci}))},\ \alpha_{c,i}F + (1-\alpha_{c,i}\,\mathrm{F}) = 1$$

The Cobb-Douglas function is homogeneous of degree one (linear homogeneous). This means that if labor and capital are increased by the factor t, then the output would also increase by this factor t, aF_i represents the state of technology. The higher aF_i, the more efficient the employment of the production factors. Capital and labor are assumed to be internationally immobile.

A. *The Social Accounting Matrix*

The social accounting matrix (SAM) (Table I and II) represents the stylized status quo data set of each country of our model economy. The fictitious data sets of the two SAMs were compiled to illustrate and stress the effects of different growth scenarios in a model economy world unbiased. Table I shows the stylized SAM of Ecomodernist country A containing the expenditures for consumption, investment and exports and the capital and labor expenditures to enable the production of the gross output and the imports.

TABLE I. SAM COUNTRY A

Social Accounting Matrix Country A - in currency units

	FEW	Industry	Service	Consumption	Investment	Exports	Total
FEW	0	0	0	68	6	16	90
Industry	0	0	0	122	39	19	180
Service	0	0	0	184	99	52	335
Capital (K) payments	49	59	99				
Labour (L) payments	20	91	200				
Gross Output (XD)	69	150	299				
Imports	21	30	36				
Total	90	180	335				

Source: Authors, 2021 based on Ecomod, 2003

Table II documents the economic status quo of the Degrowth country B. The table shows that in all sectors, the total output of country B is at the beginning higher than that of country A.

TABLE II. SAM COUNTRY B

Social Accounting Matrix Country B - in currency units

	FEW	Industry	Service	Consumption	Investment	Exports	Total
FEW	0	0	0	123	11	21	155
Industry	0	0	0	218	82	30	330
Service	0	0	0	407	207	36	650
Capital (K) payments	99	130	199				
Labour (L) payments	40	181	399				
Gross Output (XD)	139	311	598				
Imports	16	19	52				
Total	155	330	650				

Source: Authors, 2021 based on Ecomod, 2003.

In both countries the, trade balance is balanced and exports equal imports.

B. *Calibration*

Our CGE model needs to be calibrated in order to reproduce the data set of the status quo as determined by the Social Accounting Matrix correctly. This requires the determination of exogenous parameter values (see Table III).

TABLE III.

Exogenous parameters

	Ecomodernist country A	Degrowth country B
Interest rate	5.0%	4.0%
Time preference rate	5.0%	4.0%
Steady state growth rate	2.5%	-1.0%
Labor development rate	0.0%	0.0%
Source: Authors, 2022		IEK-STE/SRH 2022

This includes the following parameters: the steady state growth rate, the interest and time preference rate between the countries in order to elaborate specifically and exclusively the effects of the different growth models, as the Table 3 shows.

- Ecomodernist country A will grow conventionally by 2.5%.
- Degrowth country B will shrink by 1.0%, based on the ideas and models developed by Jackson [19], Victor [20], Weitzman [21], Paech [22], Trainer [23] and D'Alisa [24, 25] and its already high technological level.

The three economic sectors of each country represent a cross-country Food-Energy-Water-Nexus, where the agricultural sector is located in country A, the utility sectors (energy, water) are located in country B, a service and an industry sector in both countries. The sectors therefore have different states of technology, which is represented by α_i in Equation XD. The higher aF_i, the higher the level of output that can be produced by any particular combination of the inputs [17].

TABLE IV.

Technological efficiency parameter, aF

Ecomodernist country A		Degrowth country B	
Agriculture	0.411	Utilities	0.675
Service	0.853	Service	1.125
Industry	0.944	Industry	1.190
Source: Own calculations, 2022			IEK-STE/SRH 2022

Table IV shows that the industry sector of country B has the highest technological level, followed by the service and utility and agricultural sector of country B. The starting efficiency level of country B is in every sector higher than in country A. The efficiency parameter is the lowest for the agricultural sector of country A.

C. *The de-growth wedge approach and the Harberger triangle*

The presented idea of the de-growth wedge approach is built on the Harberger triangle approach [4-6], which is used "to calculate the efficiency costs of taxes, government regulations, monopolistic practices, and various other market distortions [4]." The de-growth approach can be interpreted as a distortion to the current market economy approach. The wedge is creating an excess burden of welfare losses against the Ecomodernist green economy approach. The wedge is measured for the following economic indicators: gross output, CO_2 emissions and the welfare of the people (utility).

III. Results and Discussion

In the following, the results of our stylized economic model for the Ecomodernism path of country A and for the Degrowth path of country B are analyzed.

