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Economic growth, sectoral structures, and environmental methane footprints. *

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Abstract

We analyze the impacts of economic growth on methane emissions per capita at the sectoral level for the period 1997–2014. We cover three stages of the supply chain, distinguishing between emissions embodied in production, final-production, and consumption. We investigate the effects of economic growth on two components of methane emissions per capita, namely methane emissions per value added and value added per capita. We uncover substantial heterogeneity across sectors. Economic growth led to expansions of economic activity in all sectors, but reduced the methane intensity of sectoral value added. In sectors that experienced pronounced reductions in methane intensity, economic growth did not strongly affect emissions per capita. However, in the absence of methane-intensity gains, economic growth raised emission per capita substantially.

Keywords: Economic growth, methane emissions, sectoral analysis, threshold estimation.

JEL-codes: F18, F64, O44, Q54, Q56.

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I INTRODUCTION

Economic growth and development entail changes in the scope and composition of economic production and consumption patterns (Kuznets, 1973; Herrendorf et al., 2013). Both the scope and the composition of economic activity affect environmental degradation and greenhouse gas emissions, what in turn might harm prospects for sustainable economic development in the future. Methane (CH_4) is one of the most important greenhouse gases and an important contributor to climate change. The warming potential of anthropogenic methane emissions released between 1997–2011 was equivalent to about 84% of the warming potential of Carbon Dioxide (CO_2), computed over a 20-year period (Fernández-Amador et al., 2017b).

An emerging literature has focused on quantifying the impact of economic growth and development on anthropogenic methane emissions. Jorgenson and Birkholz (2010) reported that the elasticity methane emissions with respect to income per capita was rather low (about 0.1–0.2) and decreased over time, and that the production structure of the economy played an important role as a determinant of emissions. Using more current data, Fernández-Amador et al. (2018) detected a slightly higher income-elasticity of emissions per capita, ranging between 0.2 and 0.3, and identified a quantitatively smaller impact of economic growth on emissions at higher levels of economic development. The authors also showed that the binding emission constraints specified in Annex B to the Kyoto Protocol did not have the expected effects, partly on account of the potential for emissions leakage.

Anthropogenic methane emissions are produced by only few economic sectors, mainly cattle breeding, rice cultivation, extraction and transport of fossil fuels, and waste management (see Fernández-Amador et al., 2017b). Also, these emissions result from very heterogeneous processes. Heterogeneity in economic structures across countries is likely to complicate the implementation of environmental policies and international negotiations and needs to be taken into account when assigning responsibilities for emissions and determining emission-caps. It is thus essential to understand the effect of economic growth and other socio-economic factors on sectoral methane emissions, and to evaluate the potential impacts of improvements in emission intensities for the different economic sectors. Understanding the factors that determine emissions at the sectoral level and particularly the role of economic growth will help policy makers and negotiators to assess options concerning how to achieve a reduction in emissions without compromising economic growth targets. Differences in economic development and production structures may make certain countries and sectors more vulnerable to caps on methane. Policy makers and negotiators have to consider country and sector specificities. Nevertheless, despite the implications for environmental policies and climate negotiations and sustainable economic growth, hitherto no sectoral analysis of the socio-economic drivers of methane releases has been carried out.

This paper contributes novel findings concerning anthropogenic methane emissions in three respects. First, it provides a sectoral analysis of the determinants of emissions, distinguishing between emissions from seven broad economic sectors that add up to economy-wide methane releases. We use recently updated data on anthropogenic methane emissions for the period 1997–2014, available from Fernández-Amador et al. (2017b). The data covers a global sample of countries (in some cases aggregated to regions), representative for anthropogenic methane emissions worldwide. In the econometric analysis, we pay attention to the relationship between income per capita and methane emissions and test for the existence of different forms of non-linearities in the income–methane relationship. Besides, we account for a large number of economic and political factors that may affect emissions.

Second, additionally to assessing the impact of these factors on sectoral emissions per capita, we decompose emissions per capita into sectoral emissions per unit of value added (methane intensity) and sectoral value added per capita (sectoral expansions). We use these two components as dependent variables in subsequent regressions, what allows to assess the compound effect of economic growth, via its impacts on methane intensity and sectoral expansions, on sectoral methane emissions per capita. Based on this analysis, we draw conclusions at the sectoral level concerning the extent of scale effects (via sectoral expansions) and composition and technique effects of economic growth (via changes in methane intensity).[1]

Third, we evaluate the effectiveness of emission targets specified in Annex B to the Kyoto Protocol and assess the impact of trade relations at the sectoral level. Because the data that underlies our analysis distinguishes between emissions of three different stages of the supply chain, it permits to account for trade linkages and to assign the responsibility for emissions either to the producer, final producer or consumer of products containing embodied emissions. This allows to gain insights not only concerning potential reductions of emissions from production activities, for example in Annex B countries, but also to evaluate whether potential emission gains were reflected in consumption patterns.

Our results confirm substantial sectoral heterogeneity in (i) the relation between income and emissions; (ii) the realized reductions in methane intensity; and (iii) the impact of economic and political determinants on methane releases. These sectoral differences have so far remained hidden.

Although previous estimates suggest that economic growth resulted in higher economy-wide methane emissions (Jorgenson and Birkholz, 2010; Fernández-Amador et al., 2018),

[1] See Copeland and Taylor (2004) for a definition of scale, composition and technique effects.

we show that this was not equally the case for all economic sectors. Economic growth did not significantly affect CH_4 emissions per capita in sectors accounting for more than 40% of methane emissions between 1997 and 2014, but induced higher emissions in the remaining sectors. Especially the transport sector and energy production were characterized by absence of decoupling, indicating that their contribution to emissions is likely to increase further. Moreover, the relationship between income per capita and emissions is piecewise-linear for most sectors and methane-inventories. The detected changes in the income-elasticities of methane when reaching higher levels of economic development are in line with the process of structural transformation, in which the role of primary sectors declines while the industry and service sectors, and with them energy production, gain importance (Kuznets, 1973; Herrendorf et al., 2013).

Changes in methane intensity explained a large part of the developments in emissions per capita. Economic growth reduced the methane intensity of most sectors, what counteracted the increase in emissions resulting from sectoral expansions. The sectors in which emissions per capita increased most strongly with economic growth were the ones characterized by the absence of significant methane intensity gains.

Additionally, the impact of environmental policy and other economic and political factors on methane emissions differed across sectors. The ratification of the Kyoto Protocol by Annex B countries reduced emissions per capita on the production side only in the transport and public administration sectors. At the same time, emissions derived from final-production and consumption inventories increased in the agriculture and transport sectors for Annex B members, and were not significantly affected in the remaining sectors. The ratification of the Kyoto Protocol by Annex B members did not reduce their sectoral methane intensities. Altogether, these results indicate more methane-intensive imports by Annex B countries and are consistent with the existence of methane leakage. Finally, openness to international trade, where significant, increased methane emissions.

The paper is organized as follows. The next section describes the data and provides descriptive statistics. The econometric specification is summarized in Section 3. Section 4 presents the results, and Section 5 concludes.

II DATA AND DESCRIPTIVE STATISTICS

Our analysis relies on a recently developed dataset by Fernández-Amador et al. (2017b) on anthropogenic methane emissions. The dataset provides detailed information on emission from seven economic sectors, including agriculture, livestock, energy, manufacturing, services, transport, and public administration, and comprises 187 economies (aggregated to 66 countries and 12 composite regions) for the years 1997, 2001, 2004, 2007, 2011, and 2014. The data covers the level of emissions, emissions per capita, and emissions per unit of value added for three inventories: emissions embodied in production, in final-production, and in consumption activities.[2]

Methane emissions released in the production process were primarily concentrated in the livestock, energy, and public administration (mainly waste management) sectors, which together amounted to 80% of total emissions between 1997 and 2014. These sectors' emissions were the result of very heterogeneous production processes. Emissions embodied in final-production and consumption were more evenly spread across sectors and these three sectors only accounted for about 50% of total emissions (see Table 1).

	CH_4 in Mt	**Sectoral contribution in %**						
	(CO_2e, 100y)	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
				Production inventory				
1997	5986.73	9.24%	35.51%	23.08%	4.57%	0.71%	5.74%	21.16%
2001	5910.17	8.92%	36.54%	21.67%	5.14%	0.37%	6.20%	21.15%
2004	6233.65	8.52%	35.81%	24.11%	5.76%	0.34%	4.66%	20.80%
2007	6548.36	8.28%	35.33%	24.65%	5.69%	0.27%	4.82%	20.95%
2011	6921.40	8.60%	34.19%	24.62%	4.48%	0.67%	6.06%	21.37%
2014	7070.82	8.50%	32.90%	25.89%	4.61%	0.66%	5.90%	21.54%
Average	**6445.19**	**8.68%**	**35.05%**	**24.00%**	**5.04%**	**0.50%**	**5.56%**	**21.16%**
				Footprint inventories				
1997	5986.73	14.57%	26.35%	4.30%	14.22%	11.81%	4.63%	24.12%
2001	5910.17	15.12%	24.37%	5.61%	14.74%	10.88%	4.48%	24.80%
2004	6233.65	12.56%	24.61%	5.51%	15.26%	13.27%	4.31%	24.48%
2007	6548.36	12.10%	23.41%	5.34%	16.55%	13.48%	4.43%	24.69%
2011	6921.40	12.61%	22.87%	4.85%	15.43%	14.13%	4.78%	25.33%
2014	7070.82	12.87%	22.03%	5.06%	15.39%	14.57%	4.84%	25.24%
Average	**6445.19**	**13.30%**	**23.94%**	**5.11%**	**15.27%**	**13.02%**	**4.58%**	**24.78%**

Table 1: Sectoral contributions to total CH_4 emissions. Note: Mt. stands for Megatons, CO_2e, 100y stands for CO_2 equivalents based on a global warming potential over 100 years, using the conversion factors of 21 (IPCC, 2007). agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration.

There was considerable heterogeneity across sectors concerning the development of emissions over time. Between 1997 and 2014, total methane emissions grew by 18%. Emissions embodied in production grew above the average in the energy (33%), transport (21%), public administration (20%), and manufacturing (19%) sectors, while in the remaining sectors they increased by approximately 9%. The growth of emissions embodied in final-production and consumption was especially high in the service (46%), energy (39%), manufacturing (28%), public administration (24%) and transport (23%) sectors. It was rather

[2] Details on the country coverage and the composition of the seven sectors are provided in Tables A.1 and A.2 in the Online Appendix.

low in the agriculture sector (4%), and emissions in the livestock sector even experienced a decline (of about 1%) in this period. Given this sectoral heterogeneity, it is essential to understand whether and which socio-economic drivers can explain methane releases at the sectoral level.

In our empirical analysis, we include a set of baseline variables to explain sectoral methane emissions, which we consider the most important for our purpose. These variables include income per capita, the ratification of the Kyoto Protocol by Annex B countries, and openness to international trade. The inclusion of these variables is motivated by previous literature on methane releases or greenhouse gas emissions in general. Income per capita has often been used as a proxy for economic development or to evaluate the effect of economic growth in models including individual fixed effects, and was found to have a positive effect on methane emissions (Jorgenson and Birkholz, 2010; Fernández-Amador et al., 2018). Fernández-Amador et al. (2018) evaluated the effect of binding emission constraints specified in Annex B to the Kyoto Protocol and found an insignificant effect on methane releases from production but a significant and positive effect on footprint-based methane emissions. Concerning openness to international trade, the authors found evidence for a positive impact on methane releases at the economy-wide level. The variables that we define as the baseline have also been included in various studies focusing on other greenhouse-gases (e.g. Aichele and Felbermayr, 2012, 2015; Antweiler et al., 2001; Cole and Elliott, 2003; Cole, 2004; Fernández-Amador et al., 2017a; Frankel and Rose, 2005; Harbaugh et al., 2002; Kearsley and Riddel, 2010).

Apart from the baseline regressors, we control for a set of economic and political variables. Together with individual and time fixed effects, the inclusion of the control variables should reduce potential omitted variable bias and capture heterogeneity concerning the drivers of emissions across economic sectors. Motivated by previous literature, we include food and fuel exports as a share of total exports (Jorgenson and Birkholz, 2010), the logarithm of population density (Torras and Boyce, 1998; Harbaugh et al., 2002; Frankel and Rose, 2005; Fernández-Amador et al., 2017a), urbanization (motivated by Herrendorf et al., 2013; Jorgenson, 2006), fossil rents as a share of GDP (Richmond and Kaufmann, 1997; Fernández-Amador et al., 2017a, 2018), an indicator for political regimes (Frankel and Rose, 2005; Aichele and Felbermayr, 2012; Fernández-Amador et al., 2017a), and development-group categories (Perrings and Ansuategi, 2000; Fernández-Amador et al., 2017a).

Some variables may be endogenous with respect to methane emissions. In the econometric analysis, we explicitly account for potential endogeneity of income per capita and Annex B membership. Economic growth will be endogenous if, for example, growth depends on a country's resource endowments or if environmental regulation limits a country's growth potential (e.g. Stern et al., 1996; Dinda, 2005; Frankel and Rose, 2005). Environmental regulation may be endogenous if countries decide to adopt it based on climate change vulnerability, endowments of renewable energy sources, patterns of comparative advantage, or prospects of decreasing emissions (e.g. Aichele and Felbermayr, 2012, 2015; Fernández-Amador et al., 2017a). Our choice of instruments is based on Frankel and Rose (2005); Aichele and Felbermayr (2012, 2015), and Fernández-Amador et al. (2017a, 2018). We instrument current income per capita with three years lagged income per capita, and binding emission constraints specified in Annex B to the Kyoto Protocol with the ratification of the Rome Statute of the International Criminal Court (ICC) by Annex I countries of the United Nations Framework Convention on Climate Change (UNFCCC).[3]

We source data on income per capita corrected for purchasing power, population density, the share of fossil fuel rents with respect to GDP, and urbanization from the World Development Indicators (WDI) database. Trade openness and the shares of food and fossil fuel exports with respect to total exports are based on data from GTAP. We use a political regime index from the Polity IV database, development categories of the Human Development Index (HDI) from the HDI database, and information concerning Annex B membership and the ratification of the Rome Statute of the ICC from the UN Treaty Collection Database.[4]

III ECONOMETRIC SPECIFICATIONS

The econometric identification of the determinants of CH_4 emissions is outlined below. Since the failure to account for potential non-linearities between income and emissions could lead to omitted variable bias, we address specifically the form of the relationship between pollution and income per capita. In particular, we estimate polynomial specifi-

[3] In econometric models that include a squared income term, we instrument this term by using the square of lagged income per capita as additional instrument. In the threshold models, we instrument regime-specific effects of income per capita using regime-specific terms for lagged income per capita as instruments. To avoid noise in the instrument for Annex B membership, we restrict the dummy for ICC ratification to Annex I members of the UNFCCC. Neither ICC ratification nor Annex I membership to the UNFCCC (which was determined by development status, see UNFCCC 2018) are likely to be caused by prospects of greenhouse gas emissions, which makes them valid instruments. We acknowledge that also international trade might by affected by reverse causality if the implementation of stringent environmental regulation leads to a decrease in emissions and at the same time induces firms to shift heavily polluting activities to other countries from which the produced goods are imported. This potential endogeneity has been tackled in cross sectional studies on greenhouse gas emissions using gravity estimators (e.g. Frankel and Rose, 2005; Managi et al., 2009). Yet, in our panel setup we cannot use the gravity-based trade instrument together with fixed effects, because the gravity framework makes use of time-invariant explanatory variables which are captured by the fixed effects in the main equation.

