Trade Effects of Supply Chain Regulations: Empirical Evidence from the Loi de Vigilance

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Abstract

The paper represents a first attempt to evaluate the trade effects of a binding due-diligence regulation of international supply chains using a partial gravity model of trade between France and its trading partners. Since 2017 France has been following a cross-sectoral approach with a corporate due diligence law (Loi de Vigilance) that applies to all large French companies. The stated goal of the law is to strengthen sustainability along the value chain in the production of internationally traded goods. However, the costs of compliance may be substantial and can be considered a non-tariff trade barrier negatively affecting trade especially with developing countries. The empirical part of the paper investigates the trade effects in two steps. In the first step, it analyses the potential effect of the law on trade with countries with weak governance using a difference-in-difference approach. In the second step, it applies a triple-difference approach to address the question of industry-specific effects of the due diligence regulation. The results indicate that the introduction of the corporate due diligence law in France is associated with a systematically lower trade with least-developed countries after taking into account the development of the standard gravity variables. Within this group of countries, especially exports of apparel products and products beyond high-impact sectors have experienced a negative shock in their trade with France. The results indicate that supply chain regulations, while addressing negative externalities, are also associated with adverse effects, especially in those countries, where compliance costs are high. This should be considered in the discussion around the proposed EU Due Diligence Directive. An optimal law should tackle potential negative externalities of EU companies abroad without creating non-tariff trade barriers that impede international trade and economic development abroad.

Keywords: Trade and Development, Sustainable Development, International Supply Chains

JEL-Classification: F18, Q56, Q01

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1. Introduction

Global supply chains have become extensive networks that are almost impossible to monitor seamlessly. The complexity and unpredictability that such an intricate network of economic relationships entails pose new challenges for globally active companies in terms of their responsibility in global value chains. At the same time sustainability in the economic, ecological and social sense has become an essential guiding principle for political and economic action and has found its way into international, European and national sustainability strategies. With the Paris Climate Agreement and the UN 2030 Agenda for Sustainable Development, global agreements for a more sustainable economic path have been reached. Furthermore, in December 2023, the European Parliament and the Council of the European Union reached a provisional deal on the Corporate Sustainability Due Diligence Directive (CSDDD), which aims to enhance environmental and social sustainability in the EU and globally. According to the directive, companies should integrate the impact of their economic activity on human rights and the environment into their management systems and ensure that their activities are not based on child labour, forced labour, exploitation, pollution or other damage to ecosystems (European Parliament 2023). They must also establish a code of conduct and adopt a plan to ensure that their business model is consistent with limiting global warming to 1.5°C.

According to the draft, the directive is intended to apply to EU companies and parent companies with more than 1000 employees and a global turnover of more than 150 million euros. Non-EU companies and parent companies with corresponding sales in the EU are also covered by the directive. The implementation of the directive requires investment in risk management, contractual assurances about the fulfilment of the obligations from the business partners such as suppliers of intermediate products and a reassessment of the business plan. The directive is intended to replace national measures like the Loi de Vigilance in France introduced in 2017 or the German Lieferkettensorgfaltspflichtengesetz (German Supply Chain Act) introduced in 2023.

Whereas such regulatory measures are aimed at increasing sustainability along the value-added chain of international enterprises, they also bear significant costs of compliance which may have prohibitive impact on trade, especially with countries with weak governance where assuring and certifying good human rights and labour standards on every stage of production is challenging. While intended to improve social and environmental sustainability in developing countries, the regulation can result in decreasing trade flows between developed countries from the EU and developing economies as the high costs of compliance can have an effect comparable to a non-tariff trade barrier. Therefore, it is crucial to better understand the reaction of businesses to such regulations in the course of the legislative process in order to design them in a way that maximizes the benefits from the regulations in terms of increasing sustainability along the value chain without endangering economic development in countries with weak governance.

A growing body of literature considers theoretical issues regarding the design, enforceability and the political economy of due diligence regulations (see e.g. Elbel et al., 2023; Gustafsson et al., 2023; Mason et al., 2023). As such regulations are a novelty, empirical investigations of their effects are almost lacking, though. An empirical analysis by Lafarre and Rombouts (2022) considers the effectiveness of the French Loi de Vigilance in terms of increased sustainability by using human rights scores on 64 French

corporations provided in the Refinitiv Environmental, Social and Governance database. Using a difference-in-difference approach, the study reveals that the introduction of the law may have had a positive impact on the scores of French firms that prior to the introduction lied behind. However, it remains unclear, at which price this improvement was achieved. If complying with the Loi de Vigilance was associated with shifting purchases and activities to countries with higher sustainability standards, then the net effect on developing countries with lower production standards is unequivocally negative. To address this issue, a closer look at the development of trade flows is needed.

The empirical literature on potential trade effects on developing countries is by and large limited to studies using survey data to capture the reaction of companies e.g. to the German Supply Chain Act. Kolev and Neligan (2021a) point out, for instance, that almost one out of five surveyed companies intended to purchase primary products only from countries with high human rights and environmental protection standards after the introduction of the new law. Among large enterprises with more than 250 employees every third company had such plans one year prior to the introduction of the law. In a later survey, Kolev-Schaefer and Neligan (2024) find out that 22 percent of the directly or indirectly affected companies (which according to the survey results are almost half of the surveyed companies) state to use more foreign production in or suppliers from countries with safe and good working conditions and high standards for the protection of human rights since the introduction of the law. Furthermore, they observe that the value of German imports of apparel products (one of the high-impact sectors, see below) from countries like Bangladesh, Pakistan, Myanmar or China have dropped by more than one fifth since the introduction of the German supply chain act while imports from Tunisia, Morocco, Portugal or North Macedonia have increased at the same time. Although their analysis is only indicative and not conclusive, the results point towards trade diversion effects which in combination with the survey results can be attributable to adverse side effects of the supply chain regulation.

Similar results were found in the survey by the IHK (2023) six months after the introduction of the German supply chain act. Almost one out of three surveyed companies reports to have started to select supplying countries in accordance with social and environmental criteria. Among big companies with at least 1000 employees, it is even every second respondent who confirms this statement.

A more in-depth analysis is presented by Wolfmayr et al. (2023). In an ex-ante assessment, they simulate the expected trade effects of the CSDDD using a general equilibrium global economy and trade model. The results show that international trade between the EU and countries with weak governance, where due diligence violations are more likely, decreases significantly. The authors estimate a decrease of EU imports from high-risk countries of 26 percent for high-impact sectors where the probability of human rights and environmental violations is comparatively high. Ex-post empirical assessments of due diligence regulations of the value chain are still lacking, though.

