Navigating the Amazon: The Incidence of Digital Service Taxes *

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Abstract

Firms in the digital economy often pay little tax in the countries where their customers are based. In response, market countries have introduced digital service taxes on the revenue of these firms to indirectly tax their profits. We study the incidence of these taxes using data on Amazon, the largest online retailer. We find that, on average, Amazon increased its fees by roughly half the amount of the digital service tax. Firms using Amazon as a platform have largely passed these increased fees on to consumers. Large digital firms thus bear only a small part of the tax burden, but the tax may nevertheless succeed in making them less competitive relative to brick-and-mortar competitors.

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1 Introduction

Several countries have recently introduced digital service taxes (DSTs). These taxes respond to concerns that digital firms pay too little profit tax in the countries where they serve customers. In 2018, the European Commission estimated that digital businesses faced an effective tax rate of only 9.5%, compared to 23.2% for traditional firms (European Commission, 2018). This disparity may reflect the digital sector's reliance on intangible assets, which make it easier to shift profits to low-tax jurisdictions.

DSTs aim to sidestep this avoidance. Rather than taxing profits, they impose a levy on revenues generated from user-based digital services. In the absence of a globally coordinated solution—such as the OECD's Pillar One proposal to reallocate taxing rights toward market countries—more governments are considering unilateral DSTs. In particular, the European Union is currently debating introducing a European-wide DST. Some policymakers have also proposed such a measure as a response to U.S. tariffs.[1]

The shift from profit to revenue taxation raises a key question: Are these taxes passed on to other market participants, including consumers and smaller businesses reliant on these platforms? Other revenue-based taxes, particularly the value-added tax (VAT), are known to be at least partially passed on to consumers (see, e.g., Benzarti and Carloni, 2019; Benzarti et al., 2020). However, the applicability of VAT findings to digital service taxes (DSTs) is not straightforward. The digital economy frequently operates through platform-based models, where digital firms offer platforms for other firms to reach consumers. Tax incidence in such two-sided markets may differ substantially from standard incidence results (see, e.g., Kind et al., 2010; D'Annunzio et al., 2020)

So, who bears the burden of digital services taxes? We answer this question using data from Amazon, which is the largest online retailer (and, by revenue, the largest firm in the digital economy). We divide our study into two parts. First, we study the fees Amazon charges retailers who use its platform to reach consumers. Second, we study prices faced by consumers. In this way, we study the pass-through of DSTs from the point of application to the end consumer. Our focus is therefore on Amazon as a platform rather than a direct seller.

In the first part of our paper, we use information on Fulfillment by Amazon (FBA)

[1] In this context, DSTs are increasingly seen not only as a tax instrument, but also as a potential lever in international trade disputes, effectively functioning like a tariff on digital services.

fees, i.e., the fees Amazon charges for storing, packing, and delivering goods.[2] We have fee information on France, Germany, Italy, Spain, and the United Kingdom. Except for Germany all of these countries introduced a DST during our sample period (December 2017 to February 2022). Using a two-way fixed effects (TWFE) model, we find that for every one percentage point increase in DST, we observe a 0.5% increase in the FBA fees. Using the Callaway and Sant'Anna (2021) estimator, we find considerable cross-country heterogeneity. In the UK, fees rose by more than the DST. In France and Spain, the tax was fully passed through. In Italy, fees rose slightly, but the increase is not statistically significant.

In the second part of our paper, we analyze whether these fee increases are passed on to consumers via higher retail prices. To do so, we use data on prices listed on Amazon, obtained from Keepa.com, an independent price tracking website. We implement a difference-in-differences (DiD) framework that compares identical products sold by third-party sellers using FBA (and thus subject to the DST) to those sold directly by Amazon (not subject to the DST). We find that sellers largely pass on the higher fees to consumers: prices for FBA-sold products increase by 0.8–2.6% after the DST is introduced, depending on the country.

The estimated price effects are economically meaningful. For a representative product, net-of-VAT prices increase by EUR 0.25–0.53 in France, EUR 0.36–0.57 in Spain, and GBP 0.12–0.25 in the UK. These price changes translate into pass-through ratios between 1.1 and 2.7, meaning that consumers pay more than one euro (or pound) for every euro (or pound) that Amazon remits in DST. This over-shifting likely reflects a combination of rounding practices, adjustments in other Amazon fees, and sellers' strategic pricing behavior. In Italy, where Amazon's fees increased only slightly, the implied pass-through is more limited, with estimated ratios between 0.2 and 1.1. This pattern suggests that Amazon absorbed part of the tax in Italy, possibly to maintain competitiveness in a less developed market.

To better understand the conditions under which pass-through occurs, we also explore heterogeneity by product type. In particular, we exploit fixed book price regulations in France and Spain, which restrict price adjustments for newly published books. These legal constraints provide a natural test: if sellers are unable to adjust prices freely, pass-through should be muted. Consistent with this prediction, we find no price effects for books in France and Spain, while non-books exhibit significant increases. In the UK, where book prices are unregulated, the effects are similar for both

[2]It is also possible for third-party sellers to use Amazon as a pure platform and ship goods directly to consumers. However, information on the selling and referral fees due in this case are not publicly available.

product types.

As a robustness test, we re-estimate our results using an instrumental variable (IV) approach, where we use changes in DSTs as an instrument for changes in Amazon's fulfillment fees. The IV estimates confirm substantial pass-through.

Our findings are relevant for policymakers who debate introducing or continuing DSTs. If the DST is largely passed onto local sellers and customers, it is not suitable as an indirect tax on firms in the digital economy. However, if the policy goal is to make digital marketplaces less attractive compared to brick-and-mortar retailers, it may still be considered a success.

We contribute to two strands of literature. First, we add to the literature studying the incidence of indirect taxes. Regarding VAT, papers have studied individual sectors such as Finnish hairdressers (Kosonen, 2015) or French car sales and housing repair services (Carbonnier, 2007), or used broad international panel datasets (Benedek et al., 2020). Results vary between settings, showing partial or complete pass-through to consumers. There is also substantial heterogeneity at the firm level: Studying restaurants in Finland and Sweden, Harju et al. (2018) show that some restaurants passed a tax cut on completely, while others did not react at all. Papers studying temporary VAT cuts find asymmetric effects of tax cuts and increases (Benzarti et al., 2020; Fuest et al., 2025). We are the first to empirically explore the incidence of an indirect tax in a two-sided market, studying pass-through on both sides of the platform.

We also contribute to the small empirical literature studying tax effects in the digital economy. Bibler et al. (2021) show that better enforcement of hotel taxes increased prices on Airbnb. Lassmann et al. (2025) show that (effective) corporate tax burdens are passed onto ad prices using Facebook data. None of these papers has studied a tax specifically aimed at the sector, such as the DST. From a theoretical perspective, Hines (2023) models a digital service tax on advertising income or other goods with a marginal cost of zero but positive costs of quality. He shows that countries have incentives to set these taxes inefficiently high.

The rest of the paper is structured as follows. Section 2 describes the DSTs in the countries we study and Amazon's fee structure. Section 3 overviews the theoretical literature on tax incidence in two-sided markets before we describe the empirical strategy in Section 4. Section 5 presents the data and Section 6 describes the results. Section 7 concludes.

2 Institutional Setting

2.1 Digital Service Taxes

The business model of firms in the digital economy differs substantially from that of their peers in more traditional industries. In particular, firms in the digital economy rely much more on intangible assets. These assets are hard to value and easy to relocate, making them especially suited to shift profits to low-tax jurisdictions. Consequently, despite generating substantial revenue in many European countries, these firms pay little corporate income taxes there.

In response, several countries have introduced DSTs. Among OECD countries, France was the first to implement a DST in July 2019. Initially, France suspended the tax due to ongoing international negotiations, but began collecting it in December 2020 when it became clear that a larger consensus on digital taxation—either through the implementation of Pillar 1 of the OECD's Base Erosion and Profit Shifting (BEPS) project, or an EU-wide DST—was unlikely to be reached soon. By this time, Italy and Spain had already started collecting DSTs. By 2022, France, Italy, the UK, Spain, and Turkey had adopted broad-scope DSTs.[3]

The US, home to many large digital firms affected by DSTs, has strongly opposed these taxes. It argues that DSTs unfairly target American companies. In response, the US has threatened tariffs and launched trade investigations.[4] Meanwhile, OECD member countries continue to negotiate over BEPS Pillar 1, which aims to allocate some taxing rights to countries where multinational firms have significant consumer-facing activities. A key condition of Pillar 1 is that countries must repeal their DSTs once it is implemented. As agreement on Pillar 1 is uncertain, more countries have introduced DSTs. Most recently, Canada passed a DST in June 2024, applying retroactively to in-scope revenues earned since January 1, 2022.

Our study focuses on the European DSTs in place by 2021, specifically those in France, Italy, Spain, and the UK (see Table 1 for an overview). These countries apply

[3]Austria and Portugal have DSTs with a narrower focus, targeting only online advertising. Several non-OECD countries, such as India, Kenya, Kyrgyzstan, Nepal, and Tanzania, also have broad DSTs in place.

[4]In July 2020, the U.S. Trade Representative determined that France's DST unfairly targeted American companies and announced retaliatory tariffs of 25% on a significant portion of French exports to the U.S. These tariffs were repeatedly delayed until October 2021, when the U.S. and several European countries (Austria, France, Italy, Spain, and the UK) reached an agreement. Under this deal, the U.S. agreed to drop the tariffs, while the European countries allowed U.S. firms to offset their DST payments against future obligations under Pillar 1 of the OECD's global tax framework (Hines, 2023).