[4] A complete description of the data and a summary of data sources is available in Table A.3 in the Appendix. Summary statistics for the variables used are reported in Table A.4.

cations and threshold (piecewise linear) models. We test these non-linear model specifications against specifications in which the effect of income on emissions is linear. If the polynomial and threshold specifications both provide evidence against the linear model, we report the results of the model that minimizes the sum of squared residuals. If both non-linear specifications fail to reject non-linearities at the 10% significance level, we report the results of linear model specifications.

III.1 Polynomial specification

The polynomial models of the determinants CH_4 emissions take the form:

$$E_{it} = \beta_1 y_{it} + \beta_2 y_{it}^2 + \gamma_1 a_{it} + \gamma_2 t_{it} + Z_{it}'\delta + \nu_t + \mu_i + u_{it}. \quad (1)$$

E_{it} are (logged) sectoral CH_4 emissions per capita of region i in period t, y_{it} stands for the logarithm of purchasing power parity (PPP) adjusted real GDP per capita, a_{it} is a dummy variable equal to one for Annex B members of the Kyoto Protocol, t_{it} measures openness to international trade, and Z_{it} is a vector of control variables. ν_t and μ_i capture time and individual fixed effects (FE), and u_{it} is the error term. $\beta_1, \beta_2, \gamma_1$, and γ_2 are coefficient estimates and δ is a coefficient vector. The control variables, Z_{it}, comprise food exports and fuel exports as share of total exports, (log) population density, urbanization, fossil rents as a share of GDP, a political regime index, and development group dummies.

We account for the potential endogeneity of income per capita, its square, and Annex B membership following the instrumentation strategy described above. We estimate the instrumental variable (IV) regression models using 2-stage Generalized Methods of Moments (GMM).[5] We test for the statistical significance of the polynomial relationship between income and emissions by applying the (inverse) U-test developed by Lind and Mehlum (2010).

III.2 Threshold specification

Additionally, we consider the threshold (piecewise linear) specification

$$E_{it} = \beta_1 y_{it} I(q_{it} \leq \tau) + \beta_2 y_{it} I(q_{it} > \tau) + \gamma_1 a_{it} + \gamma_2 t_{it} + Z_{it}'\delta + \nu_t + \mu_i + u_{it}, \quad (2)$$

[5] In the main text, we report only the results from the IV regressions. The results of uninstrumented regressions are reported in the Online Appendix.

where $I(\cdot)$ are indicator functions that determine regimes with different income elasticities, which depend on whether the threshold variable q_{it} (in our case the logarithm of GDP per capita five years lagged) is smaller or larger than the threshold value τ. The threshold τ lies in the domain of q_{it}, ($\tau \in [q_{it}^{min}, q_{it}^{max}]$). The continuous threshold variable q_{it} is assumed to be exogenous. All other variables and parameters are defined as before.

To allow for potential endogeneity of income per capita and Annex B membership, we follow Caner and Hansen (2004) and estimate IV-FE threshold models using the instruments described above. We regress the endogenous variables on the exogenous variables and instruments to obtain the predicted values of the endogenous variables. Then, we regress E_{it} on these predicted values and the exogenous controls and estimate the threshold parameter τ, which is treated as unknown (see Hansen 1999, 2000).

The least squares estimator for the threshold τ is defined as minimizing the concentrated sum of squared errors (conditioned on τ), where minimization is based on a grid search over the domain of the threshold variable q_{it}. To avoid regimes with too few observations, we restrict the searchable domain to values of q_{it} such that at least 10% of the observations lie in each regime.

Given a threshold estimate $\hat{\tau}$, we use a likelihood ratio (LR) test with the null hypothesis of the non-existence of the threshold. Since this test is non-standard, we use a bootstrap procedure based on Hansen (1996) to simulate the asymptotic distribution and to construct the p-values (see Hansen, 1999, for details). $\hat{\tau}$ is a consistent estimator of τ, but its asymptotic distribution is also non-standard. Therefore, following Hansen (1996), we define the 99% confidence interval for $\hat{\tau}$ as the non-rejection region of an LR test with the null of no statistically significant difference between a proposal for τ and $\hat{\tau}$ at the 1% significance level. Finally, we estimate the coefficients of the second-stage by 2-stage GMM, conditioned on the estimate for the threshold $\hat{\tau}$.

IV RESULTS

IV.1 Methane per capita

Table 2 presents the regression results of the IV-FE estimations for (the logarithm of) methane emissions per capita derived from production (Panel 1), final-production (Panel 2), and consumption activities (Panel 3) as dependent variables. The table reports the coefficients and standard errors of the baseline regressors and several test statistics.[6]

[6] The results for the full list of regressors are available in Tables B.1 to B.3 in the Online Appendix. The corresponding results for FE estimations are presented in Tables B.10 to B.12.

There is remarkable heterogeneity at the sectoral level in terms of (i) functional form; (ii) threshold values; (iii) magnitude and significance of income-elasticities; and (iv) impacts of climate agreements and economic factors on methane emissions. In terms of functional form, most sectors were characterized by a (threshold) piecewise-linear relationship between income and methane emissions per capita (see the bootstrap p-value, testing the H_0 of linearity). Exceptions were the livestock and manufacturing sectors for production-based methane inventories, for which we failed to find non-linearities. The threshold values that define income-regimes with different income-elasticities of methane differed largely across sectors. In most cases, the thresholds were narrowly defined, as indicated by their confidence intervals, what highlights that this form of non-linearity may fit the data better than other forms of non-linearity such as polynomial or smooth transition specifications. High income-thresholds were detected in agriculture, livestock, energy, and public administration, while manufacturing, services, and transport were characterized by moderate to low threshold values.[7]

The estimated income-elasticities reveal some interesting patterns. First, the income-elasticity decreased when passing through the income-threshold from the lower to the higher income-regime in the primary sectors, transport, and public administration. By contrast, the income-elasticity increased when moving from the lower to the higher income-regime in the energy, manufacturing, and service sectors. This sectoral pattern is consistent with the declining role of primary sectors and the rising importance of industrialization, which is accompanied by increased demand for energy, in the course of economic development (see Kuznets, 1973; Herrendorf et al., 2013). A notable exception to this pattern was production in the service sector, for which the income-elasticity of emissions strongly decreased (by 0.22 percentage points) when moving to the higher income-regime. This decrease may be partly driven by a declining methane content per unit of value added associated with economic development, either through methane efficiency gains or through composition effects, issues that we will pick up again below.[8] In all other sector–inventory combinations, the difference in income-elasticities across income-regimes was usually far below 0.1 percentage points, but despite its small magnitude the difference was mostly statistically significant (see the Wald tests of the equality of coefficients).

Turning to quantitative differences in the income-elasticities as we move down the supply chain (i.e. from production to final-production and to consumption inventories), the general pattern was a decrease in income-elasticities from production to final-production,

[7] Exceptions to this general pattern were the production inventories in agriculture and energy and to some extent the final-production inventory in the transport sector.

[8] Another exception was the public administration sector for the consumption inventory, where income-elasticity increased when moving to the higher income-regime.

	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
			Panel 1: CH_4 per capita embodied in production				
ln(Income), reg.1	0.491 **	0.176	0.725 ***	-0.007	0.857	1.819 ***	0.297 **
	(0.205)	(0.158)	(0.187)	(0.406)	(0.819)	(0.639)	(0.123)
ln(Income), reg.2	0.424 **		0.762 ***		0.631	1.727 ***	0.275 **
	(0.192)		(0.183)		(0.747)	(0.612)	(0.128)
Annex B	-0.178	0.736	0.067	0.179	0.768	-0.424 *	-0.192 *
	(0.227)	(0.731)	(0.160)	(0.299)	(0.534)	(0.257)	(0.101)
Openness	0.303 ***	0.614	0.191 *	-0.109	0.269	0.151	0.011
	(0.078)	(0.451)	(0.105)	(0.161)	(0.355)	(0.245)	(0.077)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Threshold (value)	8.086		8.842		7.652	7.689	10.489
99% CI lower bound	8.047		8.803		7.652	7.652	10.487
99% CI upper bound	8.245		8.994		7.652	7.901	10.490
Bootstrap p-value	0.018		0.004		0.000	0.002	0.000
Wald equal. coeff. (p)	0.007		0.003		0.018	0.005	0.004
N regime 1/2	69/399	468	129/339	468	47/421	49/419	392/76
			Panel 2: CH_4 per capita embodied in final production				
ln(Income), reg.1	0.297	0.079	0.027	0.376	0.241	1.174 ***	0.343 ***
	(0.231)	(0.137)	(0.231)	(0.260)	(0.318)	(0.334)	(0.080)
ln(Income), reg.2	0.253	0.058	0.061	0.437 **	0.293	1.147 ***	0.327 ***
	(0.231)	(0.141)	(0.232)	(0.221)	(0.305)	(0.331)	(0.081)
Annex B	0.320 *	0.088	-0.135	-0.110	0.234	0.576 **	-0.078
	(0.190)	(0.255)	(0.244)	(0.222)	(0.179)	(0.239)	(0.098)
Openness	-0.112	0.153 **	0.062	0.192 **	-0.019	0.244	0.103
	(0.107)	(0.072)	(0.196)	(0.084)	(0.144)	(0.163)	(0.081)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Threshold (value)	9.952	10.415	10.222	8.055	7.963	9.669	10.443
99% CI lower bound	9.939	10.236	10.008	8.051	7.901	9.500	10.405
99% CI upper bound	9.955	10.604	10.314	8.055	8.137	9.828	10.526
Bootstrap p-value	0.000	0.014	0.010	0.000	0.010	0.040	0.000
Wald equal. coeff. (p)	0.001	0.043	0.002	0.290	0.002	0.027	0.005
N regime 1/2	293/175	370/98	329/139	68/400	63/405	249/219	377/91
			Panel 3: CH_4 per capita embodied in consumption				
ln(Income), reg.1	0.413 **	0.150	0.154	0.509 **	0.246	1.546 ***	0.248 **
	(0.190)	(0.161)	(0.276)	(0.245)	(0.307)	(0.367)	(0.118)
ln(Income), reg.2	0.385 **	0.128	0.187	0.571 ***	0.297	1.498 ***	0.269 **
	(0.189)	(0.165)	(0.275)	(0.206)	(0.294)	(0.351)	(0.113)
Annex B	0.531 ***	-0.128	-0.081	0.155	0.184	0.687 ***	-0.191 *
	(0.183)	(0.224)	(0.284)	(0.141)	(0.162)	(0.206)	(0.110)
Openness	0.079	0.087	0.040	0.002	-0.043	0.193	0.109
	(0.092)	(0.105)	(0.202)	(0.096)	(0.162)	(0.169)	(0.086)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Threshold (value)	9.947	10.302	10.166	8.055	7.963	7.689	9.493
99% CI lower bound	9.929	10.241	7.652	8.055	7.901	7.652	9.493
99% CI upper bound	9.968	10.539	10.609	8.055	8.100	7.802	9.508
Bootstrap p-value	0.006	0.000	0.006	0.000	0.004	0.020	0.000
Wald equal. coeff. (p)	0.001	0.067	0.021	0.257	0.002	0.095	0.016
N regime 1/2	290/178	341/127	317/151	68/400	63/405	49/419	219/249

Table 2: IV-FE results: CH_4 per capita. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). CI stands for confidence interval and N is the number of observations. Cluster robust standard errors (Stock and Watson, 2008) in parentheses. Panel 1: The threshold estimate and the lower bound of the CI for services, and the lower bound of the CI for transport are truncated at 7.652 as a result of the 10% trimming. Panel 3: The bounds of the threshold CI for energy, and the lower bound of the CI for transport are truncated at 7.652 and 10.609.

and a slight renewed increase from final-production to consumption-based inventories.[9] This pattern suggests that production and consumption activities—and CH_4 embodied in them—were significantly influenced by growing incomes, whereas economic growth did not strongly affect where the assembly of final products occurred.

The magnitude and the statistical significance of the estimated income-elasticities differed widely across sectors. Interestingly, we could not reject the null hypothesis of coupling of emissions in several sectors (i.e. the income-elasticity was not significantly different from one, indicating the absence of decoupling).[10] Most striking was the very high income-elasticity of CH_4 emissions in the transport sector, which was consistently larger than one for all CH_4 inventories. In this sector, a one percent increase in income per capita led to an expansion of CH_4 emissions per capita by between 1.1 (final-production) and 1.8 (production) percent, which points to the absence of decoupling. Also for the production of energy, the absence of decoupling could not be rejected, since the income-elasticity was not statistically different from one at conventional significance levels. By contrast, evidence for relative decoupling—i.e. a positive and statistically significant income-elasticity that is also significantly smaller than one—was found in agriculture, manufacturing, and public administration.[11] In these sectors, a one percent increase in income per capita entailed an increase in emissions per capita of roughly 0.3 (public administration) to 0.5 percent (manufacturing). Finally, for other sectors the income-elasticity of emissions was not statistically different from zero and thus we could not reject absolute decoupling. This applied to the livestock and service sectors, and to footprint-based emissions in the energy sector. Taken together, the sectors in which income growth did not significantly affect CH_4 emissions accounted for about 40% of emissions from production and consumption, and for 55% of final-production.

Regarding the other covariates, being an Annex B member of the Kyoto Protocol significantly lowered CH_4 emissions derived from production in the transport and public administration sectors only. For footprint-based emissions (final-production and consumption inventories), by contrast, Annex B membership had the opposite effect in the agriculture and transport sectors, where emissions were higher in Annex B countries than in their non-Annex B counterparts. The only footprint-based inventory in which Annex B membership significantly reduced CH_4 emissions was the consumption inventory in the public administration sector. Together, these findings show that the CH_4-reducing effect of An-

[9] The public administration sector was an exception, with the income-elasticity being the highest for the final-production inventory and the lowest for consumption-based CH_4 emissions.

[10] For a definition of coupling, relative decoupling, and absolute decoupling see OECD (2002) and Jackson (2009).