Our study is aimed to fill this gap by offering a first ex-post assessment of the impact of binding due-diligence regulations on trade flows between advanced countries and developing and emerging economies. As the German supply chain act was introduced in 2023 only, we specifically examine the observed trade effects of the French Loi de Vigilance

of 2017, for which there is already more data available. We apply a partial gravity equation model covering trade flows between France and its trading partners over the time period 2014-2019. An important issue in the estimation of the trade effects of the due diligence regulations refers to identifying causal relationship between the introduction of the regulation and the development of the trade flows. We address this issue by using difference-in-difference estimation procedure in a two-step empirical model. First, we apply the gravity model at country level to prove the effect the introduction of the law has had on different country groups. Second, we combine a triple-difference approach with the gravity model (see Kern et al., 2021, and Slaughter, 2001) and use sectoral data to gain better understanding of the dynamics of trade since the introduction of the law.

Since 2017 France has been following a cross-sectoral approach with a corporate due diligence law (Loi de Vigilance) that applies to all large French companies (EPRS, 2020). Although the law is applicable only to a small share of French firms, survey evidence from Germany shows that the share of companies affected increases several times if the indirect effect of such a regulation is also taken into account (Kolev and Neligan, 2022a). The costs of compliance with the law may therefore be substantial and operate as a non-tariff trade barrier negatively affecting trade especially with developing countries.

The results of the empirical model indicate that the introduction of the corporate due diligence law in France is associated with systematically lower value of trade with least developed economies (LDCs) after considering the development of the standard gravity variables. Within this group of countries, especially exports of products of the apparel industry as well as those with higher complexity and thus beyond high-impact sectors have experienced a negative shock in their trade with France. The results thus indicate that supply chain regulations can be associated with adverse effects, especially in those countries, where compliance costs are high. This should be considered within the next regulatory steps towards the introduction of the CSDDD.

The remainder of the paper is organized as follows: Section 2 gives an overview on the role of due diligence regulations. Section 3 presents the data and the empirical methodology used to identify the trade effects of the Loi de Vigilance. Section 4 elaborates the results of the empirical analysis. In Section 5, some concluding remarks and policy implications are discussed.

2. The effect of due diligence on trade

2.1. Due diligence regulations in the European Union

The UN Guiding Principles on Business and Human Rights require companies to respect human rights in their global business activities (UN, 2011). Until recently multinational companies have been expected to fulfil their due diligence obligations mainly based on voluntary measures. There are various international standards and frameworks available as guidance for this. Only for certain areas/sectors there is EU legislation available. Some countries, such as France, the Netherlands, UK, Australia, California and recently Germany, have also passed national due diligence laws. There are also initiatives in many countries as well as votes, such as recently in Switzerland, that seek such regulation. EU member states such as Sweden, Austria, Finland, Denmark and Luxembourg are also considering such legislation. In the case of the existing United States' Dodd-Frank Act the

focus is on a specific sector of the extractive industry. Various African countries, including the Democratic Republic of Congo and Rwanda, have also passed laws requiring companies to control their supply chains in conflict minerals (European Commission, 2018). In other countries, the focus is concentrated on specific human rights violations, such as child labour in the Netherlands or the relatively soft regulations on forced labour in California, the United Kingdom and Australia. Only France and Germany have implemented a comprehensive due diligence law so far.

With its Loi de Vigilance („Loi relative au devoir de vigilance des sociétés meres et des enterprises donneuses d'ordre") France adopted a cross-sectoral approach in 2017 with a corporate due diligence law that applies to all large French companies (with more than 5,000 employees in France or more than 10,000 employees worldwide) (EPRS, 2020). These companies must develop, implement and publish a due diligence plan enabling them to prevent serious violations of human rights, fundamental freedoms, health, safety and environmental protection and to identify corresponding risks. The plan should include a mapping of risks, regular risk assessment procedures, mitigation and prevention actions, an alert mechanism, and a monitoring mechanism. The goal is to evaluate, prevent, monitor, and decrease social and environmental risks throughout the entire supply chain which includes their own activities as well as the activities of subsidiaries, sub-contractors and suppliers with established relationships. A crucial factor is to first map the risks, which must reflect both the reality of a company's activity throughout its supply chain and the various stakeholders e.g., trade unions affected by this activity. This forms the basis for determining mitigating measures and their implementation in a second step. Companies that fail to comply with their due diligence obligations can be held civilly liable to fulfil their obligation (Camerlynck, 2017; EPRS, 2020). An assessment of the application of the law showed that while the majority of the 265 obligated firms have made progress, around a quarter of the firms do not apply the law effectively (Bommier and Chatelain and Loyer, 2021). In addition, companies can be sued under certain conditions. In this case, the culpable conduct of their subsidiaries, sub-contractors or suppliers - also to be examined by the court - is not attributed to the company, but they are liable for having breached their own existing duty of care. However, they are only liable if the plaintiff can prove that this breach of duty was also causal for the damage, i.e., that no damage would have occurred if the company had fulfilled its duty of care (Kusch and Valeske, 2018). Only in January 2020 the first lawsuit was filed based on this regulation. A dozen French cities and environmental organisations accused the mineral oil company TOTAL of not developing a sufficiently effective due diligence plan to be able to achieve the Paris Climate Agreement and more effective measures to protect the environment were needed (Koch, 2021).

In contrast to this comprehensive French legislation, the German government initially relied on the voluntary commitment of companies with the NAP Action Plan adopted at the end of 2016 to implement the UN Guiding Principles on Business and Human Rights. After survey evidence was presented that voluntary measures in place were insufficient and only about one out of four German enterprises fulfil or is about to fulfil the sustainability criteria set by the government, a supply chain law ("Lieferkettengesetz") was initiated. In May 2021 the law was passed and in 2023 it entered into force. The main focus of the law is to minimize human rights risks in the supply chain of German producers abroad with more than 3,000 employees from 2023 on and more than 1,000 employees from 2024 on. Even though the due diligence obligation of companies is to apply to the entire supply chain, it limits the direct duty of care to the company itself and direct

suppliers. Only in suspicious cases indirect suppliers must be checked. Numerous German economists supported the initiative and issued a call for a supply chain law in early 2020 arguing that the law can help internalise negative externalities along the value chain of production (Anwander et al., 2020). Others pointed out that such a regulation should be defused, since it may trigger trade diversion effects and decrease demand for products from countries with governance challenges (Felbermayr, 2021, Kolev and Neligan, 2021a, Marin, 2021).