Table 1: **Digital Service Tax Characteristics in France, Italy, Spain & UK**

Country	Date Law Passed	Tax Rate	Global Rev. Threshold	Dom. Rev. Threshold	Date Implemented
France	Jul 24, 2019	3%	€750 mil	€25 mil	Dec 1, 2020
Italy	Dec 19, 2019	3%	€750 mil	€5.5 mil	Jan 1, 2020
Spain	Oct 7, 2020	3%	€750 mil	€3 mil	Jan 16, 2021
UK	Jul 16, 2020	2%	£500 mil	£25 mil	Apr 1, 2020

Notes: This table provides an overview of the DSTs in the countries studied. "Date Law Passed" refers to when the DST legislation was approved. The "Global Rev. Threshold" indicates the minimum worldwide revenues a firm must have to be subject to the DST, while the "Dom. Rev. Threshold" specifies the minimum revenues within the respective country. Both thresholds must be met for the DST to apply. "Date Implemented" is when DST collection began. *Source:* KPMG (2024).

DSTs only to large digital firms with global revenues exceeding EUR 750 million (or 500 million GBP). In addition to this global threshold, they also have national thresholds that vary widely, ranging from EUR 3 million in Spain to GBP 30 million in the UK. OECD countries typically impose DSTs at rates of 2% or 3% on a relatively small number of larger firms, while non-OECD countries levy lower rates (1.5% or 2%) on a broader range of firms (Borders et al., 2023).

Countries designed broad-based DSTs to capture the value generated from user interactions, based on the view that digital firms create value through user engagement and data collection in each market.[5] Generally, the tax base includes revenue from specific digital services. In France and Italy, DSTs cover revenues from online advertising, the sale of user data, and digital intermediary activities, such as marketplace services. Spain's DST is similar but excludes user data sales. The UK's DST is more narrowly defined, applying only to revenues from social media platforms, search engines, and online marketplaces. For Amazon, which is the focus of our empirical study, this means that fees charged to third-party sellers using its platform are taxed, while revenues from Amazon's direct sales to consumers are not.

Due to their limited scope, DST revenues are relatively small, ranging from EUR 279 million in Spain to GPB 713 million in the UK in 2022, amounting to roughly 0.1% of total tax revenues (OECD, 2024). As the digital economy is growing rapidly, there is some scope for increases in revenue. Notably, the revenue comes from a very small number of firms. In the UK, approximately 90% of total DST revenue was generated

[5]Cui (2019); Cui and Hashimzade (2019) argue that DSTs are better placed to tax location-specific rents from the user base than other proposals to tax the digital sector (such as significant digital presence proposals).

by just five companies (National Audit Office, 2022).[6]

2.2 Amazon's Business Model and Fee Structure

Amazon operates a dual business model, serving both as a direct retailer and as a platform for third-party sellers. In 2023, the worldwide sales by Amazon and sellers on its platform reached USD 700 billion, with third-party marketplace sales accounting for USD 480 billion—more than double its first-party sales of USD 220 billion (Kaziukėnas, 2024). Almost 70% of these sales occured in the US. Among European countries, Germany (with a 2023 revenue of USD 38 billion) and the UK (USD 34 billion) are the largest markets. Penetration rates—the proportion of consumers who have made a purchase among potential consumers— are similarly high across all countries we study, ranging from 50% in Spain and 52% in France to 58% in the UK and 61% in Italy (NielsenIQ, 2024).

Amazon charges a variety of fees to third-party sellers using its platform, depending on the services they utilize. The primary fee is the *referral fee* for each item sold, which is charged as a percentage of the total sales price and varies by product category. For most categories, the fee is around 15%, but it can be higher or lower depending on the type of product being sold. Sellers who use Amazon's *Fulfillment by Amazon (FBA)* service, where Amazon manages storage, packaging, and shipping, are also subject to *FBA fees*. These fees are based on the size and weight of the item, with larger or bulkier products incurring higher costs. Additionally, sellers may incur *storage fees* if they store products in Amazon's warehouses for extended periods, as well as *optional service fees* such as advertising costs or multi-channel fulfillment fees for orders from other platforms that are fulfilled by Amazon.[7]

All these fees are subject to the DST in all the countries we study. Our analysis focuses on the FBA fees, as these are publicly available for the EU countries and the UK.

[6] In 2020-21, 18 business groups paid DST in the UK. Interestingly, eleven of the 20 business groups initially expected to make a payment determined that they did not owe any DST (National Audit Office, 2022).

[7] Regulatory bodies in both the US and EU have scrutinized Amazon's fee structure. The Federal Trade Commission (FTC) in the US has initiated investigations into Amazon's practices, particularly focusing on whether its complex fee structure may harm competition by imposing excessive costs on smaller sellers. In the EU, the Digital Markets Act (DMA) targets 'gatekeepers' like Amazon, imposing stricter regulations to ensure fair competition in digital markets. The DMA aims to prevent anti-competitive practices by requiring large digital platforms to adhere to specific obligations, such as providing transparency in fees and services.

3 Theoretical Expectations

Studying tax incidence implies asking who ultimately bears the economic burden of a tax. The core idea is that the legal responsibility to pay a tax (the statutory incidence) may not align with the true economic impact (the economic incidence). This discrepancy arises because taxes alter behavior, influencing equilibrium prices and shifting the burden between buyers and sellers. In basic partial-equilibrium models, the distribution of the tax burden depends on the relative elasticities of supply and demand (see Fullerton and Metcalf, 2002, for a review). When demand is less elastic than supply, consumers bear a larger share of the tax burden because they are less responsive to price changes. Conversely, when supply is less elastic than demand, producers shoulder more of the tax burden because they are less able to adjust their output.

In perfectly competitive markets with constant marginal costs, the entire tax burden typically falls on consumers: Since prices equal marginal costs and firms operate at minimum average cost, firms cannot lower prices to absorb the tax without incurring losses. As a result, the tax is fully passed onto consumers through higher prices. In contrast, under monopoly, tax incidence depends on the monopolist's ability to adjust prices. A monopolist may pass a portion of the tax onto consumers, but the extent of this pass-through depends not only on the elasticity of demand, but also on the shape of the demand curve. Moreover, the total economic burden of the tax under monopoly is greater because the quantity sold is already below the socially optimal level (Weyl and Fabinger, 2013). In oligopolistic markets, tax incidence depends on strategic interactions among firms, such as price-setting behavior and the potential for collusion. Thus, market structure and the distribution of market power are crucial determinants of how the tax burden is shared between producers and consumers.

In a two-sided market such as Amazon's marketplace, additional effect occur. Amazon acts as an intermediary platform connecting two distinct groups—sellers and consumers. The value of the platform to each group depends on the size and activity of the other: sellers are attracted by a large consumer base, while consumers benefit from a wide variety of sellers. This interdependence creates challenges for analyzing tax incidence because a tax on one side of the market can affect the behavior and outcomes on both sides. Standard models of tax incidence, which assume independent supply and demand curves, can thus provide misleading results.

Kind et al. (2010) model tax incidence in a two-sided platform. They show that an increase in an ad valorem tax on one side of the market affects the relative profitability of the two sides of the platform. Therefore, the firm will want to shift its earnings to the

untaxed side. By doing so it reduces the burden of the tax increase. Contrary to what one might expect, this may involve increasing output and reducing prices on both sides of the market. Kind and Koethenbuerger (2018) show that these findings also apply to platforms that do not charge one side of the market. Taking into account that digital companies typically sell services, like advertising, through affiliates in low-tax countries, Kind et al. (2024) study how a DST affects consumer prices. They find that a DST can intensify competition with non-digital retailers and thus lower consumer prices.[8]

We can apply the insights from Kind et al. (2010) to the context of the DST on Amazon. The Amazon marketplace is a two-sided platform that generates revenue primarily from fees charged to sellers and, to some extent, from customer memberships like Amazon Prime.[9] The attractiveness of the platform to consumers is positively related to the number of sellers, and vice versa. Kind et al. (2010) suggest that a DST on the fees Amazon charges to sellers may prompt the platform to rely more on income from customers, e.g., by trying to make it more attractive to sign up to Amazon prime. To counteract the tax impact on sellers, Amazon might reduce its fees to attract more sellers, thereby enhancing the platform's appeal to consumers. This strategy could lead to an increase in both the number of sellers and consumer subscriptions to Amazon Prime.[10]

To assess whether Amazon responded to the DST by adjusting Prime membership fees, we examine Prime fees in the countries under study. Our analysis shows that during the period we investigate, Amazon Prime fees were adjusted only once, in August 2022, and this change occurred simultaneously across all countries (France, Spain, UK, Italy, and Germany). Thus, there is no evidence that the DST influenced Prime fees, suggesting that Amazon did not shift the tax burden to consumers via subscription pricing. This leaves three potential groups that can bear the burden of the DST: Amazon itself, third-party firms selling on Amazon, or the final consumers buying from

[8] Belleflamme and Toulemonde (2018) analyze the effect of taxes on competing two-sided platforms. The authors use a Hotelling competition model, focusing on how platforms set access prices for two distinct groups of agents who benefit from interacting with each other. They also show that ad-valorem taxes may benefit users that are taxed, but hurts agents on the other side of the market. In a somewhat similar vein, D'Annunzio et al. (2020) study ad-valorem taxes in settings were firms charge multi-part tariffs. Some of these findings can be applied to Amazon's complex fee structure. They also find that ad-valorem taxes can, in some settings, correct underprovision, but only if the government applies differentiated tax rates to different parts of the tariff—a condition not met by the uniform DST.

[9] See Sanchez-Cartas and León (2021) for an overview of the theoretical literature on multisided platforms.

[10] Kind et al. (2008) ask whether taxes can be efficiency enhancing in such a setting. Whether a DST can increase efficiency depends on whether firms over- or underprovide their goods in the absence of the tax. For a monopolistic platform, underprovision can be alleviated by charging a positive ad-valorem tax, due to its counterintuitive effect on quantities described above.

these firms via Amazon.

We now explore these possibilities in more detail. We first ask whether Amazon changed its fees in response to the tax. Then, we study whether sellers using Amazon as a platform pass on potentially increased fees to consumers.

