



OUTSOURCING DEFORESTATION: ASSESSING THE ROLE OF THE CZECH REPUBLIC AND THE EU

Nicolás Blampied, Mazlum Karatas

July 2025

WWW.SYRI.CZ



SYRI STUDY / RG 8
ECONOMIC IMPACTS

OUTSOURCING DEFORESTATION: ASSESSING THE ROLE OF THE CZECH REPUBLIC AND THE EU

Nicolás Blampied¹, Mazlum Karatas²

afiliation:

1 Department of Economics, Masaryk University

2 GESIS – Leibniz Institute for the Social Sciences

July 2025

WWW.SYRI.CZ

Tato práce vznikla v rámci projektu NPO „Národní institut pro výzkum socioekonomických dopadů nemocí a systémových rizik,“ č. LX22NPO5101, financovaného Evropskou unií – Next Generation EU (MŠMT, NPO: EXCELES)

Summary

Although many economies have reduced their rates of deforestation in recent decades, they have simultaneously increased their imports, thereby replacing domestic deforestation with foreign deforestation. In this paper, we use data on deforestation embedded in the international trade and domestic consumption of forest-risk commodities to estimate a Kuznets curve both for produced and consumed deforestation. We assess the position of the Czech Republic relative to other European Union (EU) economies and examine whether this position has changed significantly compared to the period before the COVID-19 pandemic.

Main Findings

Our findings suggest that most EU economies (including the Czech Republic) have increased deforestation and displaced more deforestation abroad during the pandemic. This raises concerns about the potential effects that the entry into force of Regulation (EU) 2023/1115 on deforestation-free products (EUDR) in 2026 could have, particularly on small and medium-sized firms.

Main policy recommendations

The proximity of the entering into force of the EUDR calls for immediate action, in particular aiming to reduce the impact the regulation will have on SMEs firms, especially, as pointed by the Czech Ministry of Agriculture, in the wood processing industry, publishing houses and retail chains, among others.

The current situation can be approached from several strategic angles, including:

1. Establishing a dedicated body within the Ministry of Agriculture to monitor developments related to the EUDR.
2. Actively seeking clear and detailed implementation guidelines from the European Commission (EC).
3. Enhancing communication with SMEs in high-risk sectors by providing transparent and accessible information on compliance procedures, and by actively collecting feedback and specific demands from these firms to inform policy adjustments.
4. Assessing the economic impact on affected sectors through dedicated research and impact studies.
5. Considering targeted financial support or temporary exemptions to help cover adaptation costs during the transition period.

Introduction

Deforestation remains a critical global environmental issue, contributing significantly to carbon release, species decline, and the breakdown of ecological systems (Hubau et al. 2020; Betts et al. 2017; Zematova 2017). It also carries along important health issues

(see, e.g., Rosen, 2016, and references therein). In recognition of its broader socio-economic impacts, including poverty, forest conservation was included among the UN's 2030 Sustainable Development Goals (SDG 15). Though the FAO's Global Forest Resources Assessment 2020 estimates that net forest losses have declined from an annual average of -7.8 million hectares (ha) in the 1990s to -4.7 million ha in 2010–2020, trends vary widely by region. South America and Africa continue to register significant net declines in forest stocks, while Asia and Oceania report net gains. Europe also shows overall increases, but patterns differ across countries, revealing a mixed performance. Tropical regions remain the most affected globally.

Reducing global deforestation has been identified as a major priority for the European Union (EU). In line with its goal of reducing greenhouse gas emissions and preventing habitat destruction, the EU enacted, among other regulations, Regulation (EU) 2023/1115 on deforestation-free products (EUDR). The EUDR aims to curb deforestation driven by agricultural expansion linked to commodities such as cattle, soy, cocoa, palm oil, and wood. It requires companies placing these goods on the EU market or exporting them from it to prove they are not sourced from recently deforested land or associated with forest degradation. In response to stakeholder concerns, the EU granted a 12-month extension before the EUDR enters into force: it will apply from 30 December 2025 for larger firms and from 30 June 2026 for smaller ones.

Among those requesting a delay in the implementation of the EUDR is the Czech Republic. The Ministry of Agriculture has argued that poor communication from the European Commission (EC) regarding the specific actions companies need to take has left them with insufficient time to prepare, putting many businesses and jobs at risk.¹ Furthermore, the Ministry emphasized that deforestation does not occur in the Czech Republic, where forest cover has been stable or slightly growing in recent decades. Indeed, between 1990 and 2023, the country's forest area went from around 2.63 million ha to 2.68 million ha.