The CSDDD of the EU is expected to remove market distortions within the common market coming from the different approaches of the member states. As due diligence regulations of international supply chains are associated with significant compliance costs, they represent non-tariff barriers differing from country to country which is not in the sense of the common market. However, the legal obligations arising from the CSDDD go far beyond those in the French or the German supply chain law. The current proposal calls for due diligence obligation to apply to the entire chain of activities of EU companies (Council of the European Union, 2022). It covers a broader range of companies as well as activities and entails civil liability for particular cases. Similar to Germany the main argument for a legal solution is that according to a study carried out for the European Commission voluntary measures fail (European Commission, 2020).

2.2. Effects of due diligence regulations on trade

The objective of due diligence regulations is the introduction of measures to increase sustainability of corporate supply chains. With targeted measures it can reduce the incentives for local companies to exploit regulatory loopholes to the detriment of the environment and workers in third countries. However, it can also have negative effects, especially concerning the engagement of foreign companies in these countries. Their local investments and demand for preliminary products create jobs. As shown in Figure 1, final demand and exports of EU countries generate total value added worth 977 billion US dollars in the listed non-OECD emerging economies as well as for Mexico and Turkey. In Tunisia, almost 17 per cent of the value added is generated by EU demand and exports, in Kazakhstan more than 15 percent and Morocco it is almost 13 per cent.

Overall, the EU accounts for an important part of the value added of the countries concerned. These are often countries with weak governance, though, less concerned with sustainability aspects, both in terms of ecological as well as social and economic dimensions. In addition to the economic interdependence of the countries with the EU, the figure also shows their rank according to the Corruption Perception Index (CPI) developed by Transparency International. While Costa Rica performs well in terms of corruption perception, corruption seems to be a serious problem in many other countries, especially compared to the performance of EU economies (for example, Germany ranks 9th). In countries such as Kazakhstan, Morocco and Russia, where more than one tenth of domestic value added finds its end use in the EU and its exports, the problem of corruption is even more widespread. Cambodia, which generates almost 7 per cent of its own economic output for final demand and exports of the EU, ranks 160th in the world in terms of the prevalence of corruption.

The involvement of Western companies in developing and emerging countries is also associated with improved access to newer and better technologies, for example in the field of environmental and climate protection. Hence, they promote the growth process and

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sustainability with their investments and know-how. Furthermore, European companies influence product and production standards of many countries. They are committed to ensure a sufficient level of quality for goods imported from third countries due to the high product standards and the principle of prudence that applies in the EU.

Figure 1. Value-added from final demand and exports of the EU versus corruption in source countries

Value added in EU final demand and exports: 2018, percent of total value-added; Corruption Perception Index (CPI): 2021, ranking among 180 countries (right axis)
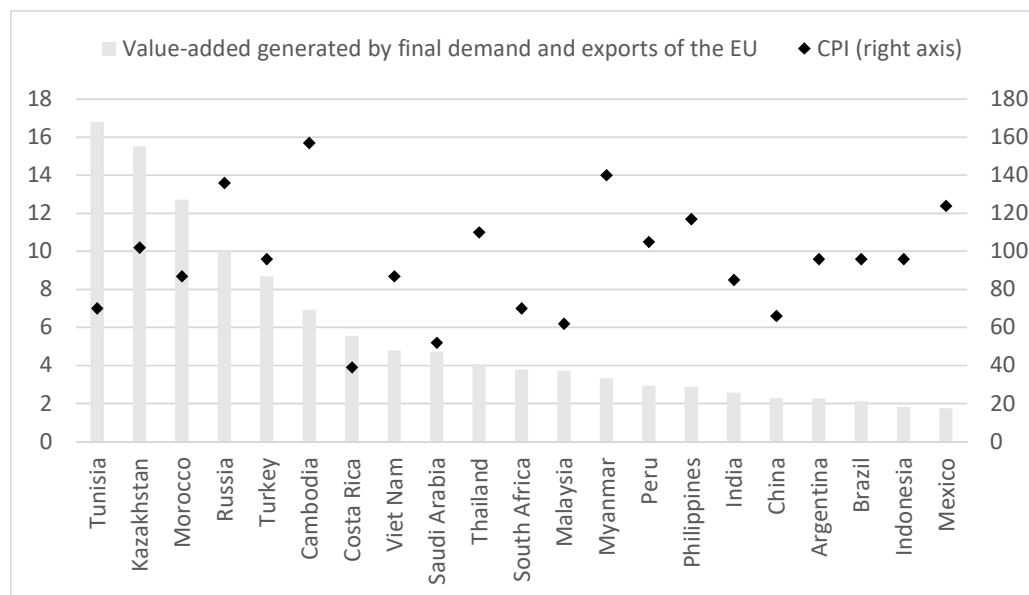
Source: OECD, Transparency International, German Economic Institute

The question arises whether and how stricter due diligence requirements affect corporate decisions. Some companies will have to continue sourcing their intermediate products from the same countries as before, due to significant cost advantages or a lack of alternatives and put up with potentially higher bureaucratic costs. Other companies, though, might be prompted to review their supply structures because of higher compliance costs due to stricter due diligence requirements and the threat of fines. These costs could force many companies to leave developing and emerging countries and look for alternatives. The consequences for the countries concerned are hardly foreseeable. In these countries Western investors are already competing with Chinese firms that have lower requirements regarding production standards and sustainability aspects of potential investment projects.

The empirical evidence already shows that the traditional economic relations between African countries and countries such as Germany and the USA have changed due to the increasing presence of China in the region (Donou-Adonsou and Lim, 2018). A displacement effect cannot be rejected, especially for US investments. Chinese investors, unlike Western investors, seem to make no distinction between countries with good and bad governance structures (Chen et al., 2018). Further empirical evidence for Ghana, Uganda and Tanzania shows that Chinese investments in infrastructure projects are preferred over western investments (Swedlund, 2017). Their development projects also go hand in hand with falling trade union participation in the respective countries (Isaksson and Kotsadam, 2018).

The planned tightening of due diligence requirements at European level can therefore have a negative impact both on EU companies and the corresponding countries. The associated additional costs will be higher for imports from countries with regulatory gaps

- which is likely to have the same trade diversion effect as an increase in tariff rates on products from these countries.