4 Empirical Strategy

4.1 Pass Through to Sellers on Amazon Marketplace

To examine whether Amazon adjusted its FBA fees in response to the introduction of DSTs, we use a staggered DiD approach. This method takes advantage of the different timing of DST implementation across countries. Countries that have introduced DSTs are the treatment group. The control group comprises countries that have not yet implemented DSTs, as well as Germany, which has not introduced a DST.

Our baseline regression equation is

$$\ln(\text{FBA fee})_{jct} = \alpha_1 DST_{ct} + \alpha_2 X_{ct} + \delta_{jc} + \delta_t + \epsilon_{jct}. \tag{1}$$

The dependent variable, $\ln(\text{FBA fee})_{jct}$, is the natural logarithm of the FBA fee for a size, weight, product- and packaging-category tuple j in country c at time t. The key explanatory variable, DST_{ct}, captures the presence of a DST in country c at time t. We operationalize this variable in two ways: first, as a continuous measure reflecting the DST rate in percent, and second, as a binary indicator that takes the value of one when the DST is in effect and zero otherwise. In some specifications, we include control variables X_{ct}, comprising inflation, the share of digital sales in all retail sales, and a measure for covid policy stringency (see Table A.2 for variable definitions and sources). We add fixed effects δ_{jc} for each fee category j in each country c to control for time-invariant characteristics, and month fixed effects δ_t to account for common temporal shocks.

Defining the treatment timing is challenging here, as there are often substantial delays between when a DST law is passed and when collection starts (see Table 1). For instance, France delayed collection by over a year to allow for international tax negotiations. In the UK, the tax was collected before the law was officially passed; guidance on the expected implementation was published two weeks before collection started. To reflect the actual economic impact, we use the date the tax was first collected as the treatment start date, rather than the legislative date.

The staggered introduction of DSTs across countries can bias estimates from the traditional TWFE estimator when treatment timing varies across units. This issue arises because TWFE estimators can produce negative weights, as highlighted by Goodman-Bacon (2021). To diagnose this problem in our context, we use the Bacon decomposition (see Table A.3 and Figure A.1 in the Appendix), which shows that no negative weights are present in our sample. We therefore report results using the traditional TWFE approach as the main results, but also implement alternative estimators (Sun and Abraham, 2021; Borusyak et al., 2024; Callaway and Sant'Anna, 2021) that are robust to these issues.

The fees for the different size, weight, product- and packaging-category tuples are of different importance for sellers. We therefore apply weights in our regression. The weights are based on the frequency of each fee category in the price dataset, so that more commonly used categories receive higher weight in the estimation.[11]

We cluster standard errors by country-month. This approach captures common shocks that affect all units within a country during the same month.[12]

4.2 Pass Through to Consumers

Our next step is to investigate whether third-party sellers on Amazon pass on potential increases in fees due to DSTs to consumers. Our main approach is again a DiD analysis. As a robustness check, we also implement an instrumental variable approach.

To estimate the extent to which changes in Amazon's fees due to DSTs are passed on to consumers, we compare the evolution of prices for identical products sold on Amazon by different sellers. The treated group consists of products sold by third-party sellers using Fulfillment by Amazon (FBA). These sellers pay Amazon fulfillment and referral fees, which are subject to the DST. The control group consists of the same products, but sold directly by Amazon as the retailer. Since Amazon's direct sales revenue is not subject to the DST, prices in this group should not be directly affected by the tax.

A potential limitation of this strategy is that it may underestimate the true pass-through effect if Amazon also adjusts its own prices in response to the DST. Since third-

[11]Some fee categories do not appear in the price data for certain countries, which leads to slight differences in the number of observations across countries.

[12]When using the Callaway and Sant'Anna (2021) estimator, clustering by country-month is not possible, as it requires clusters to be nested within the panel ID. In analyses looking at all countries, we can cluster by country, using a multiplicative wild cluster bootstrap. However, this is not possible when we study individual countries. In that case, we cluster by the cross-sectional identifier (i.e., at the country-product level).

party sellers on the marketplace face higher fees and may raise their prices accordingly, Amazon—acting as a direct competitor—might also increase its prices. If this occurs, the control group would no longer provide a fully unaffected counterfactual, leading to a downward bias in our estimate of the pass-through to consumers.[13]

We estimate the following regression equation:

$$\ln(\text{Price})_{icts} = \beta_1(FBA_s \times \text{DST}_{ct}) + \delta_i + \delta_t + \epsilon_{icts}. \tag{2}$$

The dependent variable, $\ln(\text{Price})_{ijct}$, is the natural logarithm of the price of product i in country c at time t, sold by seller type s. The key explanatory variable, $FBA_s \times \text{DST}_{ct}$, is an interaction term between an indicator variable FBA_s, which equals one if the seller is a third-party seller using FBA, and DST_{ct}, a binary variable indicating whether the DST is in effect in country c at time t. The coefficient β_1 captures the differential change in prices for FBA-sold products after DST implementation, relative to those sold directly by Amazon.

We include product fixed effects, δ_i, to control for time-invariant product characteristics, and time fixed effects, δ_t, to account for common shocks affecting all products at a given time. Standard errors are clustered at the product category–month level to account for serial correlation in prices within product categories over time.

We estimate eq. (2) separately for each country, treating the introduction of the DST as a single discrete event. This non-staggered design allows us to examine country-specific effects without imposing additional assumptions.

In Appendix A, we additionally employ an instrumental variable (IV) approach, where we instrument the fees with the DST and then analyze how the DST-induced changes in the fees are passed on to consumers. This approach has the advantage that it does not rely on assumptions about the pricing behavior of Amazon. However, as the DST-induced variation in the fees is small, the instrument is not very strong, and we therefore present the DiD as our main approach.

[13]We can use our data to some extent to check whether this is the case, by comparing Amazon prices for the same product across countries. The results in Table A.5 in the appendix show a very small and insignificant coefficient of 0.001 both when comparing prices in a standard two-way fixed effects setting (with cross-sectional, i.e. product-country, and time fixed effects) or when comparing prices for the same product in the same month across countries.

5 Data

5.1 Fee Data

To analyze the impact of DSTs on Amazon's fees, we use data on Fulfillment by Amazon (FBA) fees. Amazon's FBA service includes storing sellers' products in its warehouses, as well as handling the packaging and shipping of these items once an order is placed.

Amazon publishes "rate cards" that specify fees for each service separately, allowing us to calculate the total FBA fee for various product categories, based on a product's weight and size (see Figure 1 for a snippet of such a rate card). Amazon distinguishes between local and cross-border shipping fees.[14] We only use local shipments, as cross-border movements were significantly disrupted by Brexit and the COVID-19 pandemic during the period we study (December 2017 to February 2022). We also focus in the main part on standard-sized goods, as the fees for these goods are more stable over time. Storage fees vary by product category[15], the volume stored, and the season, with higher rates charged from October to December due to increased warehouse demand during peak shopping seasons.[16]

We calculate the FBA fee by summing the individual fees for storage and shipping. The rate cards provide these fees as pre-VAT amounts, and we use them as such in our analysis. Our analysis covers Germany, France, Spain, Italy, and the United Kingdom. We exclude data from the Netherlands, Sweden, and Poland because these marketplaces were included only from April 2020 onwards. For each country, we observe 180 distinct combinations of product type, package type, weight, and size.

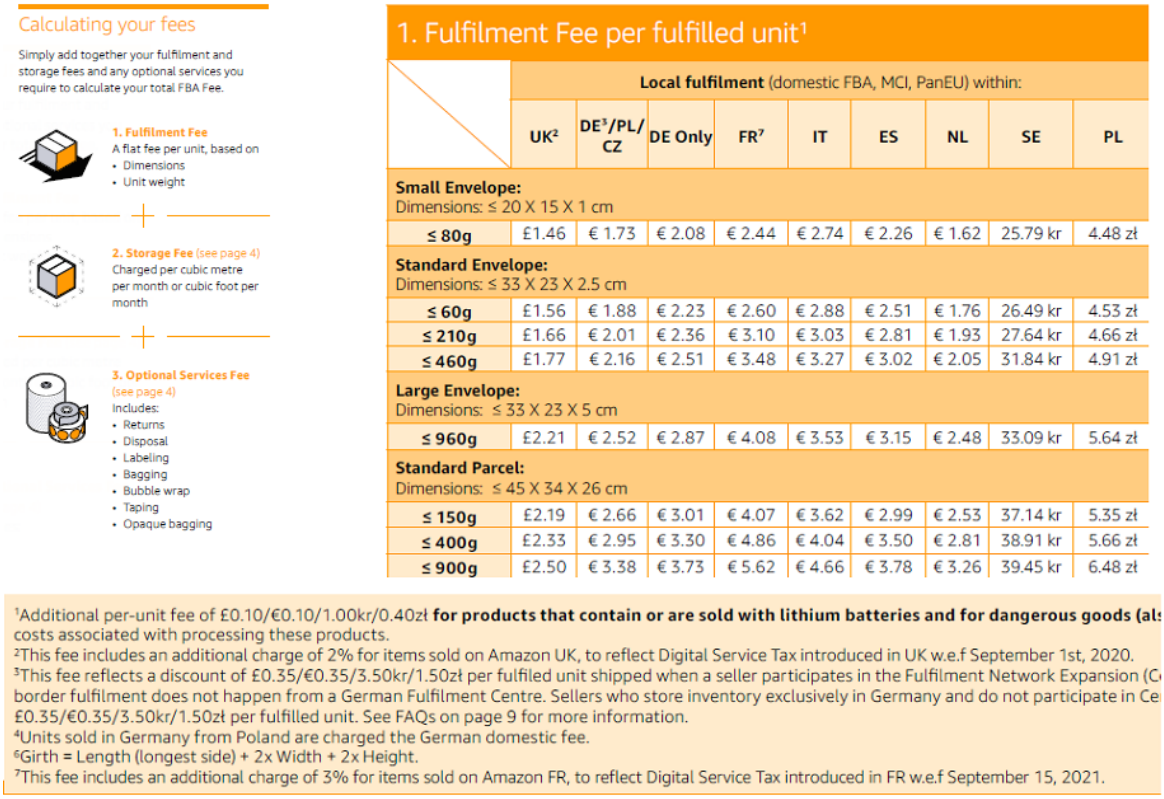
We obtain the fee information starting in December 2017, when Amazon first released a consolidated rate card for all EU marketplaces, up to February 2022. In this period, Amazon published 14 rate cards. As we know that the fees did not change in between, we impute the data so that the final dataset has monthly observations. Amazon charges additional fees, such as a referral fee for using its marketplace. As we were unable to obtain information on these fees over time, our analysis focusses on FBA fees.