A. Gross Output

Figure 1 focuses on the gross output (output approach) of the two different economies and of the total output of both countries.

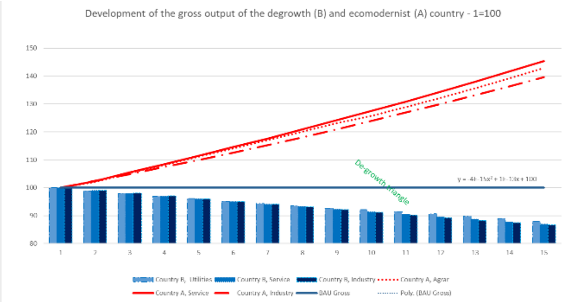

Fig. 1. Development of gross output

The development of the **gross output in the industry sector** can be described by three equations. For country A:

$$Y^{A}_{Gross,I} = 2.8273 \cdot x + 96.185$$

and of country B by the following equation

$$Y^{B}_{Gross,I} = -0.9632 \cdot x + 100.89$$

And the BAU industry development scenario for both countries:

$$Y^{BAU}_{Gross_{A,B}} = -4E-15 \cdot x^2 + 1E-13 \cdot x + 100$$

Hence, we can derive the following integrals to describe the gross output wedge formed between the industry sector of country A: $f(x^{A}_{Gross,I}) = \int_{1}^{15} (2.8273 \cdot x + 96.185)\, dx = 1663.24$

and the industry sector of country B: $f(x^{B}_{Gross,I}) = \int_{1}^{15} (-0.9632 \cdot x + 100.89)\, dx = 1304.58$

And the BAU development for country A and B:

$$f(x^{BAU}_{Gross_{A,B}}) = \int_{1}^{15} \left(-4E-15 \cdot x^2 + 1E-13 \cdot x + 100\right) dx = 1400$$

Hence, we can determine the gross output industry wedge between country A and the BAU scenario:

$$Wedge^{Gross,A}_{Industry} = f(x^{A}_{Gross,A}) - f(x^{BAU}_{Gross,A}) = 1663.24 - 1400 = 263.24$$

Hence, we can determine the gross output industry wedge between country B and the BAU scenario:

$$Wedge^{Gross,B}_{Industry} = f(x^{B}_{Gross,B}) - f(x^{BAU}_{Gross,B}) = 1304.581 - 1400 = |-95|$$

So that we get the total industry wedge between country A0 and B.

$$Wedge^{Gross}_{Industry_{A,B}} = W_A + |W_B| = 263.24 + |-95.418| = 358$$

The development of the **gross output of the service sector** of country A is described by:

$$Y^{A}_{Gross,S} = 3.2495 \cdot x + 95.528$$

and of country B by the following equation

$$Y^{B}_{Gross,S} = -0.9315 \cdot x + 100.76$$

And the BAU service development scenario for both countries:

$$Y^{BAU}_{Gross_{A,B}} = -4E-15 \cdot x^2 + 1E-13 \cdot x + 100$$

Hence, we can derive the following integrals to describe the gross output wedge formed between

the service sector of country A: $f(x^{A}_{Gross,S}) = \int_{1}^{15} (3.2495 \cdot x + 95.528)\, dx = 1701.336$

and the service sector of country B: $f(x^{B}_{Gross,I}) = \int_{1}^{15} (-0.9315 \cdot x + 100.76)\, dx = 1306.312$

And the BAU development for country A and B:

$$f(x^{BAU}_{Gross_{A,B}}) = \int_{1}^{15} \left(-4E-15 \cdot x^2 + 1E-13 \cdot x + 100\right) dx = 1400$$

Hence, we can determine the gross output service wedge:

Between country A and the BAU scenario:

$$Wedge^{Gross,A}_{Service} = f(x^{A}_{Gross,A}) - f(x^{BAU}_{Gross,A}) = 1701.336 - 1400 = 301.336$$

Hence, we can determine the gross output service wedge between country B and the BAU scenario:

$$Wedge^{Gross,B}_{Service} = f(x^{B}_{Gross,B}) - f(x^{BAU}_{Gross,B}) = 1306.312 - 1400 = |-94|$$

So that we get the total service wedge between country A and B.