[11] Exceptions were the final-production inventory for agriculture, and the production inventory for manufacturing, with a statistically insignificant income-elasticity.

nex B membership disappeared when moving down the supply chain (or, respectively, that its effect reversed to inducing higher footprint-based emissions) and suggest that imports by Annex B countries were relatively methane-intensive. Concerning trade openness, we found positive and statistically significant effects on emissions from the agriculture and energy sectors (production inventories), and the livestock and manufacturing sectors (final-production inventories). The effects of the control variables, which are reported in Tables B.1 to B.3 in the Online Appendix, varied in magnitude and statistical significance across sectors, confirming the heterogeneity of drivers of CH_4 emissions at the sectoral level.

In order to address whether the effects of the baseline variables were affected by collinearity with some of the controls, we tested the sensitivity of our results to the exclusion of the control variables. The main results were qualitatively not affected, with one notable exception: We could not reject linearity between income and CH_4 per capita for the final-production inventory in the transport sector (p-value: 0.106).[12]

IV.2 Decomposition of methane per capita

A more detailed picture of the channels through which economic growth impacts on methane emissions is obtained by splitting methane per capita into methane emissions per unit of value added (methane intensity) and value added (VA) per capita (see equation (3)).

$$\underbrace{\frac{CH_{4s}}{pop}}_{\text{methane per capita}} = \underbrace{\frac{CH_{4s}}{VA_s}}_{\text{methane intensity}} \cdot \underbrace{\frac{VA_s}{pop}}_{\text{VA per capita}} \tag{3}$$

Using these two terms as dependent variables in subsequent regressions contributes additional insights. On the one hand, the patterns detected for methane per capita may be influenced by changes in methane intensity within sectors (e.g. through changes in methane efficiency or compositional changes within the seven broad sectors under investigation). In this vein, the income-elasticity of methane intensity captures the composition and technique effects of economic grwoth defined in Copeland and Taylor (2004). On the other hand, methane per capita is also affected by expansions or contractions of sectors.

[12] Some differences in terms of statistical significance levels occurred, from which we should note three. First, the income-elasticity of emissions embodied in final-production in the agriculture sector turned statistically significant. Second, the effect of Annex B membership changed its statistical significant in some sectors: It remained positive but turned statistically significant in the service sector (production-based emissions), and it turned insignificant in the public administration sector (all emission inventories). Third, trade openness remained negative but turned statistically significant in the agriculture sector (final-production inventory). Additionally, we detected an increase in the income-elasticity when surpassing the income-threshold in the final production inventory in the agriculture, transport, and public administration sectors. The results are available upon request.

Thus, the income-elasticity of sectoral value added per capita is a proxy for scale effects of economic growth as described in Copeland and Taylor (2004).

Table 3 presents the regression results for sectoral value added per capita as dependent variable. The effect of income per capita was positive and highly statistically significant in all sectors, with a particularly strong effect on the transport and manufacturing sectors, and on energy production. These positive income-elasticities underline the scale effect of economic growth on emissions, which predicts that as income rises, sectors will expand, contributing to economy-wide emissions (see Copeland and Taylor, 2004; Stern, 2004). Countries facing binding emission constraints as specified in the Kyoto Protocol downsized sectoral value added especially from the primary sectors and manufacturing, but increased value added from services. Furthermore, value added embodied in the consumption of transport services increased in Annex B countries. Trade openness was related to a decrease in value added per capita from the livestock and service sectors.

Turning to the results for methane per unit of value added as dependent variable (Table 4), we observe that income per capita was negatively connected to methane intensity in many, but not all, sectors. A negative income-elasticity of methane intensity is compatible with composition and technique effects of economic growth, which predict that with rising income the composition of the sector changes in a way that makes it less emission intensive (composition effect) and/or more environmentally friendly methods of production are developed (technique effect). Our results suggest that composition and technique effects were not present in every economic sector.

In terms of functional form, we find evidence for a piecewise linear relationship between income per capita and CH_4 intensity in all but three sector–inventory combinations. In two sectors—livestock and energy—we could not reject a linear relationship between income and CH_4 per unit of value added embodied in production activities. In contrast, the relationship between income and the CH_4 intensity of production in the transport sector followed an inverse-U shape, showing that the CH_4 intensity of transport increased at low levels of economic development but decreased after a turning-point had been reached. This polynomial relationship is statistically significant, as indicated by the (inverse) U-test of Lind and Mehlum (2010). The turning-point was identified at a log-income per capita of about 8.4 (i.e. about 4,400 constant PPP dollars), suggesting that 16.5% of the observations in our sample faced a positive income-elasticity, whereas for the richer 83.5% income growth reduced the CH_4 content of value added embodied in production.

Looking at the piecewise-linear regressions, the identified income-thresholds did not correspond in general to the ones detected for CH_4 per capita. High threshold values for CH_4 intensities were detected in the energy, service, and public administration sectors, whereas

	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
	Panel 1: Value added per capita embodied in production in:						
ln(Income), reg.1	1.003 ***	0.738 ***	1.335***	1.231 ***	1.097***	1.817 ***	0.900 **
	(0.209)	(0.166)	(0.327)	(0.194)	(0.108)	(0.640)	(0.389)
ln(Income), reg.2	0.982 ***	0.719 ***		1.217 ***		1.735 ***	0.933 **
	(0.207)	(0.163)		(0.192)		(0.573)	(0.375)
Annex B	-0.340 **	-0.422 **	0.338	-0.566 ***	0.205	-0.035	-0.154
	(0.167)	(0.191)	(0.303)	(0.161)	(0.127)	(0.256)	(0.321)
Openness	-0.132	-0.320 ***	0.219	-0.018	-0.287**	-0.273	-0.170
	(0.091)	(0.116)	(0.221)	(0.163)	(0.115)	(0.176)	(0.126)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Threshold (value)	9.509	9.493		10.173		10.222	9.508
99% CI lower bound	9.433	7.652		10.101		10.192	9.493
99% CI upper bound	9.556	10.609		10.452		10.314	9.684
Bootstrap p-value	0.036	0.044		0.002		0.000	0.018
Wald equal. coeff. (p)	0.001	0.045		0.117		0.299	0.103
N regime 1/2	222/246	219/249	468	318/150	468	329/139	221/247
	Panel 2: Value added per capita embodied in final production in:						
ln(Income), reg.1	0.934 ***	0.779***	0.775 ***	1.398 ***	1.031***	1.160 ***	0.835 **
	(0.189)	(0.184)	(0.207)	(0.177)	(0.146)	(0.237)	(0.403)
ln(Income), reg.2	0.912 ***		0.725 ***	1.374 ***		1.212 ***	0.869 **
	(0.189)		(0.204)	(0.177)		(0.225)	(0.389)
Annex B	-0.189	-0.668***	0.003	-0.253 *	0.372**	0.290	-0.189
	(0.118)	(0.165)	(0.222)	(0.154)	(0.154)	(0.193)	(0.276)
Openness	-0.071	-0.210**	0.132	0.238	-0.319**	-0.121	-0.169
	(0.118)	(0.103)	(0.149)	(0.157)	(0.144)	(0.128)	(0.138)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Threshold (value)	10.008		9.079	10.258		8.047	9.559
99% CI lower bound	9.927		9.019	10.233		8.026	9.493
99% CI upper bound	10.101		9.139	10.359		8.137	9.684
Bootstrap p-value	0.000		0.000	0.000		0.050	0.010
Wald equal. coeff. (p)	0.008		0.001	0.009		0.011	0.083
N regime 1/2	301/167	468	157/311	336/132	468	66/402	231/237
	Panel 3: Value added per capita embodied in consumption in:						
ln(Income), reg.1	0.972 ***	0.777 ***	0.743 ***	1.340 ***	1.022***	1.254 ***	0.880 **
	(0.158)	(0.181)	(0.180)	(0.147)	(0.136)	(0.214)	(0.374)
ln(Income), reg.2	0.951 ***	0.755 ***	0.703 ***	1.311 ***		1.309 ***	0.910 **
	(0.159)	(0.185)	(0.180)	(0.148)		(0.202)	(0.363)
Annex B	0.070	-0.503 ***	-0.060	0.190	0.296**	0.516 ***	-0.187
	(0.150)	(0.183)	(0.210)	(0.170)	(0.142)	(0.188)	(0.252)
Openness	-0.029	-0.079	0.062	0.002	-0.362***	-0.142	-0.155
	(0.127)	(0.114)	(0.151)	(0.116)	(0.139)	(0.129)	(0.134)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Threshold (value)	10.023	10.306	9.079	10.421		8.047	9.559
99% CI lower bound	9.988	10.251	8.762	10.382		7.963	9.493
99% CI upper bound	10.101	10.377	9.139	10.431		8.100	9.690
Bootstrap p-value	0.004	0.000	0.012	0.042		0.090	0.006
Wald equal. coeff. (p)	0.001	0.063	0.017	0.000		0.005	0.072
N regime 1/2	304/164	343/125	157/311	371/97	468	66/402	231/237

Table 3: IV-FE results: Value added per capita. Note: Abbreviations as in Table 2. Panel 1: The bounds of the threshold CI for livestock are truncated at 7.652 and 10.609 as a result of the 10% trimming.

	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
	Panel 1: CH_4 per unit of VA embodied in production in:						
ln(Income), reg.1	-0.347	-0.468*	-0.503	-1.154 **	-0.257	11.745**	-0.800 **
	(0.217)	(0.257)	(0.315)	(0.487)	(0.813)	(5.252)	(0.343)
ln(Income), reg.2	-0.425 **			-1.181 **	-0.479		-0.776 **
	(0.209)			(0.462)	(0.736)		(0.346)
ln(Income), squared						-0.701**	
						(0.320)	
Annex B	0.099	1.125	-0.287	0.772 **	0.563	0.098	0.032
	(0.287)	(0.787)	(0.351)	(0.356)	(0.536)	(0.398)	(0.395)
Openness	0.452 ***	0.938*	-0.050	-0.060	0.555	0.207	0.180
	(0.104)	(0.536)	(0.234)	(0.274)	(0.402)	(0.209)	(0.164)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Thresh. (value); [TP]	8.055			8.086	7.652	[8.374]	9.777
99% CI lower bound	8.047			7.652	7.652		7.652
99% CI upper bound	8.086			10.609	7.652		10.609
Bootstrap p-value	0.002			0.034	0.002		0.014
Wald equal. coeff. (p)	0.008			0.556	0.030		0.068
U-Test (p)						0.025	
N reg. 1/2; [%N<TP]	68/400	468	468	69/399	47/421	468 [16.5%]	270/198
	Panel 2: CH_4 per unit of VA embodied in final production in:						
ln(Income), reg.1	-0.611 ***	-0.550 ***	-0.673 **	-1.010 ***	-0.549 **	-0.120	-0.518
	(0.220)	(0.190)	(0.292)	(0.157)	(0.271)	(0.306)	(0.386)
ln(Income), reg.2	-0.591 ***	-0.580 ***	-0.619 **	-0.951 ***	-0.522 *	-0.170	-0.539
	(0.223)	(0.183)	(0.292)	(0.149)	(0.274)	(0.295)	(0.373)
Annex B	0.448 *	0.595 **	-0.241	0.229	-0.254	0.346 *	0.073
	(0.251)	(0.236)	(0.246)	(0.181)	(0.181)	(0.205)	(0.257)
Openness	-0.055	0.398 ***	-0.130	-0.063	0.356 ***	0.353 ***	0.282 ***
	(0.140)	(0.118)	(0.192)	(0.105)	(0.088)	(0.132)	(0.098)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Threshold (value)	10.470	8.055	10.131	8.217	10.455	8.055	9.559
99% CI lower bound	10.445	8.047	10.085	8.100	10.388	8.047	7.652
99% CI upper bound	10.489	8.086	10.184	8.257	10.489	8.086	10.609
Bootstrap p-value	0.016	0.004	0.040	0.000	0.070	0.006	0.044
Wald equal. coeff. (p)	0.070	0.176	0.002	0.008	0.006	0.021	0.248
N regime 1/2	385/83	68/400	314/154	74/394	384/84	68/400	231/237
	Panel 3: CH_4 per unit of VA embodied in consumption in:						
ln(Income), reg.1	-0.489 *	-0.512 ***	-0.548 *	-0.670 ***	-0.547 **	0.036	-0.761 ***
	(0.258)	(0.182)	(0.288)	(0.101)	(0.262)	(0.259)	(0.267)
ln(Income), reg.2	-0.525 **	-0.547 ***	-0.498 *	-0.650 ***	-0.524 **	-0.010	-0.746 ***
	(0.248)	(0.174)	(0.288)	(0.101)	(0.264)	(0.247)	(0.266)
Annex B	0.491 ***	0.348 *	-0.074	-0.018	-0.214	0.195	0.054
	(0.176)	(0.200)	(0.278)	(0.145)	(0.168)	(0.162)	(0.211)
Openness	0.121	0.186 *	-0.046	0.017	0.371 ***	0.309 ***	0.245 **
	(0.112)	(0.107)	(0.204)	(0.083)	(0.085)	(0.089)	(0.096)
Additional controls	yes	yes	yes	yes	yes	yes	yes
Threshold (value)	8.051	8.055	10.101	10.377	10.455	8.055	9.459
99% CI lower bound	8.047	8.047	10.013	10.241	10.369	8.047	7.652
99% CI upper bound	8.086	8.086	10.184	10.380	10.513	8.086	10.609
Bootstrap p-value	0.016	0.004	0.010	0.032	0.068	0.002	0.028
Wald equal. coeff. (p)	0.061	0.102	0.004	0.000	0.012	0.030	0.161
N regime 1/2	67/401	68/400	312/156	358/110	384/84	68/400	212/256

Table 4: IV-FE results: CH_4 per unit of value added. Note: TP stands for the value of the turning point. U-Test (p) is the p-value of the test for a polynomial relationship developed by Lind and Mehlum (2010). %N<TP refers to the share of observations before the TP. Other abbreviations as in Table 2. Panel 1: The threshold estimate and the lower bound of the CI for services, and the bounds of the CI for manufacturing and public administration are truncated at 7.652 and 10.609 as a result of the 10% trimming. Panels 2 and 3: The bounds of the CI for public administration are similarly truncated.

lower values were identified for the primary sectors, manufacturing, and transport.[13] The differences in threshold estimates between Tables 2 and 4 may be explained by the developments in sectoral value added per capita (and sectoral change) that accompany economic development.

The direction of the change in income-elasticities when moving from one income-regime to the other was more in line with the findings for CH_4 per capita.[14] Notably, the difference in the income-elasticities across regimes was usually small but statistically significant in many sectors. Like for CH_4 per capita, the only larger change in the income-elasticity across regimes was observed for services production (0.22 percentage points). Also conforming the pattern detected for CH_4 per capita, was the change in income-elasticities when moving down the supply chain. We observe an increase in the (negative) income-elasticity when moving from production to final-production inventories, and a renewed decrease when moving from final-production to consumption.[15] Taken together, our results suggest that changes in the income-elasticity of CH_4 intensities, at least partly, determined corresponding changes in the income-elasticity of CH_4 per capita that accompany economic development.