Even though forest areas have expanded in many EU countries over recent decades, this does not mean that deforestation rates have not increased, or that the EU has not contributed to deforestation abroad through international trade. As explained by Ritchie (2021) and estimated by Pendrill et al. (2019a), and later updated by Pendrill et al. (2019b, 2020, 2022) and Singh et al. (2024), approximately 30% of total global deforestation over, roughly, the past two decades was driven by international trade, meaning deforestation occurred in one country while the resulting goods were consumed in another. Of this 30%, around 40% was linked to deforestation flows towards developed economies. Within these global trade links, EU countries, including the Czech Republic, have played an active role. Moreover, the COVID-19 pandemic appears to have contributed to an increase in deforestation rates and forest consumption in several European economies.

In this paper, using deforestation-risk data embedded in international trade and sourced from Pendrill et al. (2019a, 2019b, 2020, 2022) and Singh et al. (2024), we estimate an environmental Kuznets curve (EKC) for both domestically produced and consumed deforestation and assess the position of EU countries, with a focus on the Czech Republic.

¹ For further details on the Ministry's statement, see <https://europeannewsroom.com/cs/cesko-chce-po-ek-odlozit-narizeni-o-odlesnovani-ktere-ovlivni-tisice-firem-v-cr/>.

We find that the EU has not only maintained an active role in traded deforestation but has also experienced a significant increase in deforestation following the COVID-19 pandemic. These findings carry important policy implications, highlighting the need to accelerate the implementation of the EUDR and to strengthen support for a smooth transition, particularly for small and medium-sized enterprises.

This paper is organized as follows: In Section 2, we present our data and examine the evolution of domestic and imported deforestation in EU economies over the past two decades. In Section 3, we outline the empirical strategy used to estimate the EKC. In Section 4, we present our main findings and, finally, in Section 5 we discuss our results and derive potential policy implications.

Data

In order to estimate the Environmental Kuznets Curve (EKC) using data on deforestation, we rely on the dataset compiled by Pendrill et al. (2019a, 2019b, 2020, 2022) and Singh et al. (2024). This dataset provides estimates of deforestation risk embodied in the production and consumption of forest-risk commodities at the country level. The estimates are derived from a land-use model that attributes forest loss to cropland expansion and links this to international trade, assigning deforestation to both producing and consuming countries. The dataset covers more than 190 countries over an 18-year period (2005–2022). For our baseline estimations, we also use data on GDP per capita², forest stocks in hectares³, and population⁴.

As shown in Tables 1 and 2, deforestation per capita – whether measured by consumption or production – exhibits a pattern consistent with the EKC: lower deforestation levels are observed at both ends of the income distribution, with higher levels concentrated in the middle quartiles. In the case of the EU, the picture diverges depending on whether we consider production or consumption. On the production side, the EU contributes very little to global deforestation, reporting the lowest levels among all countries in the sample (though some intra-EU variation exists). However, when viewed through the lens of consumption, the EU appears to be a significant contributor: its consumption-based deforestation is approximately 50% higher than that of the poorest quartile and 10% higher than that of the richest quartile.

2 GDP per capita data is sourced from CEPII: <http://www.cepii.fr/CEPII/en/welcome.asp>.

3 Forest stock data is retrieved from the World Bank: <https://data.worldbank.org/indicator/AG.LND.FRST.K2>.

4 Same source as the previous note.

Table 1: Deforestation consumption across income percentiles

Percentile (income)	Deforestation (ha)	Deforestation/cap	GDP/cap
0.25	21,574	100	927
0.5	24,595	243	3,398
0.75	52,479	259	9,705
1	12,487	133	41,665
EU	9,739	149.8	33,533

Notes: Deforestation refers to the average deforestation in ha consumed by countries in the corresponding quartile. Deforestation/cap denotes average deforestation in ha by average population in the corresponding quartile. The sample covers the period 2005–2022.

Table 2: Deforestation production across income percentiles

Percentile (income)	Deforestation (ha)	Deforestation/cap	GDP/cap
0.25	20,703	100	910
0.5	43,399	203	3,204
0.75	61,337	288	8,435
1	2,133	24	34,718
EU	552	9	29,383

Notes: Deforestation refers to the average deforestation in ha produced by countries in the corresponding quartile. Deforestation/cap denotes average deforestation in ha by average population in the corresponding quartile. The sample covers the period 2005–2022.