Hence, it is questionable, if the expected outcome of such a regulation are better labour and environmental standards in these countries. In a few cases, negative external effects arose in the past from business activities of European companies abroad, for example if the loss of biodiversity or unhealthy working conditions were not considered in the company's cost calculations and had to be borne by society (Anwander et al., 2021). However, this description of activities of European companies abroad, even in the countries of the global South, is narrated only one-sided. European companies create employment by purchasing products or building production capacities in developing and emerging countries, they bring new technologies and act as product and production standards setters. A fundamental prerequisite for a state intervention to internalise potential negative externalities in single cases is that the associated improvement in welfare for society exceeds the costs caused by the intervention. If the costs of the intervention are capital outflows and trade diversion away from developing countries and in favour of developed economies, then it is anything but self-evident that the total welfare effect of the intervention would be positive for developing countries.

A first look at the data covering French imports before and after the introduction of the Loi de Vigilance supports this view. Figure 2 depicts the rate of change of imports in the three years after the introduction of the law compared to the three years before. Whereas total imported value increased by 7.4 percent, imports from least developed countries (LDC) decreased by 5.7 percent in the same time. The same is true both for the imported value in high-impact sectors (like textiles, apparel, mining etc., for a definition see next section) and in low-impact sectors, where imports decreased from LDC and increased from other countries. Interestingly, imports of goods from sectors beyond the high-impact sectors decreased even faster (6.8 percent versus 3.8 percent). A more comprehensive analysis of French imports is presented in the next section.

Figure 2. Development of French imports after the introduction of the Loi de Vigilance

Relative change in imported value in 2017-2019 versus 2014-2016 in percent
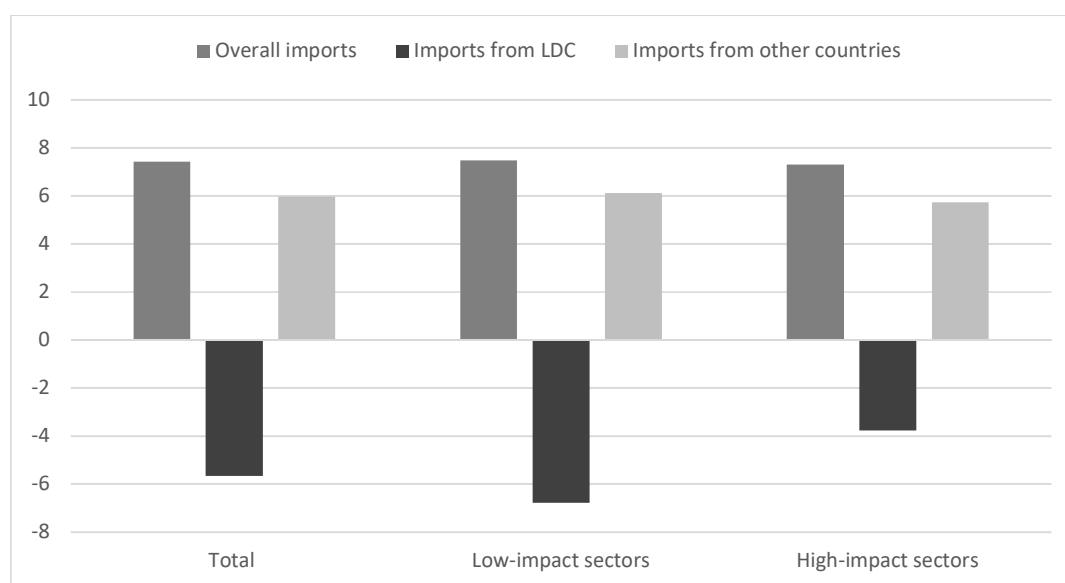
Source: own calculations based on data by CEPII and USITC

3. Data and Methodology

To estimate the effects of the introduction of the Loi de Vigilance on French imports, we use the standard gravity equation as applied in the trade literature. It dates back to Tinbergen (1962) and explains bilateral trade between two countries by the size of their markets measured by GDP of the origin and the destination economy and costs of international trade (for detailed discussion see e.g. Anderson and Van Wincoop, 2003, and Baier and Bergstrand, 2007). The latter are proxied by time invariant variables like distance between the countries and further indicators such as common language, common border, colonial relationship, and time variant variables like concluded regional trade agreements (RTA). The first stage of the empirical analysis is conducted using the standard gravity model database provided by the CEPII (see Head et al., 2010; Head and Mayer, 2014), which contains bilateral country-level trade data as well as variables used in the typical gravity equation. The main variable of interest is the value of French imports before and after the introduction of the Loi de Vigilance, X_{Fit}, where F denotes variables for France, i denotes values for the trading partners and t respectively time variable values. As the COVID-19 pandemic changed the pattern of trade in unprecedented way, the dataset is reduced to cover the time span 2014 to 2019: three years before the introduction of the Loi de Vigilance and three years after the law entered into force. Bilateral trade flows used for the empirical analysis stem from the BACI database.

In the standard trade literature applying gravity equations, country-pair and time fixed-effects capture unobserved effects not covered by the variables included into the empirical model. As we only include bilateral trade between France and its trade partners and French GDP already covers the time dimension, in the present case only country-of-origin fixed effects are used to capture the effect of unobserved country specific factors which may otherwise bias the results of the estimation. The fixed effects account for all time-invariant variables which possibly influence trade relations between France and other countries, such as distance, common language or common border.

The standard gravity model describes a multiplicative relationship between the gravity variables listed above. For practical reasons, in the empirical trade literature the model is usually estimated using a log-linearised OLS approach. To cope with the problems of inconsistent estimates in the presence of heteroscedasticity and biased estimates of the true elasticities by OLS estimators in the presence of zero-valued dependent variables, we apply the non-linear Poisson pseudo-maximum-likelihood (PPML) estimator proposed by Santos Silva and Tenreyro (2006).

The intention behind the introduction of the Loi de Vigilance is to increase sustainability along the value chain of French producers by obliging them to map and manage the risks of their activities as well as of the activities of their business partners in other countries. In the cases where compliance has increased trade costs significantly, trade flows are expected to decrease. If on the contrary, the implementation of higher sustainability standards raises the attractiveness of the imported products, trade flows are expected to increase. Furthermore, French imports from countries with level of protection of human rights and the environment is expected to increase due to trade diversion effects as compliance costs are lower for imports from those countries. Thus, the hypothesis to be tested is that the introduction of the Loi de Vigilance has left the pattern of development of French imports unchanged.