The magnitude of the income-elasticities of CH_4 intensity was relatively large (in absolute value) for the manufacturing sector, where a one percent increase in income per capita led to a more than proportional decrease in CH_4 intensity.[16] Also public administration was characterized by a rather high income-elasticity of CH_4 intensity in production and consumption (between -0.75 and -0.8). More moderate elasticities were found in the primary sectors, energy, and services, ranging between -0.42 (agricultural production) and -0.67 (final-production of energy). By contrast, economic growth did not lead to significant reductions of CH_4 intensities in the transport sector, in service and energy production, and for the final-production inventory in public administration. Noteworthy, relating these findings to the results in Tables 2 and 3, we observed that whenever the income-elasticity of CH_4 intensity was statistically insignificant, the corresponding income-elasticity of CH_4 per capita was rather high; in other words, economic growth led to an increase in CH_4 emissions per capita especially in sectors that were not able to curtail their CH_4 intensity. By contrast, sectors that reduced the CH_4 intensity as the economy

[13] The three exceptions to this broad pattern were the production-inventory for services, the final-production inventory for agriculture, and the consumption-inventory for manufacturing.

[14] The only two exceptions were the production inventory for public administration and final-production in agriculture, where the income-elasticity of CH_4 intensity was higher (i.e. less negative) in the second regime.

[15] One exception was the manufacturing sector, where the elasticity also decreased when moving from production to final-production. Furthermore, like for CH_4 per capita, public administration followed the reverse pattern.

[16] For CH_4 embodied in consumption this decrease was somewhat smaller (about 0.65 percent).

grew were able to (at least partially) counterbalance the increase of emissions arising from sectoral expansions.

The effects of the remaining explanatory variables varied across sectors and CH_4 inventories. Surprisingly, whenever the coefficient of Annex B was statistically significant, it was positive. Thus, the insignificant (or sometimes negative) effect of Annex B membership detected in Table 2 for production-based inventories was likely driven by a reduction of sectoral value added per capita in Annex B countries, rather than by a decrease in their CH_4 intensity, what is also supported by the findings in Table 3. Trade openness had a positive and statistically significant effect on the CH_4 intensity of production in the two agricultural sectors, and for the footprint-based emission inventories in the livestock, service, transport, and public administration sectors. Again, the effects of the control variables varied considerably across sectors.

The results of the robustness check in which we included only the baseline regressors were in line with these findings. The main difference was that in the robustness check we found evidence for a threshold effect for energy production, but not for manufacturing production.[17]

V DISCUSSION

We investigated the relationship between sectoral methane emissions and income per capita and other economic and political variables, using a global dataset for the period 1997–2014. We payed attention to the existence of potential non-linear effects of income on emissions and analyzed differences in the drivers of emission footprints at three stages of the supply chain.

There is considerable heterogeneity in the relationship between economic growth and methane emissions at the sectoral level. Emissions per capita were not significantly affected by income per capita in sectors accounting for more than 40% of total methane emissions. In these sectors, absolute decoupling could not be rejected. In the remaining sectors, economic growth significantly raised emissions per capita, although the magnitude of this increase varied across sectors. In some sectors, the increase was less than proportional, indicating relative decoupling, whereas in others the null hypothesis that emissions per capita grew as fast as or faster than income per capita could not be rejected.

[17] We can highlight three changes in statistical significance levels. First, the income-elasticity of the consumption inventory for energy turned insignificant, whereas the income-elasticity of the final-production inventory of public administration lost significance. Second, the negative coefficient of Annex B membership in the final-production of services turned statistically significant. Third, openness was statistically significant also in the production inventory in the service sector.

The impact of income per capita on emissions per capita was the result of the interplay of its effect on sectoral expansions (a proxy for scale effects) and on emission intensities (a proxy for composition and technique effects). Economic growth was connected to expansions of economic activity in all sectors. It also led to reductions in sectoral emission intensities, albeit the effect was insignificant in some sectors. In general, the sectors that experienced the largest increase in emissions per capita from economic growth were the ones that did not experience significant gains in emission intensities. In general, realized gains in methane intensity were too weak to outweigh the scale effect of economic growth. Thus, there is no evidence for an environmental Kuznets' curve in methane emissions.

The effectiveness of binding emission constraints, as specified by the Annex B to the Kyoto Protocol, differed across economic sectors. Significant reductions in emission per capita could only be realized in production of the transport and public administration sectors. Still, these gains were not driven by improvements in methane intensity but likely by a reduction of economic activity in these sectors. Annex B membership also resulted in increased emissions from footprint-based emission inventories in some sectors, indicating that imports of Annex B countries were relatively methane intensive. All in all, these results may be supportive for methane leakage and point to the ineffectiveness of the Kyoto Protocol.

The sectoral heterogeneity that we found for methane emissions may introduce transaction costs associated with the design and implementation of international agreements and national policies against climate change. These transaction costs find their ground in the existing asymmetries in economic structures and preferences across and within nations (Libecap, 2014). International cooperation is influenced by such transaction costs that need to be overcome to reach an agreement. The larger the heterogeneity in economic structures or preferences, the lower the probability of international cooperation to cope with the problem of global negative externalities. Asymmetries across nations deepen as a result of increasing divergence in the sectoral composition of their economies at different stages of economic development or as a consequence of economic specialization. Within nations, as methane releases are concentrated in few sectors, sectoral specificities of pollution push asymmetric preferences concerning mitigation. This influences the positions negotiators will exhibit in international agreements and affects the willingness to implement national policies, especially if the sectors affected by the new policies are able to form lobbies.

As our research underlines, there are some factors that may complicate the design and implementation of environmental instruments against pollution from methane emissions. There is a remarkable diversity in the anthropogenic processes that produce CH_4 emissions.

For climate change mitigation to be effective, national instruments must take into account the diverse nature of the processes that are responsible for emissions and the existence of international trade linkages. National environmental policies must take those sectoral specificities into consideration and act at the sectoral level with specific designs. More comprehensive, global agreements on policy instruments to combat global warming must also address these difficulties and sectoral particularities.

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ONLINE APPENDICES

A DATA APPENDIX

Aggregate	Countries and regions included
	Single Countries and Regions:
The 66 single countries and regions	Albania, Argentina, Australia, Austria, Belgium, Bangladesh, Bulgaria, Brazil, Botswana, Canada, Chile, China, Colombia, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malawi, Malaysia, Malta, Mexico, Morocco, Mozambique, Netherlands, New Zealand, Peru, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovakia, Slovenia, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Turkey, Uganda, United Kingdom, United States, Uruguay, Venezuela, Vietnam, Zambia, Zimbabwe
	The 12 Composite Regions:
Rest of Andean Pact	Bolivia and Equador
Central America, Caribbean	Anguila, Antigua & Barbados, Aruba, Bahamas, Barbados Belize, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Netherlands Antilles, Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago and Virgin Islands (GB)
Rest of EFTA	Iceland, Liechtenstein and Norway
Rest of Former Soviet Union	Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyszstan, Moldova, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan
Middle East	Bahrain, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Rep., United Arab Emirates and Yemen
Rest of North Africa	Algeria, Egypt, Libyan Arab Jamahiriya and Tunisia
Other Southern Africa	Angola and Mauritius
Rest of South African Customs Union	Lesotho, Namibia, South Africa and Swaziland
Rest of South America	Guyana, Paraguay and Suriname
Rest of South Asia (RSA)	Bhutan, Maldives, Nepal and Pakistan
Rest of Sub-Saharan Africa (SSA)	Benin, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Cote d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Magagascar, Mali, Mauritania, Mayotte, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Togo and Congo (DPR)
Rest of World	Afghanistan, Albania, Andorra, Bermuda, Bosnia and Herzegowina, Brunei, Cambodia, Faroe Islands, Fiji, French Polynesia, Gibraltar, Greenland, Guadeloupe, Kiribati, Lao (PDR), Macau, Macedonia (former Yugoslav Republic of), Marshall Islands, Micronesia, Monaco, Mongolia, Myanmar, Nauru, New Caledonia, Korea (DPR), Papua New Guinea, San Marino, Solomon Islands, Tonga, Tuvalu, Vanuatu, Western Samoa, Rest of former Yugoslavia

Table A.1: Countries and regions in the database.

Sector	**Sub-sectors**
Agriculture (agr.)	Paddy rice (pdr); Wheat (wht); Cereal grains nec (gro); Vegetables, fruit, nuts (v_f); Oil seeds (ost); Sugar cane, sugar beet (c_b); Plant-based fibers (pfb); Crops nec (ocr); Forestry (frs); Fishing (fsh); Sugar (sgr); Food products nec (ofd); Beverages and tobacco products (b_t); Vegetable oils and fats (v_f); Processed rice (pcr);
Livestock (liv.)	Cattle, sheep, goats, horses (ctl); Animal products nec (oap); Raw milk (rmk); Wool, silk-worm cocoons (wol); Meat: cattle, sheep, goats, horse (cmt); Meat products nec (omt); Dairy products (mil);
Manufacturing (mfc.)	Textiles (tex); Wearing apparel (wap); Leather products (lea); Wood products (lum); Paper products, publishing (ppp); Chemical, rubber, plastic products (crp); Mineral products nec (nmm); Ferrous metals (i_s); Metals nec (nfm); Metal products (fmp); Motor vehicles and parts (mvh); Petroleum, coal products (p_c); Transport equipment nec (otn); Electronic equipment (ele); Machinery and equipment nec (ome); Manufactures nec (omf);
Transport (trn.)	Transport nec (otp); Sea transport (wtp); Air transport (atp);
Services (ser.)	Water utility services (wtr); Construction (cns); Trade and distribution (trd); Communication (cmn); Financial services nec (ofi); Insurance (isr); Business services nec (obs); Recreation and other services (ros); Dwellings (dwe);
Energy (egy.)	Coal (coa); Oil (oil); Gas (gas); Minerals nec (omn); Electricity (ely); Gas manufacture, distribution (gdt);
Public Administration (pub.)	Public Administration (osg);

Table A.2: Sub-sectors of the seven broad economic sectors.

Variable	Description	Source
	Dependent variables	
ln(CH_4 pc), prod.	Log of production based CH_4 emissions per capita.	Fernández-Amador et al. (2017b)
ln(CH_4 pc), fin. prod.	Log of final-production based CH_4 emissions per capita.	Fernández-Amador et al. (2017b)
ln(CH_4 pc), cons.	Log of consumption based CH_4 emissions per capita.	Fernández-Amador et al. (2017b)
ln(CH_4 per VA), prod.	Log of production based CH_4 emissions per unit of value added.	Fernández-Amador et al. (2017b)
ln(CH_4 per VA), fin. prod.	Log of final-production based CH_4 emissions per unit of value added.	Fernández-Amador et al. (2017b)
ln(CH_4 per VA), cons.	Log of production-based CH_4 emissions per unit of value added.	Fernández-Amador et al. (2017b)
ln(VA pc), prod.	Log of production based value added per capita.	Fernández-Amador et al. (2017b)
ln(VA pc), fin. prod.	Log of final-production based value added per capita.	Fernández-Amador et al. (2017b)
ln(VA pc), cons.	Log of consumption based value added per capita.	Fernández-Amador et al. (2017b)
	Baseline regressors and control variables	
ln(Income pc)	Log of real GDP (PPP) per capita.	WDI
Annex B	Dummy = 1 for members of Annex B of the Kyoto Protocol.	UN
Openness	Trade openness calculated as (X+M)/GDP.	GTAP
Food exports	Share of exports from food sectors (agriculture, livestock, food processing) in total exports.	GTAP
Fuel exports	Share of exports from fossil fuel sectors (coal, gas, oil, minerals, petrochemicals) in total exports.	GTAP
ln(Pop. density)	Log of number of inhabitants per square kilometer.	WDI
Urbanization	Share of total population living in cities.	WDI
Fossil rents	Rents from fossil fuel production (including coal, gas and oil) as share of GDP.	WDI
Polity IV	Index of democracy (10) vs. autocracy (–10).	Polity IV
HDI	Development categories ranging from 1 to 4 (highest to lowest) based on categories used in the Human Development Report (2016).	HDI database/UN
	Variables used for instrumentation and threshold variable	
ICC ratification	Dummy = 1 for Annex B members that ratified the Rome Statute of the ICC (instrument for Annex B)	UN
ln(Income pc), lag 3	Lagged real GDP (PPP) per capita (3 lags; instrument for real GDP (PPP) per capita).	WDI
ln(Income pc), lag 5	Lagged real GDP (PPP) per capita (5 lags; threshold variable).	WDI

Table A.3: Definition of variables and data sources.

	N	Mean	Std. Dev.	Min.	Max.
		Dependent variables			
ln(CH4 pc), prod., agriculture	468	-4.100	1.820	-11.880	-0.520
ln(CH4 pc), prod., livestock	468	-1.110	1.230	-9.600	1.830
ln(CH4 pc), prod., energy	468	-2.630	1.920	-9.610	0.530
ln(CH4 pc), prod., manufacturing	468	-3.860	1.230	-8.640	-1.050
ln(CH4 pc), prod., services	468	-6.230	2.190	-22.130	-3.050
ln(CH4 pc), prod., transport	468	-3.620	1.610	-8.610	0.530
ln(CH4 pc), prod., public admin.	468	-1.370	0.610	-3.300	0.440
ln(CH4 pc), fin. prod., agriculture	468	-2.370	0.650	-4.500	-0.740
ln(CH4 pc), fin. prod., livestock	468	-1.340	1.000	-3.970	1.290
ln(CH4 pc), fin. prod., energy	468	-3.320	1.300	-6.720	-0.090
ln(CH4 pc), fin. prod., manufacturing	468	-1.970	0.860	-5.880	0.460
ln(CH4 pc), fin. prod., services	468	-1.980	1.010	-4.560	0.190
ln(CH4 pc), fin. prod., transport	468	-3.020	1.270	-7.020	0.080
ln(CH4 pc), fin. prod., public admin.	468	-1.200	0.610	-3.300	0.430
ln(CH4 pc), cons., agriculture	468	-2.270	0.580	-4.410	-0.760
ln(CH4 pc), cons., livestock	468	-1.250	0.770	-3.110	1.130
ln(CH4 pc), cons., energy	468	-3.280	1.340	-8.290	-0.080
ln(CH4 pc), cons., manufacturing	468	-1.820	0.920	-5.340	1.110
ln(CH4 pc), cons., services	468	-1.980	1.000	-4.570	0.060
ln(CH4 pc), cons., transport	468	-3.030	1.210	-6.710	0.010
ln(CH4 pc), cons., public admin.	468	-1.200	0.620	-3.300	0.420
ln(CH4 per VA), prod., agriculture	468	-2.770	2.130	-10.420	2.290
ln(CH4 per VA), prod., livestock	468	1.240	1.400	-9.400	4.400
ln(CH4 per VA), prod., energy	468	-0.980	1.930	-7.100	4.080
ln(CH4 per VA), prod., manufacturing	468	-3.390	2.070	-8.380	1.610
ln(CH4 per VA), prod., services	468	-6.840	2.900	-23.740	-0.590
ln(CH4 per VA), prod., transport	468	-2.050	1.740	-5.810	8.560
ln(CH4 per VA), prod., public admin.	468	-0.750	1.510	-5.160	4.460
ln(CH4 per VA), fin. prod., agriculture	468	-1.150	0.900	-2.830	2.120
ln(CH4 per VA), fin. prod., livestock	468	0.570	1.210	-2.840	4.090
ln(CH4 per VA), fin. prod., energy	468	-0.390	1.140	-4.400	2.650
ln(CH4 per VA), fin. prod., manufacturing	468	-1.640	0.930	-3.260	2.360
ln(CH4 per VA), fin. prod., services	468	-2.510	0.870	-4.140	-0.190
ln(CH4 per VA), fin. prod., transport	468	-1.220	0.800	-3.040	1.600
ln(CH4 per VA), fin. prod., public admin.	468	-0.900	1.300	-3.660	3.680
ln(CH4 per VA), cons., agriculture	468	-1.080	0.810	-2.720	2.090
ln(CH4 per VA), cons., livestock	468	0.660	1.050	-1.360	3.790
ln(CH4 per VA), cons., energy	468	-0.340	1.070	-4.200	2.640
ln(CH4 per VA), cons., manufacturing	468	-1.650	0.690	-2.690	1.280
ln(CH4 per VA), cons., services	468	-2.520	0.840	-4.110	-0.490
ln(CH4 per VA), cons., transport	468	-1.210	0.660	-2.560	1.260
ln(CH4 per VA), cons., public admin.	468	-0.910	1.260	-3.660	2.550

Table A.4: Descriptive statistics (continued on next page ...)