[14]Shipping fees are determined based on the weight and dimensions of the packaged product, which classify items as either "Standard" or "Oversize." For example, products weighing 12 kg or more, or exceeding certain dimensional thresholds, are categorized as "Oversize," which incurs higher shipping fees.

[15]Initially, Amazon classified products as "media" or "non-media." In April 2020, it introduced new categories "Clothing, Shoes and Bags," and in June 2021, "Hazmat" (hazardous materials). We use all categories for the full period to obtain a balanced panel.

[16]In addition, there are also optional fees, e.g., for special packaging. We do not include these fees.

Figure 1: Fulfilment by Amazon (FBA) Rate Card



Calculating your fees

Simply add together your fulfilment and storage fees and any optional services you require to calculate your total FBA Fee.

1. Fulfilment Fee
A flat fee per unit, based on
- Dimensions
- Unit weight

2. Storage Fee (see page 4)
Charged per cubic metre per month or cubic foot per month

3. Optional Services Fee (see page 4)
Includes:
- Returns
- Disposal
- Labeling
- Bagging
- Bubble wrap
- Taping
- Opaque bagging

1. Fulfilment Fee per fulfilled unit[1]

	Local fulfilment (domestic FBA, MCI, PanEU) within:								
	UK[2]	DE[3]/PL/CZ	DE Only	FR[7]	IT	ES	NL	SE	PL
Small Envelope: Dimensions: ≤ 20 X 15 X 1 cm									
≤ 80g	£1.46	€ 1.73	€ 2.08	€ 2.44	€ 2.74	€ 2.26	€ 1.62	25.79 kr	4.48 zł
Standard Envelope: Dimensions: ≤ 33 X 23 X 2.5 cm									
≤ 60g	£1.56	€ 1.88	€ 2.23	€ 2.60	€ 2.88	€ 2.51	€ 1.76	26.49 kr	4.53 zł
≤ 210g	£1.66	€ 2.01	€ 2.36	€ 3.10	€ 3.03	€ 2.81	€ 1.93	27.64 kr	4.66 zł
≤ 460g	£1.77	€ 2.16	€ 2.51	€ 3.48	€ 3.27	€ 3.02	€ 2.05	31.84 kr	4.91 zł
Large Envelope: Dimensions: ≤ 33 X 23 X 5 cm									
≤ 960g	£2.21	€ 2.52	€ 2.87	€ 4.08	€ 3.53	€ 3.15	€ 2.48	33.09 kr	5.64 zł
Standard Parcel: Dimensions: ≤ 45 X 34 X 26 cm									
≤ 150g	£2.19	€ 2.66	€ 3.01	€ 4.07	€ 3.62	€ 2.99	€ 2.53	37.14 kr	5.35 zł
≤ 400g	£2.33	€ 2.95	€ 3.30	€ 4.86	€ 4.04	€ 3.50	€ 2.81	38.91 kr	5.66 zł
≤ 900g	£2.50	€ 3.38	€ 3.73	€ 5.62	€ 4.66	€ 3.78	€ 3.26	39.45 kr	6.48 zł

[1]Additional per-unit fee of £0.10/€0.10/1.00kr/0.40zł **for products that contain or are sold with lithium batteries and for dangerous goods (als** costs associated with processing these products.
[2]This fee includes an additional charge of 2% for items sold on Amazon UK, to reflect Digital Service Tax introduced in UK w.e.f September 1st, 2020.
[3]This fee reflects a discount of £0.35/€0.35/3.50kr/1.50zł per fulfiled unit shipped when a seller participates in the Fulfilment Network Expansion (C border fulfilment does not happen from a German Fulfilment Centre. Sellers who store inventory exclusively in Germany and do not participate in Ce £0.35/€0.35/3.50kr/1.50zł per fulfilled unit. See FAQs on page 9 for more information.
[4]Units sold in Germany from Poland are charged the German domestic fee.
[6]Girth = Length (longest side) + 2x Width + 2x Height.
[7]This fee includes an additional charge of 3% for items sold on Amazon FR, to reflect Digital Service Tax introduced in FR w.e.f September 15, 2021.

Notes: Excerpts from Amazon's September 2021 EU FBA rate card. The panel on the left outlines how FBA fees are calculated; the panel on the right displays example fulfillment fees for standard-sized products. DST surcharges are mentioned for the UK and France, but not for Italy or Spain. *Source:* Amazon Seller Central.

From April 2021 (September 2021) the rate cards include a note that the fees include an "additional charge" of 2% or 3% to cover the British (British and French) DSTs (see footnotes 2 and 5 in Figure 1). The Italian and Spanish DSTs are never mentioned on the rate cards during the sample period.

Table 2, Panel A provides descriptive statistics on the FBA fees. The fees vary between around EUR 2.50 and EUR 12.50. On average, the fees are lowest in the UK and highest in France.[17]

[17]The GBP to EUR exchange rate was around 1.13 EUR per GBP in 2018 and 1.17 EUR per GBP in 2022.

Table 2: Fulfillment by Amazon (FBA) Fees: Descriptive Statistics

	Mean	Weighted Mean	Min	p25	p50	p75	Max	Obs
France	6.77	5.18	2.83	4.39	6.99	8.65	12.49	2,346
Germany	5.66	4.39	2.83	3.74	5.95	7.16	9.59	2,499
Italy	6.31	4.83	3.12	4.07	6.27	8.04	11.48	2,244
Spain	5.56	4.30	2.57	3.83	5.65	7.08	9.76	2,397
UK	4.04	2.92	1.60	2.56	3.86	5.24	8.75	2,244

Notes: FBA fees for standard-sized products across weight, size, and packaging categories. Fees for France, Germany, Italy, and Spain are in EUR; UK fees are in GBP (exchange rate approx. 1.14 EUR/GBP). Weighted means use frequencies from the price dataset described in Section 5.2. The number of observations varies by country as some packaging types receive zero weight. *Source:* Hand-collected Amazon rate cards, Dec 2017–Feb 2022.

5.2 Price Data

For the second part of our analysis, we use product and pricing data from Keepa.com, a pricing consultancy. Keepa collects pricing information directly from Amazon, providing sellers with historical price trends to help optimize their pricing strategies. It tracks prices of products sold on Amazon (and also on other online marketplaces) across multiple countries.

The Keepa dataset covers all five countries in our study (United Kingdom, Germany, France, Italy, and Spain) and tracks several price categories for each product. The most important one for our analysis is the *FBA price*, which is the lowest price at which a product is offered by third-party sellers using the Fulfillment by Amazon (FBA) service.[18] We additionally obtain data on the *Amazon price*, which is the price Amazon charges when it sells the product directly. All price data includes VAT but excludes shipping costs.

In addition to pricing data, we also capture the number of sellers offering a product. This variable allows us to analyze whether changes in the number of suppliers affect the degree of tax pass-through. Furthermore, we obtain information on product identifiers, product category, packaging dimensions and weights.

Keepa collects data on a non-periodic basis, meaning that some products are tracked more frequently than others, with intervals between price recordings varying across products. We include only products that have at least one observation in January 2019 or earlier, so that we have at least 12 months of data for each product before the first DST is implemented. Analogously to the analysis of FBA fees, we

[18]Note that we only observe the lowest FBA price, but not which seller offered it. Thus, we cannot include seller fixed effects or compare the prices of the same seller across countries.

download all data for the period December 2017 to February 2022. We restrict our sample to products that have both an Amazon and an FBA price and have at least one price observation both before and after the DST implementation in the respective marketplace.

We process the data by averaging prices on a monthly basis. This reduces noise due to short-term price fluctuations or discounts. We use the Amazon Standard Identification Number (ASIN) and marketplace identifiers to create a cross-sectional identifier for each product.

Table 3 provides descriptive statistics for the price data used in our analysis. The table reports various percentiles as well as the mean of prices for two types of listings: FBA prices and Amazon's own prices. The prices show some variation across countries and price percentiles. The median prices is around EUR 20. France exhibits somewhat higher price levels (with median FBA prices at EUR 21.51) than the other countries. In the UK, the median FBA price increases from GBP 12.84 pre-treatment to GBP 13.50 post-treatment.

