

## Death by Digital? Evidence from the Global Book Market

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**Abstract:** Amazon is by far the largest player in the eBook market, with its Kindle eReader the first and most popular device for this segment. I exploit variation in the timing of Kindle release around the world, combined with localization of Kindle stores that affects the languages in which content is available, to estimate the impact of Kindle availability on trade in physical books as well as services. I find a significant negative effect of the Kindle on trade in books, but a large positive effect on trade in information services. The data support the view that digitization in this case primarily involves a reallocation of trade from goods to services, not a net loss.

**JEL Codes:** F14; F16; L86.

**Keywords:** Digitization; Technology; International Trade; Trade in Services.

## 1 INTRODUCTION

In 2009, when the second version of Amazon’s Kindle eReader was released internationally, the online magazine Slate made a bold prediction:

“The Kindle 2 ... tells us that printed books, the most important artifacts of human civilization, are going to join newspapers and magazines on the road to obsolescence.”  
(Weisberg, 2009.)

Since then, the trend towards digitization and automation has intensified, particularly in media markets like books and music. The book market is ripe for study, as it saw an early shift to digital content. Amazon’s Kindle eReader was first released in 2007. Informal industry estimates put the company’s share of the US eBook market at 80-90% (Shatzkin, 2018). The US is the leading market for eReaders and eBooks. Market research firm Forrester estimates that by 2019, eBook spending as a proportion of total world spending on books could reach nearly 33%.

Given the recent nature of digitization, there is relatively little published literature looking at its impacts. Arvis et al. (2017) discuss digitization primarily in the context of 3D printing, and raise the example of the Kindle and eBooks using descriptive statistics. Freund et al. (2019) build on their work and use differences-in-differences and synthetic control methods to show that trade in hearing aids—a product where 3D printing is very extensive—in fact increased following the change in technology. Another contribution is Gomez-Herrera et al. (2014), who look at the music market. They find that the shift to digital platforms has increased the ability of consumers to access a wider range of music, and that the share of locally produced music in total music consumption is generally falling.

This paper seeks to add to the literature on digitization and trade specifically by looking at the case of Amazon’s Kindle. I exploit variation in the timing of the Kindle’s US and international release, as well as linguistic connections, to identify its effect on international trade using a structural gravity model. I estimate the effects on trade in physical books as well as disembodied services.

The paper proceeds as follows. The next section discusses data and sources. Section 3 presents a structural gravity model, and discusses estimation and simulation results. Section 4 concludes.

## 2 DATA

I source data on exports and imports of HS product 4901 (printed books) from UN Comtrade for 2005-2014 at three year intervals, to allow for adjustment (Piermartini and Yotov, 2016). I use mirroring to complete the dataset, and treat missing values as zero.

A key constraint on structural gravity modeling is the need for data on intra-national trade. I create a proxy by calculating the ratio of gross production to exports for the 63 countries present in both the Comtrade data and the OECD-WTO Trade in Value Added (TiVA) dataset, considering the paper products and printing sector. I then construct estimated intra-national trade in the Comtrade data by applying this ratio to total exports, and subtracting total exports.

For services, I use TiVA data directly. I consider two sectors: wholesale and retail; and information. The reason is that it is unclear which category, in practice, sales of eBooks fall into. Amazon is a distribution company, so the activity-based classification used by TiVA should capture eBook sales as distribution services transactions. However, services trade is typically badly measured, so it is plausible that eBook transactions are recorded in an alternative category, such as information.

For both parts of the analysis, the key variable is a measure of Kindle exposure (“Kindle”). I construct it by exploiting the Kindle’s release schedule. It was initially launched in the USA in November 2007, so I first code treatment for the USA only for 2008 and subsequent years. I then extend treatment to France, Germany, India, Italy, Japan, and Spain for 2012 and subsequent years, and to Brazil, Canada, and China for 2013 and subsequent years, as well as to Mexico for 2014. Finally, to obtain a proxy for exporter exposure to the effects of the Kindle, I interact this treatment variable with a dummy equal to unity for country pairs with a common language. My rationale is that the interaction between exporter and importer country languages with Amazon’s decision to open a Kindle store in a given importer plausibly creates an exogenous shock to export flows.