$$Wedge^{Gross}_{Service_{A,B}} = W_A + |W_B| = 301.33 + |-93.688| = 395.024$$

The development of the Gross output **in the cross-country FEW-Nexus sector** of country A, is described by:

$$Y^{A}_{Gross,Agrar} = 3.0458 \cdot x + 96.014$$

and of country B by the following equation

$$Y^{B}_{Gross,Utility} = -0.8212 \cdot x + 100.35$$

And the BAU service development scenario for both countries:

$$Y^{BAU}_{Gross_{A,B}} = -4E-15 \cdot x^2 + 1E-13 \cdot x + 100$$

Hence, we can derive the following integrals to describe the Gross output wedge formed between

the agricultural sector of country A: $f(x^{A}_{Gross,Agrar}) = \int_{1}^{15} (3.0458 \cdot x + 96.014)\, dx = 1685.325$

and the utility sector of country B: $f(x^{B}_{Gross,Utility}) = \int_{1}^{15} (-0.8212 \cdot x + 100.35)\, dx = 1312.92$

And the BAU development for country A and B:

$$f(x_{Gross_{A,B}}^{BAU}) = \int_1^{15} \left(-4E-15 \cdot x^2 + 1E-13 \cdot x + 100\right) dx = 1400$$

Between country A and the BAU scenario:

$$Wedge_{FEW}^{Gross,A} = f(x_{Gross,A}^{A}) - f(x_{Gross,A}^{BAU}) = 1685.325 - 1400 = 285.32$$

Hence, we can determine the gross output FEW-Nexus wedge between country B and the BAU scenario:

$$Wedge_{Service}^{Gross,B} = f(x_{Gross,B}^{B}) - f(x_{Gross,B}^{BAU}) = 1312.92 - 1400 = |-87.074|$$

So that we get the total FEW-Nexus wedge between country A and B.

$$Wedge_{Service_{A,B}}^{Gross} = W_A + |W_B| = 285.32 + |-87.0744| = 372.4$$

In the following, we will analyse the gross output wedge of the two-country economy, which is built over the 15-year period. The gross output is the result of the economic activities of the two economies over the observed time horizon. The analysis reveals that wedge of the gross output of the three sectors between the two countries and the assumed Business as Usual development in the two countries:

TABLE V. GROSS OUTPUT WEDGE

The wedge between the two countries

Wedge between	Gross Output Industry	Service	FEW
A and BAU	263	301	285
B and BAU	95	94	87
A and B	358	395	372

Source: Own calculations, 2021

The gross output wedges between the two countries are summarized in table V.

B. CO2-Emissions

Figure 2 reveals the development of the CO_2 emissions over the observed 15-year-period. The emissions are calculated as CO2-emission intensity: CO2-emissions per unit gross output.

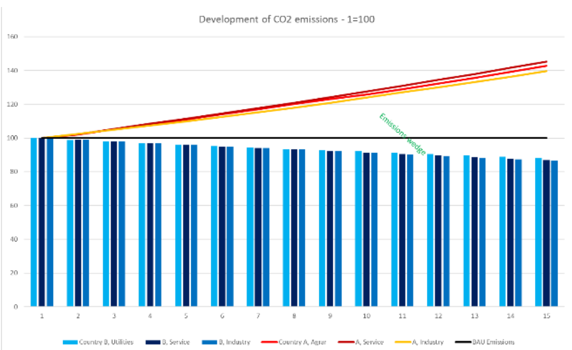

Fig. 2. Development of Sectoral CO2 Emissions

The CO2-emission intensity factor is for the country B oriented on the CO2-emissions 2019 of the EU-28 (0.172) and of the country on the OECD countries (0.23) as determined by the IEA 2019.[1] The emission intensity of the two countries is different due to the different technological level of the two countries, as defined in Chapter B. In the following, we will analyse the emission wedge of the two-country economy, which is built over the 15-year period. The emissions are the result of the production and consumption patterns. The development of the emissions of the industry sector of country A is described by:

$$Y_{ES,I}^{A} = 2.8273 \cdot x + 96.185$$

and of country B by the following equation

$$Y_{ES,I}^{B} = -0.9632 \cdot x + 100.89$$

Hence, we can derive the following integrals to describe the emissions wedge formed between

the industry sector of country A:

$$f(x_{ES,I}^{A}) = \int_1^{15} \left(2.8273 \cdot x + 96.185\right) dx = 1663.24$$

and the industry sector of country B:

$$f(x_{ES,I}^{B}) = \int_1^{15} \left(-0.9632 \cdot x + 100.89\right) dx = 1306.31$$

And the BAU Emissions development of the industry sector BAU (A+B):

$$f(x_{Es_{A,B}}^{BAU}) = \int_1^{15} \left(-4E-15 \cdot x^2 + 1E-13 \cdot x + 100\right) dx = 1400$$,

Hence, we can determine the emissions wedge of the industry between country A and the BAU scenario:

$$Wedge_{Industry}^{Emissions,A} = f(x_{Em,A}^{A}) - f(x_{Em,A}^{BAU}) = 1663.24 - 1400 = 263.24$$

and the industry emissions wedge, respectively:

$$Wedge_{Industry}^{Emissions,B} = f(x_{Em,B}^{B}) - f(x_{Em,B}^{BAU}) = 1304.58 - 1400 = |-95.42|$$