Table 3: Price Data: Descriptive Statistics

Country	Price Type	p1	p10	p50	p90	p99	Mean	Obs
Full Sample								
France	FBA Price	6.49	9.59	21.51	71.77	215.99	34.86	1 563 815
	Amazon Price	5.62	9.14	19.96	69.00	204.79	33.18	3 192 344
Germany	FBA Price	4.97	8.14	19.98	72.86	210.00	33.66	2 578 801
	Amazon Price	4.36	7.84	19.41	69.01	199.64	32.26	4 902 610
Italy	FBA Price	6.30	9.51	20.95	69.68	205.90	33.67	1 868 512
	Amazon Price	5.27	8.92	19.51	66.33	198.47	31.90	3 802 339
Spain	FBA Price	6.00	9.41	21.46	72.09	210.77	34.73	1 586 971
	Amazon Price	5.14	8.85	19.95	69.31	202.05	32.87	3 261 501
UK	FBA Price	3.30	5.32	12.99	42.42	132.00	20.78	2 774 709
	Amazon Price	3.09	5.45	12.44	41.81	127.63	20.22	4 848 430
Pre Treatment								
France	FBA Price	6.55	9.90	21.80	66.70	184.51	32.65	341 346
	Amazon Price	5.67	9.17	19.48	62.17	177.66	30.43	754 207
Italy	FBA Price	6.44	9.74	20.61	62.98	178.50	31.11	469 045
	Amazon Price	5.31	8.89	18.74	59.27	171.18	28.96	913 759
Spain	FBA Price	6.00	9.42	20.99	66.36	179.00	31.99	362 656
	Amazon Price	5.00	8.65	19.11	62.28	174.49	29.86	779 597
UK	FBA Price	3.23	5.27	12.84	39.75	118.00	19.47	623 770
	Amazon Price	3.03	5.37	12.06	38.23	112.52	18.68	1 156 607
Post Treatment								
France	FBA Price	6.46	9.64	21.10	65.66	181.00	32.09	342 694
	Amazon Price	5.70	9.24	19.35	61.70	176.30	30.32	766 328
Italy	FBA Price	6.38	9.64	20.51	64.79	181.99	31.41	393 800
	Amazon Price	5.30	8.82	18.67	59.00	170.43	28.86	924 122
Spain	FBA Price	5.97	9.18	20.36	64.99	177.84	31.30	399 610
	Amazon Price	5.06	8.80	19.19	62.04	172.88	29.92	794 582
UK	FBA Price	3.40	5.64	13.50	41.95	120.46	20.46	603 954
	Amazon Price	3.12	5.49	12.39	39.19	114.89	19.09	1 189 105

Notes: Descriptive statistics for the price data. Prices for France, Germany, Italy, and Spain are in EUR; UK prices are in GBP (exchange rate approx. 1.14 EUR/GBP). Values are based on monthly average prices per product. The full sample covers Dec 2017–Feb 2022. The pre- and post-treatment panels reflect monthly averages for the 12 months before and after DST implementation. *Data:* Keepa.com.

6 Results

6.1 Marketplace Fees

We begin by analyzing how the introduction of DSTs affected the fees Amazon charges sellers for using its fulfillment services. As outlined in Section 4.1, we estimate equation (1) using a staggered difference-in-differences design, exploiting variation in DST implementation across countries. Our main outcome is the (log) FBA fee for a given product type, size, and weight category.

Figure 2 plots the estimated dynamic effects relative to the month of DST introduction. We observe pre-treatment coefficients are centered around zero, indicating no significant differences in fee trends between treated and control countries prior to the tax. After the DSTs were implemented, the post-treatment coefficients show a marked increase in fees.

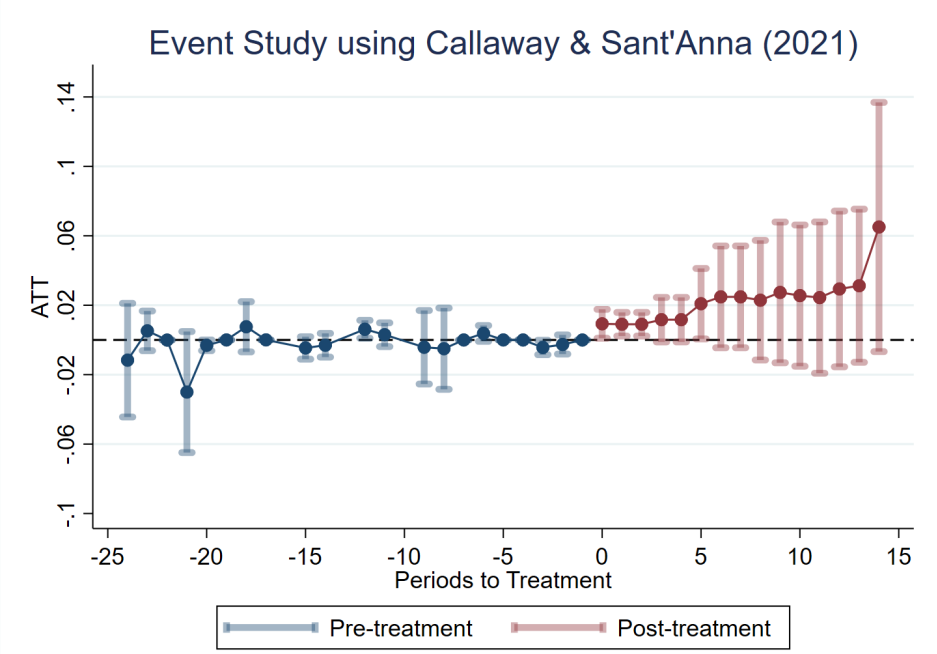


Figure 2: Fee Analysis: Event Study

Notes: Event study estimates of the effect of DST implementation on FBA fees, based on the Callaway and Sant'Anna (2021) estimator. 90% confidence intervals. Standard errors clustered by country using a multiplicative wild bootstrap. Data include only FBA fees for standard-sized products, weighted by their frequency in the price data. Monthly observations are imputed by assuming fees remain constant between published rate cards. *Data:* Hand-collected Amazon rate cards, Dec 2017–Feb 2022.

To explore the size of the coefficients, we present regression results in Table 4. In cols. (1) and (2), we use a traditional two-way fixed effects (TWFE) model. In col. (1), the explanatory variable is the DST rate. We find a positive and statistically significant

coefficient of 0.005, indicating that a one percent higher DST rate increases average FBA fees by 0.5%. Thus, about half of the DST is passed onto sellers.

To address potential biases from staggered treatment timing, we also estimate the effects using newer estimators that correct for such bias. These methods only work with a binary explanatory variable. Thus, we first replicate in col. (2) the findings with the traditional TWFE estimator using a binary DST dummy variable. Here, the introduction of DSTs is associated with a 2.0% increase in fees. Given that the DST rate is 2% in the UK and 3% in France, Italy and Spain, this confirms that there is substantial pass-through.

In cols. (3) to (5), we provide results with new estimators that take the staggered timing into account. Using the Sun and Abraham (2021) estimator in col. (3), we find a somewhat larger effect, with a 5.0% increase in fees after the tax. Using the Borusyak et al. (2024) imputation estimator in col. (4), we find a smaller point estimate of 0.024. Lastly, we use the Callaway and Sant'Anna (2021) estimator in col. (4). We find a similar overall effect of 3.3%. The Callaway and Sant'Anna (2021) estimator allows to obtain specific results for each country. It shows substantial variation: For France and Spain, the point estimates of 0.025 and 0.024 indicate roughly full pass trough. In the UK, there is more than full pass through, with an estimated average increase in fees of 6.8%. The coefficient for Italy is smaller (0.016) and insignificant, indicating little pass through.[19]

The variation in estimated effects across cols. (2) to (5) reflects differences in how each estimator defines comparison groups and assigns weights. Although all four approaches target the average treatment effect, they do so using different subsets of data and aggregation rules. The traditional TWFE estimator in col. (2) includes comparisons between early- and late-treated countries, as well as with never-treated units.[20] The Sun and Abraham (2021) estimator in col. (3) excludes already-treated units from the control group and weights cohort-specific effects by the number of treated observations. Since the UK, which shows the strongest response, has a large number of observations, this pushes the estimate upward to 5.0%. In contrast, the Borusyak et al. (2024) estimator in col. (4) re-weights group-time cells rather than cohorts, assigning more influence to late post-treatment periods with lower pass-through, which pulls the estimate down to 2.4%. The Callaway and Sant'Anna (2021) approach in col. (5) yields

[19]Note that in col. (5), we cannot cluster at the country-month level, as the Callaway and Sant'Anna (2021) estimator requires clusters to be nested in the panel ID. We cannot bootstrap standard errors clustered by country, as for the late adopting countries, we would have only one control country (Germany), i.e. two clusters. Using only two clusters leads to overfitting in the bootstrap.

[20]As shown in TableA.3, these comparisons do not generate negative weights, but they may still dilute the estimated effect by averaging across early and late post-treatment periods.

an intermediate estimate of 3.3% by aggregating cohort effects according to the population share of treated units in each period. In short, the spread from 2.0% to 5.0% across estimators is driven by differences in how much weight each method places on high-effect cohorts (such as the UK) and on later post-treatment periods, where the observed effects are smaller.

The country-specific estimates in col. (5) of Table 4 show considerable heterogeneity. While we find full or even more-than-full pass-through in the UK (6.8%) and close to full pass-through in France (2.5%) and Spain (2.4%), the effect for Italy is smaller (1.6%) and statistically insignificant. One potential explanation is that Amazon chose not to pass the DST on to sellers in Italy in order to maintain its competitiveness. As shown in Appendix Table A.4, Italy is the only country where the number of third-party sellers significantly increased after the DST was introduced. This pattern suggests that Amazon may have kept its fees (nearly) stable (effectively absorbing the DST) to attract or retain sellers in a market where it had relatively low market share (less than 17.8% in 2020, compared to 22.4% in Spain and 36.2% in Germany) [21]

We perform several robustness and heterogeneity tests to ensure the validity of our results. Table 5 shows the results, using the specification with the DST rate (Table 4, col. 1) as the baseline. In Panel A, col. (1), we re-estimate the regression without weights, and in col. (2), we use the unweighted raw data with irregular time intervals. Both specifications yield slightly higher estimates, with pass-through close to 100%. This suggests that fee increases were somewhat larger in less frequently used product categories. Since our baseline weights reflect the frequency of each category in the price dataset, this implies that the more commonly used fee categories experienced smaller increases, moderating the overall average pass-through.