### 3 STRUCTURAL GRAVITY MODEL

In the current international trade literature, the standard gravity model takes the following form:

$$(1) X_{ijt} = F_{it}F_{jt}t_{ijt}^{-\theta} e_{ijt}$$

Where:  $X_{ijt}$  is exports from country  $i$  to country  $j$  in year  $t$ ; the  $F$  terms are exporter and importer fixed effects;  $t$  is bilateral trade costs;  $\theta$  is a parameter capturing the sensitivity of demand to cost; and  $e$  is an error term satisfying standard assumptions. Arkolakis et al. (2012) show that a wide class of quantitative trade models have the same macro-level implications for the relationship between trade flows and trade costs even though their micro-level predictions are quite different. Building on these insights, Baier et al. (2019) develop a simple algorithm for solving for counterfactual changes in bilateral trade given a change in trade costs and an assumption for the trade elasticity. I adopt their model here, using a Stata package made publicly available by the authors. Concretely, their approach uses solves for counterfactual trade (and other endogenous variables, such as wages, prices, and expenditure as follows:

$$\hat{X}_{ijt} = \frac{\hat{w}_{it}^{-\theta} \hat{t}_{ijt}^{-\theta}}{\hat{p}_{jt}^{-\theta}} \cdot \hat{E}_{jt}$$

Where:  $w$  is the wage rate,  $P$  is a CES price aggregate, and  $E$  is expenditure. Hat notation means that for any variable  $v$ ,  $\hat{v} \equiv \frac{v'}{v}$  where a prime indicates variable  $v$ ’s counterfactual value.

To construct a counterfactual measure of changes in trade costs, I first need to estimate a gravity model using the data described above. I specify the trade costs function as follows:

$$(2) t_{ijt} = b_1 \text{Kindle}_{jt} * \text{common language}_{ij} + b_2 \text{RTA}_{ijt} + b_3 \log \text{distance}_{ij} \\ + b_4 \text{contiguous}_{ij} + b_5 \text{colony}_{ij} + b_6 \text{common colonizer}_{ij} \\ + b_7 \text{common language}_{ij} + b_8 \text{same country}_{ij} + b_9 \text{intl}_{ij}$$

Where:  $\text{Kindle}$  is the variable of interest, defined as above and interacted with a common language dummy; and the remaining variables are standard gravity model controls to take account of geography (distance, contiguity), history (colonial relationship, common colonizer, ever part of the same country), and common language, based on being spoken by at least 9% of the population. All control variables are sourced from the CEPII distance dataset. The  $\text{intl}$  variable is a dummy equal to unity for international trade observations, and zero when the exporter and importer are the same country.

To estimate the model defined by (1) and (2), I use Poisson Pseudo Maximum Likelihood (PPML), in line with the current literature (Yotov and Piermartini, 2016). Table 1 presents estimation results for goods; coefficients on gravity controls are suppressed for brevity. The variable of interest has the

expected negative and statistically significant coefficient (1% level) regardless of whether or not applied tariffs are included in the model. All controls have the expected signs and sensible magnitudes, and are statistically significant at the 5% level or better, except for the common colonizer dummy, which does not have a statistically significant coefficient.

Table 1: Gravity model estimation results—goods.

	(1)	(2)
Kindle	-0.508 **	-0.552 **
	(0.225)	(0.221)
RTA	0.349 **	0.285 **
	(0.144)	(0.144)
Log(Tariff)		-24.389 ***
		(4.163)
Constant	18.151 ***	18.094 ***
	(0.470)	(0.449)
Observations	15876	13129
R2	0.983	0.983
Gravity Controls	Yes	Yes
Exporter-Time Fixed Effects	Yes	Yes
Importer-Time Fixed Effects	Yes	Yes

Note: Estimation is by PPML. Robust standard errors adjusted for clustering by country pair are beneath the parameter estimates. Statistical significance is indicated by: \* (10%), \*\* (5%), and \*\*\* (1%).

Table 2 turns to services. Column 1 considers wholesale and retail services. There is no statistically significant impact of the Kindle variable in that sector, although all control variables have the expected signs and sensible magnitudes, and with the exception of the same country dummy, have statistically significant coefficients at the 10% level or better. In Column 2, however, there is a positive and statistically significant (5%) effect of the Kindle on exports of information services. This result is consistent with the misclassification possibility discussed above, where eBook transactions are recorded as trade in information services rather than according to Amazon’s primary activity.