The basic equation to be estimated for trade flows from the trading partners to France can be represented as follows:

$$X_{Fit} = \exp[\beta_1 lnGDP_{Ft} + \beta_2 lnGDP_{it} + \varphi_{it} + \omega_t + \varepsilon_j] \times \epsilon_{it} \qquad (1).$$

The effect of the introduction of the Loi de Vigilance was tested as follows. First, a dummy variable LdV was introduced, which takes the value 1 in the years 2017 to 2019. The estimation equation is thus adjusted as follows:

$$X_{Fit} = \exp[\beta_1 lnGDP_{Ft} + \beta_2 lnGDP_{it} + \beta_3 LdV_t + \varphi_{it} + \omega_t + \varepsilon_i] \times \epsilon_{it} \qquad (2).$$

The coefficient β_3 is expected to be positive, if the introduction of the Loi de Vigilance has positively impacted French imports, negative, if imports have increased since the introduction of the law, and zero otherwise.

Second, a difference-in-difference approach is used to test if the effect of the Loi de Vigilance is different for countries with weak governance. These countries are considered as the "treated" group as traceability of the supply chain is particularly difficult there and thus the compliance costs are expected to be higher. The group of treated countries is proxied by the LDC group defined by UN standards. The estimated equation can then be represented as follows:

$$X_{Fit} = \exp\begin{bmatrix} \beta_1 lnGDP_{Ft} + \beta_2 lnGDP_{it} + \beta_3 LdV_t + \beta_4 Treat_i + \beta_5 LdV_t \cdot Treat_i \\ + \varphi_{it} + \omega_t + \varepsilon_i \end{bmatrix} \times \epsilon_{it} \qquad (3).$$

The coefficient β_4 is expected to be positively signed if France imports more from LDC than predicted by the gravity equation and in particular by the level of their GDP, it will be negative if the contrary is the case, and zero otherwise. If the high compliance costs with the Loi de Vigilance have negatively impacted French imports from LDC, then the coefficient β_5 is expected to be negative. If imports from LDC have increased since the introduction of the law, e.g. due to improved sustainability standards, then the coefficient will be positive.

To gain a better understanding of the trade effects of the Loi de Vigilance, in the second step of the empirical analysis the model is expanded by using sectoral data and running the estimations at the sectoral level. Data on French imports at the sectoral level from the International Trade and Production Database (ITPD) of the US International Trade Commission (Borchert et al., 2022; Borchert et al., 2021) is imported into the CEPII database to address the question of which products were more affected by the introduction of the French supply chain law. The variables of interest are trade flows in million of current US dollars. In the last step, the industry level data is grouped into two categories: high-impact sectors according to the definition by the draft of the CSDDD of the European Commission, where the risks of violation of sustainability standards are particularly high, and low-impact sectors covering the remaining industries.[3] The resulting triple-difference estimation equation can be represented as follows:

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[3] The high-impact sectors listed by the European Commission are: the manufacture of textiles, leather and related products (including footwear), and the wholesale trade of textiles, clothing and footwear; agriculture, forestry, fisheries (including aquaculture), the manufacture of food products, and the wholesale trade of agricultural raw materials, live animals, wood, food, and beverages; the extraction of mineral resources regardless of where they are extracted from (including crude petroleum, natural gas, coal, lignite, metals and metal ores, as well as all other, non-metallic minerals and quarry products), the manufacture of basic metal

$$X_{Fitj} = \exp \left[\begin{array}{c} \beta_1 lnGDP_{Ft} + \beta_2 lnGDP_{it} + \beta_3 LdV_t + \beta_4 Treat_i + \beta_5 HighImpact_j + \beta_6 LdV_t \cdot Treat_i \\ + \beta_7 LdV_t HighImpact_j + \beta_8 Treat_i \cdot HighImpact_j + \beta_9 LdV_t \cdot Treat_i \cdot HighImpact_j \\ + \varphi_{it} + \omega_t + \varepsilon_i \end{array} \right]$$

(4)

The expected sign of the coefficient β_9 will be negative if the introduction of the Loi de Vigilance has been associated with lower levels of trade between France and its trading partners in the particular industry, ceteris paribus, zero if trade has remained unchanged, and positive otherwise.

4. Results of the empirical analysis

4.1. Country-level analysis

Table 2 summarizes the results of the first step of the empirical analysis. All estimations were conducted using robust standard errors clustered by the country of origin of French imports. In the first column, country-level data is used, and country fixed effects were included to control for omitted variables bias. The second column shows the results of a robustness check by using industry-level instead of country level data for the same regression. Here, country-industry fixed effects were included to account for unobserved effects on trade between Franche and its trade partners within particular industries. The coefficients of the gravity variables GDP of the origin and the destination country (France) are both correctly signed and significantly different from zero in both estimations. The coefficient of the dummy variable LdV is non-significant in the first column and positive and significant at the 5% level in the second estimation. Thus, French trade seems to have increased in the three years after the introduction of the supply chain law compared to the three years before. The marginal effect amounts to about 1.2 percent $[(e^{0.012} - 1)x100\% = 1.2\%]$. A major part of the increase in French imports in the years 2017-2019 reported in Figure 2 on p. 8 is therefore accounted for by the development of the gravity variables.

The coefficients of the dummy variable LDC are positive and significant at the 1% level, thus indicating that France imported more from LDCs prior to the introduction of the Loi de Vigilance than suggested by the values of the gravity variables. This may be the case due to the tight economic relationship of France with some of those countries because of historical reasons. The last coefficient captures the effect of the introduction of the law on trade with LDCs. It is negative and significant at least at the 5% level in both estimations. Therefore, although French imports seem to have increased after the introduction of the law, imports from LDC have experienced a decline at the same time, after accounting for the development of the gravity variables. The estimated marginal effect amounts to -24.2 percent in the first regression and -25.7 percent in the second regression. It is important to stress that other factors which have changed after 2016 beyond the Loi de Vigilance may have had an impact on trade with those countries as well. The estimations indicate, however, that French imports from LDCs were lower in the years after the introduction of the law and trade with other countries has increased at the same time.

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products, other non-metallic mineral products and fabricated metal products (except machinery and equipment), and the wholesale trade of mineral resources, basic and intermediate mineral products (including metals and metal ores, construction materials, fuels, chemicals and other intermediate products).