We also look at potential heterogeneity (again with the unweighted data). First, in col. (1) of Panel B of Table 5 we look at oversized goods, finding similar results. In cols. (2) and (3), we split the fees (again for standard-sized products) into fees for media and non-media products. We find identical coefficients in both cases, indicating that Amazon does not differentiate its fee adjustments by product category. The media category includes books, which we will look at it in more detail in our analysis of pass-through to consumer prices.

To analyze heterogeneity across countries, Figure 3 presents individual event studies for each case. In the UK and France, the evidence confirms significant pass-through of the DST to sellers immediately after the DST is introduced. In Spain, full pass-through

[21] See Statista Market Insights (2025); About Amazon Europe (2021a,b); Amazon.com, Inc. (2021) for the market share information.

Table 4: Fee Analysis: Main Regression Results

Estimator	TWFE		SA	BJS	CS
Expl. Var.	DST Rate %	Dummy			
	(1)	(2)	(3)	(4)	(5)
DST	0.005***	0.020***	0.050***	0.024***	0.033***
	(0.002)	(0.006)	(0.002)	(0.005)	(0.011)
Italy					0.016
					(0.015)
UK					0.068***
					(0.022)
France					0.025**
					(0.011)
Spain					0.024**
					(0.008)
Controls	✓	✓			
Cross-section FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓
R^2	0.985	0.985	0.991		
Observations	11,730	11,730	10,942	10,942	10,852
Clustering	cntry-month	cntry-month	cntry-month	cntry-month	cross-sec. id

Notes: Estimated effects of digital services tax (DST) implementation on Fulfillment by Amazon (FBA) fees across different estimators. Columns (1) and (2) use the traditional two-way fixed effects (TWFE) estimator, with column (1) based on the DST rate and column (2) on a DST dummy. Column (3) uses the estimator by Sun and Abraham (2021), column (4) the estimator by Borusyak et al. (2024), and column (5) the estimator by Callaway and Sant'Anna (2021), which also reports country-specific effects. Only standard-sized products are included. Observations are weighted by frequency in the price data. Monthly values are imputed by assuming constant fees between published rate cards. ***, **, * indicate significance at the 1%, 5%, and 10% levels. *Data:* Hand-collected Amazon rate cards, Dec 2017–Feb 2022.

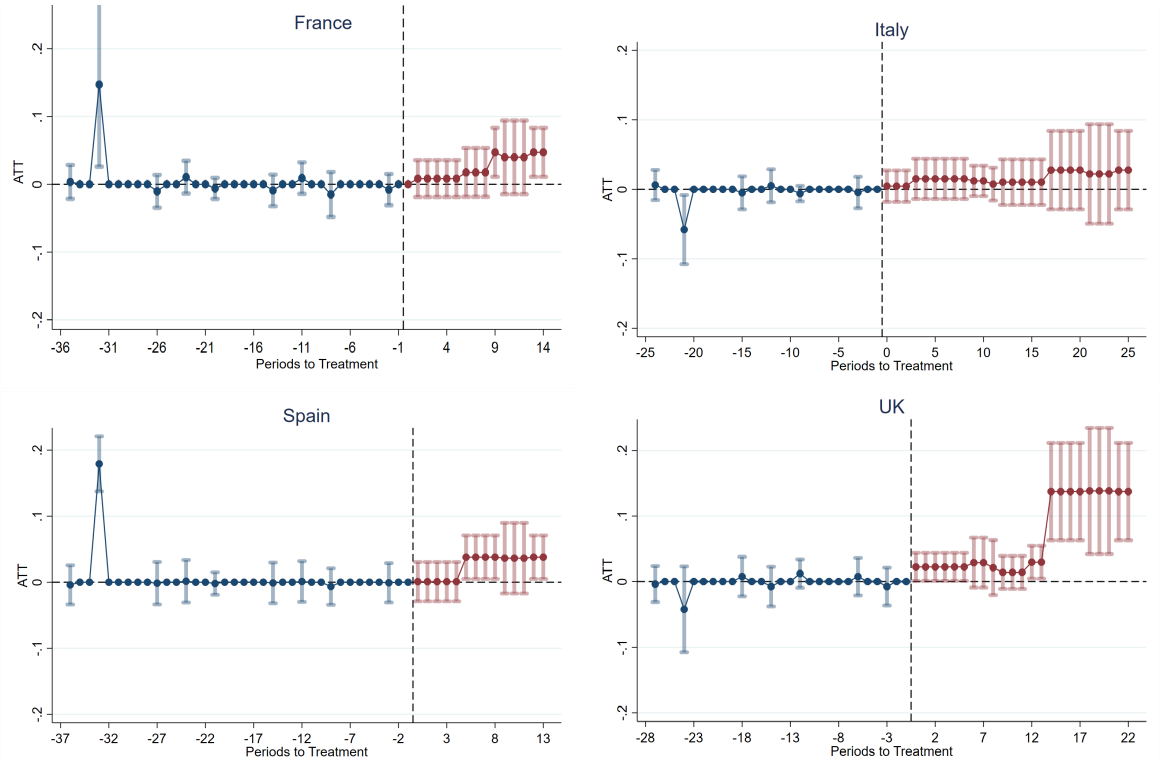
occurs, but only six months after the DST's introduction. This delay is attributable to the fact that a new rate card was only then published. Thus, the DST was passed through as soon as the next rate card was published.

Table 5: Fee Analysis: Robustness and Heterogeneity

	Panel A: Robustness		**Panel B: Heterogeneity**		
Product size	Standard		Oversize	Standard	
Product type	All			Media	Non-Media
	(1)	(2)	(1)	(2)	(3)
DST Rate	0.010***	0.008*	0.013***	0.010***	0.010***
	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)
Controls	✓	✓	✓	✓	✓
Cross-Section FE	✓	✓	✓	✓	✓
Time FE	✓	✓	✓	✓	✓
Imputed	✓	–	✓	✓	✓
R^2	0.987	0.988	0.985	0.987	0.986
Observations	15,300	4,800	19,125	5,100	10,200

Notes: Robustness and heterogeneity test for the effect of DSTs on FBA fees. Panel A tests robustness to weighting and imputation. Column (1) removes weights; column (2) additionally only uses original (non-imputed) observations. Panel B explores heterogeneity by product size and category (again unweighted): column (1) includes only oversize goods, columns (2) and (3) split the sample into media and non-media products. All regressions include inflation, the market share of the digital economy, and a COVID-19 policy stringency index as controls. Only standard-sized products are included, except in Panel B, col. (1). Monthly values are imputed by assuming constant fees between published rate cards, except in Panel A, col. (2). ***, **, * indicate significance at the 1%, 5%, and 10% levels. *Data:* Hand-collected Amazon rate cards, Dec 2017–Feb 2022.

Figure 3: Fee Analysis: Event Studies by Country



Notes: Event study estimates of the effect of DST implementation on FBA fees, separately for each country. Estimates are based on the estimator by Callaway and Sant'Anna (2021). 90% confidence intervals. Standard errors clustered by cross-sectional ID. Only standard-sized products are included. Observations are weighted by frequency in the price data. Monthly values are imputed by assuming constant fees between published rate cards. *Data:* Hand-collected Amazon rate cards, Dec 2017–Feb 2022.

6.2 Prices

Are the observed increases in fees passed on to consumers via higher prices? To analyze this question, we compare price changes for identical products sold by two groups of sellers on Amazon: third-party sellers using Fulfillment by Amazon (FBA) (treated group) and Amazon as a direct seller (control group). Since DSTs apply only to marketplace transactions, this allows us to estimate the direct effect of DSTs on prices. In this analysis we focus on the medium run, using monthly data for twelve months before and after the introduction of the DST.

Table 6 presents the DiD results. All specifications include cross-section (i.e., product-country) and month fixed effects.[22] We find positive and significant effects in all countries. The effect is smaller in Italy, in line with the results on fees from Section 6.1.

[22]We do not add the control variables, as in these regressions for individual countries, the controls are subsumed by the time fixed effects.

Table 6: Price Analysis: DiD Results

	(1) **France**	(2) **Italy**	(3) **Spain**	(4) **United Kingdom**
$FBA_{is} \times \text{DST}_{ct}$	0.022***	0.008***	0.026***	0.017***
	(0.004)	(0.003)	(0.003)	(0.003)
Cross-Section FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
R^2	0.96	0.96	0.96	0.95
Observations	2,195,111	2,685,636	2,326,889	3,555,405

Notes: Estimated effects of DST implementation on consumer prices, using a difference-in-differences specification. The outcome is the logarithm of the price for products sold by third-party sellers using FBA, compared to prices of identical products sold by Amazon directly. All columns include product and time fixed effects. Only standard-sized products are included. Standard errors are clustered at the product category–month level. ***, **, * indicate significance at the 1%, 5%, and 10% levels. *Data:* Keepa.com.

How large are these estimated price effects? Translating our log-point estimates from Table 6 into monetary values is not straightforward, as we only directly observe FBA fees, not other fees charged by Amazon (and subject to the DST). The most common rate for referral fees is 15%, and we assume this is the relevant rate in the calculations below.[23]

Using median FBA prices from Table 3, we estimate the net-of-VAT price changes for representative items, as reported in Table 7. Consumer prices increased between GBP 0.12–0.25 in the UK, EUR 0.25—0.53 in France, EUR 0.04—0.24 in Italy, and EUR 0.36-–0.57 in Spain. The corresponding pass-through ratios—which measure how much consumers pay for each unit of DST Amazon collects—vary notably across countries. They range from roughly 1.3 to 2.7 in the UK, 1.1 to 2.3 in France, and 1.7 to 2.7 in Spain, suggesting that consumers pay more than the statutory DST amount itself. In Italy, the pass-through ratios are smaller and statistically noisier, ranging from 0.16 to 1.07. These more-than-full pass-through effects may be due to sellers rounding up prices to attractive thresholds, like 0.49 or 0.99, or due to increases in other unobserved Amazon fees.