Table 2: Gravity model estimation results—services.

	(1)	(2)
	Wholesale/Retail	Information
Kindle	0.061 (0.128)	0.714 ** (0.290)
RTA	0.252 ** (0.101)	0.352 *** (0.132)
Constant	15.552 *** (0.322)	13.948 *** (0.317)
Observations	16384	16384
R2	0.992	0.988
Gravity Controls	Yes	Yes
Exporter-Time Fixed Effects	Yes	Yes
Importer-Time Fixed Effects	Yes	Yes

Note: Estimation is by PPML. Robust standard errors adjusted for clustering by country pair are beneath the parameter estimates. Statistical significance is indicated by: \* (10%), \*\* (5%), and \*\*\* (1%).

To quantify the extent to which Kindle availability has affected trade, I conduct a counterfactual general equilibrium simulation following Baier et al. (2009) separately for goods and services (information) taking 2014 as the base year. In each case, I am interested in the difference observed exports in the presence of the Kindle versus counterfactual exports without it. I assume a trade elasticity of 8.25 (Caliendo and Parro, 2015). Bootstrapped 95% confidence intervals are based on 1,000 replications.

In the physical books market, the point estimate of the decline in world trade is 6.7%, or a loss of just over \$975m (confidence interval -12.9% to -1.6%). For information services, by contrast, the point estimate is a trade gain of 11.0% or \$18bn (confidence interval -3.3% to 23.5%). Although there is minor uncertainty about the net effect, the evidence tends to suggest that the trade gains in services following introduction of the Kindle significantly outweighed the trade losses in goods.

## 4 CONCLUSION

This paper has presented the first quantitative evidence on the impact of eReaders and eBooks, in particular Amazon’s Kindle, on trade in goods and services. There is evidence of significant negative impacts on exports of physical books, but a larger increase in exports of information services. The primary effect of digitization in this case therefore appears to be a reallocation of trade from goods to services, rather than a net loss of activity

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## REFERENCES

Arkolakis, C., A. Costinot, and A. Rodriguez-Clare. 2012. “New Trade Models, Same Old Gains?” *American Economic Review*, 102(1): 94-130.

- Arvis, J.-F., P. Kent, B. Shepherd, and R. Nair. 2017. “Additive Manufacturing and the Diffusion of 3D Printing: Impact on International Trade.” Working Paper, World Bank.
- Baier, S., Y. Yotov, and T. Zylkin. 2019. “On the widely differing effects of free trade agreements: Lessons from twenty years of trade integration.” *Journal of International Economics*, 116: 206-226.
- Caliendo, L., and F. Parro. 2015. “Estimates of the Trade and Welfare Effects of NAFTA.” *Review of Economic Studies*, 82(1): 1-44.
- Forrester Research. 2014-2019. eReader and eBook Forecast, Global.
- Gomez-Herrera, E., B. Martens, and J. Waldfoegel. 2014. “What’s Going On? Digitization and Global Music Trade Patterns since 2006.” Digital Economy Working Paper 2014/04, Institute for Prospective Technological Studies, [https://ec.europa.eu/jrc/sites/jrcsh/files/JRC89696\\_Digitization\\_and\\_global\\_music\\_trade.pdf](https://ec.europa.eu/jrc/sites/jrcsh/files/JRC89696_Digitization_and_global_music_trade.pdf).
- Piermartini, R., and Y. Yotov. 2016. “Estimating Trade Policy Effects with Structural Gravity.” Working Paper ERSD-2016-10, World Trade Organization, <https://www.econstor.eu/bitstream/10419/144545/1/863718590.pdf>.
- Shatzkin, M. 2018. “A Changing Book Business: It all Seems to be Flowing Downhill to Amazon.” <https://www.idealogy.com/blog/changing-book-business-seems-flowing-downhill-amazon/#targetText=But%20a%20fair%20chunk%20of,indies%20are%20the%20growing%20segments>.
- Weisberg, J. 2009. “How the Kindle Will Change the World.” <https://slate.com/news-and-politics/2009/03/how-the-kindle-will-change-the-world.html>.