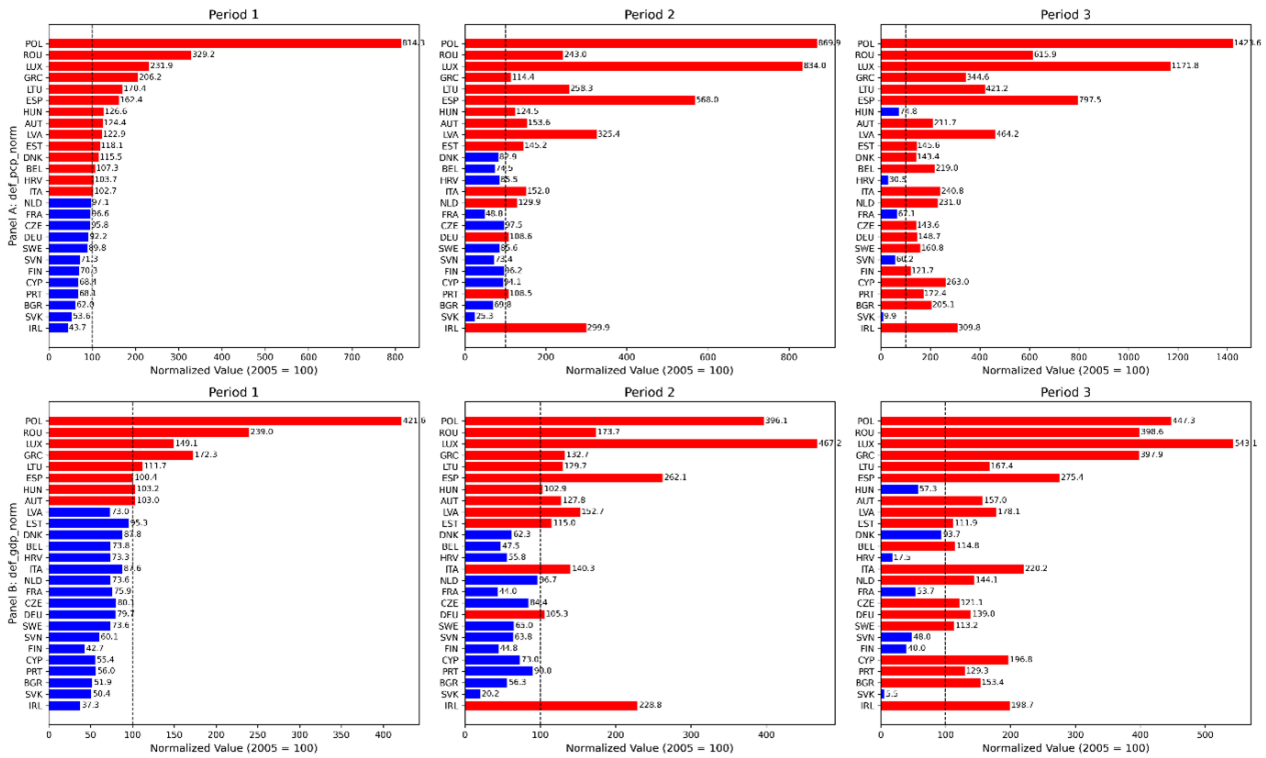


Figure 1: Deforestation produced and consumed in EU by country

Notes: This figure presents data on deforestation consumed in ha per capita (Panel A) and ha by GDP (Panel B) in EU economies. The data is normalized using the base year 2005 = 100. The three periods cover 2006–2012 (Period 1), 2013–2019 (Period 2), and 2020–2022 (Period 3). In blue: deforestation below the level of the baseline year. In red: deforestation above the level of the baseline year.

Tables 1 and 2 presented the average deforestation embodied in production and consumption over the full period of analysis (2005–2022). A natural exercise would be to examine the evolution of deforestation over time. Figure 1 illustrates deforestation per capita consumed in EU countries, normalized to 100 in the baseline year (2005), and disaggregated into three periods: 2006–2012, 2013–2019, and 2020–2022 (the COVID-19 pandemic period).

Strikingly, most EU countries exhibit an increasing trend in consumption-based deforestation over time, with the sharpest rise occurring during the pandemic. For example, in the Czech Republic, deforestation per capita rose by approximately 50%, something similar to what happened to deforestation over GDP. This latter indicator captures the intensity of deforestation use per unit of output, suggesting that the Czech economy became more deforestation-intensive during this period.

Empirical strategy

Since the beginning of the 1990s, the relationship between economic growth and environmental quality has been examined through the framework of the EKC. The idea of the EKC was initially introduced by Grossman and Krueger (1991) and coined

by Panayotou (1993), positing a nonlinear, inverted U-shaped relationship between environmental degradation and income per capita. The EKC suggests that in the early stages of development, environmental pressures intensify, but beyond a certain income level, further growth leads to improvements in environmental quality. A large literature immediately started exploring this empirical relationship (see, e.g., Shafik and Bandyopadhyay, 1992; Shafik, 1994; Selden and Song, 1994). Despite widespread use, the EKC remains highly debated. As noted by Stern (2017), the EKC remains an open question in the literature. Here, we aim to estimate and EKC for deforestation.