	N	Mean	Std. Dev.	Min.	Max.
Dependent variables					
ln(VA pc), prod., agriculture	468	-1.330	0.800	-3.510	0.600
ln(VA pc), prod., livestock	468	-2.350	1.190	-5.460	0.280
ln(VA pc), prod., energy	468	-1.650	1.370	-7.410	2.060
ln(VA pc), prod., manufacturing	468	-0.470	1.670	-5.340	2.290
ln(VA pc), prod., services	468	0.600	1.630	-3.010	3.480
ln(VA pc), prod., transport	468	-1.570	1.660	-11.440	1.910
ln(VA pc), prod., public admin.	468	-0.630	1.740	-5.820	2.400
ln(VA pc), fin. prod., agriculture	468	-1.210	0.810	-3.390	0.790
ln(VA pc), fin. prod., livestock	468	-1.910	1.180	-5.440	0.450
ln(VA pc), fin. prod., energy	468	-2.930	1.460	-7.870	-0.210
ln(VA pc), fin. prod., manufacturing	468	-0.330	1.560	-5.620	2.400
ln(VA pc), fin. prod., services	468	0.540	1.660	-3.640	3.640
ln(VA pc), fin. prod., transport	468	-1.790	1.560	-6.280	1.160
ln(VA pc), fin. prod., public admin.	468	-0.300	1.700	-5.310	2.780
ln(VA pc), cons., agriculture	468	-1.190	0.810	-3.420	0.770
ln(VA pc), cons., livestock	468	-1.910	1.120	-5.160	0.260
ln(VA pc), cons., energy	468	-2.940	1.490	-7.760	-0.210
ln(VA pc), cons., manufacturing	468	-0.160	1.450	-4.440	2.590
ln(VA pc), cons., services	468	0.540	1.630	-3.600	3.390
ln(VA pc), cons., transport	468	-1.820	1.440	-5.880	0.980
ln(VA pc), cons., public admin.	468	-0.290	1.690	-4.550	2.770
Baseline regressors and control variables					
ln(Income pc)	468	9.540	1.090	6.210	11.490
Annex B	468	0.310	0.460	0	1
Openness	468	0.820	0.470	0.180	3.270
Food exports (%)	468	0.120	0.130	0.000	0.760
Fuel exports (%)	468	0.140	0.200	0.000	0.940
ln(Pop. density)	468	-2.590	1.460	-6.030	2.040
Urbanization	468	0.630	0.220	0.120	1.000
Fossil rents	468	0.030	0.060	0.000	0.410
Polity IV	468	6.260	5.080	-7	10
HDI middle	468	0.210	0.400	0	1
HDI high	468	0.240	0.430	0	1
HDI very high	468	0.430	0.500	0	1
Instruments and threshold variable					
ICC ratification	468	0.330	0.470	0	1
ln(Income pc), lag 3	468	9.460	1.110	5.940	11.460
ln(Income pc), lag 5	468	9.400	1.110	5.870	11.430

Table A.4: Descriptive statistics (... continued from previous page.)

B APPENDIX TABLES

B.1 Detailed IV-FE results for CH_4 per capita

	Dependent variable: CH_4 per capita embodied in production in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
(% of total CH_4)	8.66%	34.98%	24.09%	5.03%	0.51%	5.57%	21.17%
ln(Income), reg.1	0.491 **	0.176	0.725 ***	-0.007	0.857	1.819 ***	0.297 **
	(0.205)	(0.158)	(0.187)	(0.406)	(0.819)	(0.639)	(0.123)
ln(Income), reg.2	0.424 **		0.762 ***		0.631	1.727 ***	0.275 **
	(0.192)		(0.183)		(0.747)	(0.612)	(0.128)
Annex B	-0.178	0.736	0.067	0.179	0.768	-0.424 *	-0.192 *
	(0.227)	(0.731)	(0.160)	(0.299)	(0.534)	(0.257)	(0.101)
Openness	0.303 ***	0.614	0.191 *	-0.109	0.269	0.151	0.011
	(0.078)	(0.451)	(0.105)	(0.161)	(0.355)	(0.245)	(0.077)
Food exports (%)	-0.026	0.400	-0.608	0.326	-0.968	-1.729 **	0.465
	(0.457)	(0.566)	(0.578)	(1.001)	(1.214)	(0.679)	(0.326)
Fuel exports (%)	-0.565 *	0.109	0.488	-0.524	-0.332	-0.770 *	-0.009
	(0.324)	(0.337)	(0.335)	(0.723)	(1.102)	(0.392)	(0.146)
ln(Pop. density)	-0.839	1.921	0.292	0.021	0.244	0.767	-0.353
	(0.547)	(1.627)	(0.523)	(1.273)	(1.280)	(1.144)	(0.253)
Urbanization	-0.377	2.018	0.299	-0.100	8.391 ***	-1.760	-1.263
	(0.785)	(1.843)	(0.986)	(0.978)	(2.762)	(2.012)	(0.814)
Fossil rents	-0.321	-0.372	-0.257	0.574	1.072	-4.965 ***	-0.874 **
	(0.753)	(0.638)	(0.962)	(1.341)	(2.311)	(0.929)	(0.421)
Polity IV	-0.002	0.001	-0.004	-0.009	-0.027	-0.037 ***	0.003
	(0.005)	(0.006)	(0.009)	(0.014)	(0.021)	(0.010)	(0.003)
HDI middle	-0.076	-0.036	-0.212	0.538	0.967	0.057	-0.020
	(0.141)	(0.098)	(0.250)	(0.463)	(0.666)	(0.176)	(0.043)
HDI high	-0.196	0.066	-0.222	0.683	1.356 **	-0.152	0.003
	(0.179)	(0.152)	(0.245)	(0.505)	(0.685)	(0.300)	(0.072)
HDI very high	-0.254	-0.013	-0.234	0.552	1.313 *	-0.319	0.090
	(0.208)	(0.159)	(0.266)	(0.526)	(0.699)	(0.395)	(0.112)
Threshold (value)	8.086		8.842		7.652	7.689	10.489
99% CI lower bound	8.047		8.803		7.652	7.652	10.487
99% CI upper bound	8.245		8.994		7.652	7.901	10.490
Bootstrap p-value	0.018		0.004		0.000	0.002	0.000
Wald equal. coeff. (p)	0.007		0.003		0.018	0.005	0.004
SSE without threshold	29.684	79.371	39.799	78.062	439.968	68.785	11.946
SSE with threshold	29.167		38.898		418.384	66.991	10.934
N regime 1	69	468	129	468	47	49	392
N regime 2	399		339		421	419	76

Table B.1: IV-FE results: CH_4 production per capita. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. The threshold estimate and the lower bound of the CI for services, and the lower bound of the CI for transport are truncated at 7.652 as a result of the 10% trimming. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: CH_4 per capita embodied in final production in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
(% of total CH_4)	13.25%	23.86%	5.11%	15.29%	13.10%	4.59%	24.80%
ln(Income), reg.1	0.297	0.079	0.027	0.376	0.241	1.174 ***	0.343 ***
	(0.231)	(0.137)	(0.231)	(0.260)	(0.318)	(0.334)	(0.080)
ln(Income), reg.2	0.253	0.058	0.061	0.437 **	0.293	1.147 ***	0.327 ***
	(0.231)	(0.141)	(0.232)	(0.221)	(0.305)	(0.331)	(0.081)
Annex B	0.320 *	0.088	-0.135	-0.110	0.234	0.576 **	-0.078
	(0.190)	(0.255)	(0.244)	(0.222)	(0.179)	(0.239)	(0.098)
Openness	-0.112	0.153 **	0.062	0.192 **	-0.019	0.244	0.103
	(0.107)	(0.072)	(0.196)	(0.084)	(0.144)	(0.163)	(0.081)
Food exports (%)	-0.592	-0.525	0.268	-1.275 *	0.694	-0.171	0.976 **
	(0.863)	(0.405)	(1.416)	(0.696)	(0.666)	(1.083)	(0.427)
Fuel exports (%)	-0.122	0.225	-0.502	-0.844	-0.408	-1.667 **	0.067
	(0.315)	(0.181)	(0.483)	(0.624)	(0.338)	(0.722)	(0.136)
ln(Pop. density)	-0.172	0.381	0.308	-0.253	0.535	0.261	-0.075
	(0.507)	(0.406)	(0.780)	(0.724)	(0.534)	(0.928)	(0.262)
Urbanization	0.157	-0.004	-2.246	-0.529	-0.230	-0.207	-0.202
	(0.923)	(0.904)	(1.405)	(0.985)	(0.886)	(1.636)	(0.687)
Fossil rents	-4.441 **	0.715	-2.195	1.165	-1.212	-3.557 *	-0.659
	(2.003)	(0.857)	(1.524)	(0.930)	(0.785)	(1.839)	(0.407)
Polity IV	-0.005	-0.005	-0.012	0.020 ***	0.002	-0.027 ***	0.006 *
	(0.009)	(0.008)	(0.014)	(0.007)	(0.009)	(0.011)	(0.003)
HDI middle	0.048	-0.033	0.044	0.313 ***	0.059	-0.112	-0.054
	(0.087)	(0.106)	(0.137)	(0.107)	(0.094)	(0.271)	(0.050)
HDI high	0.085	0.037	0.119	0.381 ***	0.216	-0.099	-0.036
	(0.157)	(0.129)	(0.201)	(0.140)	(0.142)	(0.326)	(0.079)
HDI very high	0.045	-0.040	0.169	0.357 **	0.204	-0.042	0.058
	(0.183)	(0.142)	(0.228)	(0.162)	(0.178)	(0.353)	(0.102)
Threshold (value)	9.952	10.415	10.222	8.055	7.963	9.669	10.443
99% CI lower bound	9.939	10.236	10.008	8.051	7.901	9.500	10.405
99% CI upper bound	9.955	10.604	10.314	8.055	8.137	9.828	10.526
Bootstrap p-value	0.000	0.014	0.010	0.000	0.010	0.040	0.000
Wald equal. coeff. (p)	0.001	0.043	0.002	0.290	0.002	0.027	0.005
SSE without threshold	27.711	19.482	46.150	28.299	23.423	46.092	8.816
SSE with threshold	26.280	19.055	45.167	26.697	22.918	44.760	8.266
N regime 1	293	370	329	68	63	249	377
N regime 2	175	98	139	400	405	219	91

Table B.2: IV-FE results: CH_4 final production per capita. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: CH_4 per capita embodied in consumption in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
(% of total CH_4)	13.25%	23.86%	5.11%	15.29%	13.10%	4.59%	24.80%
ln(Income), reg.1	0.413 **	0.150	0.154	0.509 **	0.246	1.546 ***	0.248 **
	(0.190)	(0.161)	(0.276)	(0.245)	(0.307)	(0.367)	(0.118)
ln(Income), reg.2	0.385 **	0.128	0.187	0.571 ***	0.297	1.498 ***	0.269 **
	(0.189)	(0.165)	(0.275)	(0.206)	(0.294)	(0.351)	(0.113)
Annex B	0.531 ***	-0.128	-0.081	0.155	0.184	0.687 ***	-0.191 *
	(0.183)	(0.224)	(0.284)	(0.141)	(0.162)	(0.206)	(0.110)
Openness	0.079	0.087	0.040	0.002	-0.043	0.193	0.109
	(0.092)	(0.105)	(0.202)	(0.096)	(0.162)	(0.169)	(0.086)
Food exports (%)	-0.839	-0.674	0.533	-0.198	0.720	0.245	0.888 **
	(0.690)	(0.430)	(1.903)	(0.600)	(0.657)	(1.054)	(0.362)
Fuel exports (%)	-0.108	0.093	-1.240	-0.089	-0.329	-0.907 *	0.070
	(0.302)	(0.194)	(1.020)	(0.312)	(0.310)	(0.470)	(0.132)
ln(Pop. density)	0.261	0.230	0.631	0.528	0.435	0.687	-0.010
	(0.488)	(0.465)	(0.937)	(0.508)	(0.501)	(0.789)	(0.261)
Urbanization	-0.140	-0.313	-1.286	-1.053	-0.109	0.617	0.044
	(0.952)	(0.815)	(1.395)	(0.902)	(0.858)	(1.633)	(0.681)
Fossil rents	-3.015	0.467	-1.599	0.475	-1.261	-3.411 **	-0.391
	(1.843)	(0.840)	(1.751)	(0.637)	(0.771)	(1.691)	(0.396)
Polity IV	0.005	-0.009	-0.003	0.016 **	0.002	-0.022 **	0.005 *
	(0.009)	(0.007)	(0.014)	(0.006)	(0.009)	(0.011)	(0.003)
HDI middle	0.055	-0.082	0.011	0.269 **	0.067	0.212	-0.017
	(0.093)	(0.105)	(0.123)	(0.117)	(0.093)	(0.214)	(0.048)
HDI high	0.205	-0.032	0.198	0.418 ***	0.225	0.264	0.015
	(0.154)	(0.121)	(0.207)	(0.149)	(0.138)	(0.270)	(0.074)
HDI very high	0.179	-0.014	0.221	0.447 **	0.211	0.152	0.133
	(0.169)	(0.130)	(0.248)	(0.174)	(0.168)	(0.289)	(0.093)
Threshold (value)	9.947	10.302	10.166	8.055	7.963	7.689	9.493
99% CI lower bound	9.929	10.241	7.652	8.055	7.901	7.652	9.493
99% CI upper bound	9.968	10.539	10.609	8.055	8.100	7.802	9.508
Bootstrap p-value	0.006	0.000	0.006	0.000	0.004	0.020	0.000
Wald equal. coeff. (p)	0.001	0.067	0.021	0.257	0.002	0.095	0.016
SSE without threshold	22.197	20.447	61.592	21.267	21.946	43.328	11.624
SSE with threshold	21.525	19.632	60.183	20.352	21.449	42.846	10.831
N regime 1	290	341	317	68	63	49	219
N regime 2	178	127	151	400	405	419	249