So that we get the total industry emissions wedge between country A and B.

$$Wedge_{Industry_{A,B}}^{Emissions} = W_A + |W_B| = 263.24 + |-95.42| = 358.66$$

Hence, we can determine the emissions wedge: $Wedge_{Industry}^{ES} = f(x_{ES,I}^{A}) - f(x_{ES,I}^{B}) = 1663.24 - 1306.31 = 358.66$

The development of the emissions of the service sector of country A, is described by:

$$Y_{ES,S}^{A} = 3.405 \cdot x + 94.25$$

and of country B by the following equation

$$Y_{ES,S}^{B} = -0.9078 \cdot x + 100.61$$

Hence, we can derive the following integrals to describe the service sector emissions wedge formed between

the service sector of country A:

$$f(x_{Im,S}^{A}) = \int_1^{15} \left(3.405 \cdot x + 94.25\right) dx = 1701.336$$

[1] https://www.deutschlandinzahlen.de/tab/welt/umwelt-energie/umwelt/co2-emissionen-in-kg-pro-bip-einheit

and the service sector of country B: $f(x_{ES,I}^{B}) = \int_{1}^{15} \left(-0.9078 \cdot x + 100.61\right)\, dx = 1306.312$

And the BAU emissions development of the service sector BAU (A+B):

$$f(x_{Service_{A,B}}^{BAU}) = \int_{1}^{15} \left(-4E-15 \cdot x^{2} + 1E-13 \cdot x + 100\right)\, dx = 1400 \, ,$$

Hence, we can determine the emissions wedge of the service between country A and the BAU scenario:

$$Wedge_{Service}^{Emissions,A} = f(x_{Em,A}^{A}) - f(x_{Em,A}^{BAU}) = 1701.33 - 1400 = 301.33$$

Hence, we can determine the service emissions wedge between country B and the BAU scenario:

$$Wedge_{Service}^{Emissions,B} = f(x_{Em,B}^{B}) - f(x_{Em,B}^{BAU}) = 1306.31 - 1400 = -93.68$$

So that we get the total industry emissions wedge between country A and B.

$$Wedge_{Service_{A,B}}^{Emissions} = W_{A} + \left|W_{B}\right| = 301.33 + \left|-93.68\right| = 395.02$$

Hence, we can determine the emissions wedge of the service sectors: $Wedge_{Service}^{ES} = f(x_{ES,S}^{A}) - f(x_{ES,S}^{B}) = 1701.336 - 1306.312 = 395.02$

The development of the emissions in the cross-country FEW-Nexus sector of country A, is described by:

$$Y_{ES,A}^{A} = 3.0458 \cdot x + 96.015$$

and of country B by the following equation

$$Y_{ES,U}^{B} = -0.9632 \cdot x + 100.89$$

Hence, we can derive the following integrals to describe the emissions wedge formed between

the agricultural sector of country A: $f(x_{ES,A}^{A}) = \int_{1}^{15} \left(3.0458 \cdot x + 96.015\right)\, dx = 1685.33$

and the utility sector of country B: $f(x_{ES,U}^{B}) = \int_{1}^{15} \left(-0.9632 \cdot x + 100.89\right)\, dx = 1304.58$

And the BAU emissions development of the FEW sector BAU (A+B):

$$f(x_{Em_{A,B}}^{BAU}) = \int_{1}^{15} \left(-4E-15 \cdot x^{2} + 1E-13 \cdot x + 100\right)\, dx = 1400 \, ,$$

Hence, we can determine the emissions wedge of the FEW sector between country A and the BAU scenario:

$$Wedge_{FEW}^{Emissions,A} = f(x_{Em,A}^{A}) - f(x_{Em,A}^{BAU}) = 1685.33 - 1400 = 285.33$$

Hence, we can determine the FEW emissions wedge between country B and the BAU scenario:

$$Wedge_{FEW}^{Emissions,B} = f(x_{Em,B}^{B}) - f(x_{Em,B}^{BAU}) = 1304.58 - 1400 = \left|-95.42\right|$$

So that we get the total FEW emissions wedge between country A and B.

$$Wedge_{FEW_{A,B}}^{Emissions} = W_{A} + \left|W_{B}\right| = 285.33 + \left|-95.42\right| = 380.75$$

Hence, we can determine the wedge of the FEW-nexus sectors: $Wedge_{FEW-Nexus}^{Em} = f(x_{Em,A}^{A}) - f(x_{Em,U}^{B}) = 1685.33 - 1304.58 = 380.75$

The CO2 wedges between the two countries are summarized in table VI.