The most standard way to test the EKC consist of estimating an equation of the following type:

$$\ln(\text{deforestationcap}_{it}) = \beta_0 + \beta_1 \ln(\text{gdpcap}_{it}) + \beta_2 [\ln(\text{gdpcap}_{it})]^2 + \text{Controls} + \alpha_i + \gamma_t + u_{it} \quad (1)$$

where:

$\text{deforestationcap}_{it}$ is deforestation per capita in country i at time t , and gdpcap_{it} is GDP per capita in country i at time t . Finally, α_i and γ_t stand for country fixed effects and time fixed effects.

The specification in Eq. 1 is standard in the literature (see, e.g., Mohammed, 2024, for a recent application for the EU using CO emissions), and in order to test whether the EKC holds, our estimates should satisfy the conditions $\beta_1 > 0$ and $\beta_2 < 0$, where β_1 is the coefficient addressing the linear increase in deforestation as GDP per capita increases, and β_2 is the coefficient for the squared GDP term, reflecting the inverted U-shape relationship between income and deforestation.

While Eq. 1 constitutes our baseline specification, several configurations are tested in order to provide robustness for our empirical exercise. These robustness include working with different sets of fixed effects, different control variables, and different time spans.

Findings

Tables 3 and 4 display the results from estimating different specifications of Eq. 1. In Table 3, the dependent variable is domestically produced deforestation, whether exported or consumed locally. In Table 4, the dependent variable is domestically consumed deforestation, whether imported or produced locally. The results are consistent across both specifications.

A quick look at our findings yields several clear conclusions. First, all specifications support the EKC hypothesis for both produced and consumed deforestation. Specifically, the coefficient on $\ln(\text{gdpcap})$ is positive and statistically significant, while the coefficient on $\ln(\text{gdpcap})^2$ is negative and significant, indicating an inverted-U relationship between income per capita and deforestation. Second, although one might expect a country's forest stock to influence deforestation levels, our estimates show that this variable is not statistically significant. Third, in the specifications with fixed effects, the coefficients estimated for the period ending before the COVID-19 pandemic are larger, suggesting that the decline in deforestation production and consumption was more pronounced before the pandemic.

Our results are consistent with recent findings indicating that the pandemic has accelerated global deforestation. While evidence for the EU remains limited, being this paper a step forward in this sense, several studies report increased deforestation due to weakened enforcement and rising illegal activity in various countries (see, e.g., Céspedes et al., 2023; Brancalion et al., 2020). The data section clearly shows that deforestation consumption has also increased in EU countries. Hence, even if deforestation had risen globally but not in the EU, the existence of an EKC for domestically-consumed deforestation implies that the location where deforestation takes place is less relevant than the role of economies in driving global deforestation through consumption and international trade links.

Table 3: Environmental Kuznets curve estimated using deforestation by producer country

	(1)	(2)	(3)	(4)	(5)	(6)
ln(gdpcap)	0.00256***	0.00250***	0.00103***	0.00092***	0.00113***	0.00113***
	(0.00050)	(0.00049)	(0.00031)	(0.00032)	(0.00033)	(0.00033)
ln(gdpcap) ²	-0.00016***	-0.00016***	-0.00005***	-0.00005**	-0.00006***	-0.00006***
	(0.00003)	(0.00003)	(0.00002)	(0.00002)	(0.00002)	(0.00002)
forestcap	0.01526***					
	(0.00202)					
ln(forestcap)		0.01807***	0.01235	0.00613	-0.00324	-0.00708***
		(0.00218)	(0.01303)	(0.01300)	(0.012653)	(0.01314)
cons	-0.00872***	-0.00852***	-0.00371***	-0.00306**	-0.00412***	-0.00363***
	(0.00207)	(0.00204)	(0.00123)	(0.00124)	(0.00127)	(0.00125)
Country FE	No	No	Yes	Yes	Yes	Yes
Country-time FE	No	No	No	Yes	No	Yes
Sample period	2005–2022	2005–2022	2005–2022	2005–2022	2005–2019	2005–2019
Observations	2771	2771	2771	2771	2445	2445
R ²	0.040	0.044	0.936	0.936	0.950	0.950