Table B.3: IV-FE results: CH_4 consumption per capita. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. The bounds of the threshold CI for energy, and the lower bound of the CI for transport are truncated at 7.652 and 10.609 as a result of the 10% trimming. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

B.2 Detailed IV-FE results for CH_4 per VA

	Dependent variable: CH_4 per unit of VA embodied in production in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
ln(Income), reg.1	-0.347	-0.468*	-0.503	-1.154 **	-0.257	11.745**	-0.800 **
	(0.217)	(0.257)	(0.315)	(0.487)	(0.813)	(5.252)	(0.343)
ln(Income), reg.2	-0.425 **			-1.181 **	-0.479		-0.776 **
	(0.209)			(0.462)	(0.736)		(0.346)
ln(Income), squared						-0.701**	
						(0.320)	
Annex B	0.099	1.125	-0.287	0.772 **	0.563	0.098	0.032
	(0.287)	(0.787)	(0.351)	(0.356)	(0.536)	(0.398)	(0.395)
Openness	0.452 ***	0.938*	-0.050	-0.060	0.555	0.207	0.180
	(0.104)	(0.536)	(0.234)	(0.274)	(0.402)	(0.209)	(0.164)
Food exports (%)	-0.271	-0.254	2.517	2.738 **	-0.915	-1.009	0.258
	(0.663)	(1.058)	(1.606)	(1.138)	(1.350)	(1.097)	(0.742)
Fuel exports (%)	0.274	0.879*	-2.245***	0.632	0.182	0.417	0.009
	(0.401)	(0.519)	(0.786)	(0.897)	(1.192)	(0.627)	(0.334)
ln(Pop. density)	-1.320 *	1.517	0.421	0.949	-0.131	-1.569	-0.580
	(0.689)	(1.869)	(0.896)	(1.324)	(1.328)	(1.710)	(0.786)
Urbanization	-1.612 *	0.299	0.677	0.135	7.866 ***	-1.246	-2.048
	(0.948)	(2.355)	(1.594)	(1.549)	(2.550)	(2.279)	(1.258)
Fossil rents	-1.250	-0.560	-2.145	1.781	1.464	-3.678	0.821
	(1.350)	(1.471)	(1.466)	(1.771)	(2.442)	(2.342)	(1.512)
Polity IV	0.008	0.021**	-0.008	-0.003	-0.026	-0.024*	0.014
	(0.007)	(0.009)	(0.018)	(0.016)	(0.020)	(0.012)	(0.009)
HDI middle	-0.236	-0.171	-0.154	0.553	0.916	-0.445	0.079
	(0.201)	(0.151)	(0.321)	(0.525)	(0.658)	(0.289)	(0.141)
HDI high	-0.342	-0.006	-0.030	0.766	1.258 *	-0.619	0.272
	(0.247)	(0.216)	(0.380)	(0.578)	(0.684)	(0.382)	(0.221)
HDI very high	-0.420	-0.275	0.163	0.685	1.170 *	-0.572	0.247
	(0.282)	(0.258)	(0.447)	(0.605)	(0.709)	(0.400)	(0.220)
Threshold (value)	8.055			8.086	7.652		9.777
99% CI lower bound	8.047			7.652	7.652		7.652
99% CI upper bound	8.086			10.609	7.652		10.609
Bootstrap p-value	0.002			0.034	0.002		0.014
Wald equal. coeff. (p)	0.008			0.556	0.030		0.068
Turning point						8.374	
Observations before TP (%)						83.5%	
U-Test (p)						0.025	
SSE without threshold	46.480	117.128	90.138	103.888	446.357	170.210	63.173
SSE with threshold	45.012			102.790	426.213		62.313
N regime 1	68	468	468	69	47	468	270
N regime 2	400			399	421		198

Table B.4: IV-FE results: CH_4 production per value added. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. TP stands for turning point, and U-Test (p) is the p-value of the test for a polynomial relationship developed by Lind and Mehlum (2010). SSE is the sum of squared errors, and N is the number of observations. The threshold estimate and the lower bound of the CI for services, and the bounds of the CI for manufacturing and transport are truncated at 7.652 and 10.609 as a result of the 10% trimming. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: CH_4 per unit of VA embodied in final production in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
ln(Income), reg.1	-0.6107 ***	-0.550 ***	-0.673 **	-1.010 ***	-0.549 **	-0.120	-0.518
	(0.220)	(0.190)	(0.292)	(0.157)	(0.271)	(0.306)	(0.386)
ln(Income), reg.2	-0.5906 ***	-0.580 ***	-0.619 **	-0.951 ***	-0.522 *	-0.170	-0.539
	(0.223)	(0.183)	(0.292)	(0.149)	(0.274)	(0.295)	(0.373)
Annex B	0.4484 *	0.595 **	-0.241	0.229	-0.254	0.346 *	0.073
	(0.251)	(0.236)	(0.246)	(0.181)	(0.181)	(0.205)	(0.257)
Openness	-0.0553	0.398 ***	-0.130	-0.063	0.356 ***	0.353 ***	0.282 ***
	(0.140)	(0.118)	(0.192)	(0.105)	(0.088)	(0.132)	(0.098)
Food exports (%)	-0.6902	-0.736	2.099	1.178	0.215	0.204	0.131
	(1.044)	(0.512)	(1.630)	(1.069)	(0.717)	(0.751)	(0.671)
Fuel exports (%)	0.2966	0.259	-0.886	-0.271	-0.043	-0.494	0.070
	(0.391)	(0.213)	(0.662)	(0.313)	(0.378)	(0.451)	(0.263)
ln(Pop. density)	-0.1810	0.180	-0.378	-0.304	-0.098	0.494	-0.974 *
	(0.532)	(0.568)	(0.663)	(0.665)	(0.521)	(0.592)	(0.535)
Urbanization	-0.8890	0.285	-1.583	-0.266	-0.781	-0.827	-1.779 **
	(0.998)	(1.181)	(1.509)	(0.807)	(0.752)	(0.945)	(0.832)
Fossil rents	-4.3456 **	0.771	-4.636 ***	1.944 **	-0.972	-2.758 ***	0.459
	(2.018)	(1.223)	(1.614)	(0.827)	(0.728)	(0.903)	(1.316)
Polity IV	0.0009	0.023 ***	-0.014	0.009	0.004	-0.004	0.012 *
	(0.008)	(0.006)	(0.011)	(0.006)	(0.009)	(0.007)	(0.006)
HDI middle	-0.1712	-0.140	-0.193	0.240 **	0.004	-0.009	-0.020
	(0.122)	(0.105)	(0.175)	(0.095)	(0.100)	(0.111)	(0.094)
HDI high	-0.1270	-0.004	-0.052	0.388 ***	0.105	0.035	0.060
	(0.196)	(0.135)	(0.234)	(0.130)	(0.133)	(0.172)	(0.140)
HDI very high	-0.0854	-0.122	0.062	0.412 ***	0.082	-0.018	0.093
	(0.225)	(0.167)	(0.283)	(0.142)	(0.159)	(0.193)	(0.159)
Threshold (value)	10.470	8.055	10.131	8.217	10.455	8.055	9.559
99% CI lower bound	10.445	8.047	10.085	8.100	10.388	8.047	7.652
99% CI upper bound	10.489	8.086	10.184	8.257	10.489	8.086	10.609
Bootstrap p-value	0.016	0.004	0.040	0.000	0.070	0.006	0.044
Wald equal. coeff. (p)	0.070	0.176	0.002	0.008	0.006	0.021	0.248
Threshold at bound	0	0	0	0	0	0	0
min CI is at bound	0	0	0	0	0	0	1
max CI is at bound	0	0	0	0	0	0	1
SSE without threshold	34.171	28.113	73.302	24.305	19.606	30.415	38.681
SSE with threshold	33.239	27.338	72.403	23.125	19.476	29.488	38.157
N regime 1	385	68	314	74	384	68	231
N regime 2	83	400	154	394	84	400	237

Table B.5: IV-FE results: CH_4 final production per value added. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. The bounds of the threshold CI for public administration are truncated at 7.652 and 10.609 as a result of the 10% trimming. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: CH_4 per unit of VA embodied in consumption in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
ln(Income), reg.1	-0.489 *	-0.512 ***	-0.548 *	-0.670 ***	-0.547 **	0.036	-0.761 ***
	(0.258)	(0.182)	(0.288)	(0.101)	(0.262)	(0.259)	(0.267)
ln(Income), reg.2	-0.525 **	-0.547 ***	-0.498 *	-0.650 ***	-0.524 **	-0.010	-0.746 ***
	(0.248)	(0.174)	(0.288)	(0.101)	(0.264)	(0.247)	(0.266)
Annex B	0.491 ***	0.348 *	-0.074	-0.018	-0.214	0.195	0.054
	(0.176)	(0.200)	(0.278)	(0.145)	(0.168)	(0.162)	(0.211)
Openness	0.121	0.186 *	-0.046	0.017	0.371 ***	0.309 ***	0.245 **
	(0.112)	(0.107)	(0.204)	(0.083)	(0.085)	(0.089)	(0.096)
Food exports (%)	-0.906	-0.775	1.513	0.746	0.290	0.461	0.034
	(0.878)	(0.488)	(1.675)	(0.739)	(0.705)	(0.628)	(0.614)
Fuel exports (%)	-0.095	0.105	-0.642	-0.399	-0.044	-0.425	-0.011
	(0.337)	(0.214)	(0.698)	(0.270)	(0.360)	(0.341)	(0.220)
ln(Pop. density)	-0.072	-0.046	-0.241	-0.165	-0.006	0.325	-0.717
	(0.422)	(0.486)	(0.833)	(0.491)	(0.494)	(0.532)	(0.533)
Urbanization	-0.159	0.066	-0.500	0.014	-0.753	-0.855	-1.538 *
	(0.887)	(1.053)	(1.630)	(0.616)	(0.727)	(0.868)	(0.850)
Fossil rents	-3.426 **	0.350	-4.760 ***	0.634	-1.074	-3.095 ***	1.161
	(1.680)	(1.130)	(1.580)	(0.696)	(0.698)	(0.784)	(1.139)
Polity IV	0.004	0.016 ***	-0.011	0.012 *	0.004	-0.005	0.009
	(0.008)	(0.006)	(0.012)	(0.007)	(0.009)	(0.006)	(0.006)
HDI middle	-0.208	-0.174 *	-0.269	0.234 **	-0.009	0.025	0.023
	(0.130)	(0.100)	(0.188)	(0.093)	(0.099)	(0.091)	(0.103)
HDI high	-0.131	-0.102	-0.075	0.303 **	0.083	0.059	0.121
	(0.192)	(0.130)	(0.240)	(0.118)	(0.131)	(0.147)	(0.152)
HDI very high	-0.113	-0.170	-0.020	0.397 ***	0.068	-0.038	0.118
	(0.214)	(0.152)	(0.283)	(0.128)	(0.156)	(0.162)	(0.156)
Threshold (value)	8.051	8.055	10.101	10.377	10.455	8.055	9.459
99% CI lower bound	8.047	8.047	10.013	10.241	10.369	8.047	7.652
99% CI upper bound	8.086	8.086	10.184	10.380	10.513	8.086	10.609
Bootstrap p-value	0.016	0.004	0.010	0.032	0.068	0.002	0.028
Wald equal. coeff. (p)	0.061	0.102	0.004	0.000	0.012	0.030	0.161
SSE without threshold	23.981	22.182	73.073	15.982	18.446	20.781	22.099
SSE with threshold	23.414	21.520	71.181	15.729	18.330	20.144	21.819
N regime 1	67	68	312	358	384	68	212
N regime 2	401	400	156	110	84	400	256

Table B.6: IV-FE results: CH_4 consumption per value added. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. The bounds of the threshold CI for public administration are truncated at 7.652 and 10.609 as a result of the 10% trimming. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

B.3 Detailed IV-FE results for VA per capita

	Dependent variable: VA per capita embodied in production in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
ln(Income), reg.1	1.003 ***	0.738 ***	1.335***	1.231 ***	1.097***	1.817 ***	0.900 **
	(0.209)	(0.166)	(0.327)	(0.194)	(0.108)	(0.640)	(0.389)
ln(Income), reg.2	0.982 ***	0.719 ***		1.217 ***		1.735 ***	0.933 **
	(0.207)	(0.163)		(0.192)		(0.573)	(0.375)
Annex B	-0.340 **	-0.422 **	0.338	-0.566 ***	0.205	-0.035	-0.154
	(0.167)	(0.191)	(0.303)	(0.161)	(0.127)	(0.256)	(0.321)
Openness	-0.132	-0.320 ***	0.219	-0.018	-0.287**	-0.273	-0.170
	(0.091)	(0.116)	(0.221)	(0.163)	(0.115)	(0.176)	(0.126)
Food exports (%)	0.351	0.767	-3.111**	-2.442 ***	-0.044	0.198	0.138
	(0.409)	(0.827)	(1.261)	(0.491)	(0.486)	(0.997)	(0.732)
Fuel exports (%)	-0.852 ***	-0.744 **	2.760***	-1.300 ***	-0.510***	-1.447 **	-0.070
	(0.223)	(0.296)	(0.633)	(0.474)	(0.165)	(0.676)	(0.300)
ln(Pop. density)	0.266	0.250	-0.197	-0.909 *	0.373	0.890	0.869
	(0.430)	(0.552)	(0.748)	(0.475)	(0.321)	(1.349)	(0.557)
Urbanization	1.078	1.521	-0.079	-0.047	0.489	-3.411	1.370
	(0.872)	(1.144)	(1.450)	(0.990)	(0.650)	(2.616)	(0.971)
Fossil rents	0.630	-0.041	1.980	-1.211	-0.389	-0.598	-1.298
	(1.145)	(1.332)	(1.333)	(1.333)	(0.706)	(1.663)	(1.406)
Polity IV	-0.007	-0.020 ***	0.006	-0.005	-0.001	-0.014 *	-0.012
	(0.007)	(0.006)	(0.021)	(0.007)	(0.005)	(0.008)	(0.008)
HDI middle	0.108	0.103	-0.106	-0.001	0.045	-0.075	0.010
	(0.117)	(0.115)	(0.225)	(0.158)	(0.088)	(0.201)	(0.107)
HDI high	0.068	0.033	-0.180	-0.079	0.095	-0.036	-0.056
	(0.152)	(0.153)	(0.310)	(0.193)	(0.103)	(0.253)	(0.161)
HDI very high	0.118	0.258	-0.401	-0.139	0.140	-0.211	-0.021
	(0.181)	(0.192)	(0.382)	(0.221)	(0.131)	(0.356)	(0.174)
Threshold (value)	9.509	9.493		10.173		10.222	9.508
99% CI lower bound	9.433	7.652		10.101		10.192	9.493
99% CI upper bound	9.556	10.609		10.452		10.314	9.684
Bootstrap p-value	0.036	0.044		0.002		0.000	0.018
Wald equal. coeff. (p)	0.001	0.045		0.117		0.299	0.103
SSE without threshold	18.866	25.930	56.721	22.968	10.546	125.618	53.259
SSE with threshold	18.617	25.705		21.964		117.623	52.002
N regime 1	222	219	468	318	468	329	221
N regime 2	246	249		150		139	247