TABLE VI. CO2 WEDGE

The wedge between the two countries

Wedge between	CO2-Emissions Industry	Service	FEW
A and BAU	263	301	285
B and BAU	95	94	95
A and B	358	395	380

Source: Own calculations, 2021

Whereas the emissions of the total FEW-Nexus sector increase about 10% over the 15-year-period.

C. Utility

Welfare can be derived from the utility of the representative consumer. The economic development of the two countries causes also a drifting of the utility level of the consumers of the two countries. The utility level of country A increases about nearly 40%, whereas the utility level of country B declines slightly about 13% over the 15 years analyzed (Figure 3).

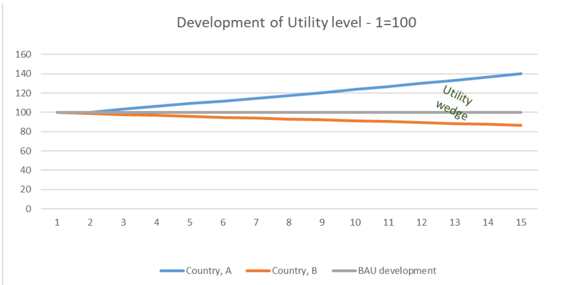

Fig. 3. Development of utility

In the following, we will analyse the utility wedge of the two-country economy, which is built over the 15-year period. The utility level is the result of all economic activities in the two economies. The development of the utility level of the country A, is described by:

$$Y_{Ut}^{A} = 2.8731 \cdot x + 95.257$$

and of country B by the following equation

$$Y_{Ut}^{B} = -0.8617 \cdot x + 100.11$$

Hence, we can derive the following integrals to describe the utility wedge formed between

BAU utility development: BAU (A+B): $f(x_{Ut}^{BAU}) = \int_{1}^{15} \left(-4E-15 \cdot x^{2} + 1E-13 \cdot x + 100\right)\, dx = 1400 \, ,$

the country A: $f(x_{Ut}^{A}) = \int_{1}^{15} \left(2.8731 \cdot x + 95.257\right)\, dx = 1655.38$

and country B: $f(x_{Ut}^{B})=\int_{1}^{15}\left(-0.8617\cdot x+100.11\right)\,dx=1305.02$

Hence, we can determine the utility wedge between the BAU development and the utility development of country A and B:

$$Wedge_{A,BAU}^{Ut}=f(x_{Ut}^{A})-f(x_{BAU,Ut})=1655.38-1400=255.38$$

$$Wedge_{B,BAU}^{Ut}=f(x_{Ut}^{B})-f(x_{BAU,Ut})=1305.02-1400=\left|-94.97\right|$$

So that we get the total wedge between country A and B:

$$Wedge_{A,B}^{Inc}=W_{A}+\left|W_{B}\right|=255.38+\left|-94.97\right|=350.355$$

Hence, we can determine the utility wedge: $Wedge_{A,B}^{Ut}=f(x_{Ut}^{A})-f(x_{Ut}^{B})=1655.38-1305.02=350.355$

The utility wedges between the two countries are summarized in table VII.

TABLE VII. UTILITY WEDGE

The wedge between the two countries	
Wedge between	Utility All sectors
A and BAU	255
B and BAU	95
A and B	350

Source: Own calculations, 2021

IV. CONCLUSION

The analysis has shown that the two approaches of the green economy will cause a split of the development of the analyzed two-economy-system, as the following table VI shows.

TABLE VIII. WEDGES OF ALL SECTORS

	Wedges between			
	Country A & BAU	Country B & BAU	Country A & B	Sum
Gross Output	849	284	1134	2267
CO2-Emissions	849	276	1133	2258
Utility	255	95	350	700

Source: Own calculations, 2022

The wedges of the two economic indicators gross output and CO2-emissisions are very similar for the three scenarios. The utility effect of the two wedges on the welfare of the households is smaller. One possible explanation could be that it takes longer than the 15 years studied for the countervailing trend of the degrowth approach to have a deeper impact on people's well-being. The analysis shows that the two different green economy approaches (Ecomodernism and Degrowth) are causing a different economic development of the two countries. The challenge for the management of the FEW-nexus is that the cross-country FEW-Nexus is confronted with two different green economy approaches. The agricultural sector of country A follows an Ecomodernism pathway, whereas the utility sector of country B is on a Degrowth pathway. This can cause economic tensions and stresses in the sector and between the countries and poses a major challenge to the management of the FEW-Nexus.

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