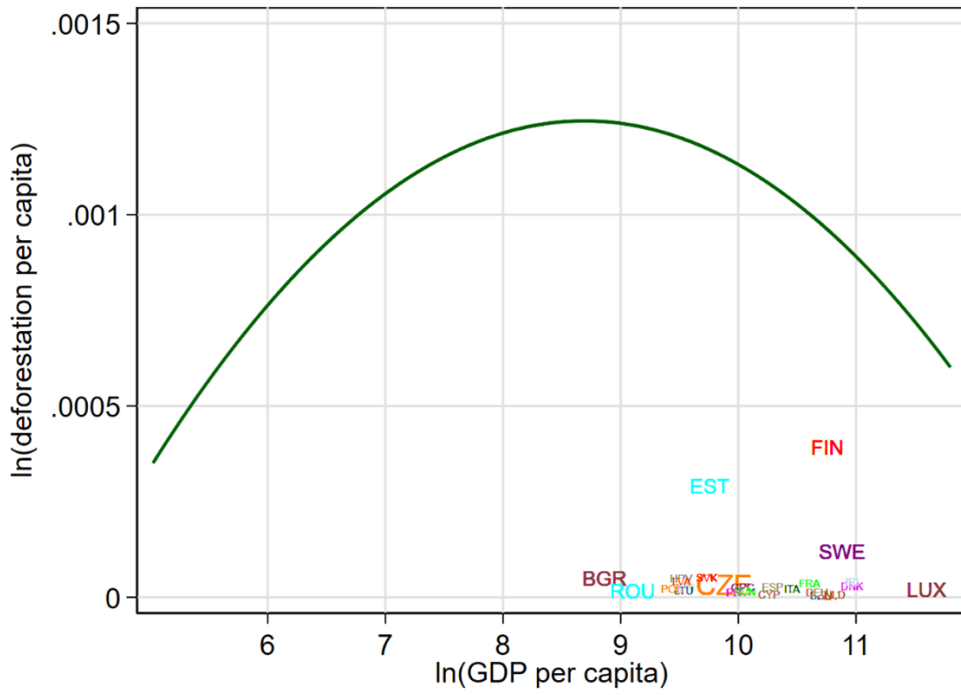
*Notes: Table 3 reports the estimated coefficients for different variations of our baseline model specification. Our dependent variable is total deforestation (in ha) per capita produced, both exported and domestically consumed. This variable is log transformed in specifications (2)–(6). The variable gdpcap stands for GDP per capita in USD, forestcap stands for stock of forests (in ha) per capita. Robust standard errors are clustered by pair and standard errors are reported in parentheses. Significance (p-values) is indicated as follows: * p < 0.10, ** p < 0.05, *** p < 0.01. The sample covers the period 2005–2018.*

Table 4: Environmental Kuznets curve estimated using deforestation by consumer country

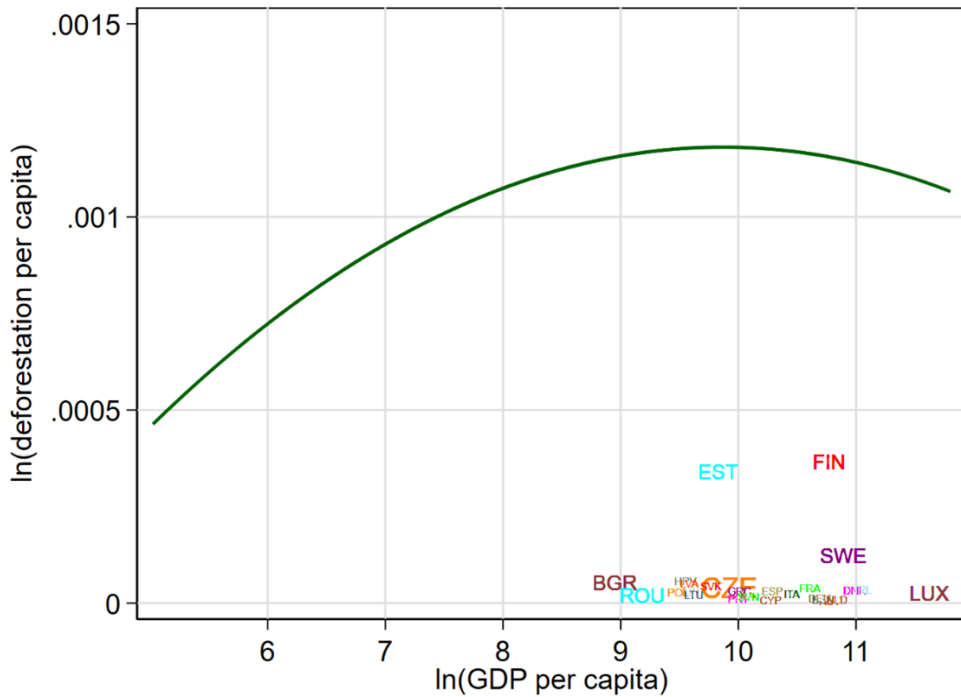
	(1)	(2)	(3)	(4)	(5)	(6)
ln(gdpcap)	0.00064**	0.00062**	0.00111***	0.00114***	0.00135***	0.00140***
	(0.00029)	(0.00026)	(0.00028)	(0.00027)	(0.00029)	(0.00030)
ln(gdpcap) ²	-0.00004**	-0.00004**	-0.00007***	-0.00007***	-0.00008***	-0.00008***
	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00002)
forestcap	0.01133**					
	(0.00112)					
ln(forestcap)		0.01333***	0.01693**	0.01023	0.00036	-0.00731
		(0.00100)	(0.00804)	(0.0087)	(0.00802)	(0.00832)
cons	-0.00172	-0.00164	-0.00369***	-0.00385***	-0.00446***	-0.00484***
	(0.00111)	(0.00110)	(0.00106)	(0.00107)	(0.00111)	(0.00112)
Country FE	No	No	Yes	Yes	Yes	Yes
Country-time FE	No	No	No	Yes	No	Yes
Sample period	2005–2022	2005–2022	2005–2022	2005–2022	2005–2019	2005–2019
Observations	3135	3135	3135	3135	2767	2767
R ²	0.034	0.039	0.814	0.815	0.917	0.918