Table B.7: IV-FE results: sectoral VA per capita in production. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. The bounds of the threshold CI for livestock are truncated at 7.652 and 10.609 as a result of the 10% trimming. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: VA per capita embodied in final production in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
ln(Income), reg.1	0.934 ***	0.779***	0.775 ***	1.398 ***	1.031***	1.160 ***	0.835 **
	(0.189)	(0.184)	(0.207)	(0.177)	(0.146)	(0.237)	(0.403)
ln(Income), reg.2	0.912 ***		0.725 ***	1.374 ***		1.212 ***	0.869 **
	(0.189)		(0.204)	(0.177)		(0.225)	(0.389)
Annex B	-0.189	-0.668***	0.003	-0.253 *	0.372**	0.290	-0.189
	(0.118)	(0.165)	(0.222)	(0.154)	(0.154)	(0.193)	(0.276)
Openness	-0.071	-0.210**	0.132	0.238	-0.319**	-0.121	-0.169
	(0.118)	(0.103)	(0.149)	(0.157)	(0.144)	(0.128)	(0.138)
Food exports (%)	0.172	0.177	-1.858 ***	-2.470 **	0.511	-0.380	0.843
	(0.414)	(0.646)	(0.660)	(1.003)	(0.486)	(0.890)	(0.770)
Fuel exports (%)	-0.430 **	-0.117	0.452	-0.697	-0.454*	-1.191 ***	0.012
	(0.184)	(0.253)	(0.433)	(0.665)	(0.276)	(0.374)	(0.282)
ln(Pop. density)	0.128	0.055	0.397	0.178	0.694*	0.003	1.004 *
	(0.375)	(0.462)	(0.547)	(0.498)	(0.412)	(0.668)	(0.551)
Urbanization	1.365	-0.173	-0.545	-0.363	0.897	0.862	1.780 **
	(0.864)	(1.293)	(1.149)	(0.716)	(0.866)	(1.066)	(0.723)
Fossil rents	0.038	-0.106	2.872 *	-0.489	-0.226	-0.401	-0.896
	(0.907)	(1.150)	(1.658)	(0.930)	(0.706)	(1.748)	(1.529)
Polity IV	-0.004	-0.025***	0.004	0.010	-0.000	-0.019 **	-0.005
	(0.007)	(0.009)	(0.016)	(0.007)	(0.006)	(0.007)	(0.007)
HDI middle	0.231 *	0.120	0.199	0.100	0.114	-0.045	-0.010
	(0.121)	(0.139)	(0.175)	(0.122)	(0.096)	(0.202)	(0.093)
HDI high	0.258 *	0.062	0.165	0.001	0.188	-0.044	-0.042
	(0.147)	(0.172)	(0.208)	(0.157)	(0.124)	(0.231)	(0.142)
HDI very high	0.188	0.148	0.041	-0.081	0.264*	-0.029	0.032
	(0.164)	(0.192)	(0.237)	(0.177)	(0.159)	(0.256)	(0.146)
Threshold (value)	10.008		9.079	10.258		8.047	9.559
99% CI lower bound	9.927		9.019	10.233		8.026	9.493
99% CI upper bound	10.101		9.139	10.359		8.137	9.684
Bootstrap p-value	0.000		0.000	0.000		0.050	0.010
Wald equal. coeff. (p)	0.008		0.001	0.009		0.011	0.083
SSE without threshold	14.770	25.389	45.519	21.262	17.378	34.557	44.421
SSE with threshold	14.150		43.805	19.908		34.170	42.804
N regime 1	301	468	157	336	468	66	231
N regime 2	167		311	132		402	237

Table B.8: IV-FE results: sectoral VA per capita in final production. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: VA per capita embodied in consumption in:						
	agr.	liv.	egy.	mfc.	ser.	trn.	pub.
ln(Income), reg.1	0.972 ***	0.777 ***	0.743 ***	1.340 ***	1.022***	1.254 ***	0.880 **
	(0.158)	(0.181)	(0.180)	(0.147)	(0.136)	(0.214)	(0.374)
ln(Income), reg.2	0.951 ***	0.755 ***	0.703 ***	1.311 ***		1.309 ***	0.910 **
	(0.159)	(0.185)	(0.180)	(0.148)		(0.202)	(0.363)
Annex B	0.070	-0.503 ***	-0.060	0.190	0.296**	0.516 ***	-0.187
	(0.150)	(0.183)	(0.210)	(0.170)	(0.142)	(0.188)	(0.252)
Openness	-0.029	-0.079	0.062	0.002	-0.362***	-0.142	-0.155
	(0.127)	(0.114)	(0.151)	(0.116)	(0.139)	(0.129)	(0.134)
Food exports (%)	0.054	0.073	-0.980	-1.021 *	0.452	-0.153	0.823
	(0.417)	(0.701)	(0.603)	(0.603)	(0.450)	(0.807)	(0.767)
Fuel exports (%)	-0.127	-0.113	-0.529	0.110	-0.372	-0.420	0.033
	(0.166)	(0.247)	(0.500)	(0.183)	(0.248)	(0.263)	(0.269)
ln(Pop. density)	0.428	0.206	0.666	0.560	0.493	0.324	0.938 *
	(0.397)	(0.492)	(0.585)	(0.375)	(0.382)	(0.604)	(0.530)
Urbanization	0.730	-0.099	-0.520	-0.385	0.982	1.021	1.860 ***
	(0.811)	(1.117)	(1.072)	(0.647)	(0.803)	(1.126)	(0.695)
Fossil rents	0.403	0.075	3.482 **	-0.266	-0.179	-0.134	-1.107
	(1.000)	(1.120)	(1.648)	(0.721)	(0.657)	(1.494)	(1.375)
Polity IV	0.001	-0.023 **	0.009	0.007	-0.000	-0.010	-0.005
	(0.007)	(0.009)	(0.018)	(0.006)	(0.006)	(0.008)	(0.006)
HDI middle	0.293 **	0.114	0.250	0.073	0.134	0.081	0.002
	(0.132)	(0.137)	(0.160)	(0.100)	(0.093)	(0.211)	(0.093)
HDI high	0.372 **	0.082	0.269	0.120	0.215*	0.137	-0.023
	(0.156)	(0.162)	(0.198)	(0.126)	(0.116)	(0.236)	(0.139)
HDI very high	0.292 *	0.149	0.213	-0.018	0.271*	0.137	0.032
	(0.164)	(0.175)	(0.224)	(0.154)	(0.140)	(0.262)	(0.144)
Threshold (value)	10.023	10.306	9.079	10.421		8.047	9.559
99% CI lower bound	9.988	10.251	8.762	10.382		7.963	9.493
99% CI upper bound	10.101	10.377	9.139	10.431		8.100	9.690
Bootstrap p-value	0.004	0.000	0.012	0.042		0.090	0.006
Wald equal. coeff. (p)	0.001	0.063	0.017	0.000		0.005	0.072
SSE without threshold	15.293	24.135	42.552	14.920	14.474	34.658	37.123
SSE with threshold	14.975	22.676	41.438	14.674		34.415	35.777
N regime 1	304	343	157	371	468	66	231
N regime 2	164	125	311	97		402	237

Table B.9: IV-FE results: sectoral VA per capita in consumption. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

B.4 Detailed FE results for CH_4 per capita

	Dependent variable: CH_4 per capita embodied in production in:						
	agr.	ctl.	egy.	mfc.	ser.	trn.	wab.
ln(Income), reg.1	0.1649	0.326	0.9032 ***	0.378*	1.036	1.242***	0.306 ***
	(0.129)	(0.236)	(0.238)	(0.225)	(0.652)	(0.418)	(0.104)
ln(Income), reg.2	0.1141		0.8504 ***		0.772		0.282 ***
	(0.123)		(0.206)		(0.579)		(0.108)
Annex B	-0.0405	0.160	-0.0173	0.009	0.077	-0.037	-0.081
	(0.064)	(0.167)	(0.070)	(0.092)	(0.378)	(0.092)	(0.059)
Openness	0.2716 ***	0.592	0.1912 *	-0.076	0.188	0.117	0.018
	(0.065)	(0.483)	(0.109)	(0.154)	(0.299)	(0.237)	(0.087)
Food exports (%)	0.0008	0.072	-0.6699	0.319	-1.400	-1.493**	0.519
	(0.390)	(0.320)	(0.574)	(0.997)	(1.234)	(0.724)	(0.359)
Fuel exports (%)	-0.4578 *	-0.139	0.3442	-0.603	-0.549	-0.529	0.032
	(0.268)	(0.158)	(0.334)	(0.763)	(1.175)	(0.340)	(0.142)
ln(Pop. density)	-0.6877 **	0.961	0.0614	-0.135	-0.948	1.212	-0.177
	(0.322)	(0.769)	(0.458)	(0.993)	(1.211)	(1.026)	(0.211)
Urbanization	-0.1334	1.084	0.8270	-0.622	7.536 ***	-1.822	-1.134
	(0.755)	(0.900)	(1.122)	(1.110)	(2.285)	(1.867)	(0.796)
Fossil rents	-0.0290	-1.351	-0.5116	0.199	-0.215	-4.089***	-0.711
	(0.725)	(1.409)	(0.676)	(1.080)	(1.747)	(0.879)	(0.445)
Polity IV	-0.0027	-0.001	-0.0007	-0.009	-0.033	-0.031***	0.003
	(0.006)	(0.004)	(0.009)	(0.014)	(0.020)	(0.010)	(0.003)
HDI middle	-0.0077	-0.165	-0.2685	0.423	0.990	-0.068	-0.008
	(0.128)	(0.175)	(0.232)	(0.457)	(0.707)	(0.256)	(0.044)
HDI high	-0.0693	-0.182	-0.1994	0.494	1.246 *	-0.135	0.027
	(0.151)	(0.211)	(0.230)	(0.475)	(0.734)	(0.351)	(0.069)
HDI very high	-0.0982	-0.250	-0.2495	0.332	1.233	-0.278	0.100
	(0.175)	(0.253)	(0.262)	(0.494)	(0.769)	(0.402)	(0.118)
Threshold (value)	8.086		8.306		7.648		10.490
99% CI lower bound	8.026		8.284		7.648		10.484
99% CI upper bound	8.442		8.371		7.652		10.492
Bootstrap p-value	0.042		0.080		0.004		0.000
Wald equal. coeff. (p)	0.013		0.311		0.008		0.002
SSE without threshold	29.104	72.229	39.744	76.669	427.452	65.716	11.652
SSE with threshold	28.321		38.608		404.296		10.676
N regime 1	69	468	81	468	46	468	393
N regime 2	399		387		422		75

Table B.10: FE results: CH_4 production per capita. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. The lower bound of the threshold CI for services is truncated at 7.648 as a result of the 10% trimming. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: CH_4 per capita embodied in final production in:						
	agr.	ctl.	egy.	mfc.	ser.	trn.	wab.
ln(Income), reg.1	0.141	0.4142 **	0.030	0.407 *	0.445*	0.808***	0.348 ***
	(0.188)	(0.171)	(0.223)	(0.239)	(0.229)	(0.277)	(0.081)
ln(Income), reg.2	0.096	0.3688 **		0.472 **			0.332 ***
	(0.188)	(0.159)		(0.199)			(0.083)
Annex B	0.259 ***	-0.0285	-0.041	0.088	0.108	0.278***	-0.026
	(0.080)	(0.063)	(0.101)	(0.061)	(0.071)	(0.084)	(0.046)
Openness	-0.133	0.2161 ***	0.074	0.208 **	0.004	0.180	0.110
	(0.100)	(0.077)	(0.194)	(0.087)	(0.148)	(0.173)	(0.078)
Food exports (%)	-0.672	-0.5022	0.243	-1.135 *	0.578	-0.495	0.976 **
	(0.860)	(0.402)	(1.438)	(0.685)	(0.674)	(1.138)	(0.450)
Fuel exports (%)	-0.145	0.1155	-0.656	-0.749	-0.544	-1.827**	0.129
	(0.295)	(0.179)	(0.534)	(0.658)	(0.362)	(0.818)	(0.140)
ln(Pop. density)	-0.339	0.3564	0.450	0.114	0.340	-0.234	-0.031
	(0.355)	(0.265)	(0.673)	(0.502)	(0.448)	(0.766)	(0.211)
Urbanization	0.178	0.2271	-2.539*	-0.316	-0.106	-0.265	-0.035
	(0.854)	(0.842)	(1.379)	(1.085)	(0.845)	(1.458)	(0.643)
Fossil rents	-4.504 **	0.7057	-2.094	1.478 *	-1.442*	-3.718**	-0.596
	(1.929)	(0.883)	(1.384)	(0.814)	(0.747)	(1.689)	(0.380)
Polity IV	-0.005	-0.0007	-0.012	0.021 ***	0.001	-0.029***	0.006 **
	(0.009)	(0.006)	(0.013)	(0.008)	(0.010)	(0.010)	(0.003)
HDI middle	0.073	-0.0306	0.025	0.333 ***	0.091	-0.070	-0.048
	(0.078)	(0.086)	(0.141)	(0.100)	(0.115)	(0.260)	(0.051)
HDI high	0.118	0.0368	0.094	0.431 ***	0.210	-0.062	-0.028
	(0.143)	(0.126)	(0.207)	(0.123)	(0.160)	(0.312)	(0.076)
HDI very high	0.096	-0.0197	0.105	0.396 ***	0.183	-0.058	0.057
	(0.163)	(0.147)	(0.234)	(0.150)	(0.191)	(0.338)	(0.106)
Threshold (value)	9.952	8.055		8.055			10.489
99% CI lower bound	9.939	8.051		8.051			10.405
99% CI upper bound	9.955	8.100		8.055			10.539
Bootstrap p-value	0.000	0.026		0.004			0.000
Wald equal. coeff. (p)	0.001	0.047		0.248			0.005
SSE without threshold	27.635	19.381	46.137	27.196	23.143	43.426	8.653
SSE with threshold	26.104	18.731		25.893			8.212
N regime 1	293	68	468	68	468	468	392
N regime 2	175	400		400			76