Figure 4 shows the country-level event studies, comparing FBA prices to Amazon's own prices, again separately for each of the countries that have introduced a DST. We see an increase in prices after the introduction of the DST in all countries (albeit insignificant in many periods). All pre-treatment periods are not statistically different

[23]In some cases, there are additional fees, such as closing fees, which we do not consider in the calculation. Examples of such closing fees include a fee of EUR 0.61 per book sold in France or EUR 1.01 in Germany, Italy and Spain.

Table 7: Digital Services Tax: Price Effects and Pass-through

	Price change (net of VAT, 95% CI)	**Pass-through ratio** (95% CI)
France	EUR 0.25–0.53	1.08–2.27
Italy	EUR 0.04–0.24	0.16–1.07
Spain	EUR 0.36–0.57	1.71–2.71
UK	GBP 0.12–0.25	1.32–2.73

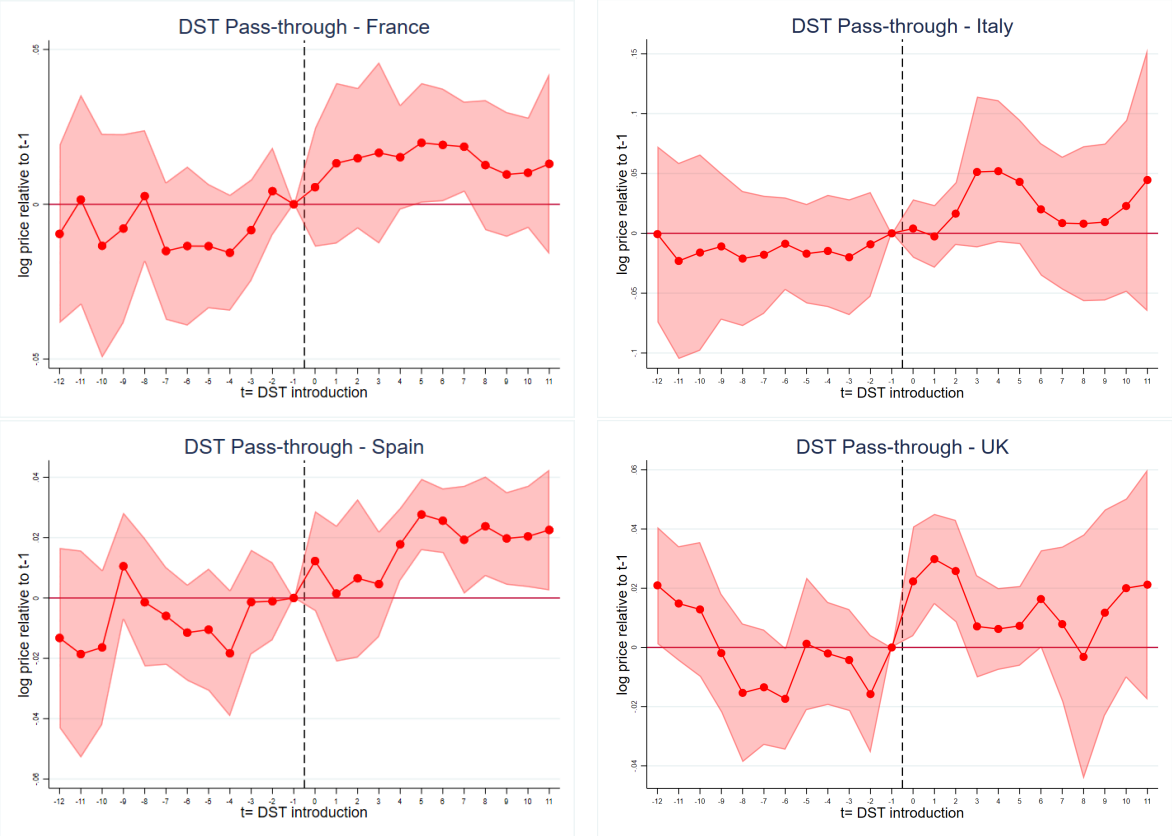
Notes: Estimated changes in net-of-VAT consumer prices and corresponding pass-through ratios for a representative product (with median FBA price) in the first year after DST implementation. Price changes are based on the coefficients from Table 6. Pass-through ratios measure the consumer price increase per euro (or pound) of DST remitted by Amazon, assuming a 15% referral fee. DST rates are 2% in the UK and 3% in France, Italy, and Spain. Median prices and weighted-mean FBA fees are taken from the descriptive statistics. *Data:* Keepa.com; Amazon rate cards.

from zero. These findings are consistent with our main results indicating that DSTs meaningfully increase marketplace sellers prices.

One limitation of this approach is that Amazon may also adjust its own prices in response to the DST, as it competes with third-party sellers on its platform. If Amazon raises its prices, our control group is partially affected, leading to a potential underestimation of the true pass-through. To directly estimate the effect of fees on prices, we next turn to an IV approach, where we use the DST as an instrument for Amazon's fulfillment fees. Details on the specification and estimation are provided in Appendix A.

The IV estimates in Table A.1 confirm substantial pass-through of DST-induced fee increases to consumer prices. Across specifications, the coefficients are large and statistically significant, with the preferred estimates ranging from 2.9 to 12.4. These magnitudes imply that prices rise by more than the observed increase in FBA fees, which is consistent with the DST also affecting referral fees—another major component of seller costs that we unfortunately do not observe. As referral fees are usually substantially higher than FBA fees, these results are in line with full pass-through.

Figure 4: Price Analysis: Event Studies by Country



Notes: Event study estimates of the effect of DST implementation on consumer prices, comparing products sold by third-party sellers using FBA to the same products sold directly by Amazon. Each panel shows log prices centered on the month of DST introduction (vertical line), with a window of 12 months before and after. 99% confidence intervals. Standard errors clustered by product category. *Data:* Keepa.com.

6.3 Effect Heterogeneity

Amazon began as a bookseller, and books still constitute a notable share of its sales. Among the DST countries in our sample, France, Spain, and Italy have fixed book price regimes that constrain price-setting: publishers determine the retail price of new books, and retailers are only allowed limited discounts (typically up to 5%). These rules generally apply for a limited period after publication, such as two years (see Ragazzo, 2017, for details).[24] This institutional feature allows us to examine heterogeneity in pass-through by product type. In countries with fixed price regimes, price adjustments should be muted for books, as prices can only change once the fixed period has expired. In contrast, in the UK—where no such restriction exists—we expect similar effects for books and non-books.

[24]The UK previously had the Net Book Agreement, a fixed book price system, but abolished it in 1995.

Table 8 examines whether price pass-through differs between books and non-books in response to the DST. We re-estimate eq. (2), but interact the treatment effect with an indicator for books. In all four countries, the baseline pass-through for non-books is positive and statistically significant, with magnitudes very similar to Table 6. In contrast, the interaction term is close to zero and insignificant in the UK, and substantially negative in France and Spain, where fixed book price regulations apply.[25] Taken together, the results support the interpretation that regulatory constraints limit pass-through for books in countries with fixed price regimes.

Table 8: Price Analysis: Books vs. Non-Books

	(1) **France**	(2) **Italy**	(3) **Spain**	(4) **United Kingdom**
$\text{FBA}_{is} \times \text{DST}_{ct}$	0.023***	0.008**	0.025***	0.017***
	(0.004)	(0.003)	(0.003)	(0.003)
$\text{FBA}_{is} \times \text{DST}_{ct} \times$ Book	-0.061***	0.000	-0.030	-0.002
	(0.005)	(0.006)	(0.007)	(0.010)
Controls	Yes	Yes	Yes	Yes
Cross-section FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.960	0.957	0.959	0.952
Observations	2,195,111	2,685,636	2,326,889	3,555,405

Notes: Estimated effects of DST implementation on consumer prices for books and non-books. The dependent variable is the logarithm of the product price. All regressions include product and time fixed effects and control for inflation, the market share of the digital economy, and a COVID-19 policy stringency index. Only standard-sized products are included. Monthly data for 12 months before and after DST implementation. Standard errors are clustered at the product category–month level. ***, **, * indicate significance at the 1%, 5%, and 10% levels. *Data:* Keepa.com.

7 Conclusion

This paper investigates the economic incidence of digital service taxes (DSTs) through the case of Amazon, the largest online retailer. Using detailed data on platform fees and consumer prices, we find that Amazon passes the DST almost entirely onto sellers via increased fees. These higher costs are largely shifted to consumers, though the extent of pass-through varies across countries. Notably, we observe full pass-through or even over-shifting in the UK, France, and Spain, but less pass-through in Italy.

Our results have important implications for policymakers. The findings suggest that DSTs largely fail to achieve their objective of taxing large digital firms, as the

[25]The interaction term is also insignificant and very close to zero in Italy, despite the Italian fixed book price regime. However, pass-through is much lower in Italy in all specifications.

economic burden falls predominantly on consumers and third-party sellers. This raises concerns about the equity and efficiency of such taxes. Policymakers should carefully evaluate the design and scope of DSTs and consider alternative approaches, such as targeted anti-profit shifting rules, that may more effectively target the digital economy while minimizing unintended consequences for other market participants.

At the same time, our results indicate that the DST increases consumer prices, which reduces the cost advantage that digital platforms have over brick-and-mortar retailers. Insofar as one goal of the DST is to create a more level playing field between online and offline commerce, it may be seen as successful in achieving this aim. However, whether this outcome justifies the broader distortions and inefficiencies introduced by the tax remains an open question for policymakers.

Our analysis is not without limitations. Our focus on Amazon may not fully capture the dynamics on other digital marketplaces or on other business models that fall under the scope of the DST. Additionally, we cannot fully explain the observed variation in pass-through across countries. Future research could explore the broader impacts of DSTs on market competition, innovation, and platform strategies, as well as their interaction with other tax instruments.