Table 1. Regression analysis of the difference-in-difference estimation

	(1)	(2)
Ln(GDP_o)	0.579***	0.542***
	(0.085)	(0.073)
Ln(GDP_d)	0.629***	0.552***
	(0.104)	(0.080)
LdV	-.017	0.012**
	(.013)	(0.006)
LDC	.458***	.444***
	(.155)	(.125)
LdV*LDC	-.297***	-.277**
	(.115)	(.133)
Constant	-8.869***	-12.677***
	(2.057)	(1.032)
Observations	1,151	122,505
Country fixed effects	Yes	No
Country-industry fixed effects	No	Yes
Pseudo R^2	0.9976	0.9977

Non-linear PPML estimators; robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
(1) Country level data (2) Industry level data
Source: own calculations based on data by CEPII and USITC

4.2. Sectoral level analysis

To gain a better understanding of the impact of the Loi de Vigilance, in the next step of the empirical analysis the trade effects were estimated at the sectoral level. Table 2 shows the results of the analysis where 170 product groups are classified into high- and low-impact sectors according to the definition by the European Commission (see footnote 3). In the first column, a difference-in-difference approach is applied where high-impact sectors are considered as the "treated" group covered by the dummy variable *HighImpact*. A set of country of origin-product group fixed effects is used to control for omitted variable bias. The results indicate an increase of French imports since the introduction of the law for low-impact sectors. High-impact products have, on the contrary, suffered a decrease in French imports on average since the introduction of the law, after accounting for the development of the gravity variables. The marginal effect is estimated at -3.5 percent.

In the second column, a triple-difference approach sheds more light on the trade effects of the Loi de vigilance by differentiating between the impact on high and low-impact industries for the two country groups considered in the previous subsection. In addition to the effects described above, the results indicate that already before the introduction of the Loi de vigilance, imports of high-impact products from LDC were lower than suggested by the level of the gravity variables. The coefficient of the triple-difference variable in the last line suggests that especially those imports may have increased from LDC (or imports of low-impact products have decreased from LDC). Thus, more complex products beyond those belonging to the high-impact industries have suffered as regards French imports from LDCs. Therefore, the results indicate that law seems to shift French imports from LDCs from more complex products towards simple products like those covered by the

definition of the high-impact industries. These results are not surprising as costs of compliance with the law are higher for complex products with a longer value chain than for simple products.

Table 2. Regression analysis of the triple-difference approach

	(1)	(2)
Ln(GDP_o)	0.545***	0.557***
	(0.073)	(0.073)
Ln(GDP_d)	0.549***	0.538***
	(0.080)	(0.080)
LdV	.016***	0.016***
	(.006)	(0.006)
LdV*HighImpact	-.036***	-.037***
	(.014)	(.014)
LDC		.517
		(.325)
LdV*LDC		-.834***
		(.302)
LDC*HighImpact		-.166
		(.343)
LdV*LDC*HighImpact		.873***
		(.311)
Constant	-12,682***	-12.697***
	(1.021)	(1.021)
Observations	122,505	122,505
Country-Industry FE	Yes	Yes
Pseudo R^2	0.9977	0.9977

Non-linear PPML estmators; Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
(1) & (2) Industry level data
Source: own calculations based on data by CEPII and USITC

In the next step, the empirical estimations described by equation (3) and conducted in the previous subsection at the country level are repeated for 170 product groups as contained in the International Trade and Production Database (ITPD) of the US International Trade Commission (Borchert et al., 2022; Borchert et al., 2021). Table A1 in the appendix shows the results for the variables *LdV*, *LDC* and the difference-in-difference term for the products, where the coefficients are significantly different from zero. Overall, the evidence is mixed as already suggested by the stylized facts shown in Figure 2. There are numerous product groups where the years 2017-2019 were associated with an increase of French imports, the highest marginal effects being for Live swine, Sugar, Machinery for textile apparel and leather and Parts and accessories for automobiles. For other products, imports seem to have declined at the same time (after accounting for the development of the gravity variables). The highest decrease in absolute terms is found for the following products: Processing of nuclear fuel, Mining of lignite, Pottery china and earthenware and Cocoa chocolate and sugar confectionery.

As concerns the development of French imports from LDCs, the results are mixed as well. Since trade with those countries is significantly lower than with emerging and developed economies, in the following discussion only product groups are considered where French imports from LDC amounted to at least one million US dollars on average prior to the introduction of the Loi de Vigilance. The results form the estimation of equation (3) for those products are summarized in Table 3. As indicated by the last column, the imports of Hard coal and Chemical products (nowhere else classified) rose in the years after the introduction of the law and the increase was particularly high for imports from LDC. Moreover, imports of Spices increased only from LDC whereas the coefficient of the *LdV* variable is insignificant. The imports of Mining and quarrying products not contained in other groups decreased since the introduction of the Loi de Vigilance and the effect was stronger for LDC. Furthermore, imports of Beverages (nec), Tobacco leaves as well as Basic precious and non-ferrous metals decreased only from LDC. The two product groups with the highest share of French imports from LDC, Crude petroleum and natural gas as well as Processing of nuclear fuel both exhibit a significant decrease of imports in the years after the introduction of the Loi de Vigilance. Trade flows within these two product groups covering mainly natural resources are, though, often driven by factors like business cycle fluctuations or the price development.

Table 3. Difference-in-difference estimation at the product group level

No.	Industry	LdV	LDC	LdV*LDC
22	Beverages, nec		.774***	-.359***
24	Tobacco leaves and cigarettes			-.780***
25	Spices		-1.62***	1.11***
27	Forestry	-.090*	.541***	
29	Mining of hard coal	.261***		.757***
31	Extraction crude petroleum and natural gas	-.141*	11.5***	
32	Mining of iron ores	.123*		
33	Other mining and quarrying	-.344***	.579**	-.387**
37	Processing/preserving of fish	.055**		
60	Wearing apparel except fur apparel	-.131**	.538***	
81	Processing of nuclear fuel	-.886***		
89	Other chemical products nec	.093***	-.709***	.200*
103	Basic precious and non-ferrous metals		2.13***	-.566***
149	Jewellery and related articles	.272**		

Non-linear PPML estimators
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Standard errors available upon request
Source: own calculations based on data by CEPII and USITC