Table B.11: FE results: CH_4 final production per capita. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: CH_4 per capita embodied in consumption in:						
	agr.	ctl.	egy.	mfc.	ser.	trn.	wab.
ln(Income), reg.1	0.303 *	0.212	0.106	0.616 ***	0.469**	1.079***	0.309 ***
	(0.177)	(0.134)	(0.244)	(0.221)	(0.226)	(0.261)	(0.109)
ln(Income), reg.2	0.273	0.190		0.672 ***			0.330 ***
	(0.177)	(0.136)		(0.180)			(0.105)
Annex B	0.317 ***	-0.012	-0.026	0.097 *	0.107	0.337***	-0.086 *
	(0.071)	(0.069)	(0.102)	(0.057)	(0.068)	(0.090)	(0.049)
Openness	0.053	0.099	0.077	0.012	-0.014	0.119	0.123
	(0.104)	(0.091)	(0.200)	(0.098)	(0.160)	(0.188)	(0.079)
Food exports (%)	-1.007	-0.569	0.494	-0.215	0.641	-0.028	0.969 **
	(0.692)	(0.422)	(1.909)	(0.585)	(0.674)	(1.017)	(0.385)
Fuel exports (%)	-0.197	0.153	-1.396	-0.132	-0.444	-1.014**	0.113
	(0.301)	(0.190)	(1.104)	(0.301)	(0.328)	(0.482)	(0.133)
ln(Pop. density)	-0.163	0.447	0.677	0.454	0.334	-0.116	0.200
	(0.327)	(0.292)	(0.781)	(0.427)	(0.437)	(0.692)	(0.206)
Urbanization	-0.381	-0.290	-1.397	-1.145	0.065	-0.081	0.152
	(0.796)	(0.701)	(1.330)	(0.885)	(0.828)	(1.454)	(0.665)
Fossil rents	-3.340 *	0.581	-1.629	0.357	-1.417*	-3.814**	-0.232
	(1.762)	(0.821)	(1.600)	(0.623)	(0.737)	(1.585)	(0.425)
Polity IV	0.004	-0.009	-0.004	0.017 **	0.002	-0.021*	0.006 **
	(0.010)	(0.007)	(0.014)	(0.006)	(0.009)	(0.011)	(0.003)
HDI middle	0.044	-0.080	-0.009	0.244 **	0.101	0.094	-0.014
	(0.078)	(0.114)	(0.127)	(0.115)	(0.113)	(0.253)	(0.053)
HDI high	0.169	-0.023	0.166	0.371 ***	0.228	0.143	0.030
	(0.137)	(0.140)	(0.205)	(0.139)	(0.156)	(0.301)	(0.073)
HDI very high	0.165	-0.029	0.204	0.391 **	0.195	0.085	0.137
	(0.151)	(0.156)	(0.237)	(0.165)	(0.182)	(0.317)	(0.098)
Threshold (value)	9.947	10.356		8.055			9.493
99% CI lower bound	9.929	10.241		8.055			9.493
99% CI upper bound	9.986	10.539		8.055			9.514
Bootstrap p-value	0.002	0.022		0.004			0.000
Wald equal. coeff. (p)	0.000	0.045		0.308			0.019
SSE without threshold	21.330	20.021	61.459	21.220	21.837	40.542	11.261
SSE with threshold	20.555	19.351		20.231			10.594
N regime 1	290	351	468	68	468	468	219
N regime 2	178	117		400			249

Table B.12: FE results: CH_4 consumption per capita. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

B.5 Detailed FE results for CH_4 per VA

	Dependent variable: CH_4 per unit of VA embodied in production in:						
	agr.	ctl.	egy.	mfc.	ser.	trn.	wab.
ln(Income), reg.1	-0.646 ***	-0.430	-0.180	-0.860***	-0.113	11.060*	-0.746**
	(0.236)	(0.317)	(0.280)	(0.260)	(0.656)	(5.633)	(0.349)
ln(Income), reg.2	-0.715 ***		-0.224		-0.374		
	(0.229)		(0.278)		(0.580)		
ln(Income), squared						-0.680*	
						(0.352)	
Annex B	0.092	0.350*	0.038	0.251**	0.065	0.081	0.082
	(0.103)	(0.209)	(0.126)	(0.121)	(0.387)	(0.139)	(0.139)
Openness	0.414 ***	0.890	-0.013	-0.067	0.484	0.177	0.200
	(0.105)	(0.592)	(0.259)	(0.244)	(0.342)	(0.248)	(0.164)
Food exports (%)	-0.341	-0.738	3.008 *	2.527**	-1.237	-1.126	0.297
	(0.618)	(0.866)	(1.604)	(1.157)	(1.378)	(1.113)	(0.757)
Fuel exports (%)	0.304	0.548	-1.939 ***	0.478	0.045	0.418	0.066
	(0.357)	(0.409)	(0.706)	(0.898)	(1.238)	(0.633)	(0.283)
ln(Pop. density)	-1.426 ***	0.165	0.794	0.189	-0.998	-1.649	-0.621
	(0.505)	(1.018)	(0.691)	(1.065)	(1.267)	(2.108)	(0.591)
Urbanization	-1.529	-0.838	1.002	-1.141	7.320 ***	-0.989	-2.108*
	(0.958)	(1.482)	(1.583)	(1.349)	(2.258)	(2.058)	(1.067)
Fossil rents	-1.195	-1.835	-2.028	0.829	0.503	-3.621*	1.133
	(1.338)	(2.086)	(1.394)	(1.615)	(1.978)	(2.174)	(1.672)
Polity IV	0.007	0.019**	-0.004	-0.005	-0.031	-0.024*	0.015*
	(0.007)	(0.007)	(0.015)	(0.014)	(0.020)	(0.012)	(0.009)
HDI middle	-0.186	-0.307	-0.177	0.355	0.979	-0.367	0.063
	(0.202)	(0.227)	(0.290)	(0.528)	(0.710)	(0.303)	(0.120)
HDI high	-0.260	-0.283	-0.007	0.435	1.225	-0.508	0.238
	(0.241)	(0.271)	(0.339)	(0.554)	(0.743)	(0.405)	(0.174)
HDI very high	-0.306	-0.522	0.203	0.353	1.162	-0.433	0.296
	(0.285)	(0.330)	(0.398)	(0.584)	(0.799)	(0.409)	(0.246)
Threshold (value)	8.055		9.291		7.648		
99% CI lower bound	8.047		9.215		7.648		
99% CI upper bound	8.137		9.480		7.652		
Bootstrap p-value	0.016		0.128		0.004		
Wald equal. coeff. (p)	0.020		0.009		0.013		
Turning point						8.137	
Observations before TP (%)						86.8%	
U-Test (p)						0.041	
SSE without threshold	46.115	104.604	87.703	96.707	439.291	169.750	62.956
SSE with threshold	44.652		85.660		416.730		
N regime 1	68	468	186	468	46	468	468
N regime 2	400		282		422		

Table B.13: FE results: CH_4 production per unit of value added. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. TP stands for turning point, and U-Test (p) is the p-value of the test for a polynomial relationship developed by Lind and Mehlum (2010). SSE is the sum of squared errors, and N is the number of observations. The lower bound of the threshold CI for services is truncated at 7.648 as a result of the 10% trimming. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: CH_4 per unit of VA embodied in final production in:						
	agr.	ctl.	egy.	mfc.	ser.	trn.	wab.
ln(Income), reg.1	-0.810***	-0.685***	-0.448 *	-1.015 ***	-0.669 ***	-0.257	-0.631**
	(0.196)	(0.165)	(0.260)	(0.152)	(0.212)	(0.277)	(0.297)
ln(Income), reg.2			-0.395	-0.957 ***	-0.698 ***	-0.306	
			(0.260)	(0.143)	(0.213)	(0.265)	
Annex B	0.372***	0.217***	0.104	0.192 ***	0.026	0.205 ***	0.119
	(0.098)	(0.073)	(0.126)	(0.061)	(0.064)	(0.071)	(0.111)
Openness	-0.104	0.350**	-0.083	-0.065	0.375 ***	0.328 **	0.269**
	(0.134)	(0.147)	(0.184)	(0.104)	(0.100)	(0.138)	(0.103)
Food exports (%)	-0.894	-0.973*	2.365	1.152	0.203	0.080	0.072
	(1.027)	(0.489)	(1.639)	(1.037)	(0.710)	(0.734)	(0.656)
Fuel exports (%)	0.235	0.180	-0.754	-0.290	0.021	-0.548	0.039
	(0.376)	(0.176)	(0.610)	(0.315)	(0.312)	(0.475)	(0.218)
ln(Pop. density)	-0.559	-0.488	0.304	-0.374	0.026	0.196	-0.789*
	(0.387)	(0.433)	(0.637)	(0.516)	(0.401)	(0.505)	(0.402)
Urbanization	-1.031	-0.510	-1.306	-0.299	-0.579	-0.945	-1.532*
	(0.934)	(0.943)	(1.499)	(0.796)	(0.721)	(0.896)	(0.792)
Fossil rents	-4.587**	0.160	-4.139 ***	1.881 **	-0.879	-2.955 ***	0.810
	(1.961)	(1.290)	(1.587)	(0.737)	(0.684)	(0.862)	(1.277)
Polity IV	-0.001	0.020***	-0.012	0.009	0.002	-0.005	0.011
	(0.009)	(0.006)	(0.010)	(0.006)	(0.009)	(0.007)	(0.007)
HDI middle	-0.164	-0.215**	-0.190	0.236 **	0.028	-0.003	0.019
	(0.118)	(0.096)	(0.188)	(0.099)	(0.096)	(0.103)	(0.090)
HDI high	-0.155	-0.138	-0.018	0.379 ***	0.112	0.032	0.123
	(0.186)	(0.118)	(0.245)	(0.126)	(0.126)	(0.153)	(0.130)
HDI very high	-0.153	-0.219	0.042	0.405 ***	0.044	-0.002	0.102
	(0.218)	(0.159)	(0.286)	(0.138)	(0.151)	(0.180)	(0.167)
Threshold (value)			10.101	8.217	10.004	8.055	
99% CI lower bound			10.059	8.100	9.951	7.998	
99% CI upper bound			10.184	8.245	10.012	8.137	
Bootstrap p-value			0.002	0.000	0.002	0.094	
Wald equal. coeff. (p)			0.004	0.012	0.002	0.029	
SSE without threshold	33.643	24.679	72.863	24.302	18.904	29.766	38.680
SSE with threshold			69.922	23.097	18.105	29.017	
N regime 1	468	468	312	74	299	68	468
N regime 2			156	394	169	400	

Table B.14: FE results: CH_4 final production per unit of value added. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.

	Dependent variable: CH_4 per unit of VA embodied in consumption in:						
	agr.	ctl.	egy.	mfc.	ser.	trn.	wab.
ln(Income), reg.1	-0.762***	-0.704***	-0.355	-0.924 ***	-0.646 ***	-0.242	-0.680***
	(0.205)	(0.151)	(0.265)	(0.111)	(0.207)	(0.198)	(0.252)
ln(Income), reg.2			-0.304	-0.889 ***	-0.673 ***	-0.218	
			(0.265)	(0.104)	(0.209)	(0.199)	
Annex B	0.337***	0.139**	0.105	0.111 ***	0.028	0.097 *	0.073
	(0.078)	(0.067)	(0.127)	(0.042)	(0.060)	(0.056)	(0.079)
Openness	0.069	0.141	-0.012	-0.035	0.391 ***	0.265 ***	0.253***
	(0.116)	(0.118)	(0.189)	(0.068)	(0.082)	(0.094)	(0.095)
Food exports (%)	-1.021	-0.913*	1.679	0.736	0.277	0.415	0.145
	(0.906)	(0.496)	(1.665)	(0.687)	(0.697)	(0.627)	(0.621)
Fuel exports (%)	-0.057	0.113	-0.568	-0.327	0.009	-0.218	0.043
	(0.357)	(0.180)	(0.655)	(0.274)	(0.301)	(0.301)	(0.201)
ln(Pop. density)	-0.390	-0.429	0.147	-0.057	0.093	0.115	-0.774**
	(0.323)	(0.392)	(0.709)	(0.383)	(0.391)	(0.457)	(0.378)
Urbanization	-0.613	-0.505	-0.382	-0.224	-0.589	-1.116	-1.623**
	(0.743)	(0.912)	(1.637)	(0.626)	(0.707)	(0.773)	(0.737)
Fossil rents	-3.626**	0.025	-4.515 ***	0.841	-1.009	-3.159 ***	1.032
	(1.626)	(1.168)	(1.571)	(0.644)	(0.654)	(0.758)	(1.107)
Polity IV	0.003	0.013**	-0.010	0.007	0.002	-0.008	0.010*
	(0.009)	(0.005)	(0.011)	(0.007)	(0.009)	(0.006)	(0.006)
HDI middle	-0.220*	-0.217**	-0.283	0.261 ***	0.008	0.030	0.007
	(0.116)	(0.090)	(0.197)	(0.083)	(0.094)	(0.102)	(0.091)
HDI high	-0.146	-0.167	-0.080	0.335 ***	0.084	0.087	0.098
	(0.173)	(0.111)	(0.253)	(0.106)	(0.125)	(0.146)	(0.127)
HDI very high	-0.087	-0.199	-0.052	0.413 ***	0.031	0.057	0.120
	(0.191)	(0.144)	(0.291)	(0.120)	(0.151)	(0.159)	(0.154)
Threshold (value)			10.101	8.217	10.004	10.263	
99% CI lower bound			10.013	8.051	9.951	10.166	
99% CI upper bound			10.184	8.257	10.086	10.356	
Bootstrap p-value			0.010	0.056	0.006	0.044	
Wald equal. coeff. (p)			0.004	0.059	0.004	0.023	
SSE without threshold	23.126	20.949	72.989	15.907	17.930	20.380	22.064
SSE with threshold			70.393	15.472	17.234	19.825	
N regime 1	468	468	312	74	299	338	468
N regime 2			156	394	169	130	

Table B.15: FE results: CH_4 consumption per unit of value added. Note: agr. stands for agriculture, liv. for livestock, egy. for energy, mfc. for manufacturing, ser. for services, trn. for transport, and pub. for public administration (see Table A.2 in the Appendix). min CI and max CI stand for the lower- and the upper-bound of the confidence interval. SSE is the sum of squared errors, and N is the number of observations. Cluster robust standard errors (Stock and Watson, 2008) in parentheses.