Notes: Table 4 reports the estimated coefficients for different variations of our baseline model specification. Our dependent variable is total deforestation (in ha) per capita consumed, both imported and domestically produced. This variable is log transformed in specifications (2)–(6). The variable *gdpcap* stands for GDP per capita in USD, *forestcap* stands for stock of forests (in ha) per capita. Robust standard errors are clustered by pair and standard errors are reported in parentheses. Significance (*p*-values) is indicated as follows: * *p* < 0.10, ** *p* < 0.05, *** *p* < 0.01. The sample covers the period 2005–2018.

Figures 2 and 3 present the EKC fitted using Eq. 1. EU economies are also shown, with the Czech Republic highlighted in orange and labeled in a larger font. On average, most EU countries exhibit lower deforestation levels than predicted for economies worldwide. However, there is notable heterogeneity across EU countries and, particularly, between produced and consumed deforestation. In terms of produced deforestation, all EU economies – despite some cross-country variation – perform well, falling significantly below the predicted EKC. In contrast, for consumed deforestation, not only are some EU countries above the EKC, but all now lie much closer to the predicted curve. Comparing the results before the COVID-19 pandemic with those from the full sample reveals several key insights. First, the EKC visibly flattens after the pandemic, suggesting that high-income economies increased deforestation and that the EKC relationship has weakened. This is particularly notable given that the shift is driven by only a 20% increase in observations. Second, focusing on EU economies, the flattening of the EKC has brought most countries in the middle of the income distribution closer to the fitted curve – this is the case of the Czech Republic. Finally, when analyzing the Czech Republic’s performance in terms of consumed deforestation, we find at least seven economies with lower or similar GDP per capita that consume less deforestation, and at least 15 wealthier economies that consume more. This places the Czech Republic around the middle of the distribution, indicating that there is room for improvement.



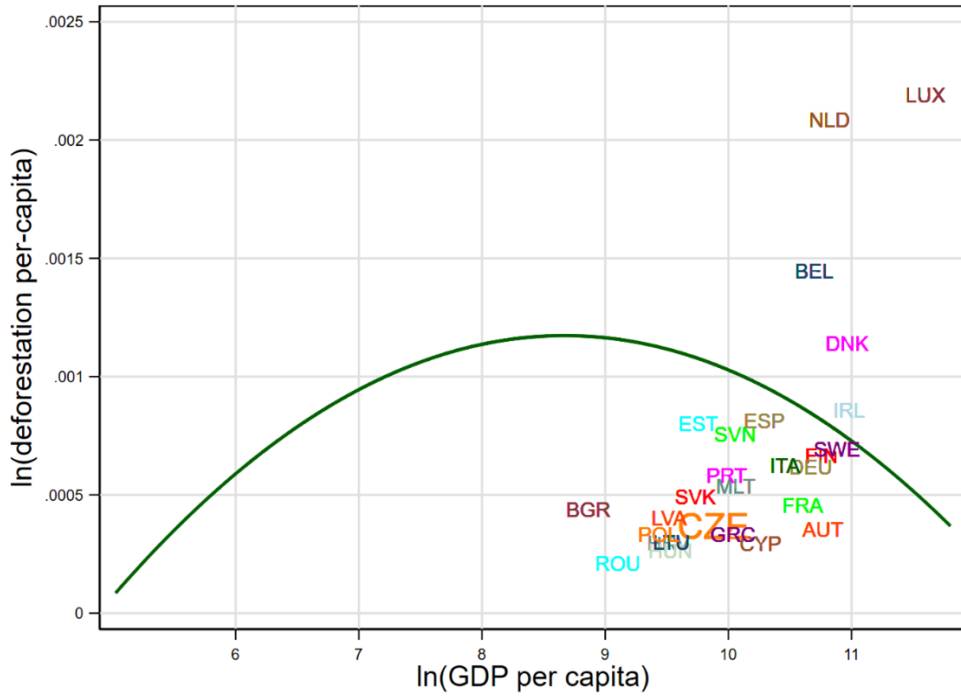
Panel A: EKC – Subsample (2005–2019)