A particular industry, where non-governmental organizations call for regulations of the sustainability of international value chains is the apparel industry. The production of apparel products has been often used as an illustrative example for lacking sustainability, both in terms of environmental pollution and poor working conditions. Especially since the tragedies in Pakistan in 2012 and Bangladesh in 2013, where more than 1300 people died in the fire of the Ali Enterprises factory and the collapse of the Rana Plaza factory, it has become clear that production standards in the apparel in developing countries are not comparable to European levels and can be highly problematic. The European Commission lists textiles, clothing and related products first when it comes to high-impact sectors where tighter regulation is planned in the draft of the CSDDD. The introduction of the Loi

de Vigilance has not left trade with apparel products unchanged. As indicated by the results of the empirical analysis, French imports of wearing apparel has decreased significantly in the years 2017-2019 compared to the three years before. The estimated marginal effect amounts to -12.3 percent and is similar for LDC and for other countries. The product group of wearing apparel is the third most important French industry importing from LDC measured by the value of the average French imports in the year before the introduction of the Loi de Vigilance. As suggested by the positive coefficient of the variable *LDC*, apparel imports from LDC are significantly higher than from other countries, after accounting for the level of the gravity variables. The estimated coefficient corresponds to a marginal effect of 71.3 percent. For many LDC, the apparel industry is a major employer and makes up a significant share of total value added. According to data by the World Bank, the share of clothing and textiles in GDP lied at 14 percent in Cambodia, 12 percent in Bangladesh in 2021 for instance. Decreasing demand from developed economies can thus have significant impact on economic development. Calculations using COMTRADE data show that the share of France in the exports of apparel articles from Cambodia was on average 7.5 percent in the three years prior to the introduction of the Loi de Vigilance and decreased to 6.1 percent on average in the three following years. In 2022, only 3.1 percent of Cambodian exports of apparel products were shipped to France. The latter result may be due to rising demand from countries like the US and China. However, comparing the development with Germany as another European big economy with similar dynamics and regulations (besides the introduction of the Loi de Vigilance) shows that there may be other factors driving French imports from Cambodia. The share of Germany in Cambodian exports increased on average in 2017-2019 compared to the three years before and decreased only slightly in the most recent years – a big contrast to France. In, 2023, the year of the introduction of the Lieferkettengesetz in Germany, German apparel imports from Cambodia dropped by more than one fifth according to data by the Federal Statistical Office of Germany (Kolev-Schaefer and Neligan, 2024). The same is true for imports from Bangladesh and Myanmar. Although there may have been also other unobserved factors, which have changed in France in 2017, one possible and plausible explanation for the decrease in French imports of apparel products is the introduction of the Loi de Vigilance.

3. Concluding remarks

Supply chain due diligence regulations are still a novelty in international trade law. The intention behind the introduction is mostly clear: they should contribute to sustainable development in third countries by addressing negative externalities which may result from the global activities of local companies. The expected effects of the regulations remain ambiguous, though, as the lacking traceability and transparency of supply chains especially in developing countries make compliance costs particularly high for these countries. As suggested by the classical trade theory, the resulting cost disadvantage is expected to have negative effects on trade in terms of trade destruction and trade diversion.

The results presented in this paper are in line with the hypothesis that supply chain regulations can be viewed as a trade barrier discriminating against suppliers mainly from developing economies. As shown by the difference-in-difference analysis of trade flows, the introduction of a corporate due diligence law in France is associated with systematically

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lower values of French imports and thus with adverse effects, especially in LDC, with which France traditionally traded more than suggested by the level of the gravity variables. Imports from LDC decreased particularly in the apparel industry which is an important employer and contributor to total value-added. Furthermore, the triple difference approach shows that French imports from LDC decreased stronger for more sophisticated products beyond those covered by the list of high-impact sectors with high risk for violations of human rights and environmental standards. These results need to be considered in the context of the overall effects of the introduction of the Loi de Vigilance. As Lafarre and Rombouts (2023) show in their analysis, the law has incentivised corporations to prevent and mitigate the risks that their business activities along the global value chains pose to human rights and the environment. However, it still remains unclear, how this improvement was achieved. If complying with the Loi de Vigilance was associated with higher production standards in developing countries, then the trade off between higher sustainability and lower demand and thus lower economic growth arises. If on the contrary, the positive impact on the human rights scores found in the analysis by Lafarre and Rombouts (2022) was achieved mainly by shifting purchases and activities to countries with higher sustainability standards as suggested by the analysis of trade flows in the present paper, then the net effect on developing countries with lower production standards is unequivocally negative.

Whereas the German supply chain law is already introduced, the results of this analysis using data on French trade have important policy implications for the EU CSDDD. A far-reaching supply chain regulation at EU level will restrict market access for many countries which rely on demand from the EU. Indeed, the EU solution is preferable to national regulations to avoid distortions of competition in the internal market. However, it is crucial to design it in a way which addresses potential negative externalities without creating non-tariff trade barriers. A possible approach is to follow the US example laid down in Section 307 of the Tariff Act of 1930 which prohibits the importation of goods produced by forced or indentured labour, including child labour. The main difference between the US regulation and the European plans is that the former only applies to cases where information reasonably indicates that imported merchandise may have been produced by forced labour and not to all importers of goods from abroad. This enables tackling the problem of negative externalities while leaving the positive effects of international trade untouched. Furthermore, a well-tailored approach would include the participation of actors from affected third countries in the drafting and implementation process as well (see e.g. Elbel et al., 2023; Mason et al., 2023) in order to increase the acceptance and to improve the chance of effective implementation of the regulation.

Our analysis also points to a range of future research avenues. First, as the present paper only addresses trade effects, it is convenient to investigate the impact of supply chain regulations on the implementation of sustainability standards in third countries. In addition, the analysis can be extended to consider the trade effects of the German Lieferkettengesetz when sufficient data is available. Third, existing sector-specific due diligence regulations (e.g. in the field of critical minerals) could also be analysed to get a better understanding of the trade effects of such laws. And lastly, it is important to investigate the perception, implementation and impact of new supply chain regulations in producing states affected by them.