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A Instrumental Variable Analysis

For the IV, the baseline regression model is

$$\text{Price}_{ijct} = \beta_1 \text{FBA fee}_{jt} + \delta_i + \delta_t + \varepsilon_{ijct}, \tag{A.1}$$

where Price_{ijct} is the price of a product i, listed on Amazon and sold by a third-party seller using FBA in country c at time t. The variable FBA fee_{jt} represents the FBA fee for the relevant size-weight-product category tuple j. $\delta_i c$ denotes product-country fixed effects, δ_t time fixed effects. The coefficient of interest β_1 captures how much of the fee is passed on to consumers. A value of 1 implies full pass-through. Since we are interested in absolute changes, we estimate the model in levels rather than logs.

To isolate the pass-through of fee changes induced by DSTs, we use changes in digital service taxes (DSTs) as an instrument for the FBA fees. The introduction of DSTs is plausibly exogenous: these taxes are levied on large digital platforms like Amazon, not on the sellers themselves, and should influence pricing only through their impact on the affected fees.

Our first-stage regression is

$$\text{FBA fee}_{jt} = \pi_1 \text{DST} * \overline{\text{FBA fee}}_{ct} + \delta_j + \delta_t + u_{jct}. \tag{A.2}$$

The digital service tax (DST) is expressed in percentage points, creating a mismatch in units. To address this, we construct the explanatory variable $\text{DST} * \overline{\text{FBA fee}}_{ct}$, where $\overline{\text{FBA fee}}_{ct}$ represents the baseline fee for the size-weight-product category group j at the beginning of the sample period. This transformation allows us to interpret the coefficient π_1 in the first-stage regression as the extent to which DSTs, expressed as a percentage of revenue, are reflected in changes to Amazon's FBA fees. If the DST is fully passed through to fees, we would expect $\pi_1 = 1$.

The second stage of the IV estimation substitutes the predicted values $\widehat{\text{FBA fee}}_{jt}$ from the first stage into the main regression:

$$\text{Price}_{ijct} = \beta_1 \widehat{\text{FBA fee}}_{jt} + \delta_i + \delta_t + \varepsilon_{ijct}. \tag{A.3}$$

Table A.1 presents the results. In col. (1) to (3), we show results for the full sample; in col. (4) to (6) we drop Italy, as our analysis for the fees did not show an effect on Italy. In all specifications, the first-stage coefficients are positive and statistically significant, confirming that the DST affects FBA fees. The corresponding F-statistics are above

Table A.1: Prices Analysis: IV Results

	(1)	(2)	(3)
FBA Fee	12.361***	12.029***	2.855**
	(3.961)	(3.333)	(1.384)
1^{st} stage coeff.	0.09***	0.06***	0.21**
1^{st} stage F-stat.	17.05	27.27	5.20
Controls	✓	✓	✓
Cross-sec. FE	✓	✓	✓
Time FE	✓		
Prod.group-time FE		✓	
Product-time FE			✓
Obs.	29,066,522	29,066,242	22,006,811

Notes: Instrumental variable estimates of the effect of FBA fees on consumer prices. The FBA fee is instrumented with the DST due. Column (1) includes time fixed effects; column (2) includes product group–time fixed effects; column (3) includes product–time fixed effects. All specifications control for inflation, the market share of the digital economy, and a COVID-19 policy stringency index. The dependent variable is the FBA price, aggregated to monthly values. Standard errors are two-way clustered by product and by country–month. ***, **, * indicate significance at the 1%, 5%, and 10% levels. *Data:* Keepa.com and hand-collected Amazon rate cards.

conventional thresholds, except in col. (3), where the value of 5.2 suggests some concern about instrument strength.

The second-stage estimates indicate large and significant price responses to DST-induced fee changes. In col. (1), the coefficient implies that a one-euro increase in FBA fees raises prices by over EUR 12. This effect declines somewhat when we replace time fixed effects with product group–time (col. 2) or product–time fixed effects (col. 3), suggesting that part of the variation may be absorbed by finer fixed effects.

The large estimated pass-through reflects the fact that the DST applies not only to FBA fees but also to referral fees, which we do not observe in our data. Usually, referral fees are substantially higher than FBA fees.

B Additional Tables and Figures

Table A.2: Variable Definitions and Sources

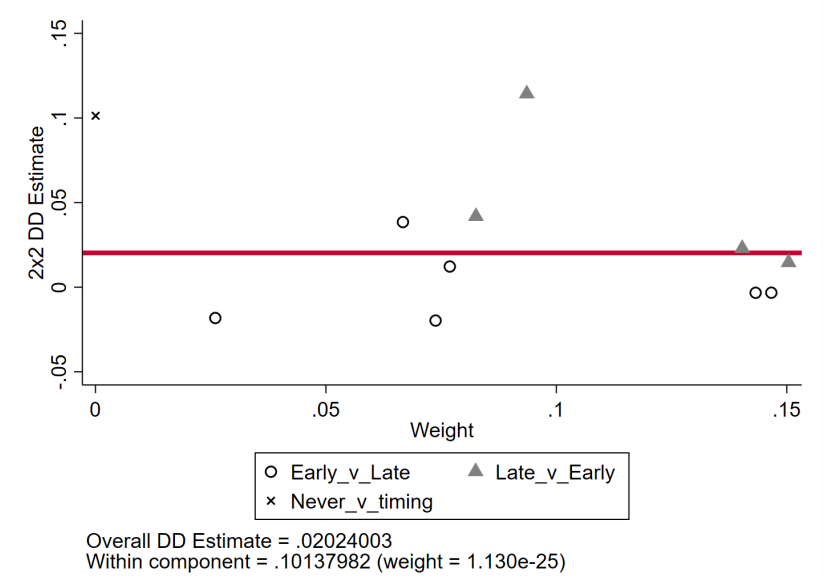
Variable	Definition	Source
FBA fee	Sum of storage fee, shipment fee and optional services fees. The shipment fee is the fee as given in the rate cards for a given weight, size and packaging type. The storage fee is calculated as the rate per volume multiplied by the maximum volume of the packaging type. Among the optional services, we only consider the bagging, labelling and taping fees.	FBA Rate Cards (Available at: sell.amazon.co.uk)
Inflation	Headline consumer price index, monthly	Worldbank
Covid index	Economic Support Index from the Oxford Covid-19 Government Response Tracker aggregated to monthly level. Set to zero for periods before 01/01/2020.	Oxford Covid-19 Government Response Tracker (OxCGRT)
Market share of the digital economy	'Retail sale via mail order houses or via Internet' divided by the total retail sales in the country (approximated by 'Retail trade, except of motor vehicles and motorcycles'). Annual levels interpolated to monthly data using the monthly sales growth data.	Eurostat
FBA price	Lowest price for the new product offered by a seller using the Fulfillment by Amazon service. Data scraped at irregular time intervals, averaged to monthly.	Keepa.com
Amazon price	Price for the new product when Amazon is the seller, averaged to monthly.	Keepa.com
Average supplier count	The monthly average of the number of suppliers selling the (new, not used) product on Amazon.	Keepa.com

Table A.3: **FBA Fees: Bacon Decomposition**

	β	**Total Weight**
Timing Groups	0.001	0.53
Never vs. Timing	0.041	0.47

Notes: Decomposition of the estimated treatment effect on FBA fees using the method by Goodman-Bacon (2021). Results correspond to the specification in Table 4, column (2). The table separates the overall estimate into contributions from comparisons between units treated at different times ("Timing Groups") and comparisons between treated and never-treated units ("Never vs. Timing"). β denotes the average treatment effect within each group, and "Total Weight" indicates its contribution to the overall effect. *Data:* Hand-collected Amazon rate cards, Dec 2017–Feb 2022.

Figure A.1: Bacon Decomposition



Notes: Visual representation of the Bacon decomposition of the estimated effect of the DST on FBA fees. Results correspond to the specification in Table 4, column (2), and are based on the method by Goodman-Bacon (2021). *Data:* Hand-collected Amazon rate cards, Dec 2017–Feb 2022.

Table A.4: **Regression Results: Number of Marketplace Sellers**

	France	**Italy**	**Spain**	**United Kingdom**
	(1)	(2)	(3)	(4)
DST × Post	-0.187	1.431***	-0.140	0.458
	(0.445)	(0.324)	(0.822)	(0.339)
Controls	✓	✓	✓	✓
Product FE	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
R^2	0.716	0.728	0.717	0.708
Observations	11,049,186	11,943,635	11,111,835	13,904,048

Notes: Estimated effects of DST implementation on the number of sellers on the Amazon marketplace, using a DiD design. Each column compares a treated country (France, Italy, Spain, or the UK) to Germany as a control. All regressions include product, country, and time fixed effects and control for inflation, the market share of the digital economy, and a COVID-19 policy stringency index. Standard errors are clustered at the country–month level. ***, **, * indicate significance at the 1%, 5%, and 10% levels. *Data:* Keepa.com.

Table A.5: **Regression Results: Amazon Prices**

	(1)	(2)
DST Rate	0.001	0.001
	(0.001)	(0.001)
Controls	✓	✓
Cross-section FE	✓	
Time FE	✓	
Product-time FE		✓
R^2	0.964	0.980
Observations	16,346,688	13,544,651

Notes: Estimated effects of DST implementation on prices for products sold directly by Amazon. Column (1) uses a two-way fixed effects specification with product–country and time fixed effects. Column (2) compares prices of the same product across countries in the same month using product–time fixed effects. Both specifications include controls for inflation, the market share of the digital economy, COVID-19 policy stringency, and the standard VAT rate to account for the temporary VAT reduction in Germany. The sample covers 12 months before and after DST implementation. Standard errors are clustered at the product group–time level. ***, **, * indicate significance at the 1%, 5%, and 10% levels. *Data:* Keepa.com.