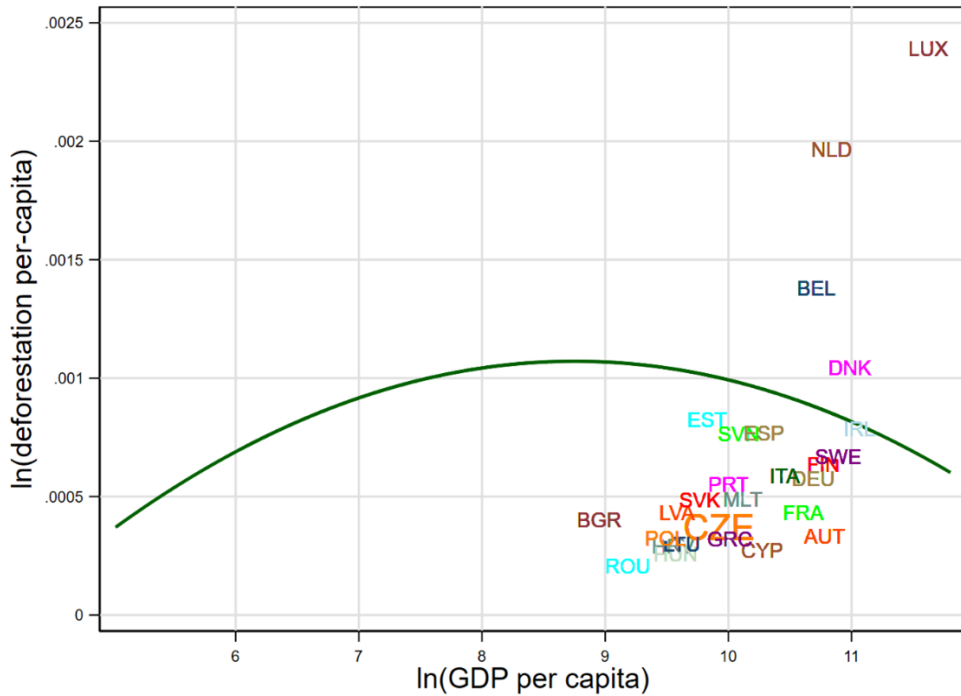
Panel B: EKC – Full sample (2005–2022)

Figure 2: EKC for domestically-produced deforestation (EU countries highlighted)

Notes: The environmental Kuznets curve was estimated on data on domestically produced deforestation fitting Eq. 1. The labels for EU economies, instead, correspond to the real data, based on the calculation of the average GDP and deforestation per capita for the whole period under analysis.



Panel A: EKC – Subsample (2005–2019)



Panel B: EKC – Full sample (2005–2022)

Figure 3: EKC for domestically-consumed deforestation (EU countries highlighted)

Notes: The environmental Kuznets curve was estimated on data on domestically consumed deforestation fitting Eq. 1. The labels for EU economies, instead, correspond to the real data, based on the calculation of the average GDP and deforestation per capita for the whole period under analysis.

Discussion and policy implications

Reducing global deforestation has been identified as a major priority for the EU, and the enactment of the EUDR is clear evidence of this commitment. However, recent delays in implementation, due to stakeholder complaints (such as from the Czech Republic) and communication weaknesses pose a challenge in quickly addressing deforestation dynamics. The COVID-19 pandemic has worsened the situation, and most European economies, including the Czech Republic, have increased the production and consumption linked to deforestation.

The argument that the Czech Republic does not play a role in deforestation because forest cover has slightly increased in the last decades⁵ masks the role played by the country through international trade links. The proximity of the entering into force of the EUDR calls for immediate action, in particular aiming to reduce the impact the regulation will have on SMEs firms, especially, as pointed by the Czech Ministry of Agriculture, in the wood processing industry, publishing houses and retail chains, among others.