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Appendix

Table A1. Difference-in-difference estimation at the product group level

No.	Industry	LdV	LDC	LdV*LDC
3	Corn			-3.17***
5'	Cereal products	-.327***		-1.46**
6	Soybeans			2.90***
7	Other oilseeds (excl. peanuts)		-1.07**	
10	Other sweeteners			1.22*
11	Pulses and legumes, dried, preserved	.328***	1.68**	-.456**
12	Fresh fruit			.791***
14	Prepared fruits and fruit juices		-.994**	
15	Prepared vegetables	.265**		
16	Nuts		-2.82***	.681*
18'	Live swine	.541**		
20	Other meats, livestock products, and live anim..			.706**
21	Cocoa and cocoa products			.349***
22	Beverages, nec		.774***	-.359***
23	Cotton			-.625**
24	Tobacco leaves and cigarettes			-.780***
25	Spices		-1.62***	1.11***
26	Other agricultural products, nec	.025*	.340**	
27	Forestry	-.090*	.541***	
29	Mining of hard coal	.261***		.757***
30'	Mining of lignite	-.762		
31	Extraction crude petroleum and natural gas	-.141*	11.5***	
32	Mining of iron ores	.123*		
33	Other mining and quarrying	-.344***	.579**	-.387**
34'	Electricity production, collection, and distrib…	.027***		
36	Processing/preserving of meat	-.116***		
37	Processing/preserving of fish	.055**		
38	Processing/preserving of fruit & vegetables	.041**		.312***
39	Vegetable and animal oils and fats	.192***		
40	Diary products	.088***		-1.80**
42	Starches and starch products	-.077***		
43	Prepared animal feeds	-.618***		10.28***
44	Bakery products		1.87***	
45	Sugar	.531***		-3.43***
46	Cocoa chocolate and sugar confectionery	-.616***	1.48*	-.901**
47	Macaroni noodles & similar products	-.058*		-3.26***
48	Otherood products nec	.124***		
50	Wines	.159***		
51	Malt liquors and malt	.235**		
52	Soft drinks, mineral waters	.076**	-1.37***	
54	Textile fibre preparation; textile weaving			1.45**
55	Made-up textile articles except apparel	-.062**		
56	Carpets and rugs	-.102**		
57	Cordage rope twine and netting			-.348***
60	Wearing apparel except fur apparel	-.131**	.538***	
61	Dressing & dyeing of fur, processing of fur			-1.66***
62	Taning and dressing of leather		-.852***	
63	Luggage handbags etc.; saddlery & harness			.646***
64	Footwear			.800**
65	Sawmilling and planning of wood			-.462***
67	Builders' carpentry and joinery	-.183***		
68	Wooden containers		2.71***	
69	Other wood products; articles of cork/straw		.294**	
70	Pulp paper and paperboard	-.147***		-.300***
71	Corrugated paper and paperboard		.563*	1.20**
72	Other articles of paper and paperboard	.101**		
73	Publishing of books and other publications		-.626**	
74	Publishing of newspapers journals etc.	-.243***		3.97***
76	Other publishing	-.295***	-1.91**	3.36***
77	Printing	-.043***		
78'	Service activities related to printing	-.178***		
79'	Coke oven products	.304*		
80	Refined petroleum products	-.183***		
81	Processing of nuclear fuel	-.886***		
82	Basic chemicals except fertilizers		2.95***	-2.85***
83	Fertilizers and nitrogen compounds	-.156***	-2.44**	-3.87***
84	Plastics in primary forms; synthetic rubber			-2.46***

#	Product			
86	Paints varnishes printing ink and mastics	.119***		
87	Pharmaceuticals medicinal chemicals etc.		-1.47***	
88	Soap cleaning & cosmetic preparations		.669**	
89	Other chemical products nec	.093***	-.709***	.200*
90	Man-made fibres	-.114***	-3.37***	
91	Rubber tyres and tubes	.298***	2.29***	
94	Glass and glass products	.227**	.531***	
95	Pottery china and earthenware	-.653***	.998**	
96	Refractory ceramic products	-.082***		-1.99*
97	Struct. Non-refractory clay; ceramic products	.273***		
98	Cement lime and plaster		1.20*	-1.86**
99	Articles of concrete cement and plaster	-.021**		
100	Cutting shaping & finishing of stone	-.201***		.868**
101	Other non-metallic mineral products nec	-.379***	1.937**	-1.92***
102	Basic iron and steel	.086*		1.28***
103	Basic precious and non-ferrous metals		2.13***	-.566***
104	Structural metal products			-1.06***
105	Tanks reservoirs and containers of metal		1.25*	
106	Steam generators			2.35*
107	Cutlery hand tools and general hardware	.072**		
108	Other fabricated metal products nec	.042*		-.356**
109	Engines & turbines (not for transp. equipment)	.220**		
110	Pumps compressors taps and valves	.090**	-.736*	
111	Bearings gears gearing & driving elements			-1.50***
112	Ovens furnaces and furnace burners			-1.76**
113	Lifting and handling equipment	.343***	3.48***	
114	Other general purpose machinery	.359***		
115	Agricultural and forestry machinery	.093*	3.38***	2.35***
116	Machine tools	.076***	1.59*	
117	Machinery for metallurgy	-.537**		
118	Machinery for mining & constructions	.119***	3.34***	
119	Food/beverage/tobacco processing machinery	-.182***		
120	Machinery for textile apparel and leather	.441***	1.32*	-1.23*
121	Weapons and ammunition	.545***	-2.00**	3.35***
122	Other special purpose machinery		-1.21**	1.17***
123	Domestic appliances nec	.152***		
124	Office accounting and computing machinery	.097**		
125	Electric motors generators and transformers	.286***		2.19***
126	Electricity distributions & control apparatus			-1.25***
127	Insulated wire and cable		1.94**	1.43***
128	Accumulators primary cells and batteries			-1.00**
129	Lighting equipment and electric lamps	.116**	3.30***	1.80***
130	Other electrical equipment nec	.085***		
131	Electronic valves tubes etc.	-.182***		
132	TV/radio transmitters; line comm. Apparatus			-.661*
133	TV and radio receivers and associated goods	-.121***	-3.66***	-2.085***
134	Medical surgical and orthopaedic equipment		.947*	
138	Motor vehicles	.188***	-.704**	
139	Automobile bodies trailers & semi-trailers	.125***	4.24***	2.02**
140	Parts/accessories for automobiles	.435***		-2.62***
141	Building and repairing of ships	.124**	3.62***	-4.83***
142	Building/repairing of pleasure/sport. Boats		1.84**	
144	Aircraft and spacecraft		-3.50***	
145	Motorcycles		1.19***	
146	Bicycles and invalid carriages	.221***	1.47***	
147	Other transport equipment nec	-.103**		
148	Furniture			-.475***
149	Jewellery and related articles	.272**		
150	Musical instruments			-.332**
152	Games and toys	.240***		
154'	Manufacturing services on physical inputs	.203**		
155'	Maintenance and repair services	.178**		
156'	Transport	.026***		
159'	Insurance and pension services	-.044***		
162'	Telecom, computer, information services	.049***		
163'	Other business services	.039***		
164'	Heritage and recreational services	.020***		
168'	Services not allocated	9.49***		
169'	Trade-related services	.015***		

Non-linear PPML estimators
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Standard errors available upon request
' N<5 for the treated group (LDC) in 2016

Average trade with LDC > 1 mill USD in 2016
Average trade with LDC > 10 mill USD in 2016

Source: own calculations based on data by CEPII and US