The current situation can be approached from several strategic angles, including:

1. Establishing a dedicated body within the Ministry of Agriculture to monitor developments related to the EUDR.
2. Actively seeking clear and detailed implementation guidelines from the EC.
3. Enhancing communication with SMEs in high-risk sectors by providing transparent and accessible information on compliance procedures, and by actively collecting feedback and specific demands from these firms to inform policy adjustments.
4. Assessing the economic impact on affected sectors through dedicated research and impact studies.
5. Considering targeted financial support or temporary exemptions to help cover adaptation costs during the transition period.

It should be understood that, since the argument claiming the Czech Republic does not contribute to deforestation can be easily disproven, and given that the EUDR will come into force sooner rather than later, the postponement of its implementation has provided valuable time. This time should be used to actively pursue policies targeting potentially affected sectors to ensure a smooth transition.

References

- [1] Betts, M. G., Wolf, D. B., Haddad, A. M., Friedrich, T. G., Devenish, C. J. S., Čarni, A., and Walker, L. R. (2017). Tropical Biodiversity Losses Are Driven by Industrial Agriculture and Logging. *Conservation Biology*, 31(5): 1120–1130. <https://doi.org/10.1111/cobi.12715>.
- [2] Brancalion, P.H.S., Broadbent, E.N., De-Miguel, S., et al. (2020). Emerging threats linking tropical deforestation and the COVID-19 pandemic. *Perspectives in Ecology and Conservation*. <https://pmc.ncbi.nlm.nih.gov/articles/PMC7526655/>

⁵ See <https://europeannewsroom.com/cs/cesko-chce-po-ek-odlozit-narizeni-o-odlesnovani-ktere-ovlivni-tisice-firem-v-cr/>.

- [3] Céspedes, J., Sylvester, J.M., Pérez-Marulanda, L., et al. (2023). Has global deforestation accelerated due to the COVID-19 pandemic? *Journal of Forestry Research*, 34, 1153–1165. <https://link.springer.com/article/10.1007/s11676-022-01561-7>
- [4] FAO. (2020). *Global Forest Resources Assessment 2020 – Main Report*. *Food and Agriculture Organization of the United Nations*. <https://www.fao.org/documents/card/en/c/ca9825en>.
- [5] Hubau, W., Lewis, S. L., Phillips, O. L., et al. (2020). Asynchronous Carbon Sink Saturation in African and Amazonian Tropical Forests. *Nature*, 579: 80–87. <https://doi.org/10.1038/s41586-020-2035-0>.
- [6] Kuznets, S. (1955). Economic Growth and Income Inequality. *The American Economic Review* 45(1): 1–28.
- [7] Pendrill, F., M. Persson, and T. Kastner (2020). Deforestation risk embodied in production and consumption of agricultural and forestry commodities 2005–2017.
- [8] Pendrill, F., M. Persson, T. Kastner, and R. Wood (2022). Deforestation risk embodied in production and consumption of agricultural and forestry commodities 2005–2018.
- [9] Pendrill, F., U. M. Persson, J. Godar, and T. Kastner (2019). Deforestation displaced: trade in forest-risk commodities and the prospects for a global forest transition. *Environmental Research Letters* 14 (5), 055003.
- [10] Pendrill, F., U. M. Persson, J. Godar, T. Kastner, D. Moran, S. Schmidt, and R. Wood (2019). Agricultural and forestry trade drives large share of tropical deforestation emissions. *Global Environmental Change* 56, 1–10.
- [11] Kuznets, S. (1955). Economic Growth and Income Inequality. *The American Economic Review* 45(1): 1–28.
- [12] Ritchie, H. (2021). Do rich countries import deforestation from overseas? Published online at OurWorldInData.org. Retrieved from: <https://ourworldindata.org/exporting-deforestation>.
- [13] Rosen, J. (2016). Climate, Environmental Health Vulnerability, and Physical Planning: A Review of the Forecasting Literature. *Journal of Planning Literature*, 31(1), 3–22. <https://doi.org/10.1177/0885412215603769> (Original work published 2016).
- [14] Safwan M., Gill, A. R., Ghosal, K., Al-Dalahmeh, M., Alsafadi, K., Szabó, S., Oláh, J., Alkerdi, A., Ocwa, A., Harsanyi, E. (2024). Assessment of the environmental kuznets curve within EU-27: Steps toward environmental sustainability (1990–2019). *Environmental Science and Ecotechnology*, (18), 100312.
- [15] United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*. <https://sdgs.un.org/goals>.
- [16] Zematova, S. (2017). Forest Fragmentation and Its Impact on Biodiversity. *Ecological Studies Journal*, 12(3): 45–52. Summary