

# Economic Growth, Technological Change, and the Global Demand for Newsprint: Implications for the US Industry

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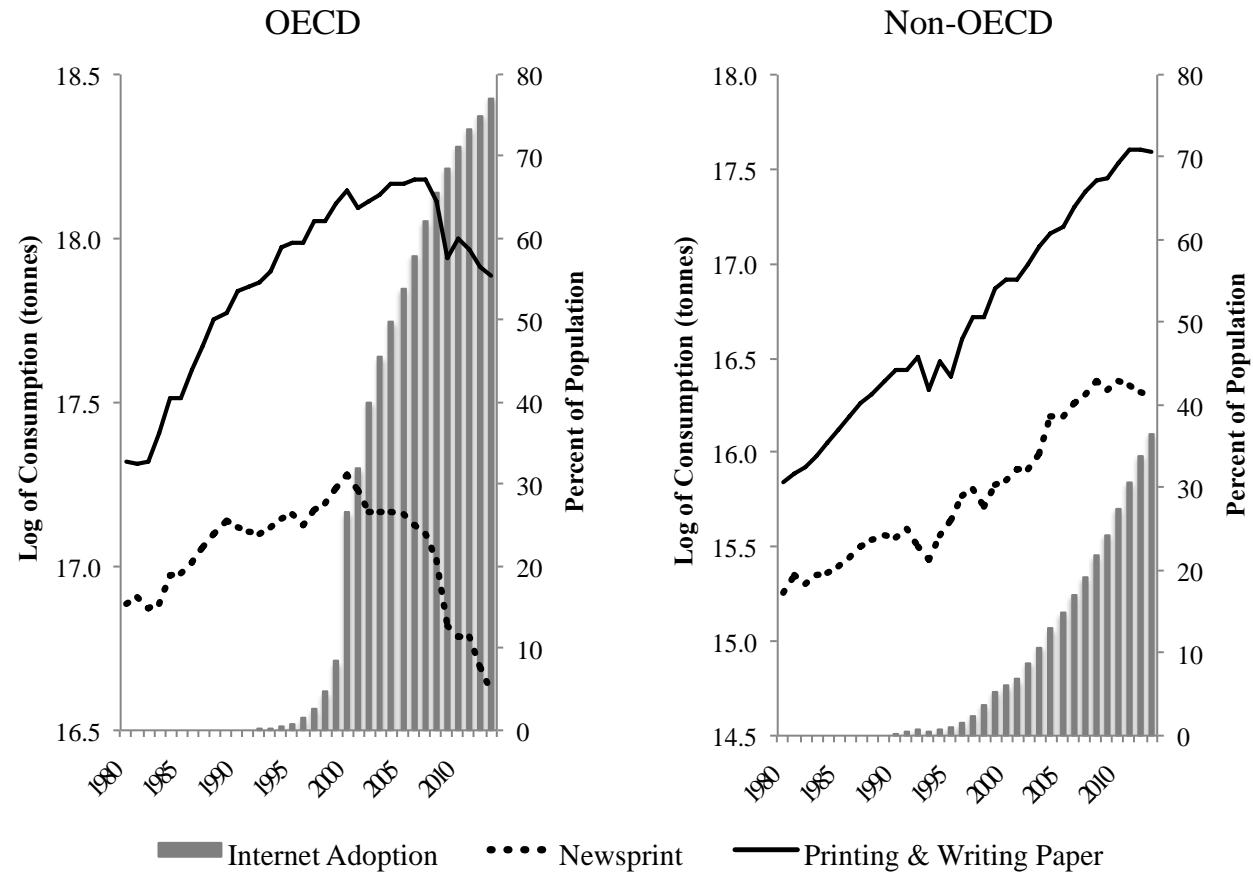
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# Paper and the Internet

**Fig. 1** – Observed newsprint consumption, printing and writing paper consumption, and Internet adoption for OECD and non-OECD regions, 1980-2013.



# Paper and the Internet

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## In the 1990's...

- Demand for paper in communication was found to be statistically independent of electronic substitutes
  - (e.g. Miller Freeman inc. 1995, p. 146; Zhang & Buongiorno 1997).

## More recently...

- There is increasing evidence that a structural shift has occurred in communication consumption patterns
  - (Hetemäki & Obsersteiner 2001; Hetemaki 2005, 2008; Szabo et al. 2009)
- Preferences have shifted away from paper products and toward electronic media as populations adopt the Internet
  - (Hujala 2011; Latta et al. 2016)
- Failure to account for this shift in preferences is likely to bias estimates of the evolution of the paper products industry.

# Question and Methodology

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How will future rates of Internet use affect the markets for paper based media?

Model

- GFPM 2015
- Newsprint, printing and writing paper, mechanical and chemical pulp

Key Updates:

- Integrate Internet adoption into demand function for paper products
  - Updated elasticities from Latta et al. (2016)
- Interaction between Internet adoption and GDP per capita allows for evolving demand response to future paths of income growth
- Shared Socioeconomic Pathways (SSPs)
  - SSP2 most closely matches middle of the road economic assumptions

Main Finding:

- Failure to account for future rates of Internet adoption may result in an upward bias on paper product market forecasts.

# Updated Elasticities

**Table 1** – Estimated effects of increases in price, Internet adoption, and GDP per capita on consumption of newsprint and printing and writing paper.

Variable	Demand for:	
	Newsprint	Printing and writing paper
Constant	8.406 ***	10.032 ***
Log of price	-0.474 ***	-0.660 ***
Log of GDP per capita	1.080 ***	1.105 ***
Log of Internet use per capita	0.080	0.365 ***
Interaction of Internet and GDP	-0.018 **	-0.037 ***
Dummy for OECD region	0.314 ***	0.645 ***
Dummy for Asia region	2.515 ***	3.045 ***
Dummy for Reform region	-0.013	0.162
Dummy for ALM region	0.890 ***	1.184 ***
Internet use per capita for US	11.091 ***	7.495 ***
Interaction of Internet and GDP for US	-1.054 ***	-0.707 ***

\*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level

Source: Latta et al. (2016)

# Demand: a Function of Internet Adoption

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Demand shifter for newsprint, and printing and writing paper, is a function of the rate of growth of Internet adoption  $\frac{d\dot{I}}{\dot{I}}$ , and the rate of growth of GDP per capita  $\frac{d\dot{Y}}{\dot{Y}}$ , plus a period trend  $\alpha_t$

- $\dot{I}$  is Internet per capita,
- $\dot{Y}$  is GDP per capita
- $\alpha_t$  is a period trend term for time  $t$

$$D_{it}^* = D_{i,t-1} \left( 1 + \beta_2 \frac{d\dot{Y}_{it}}{\dot{Y}_{it}} + (\beta_3 + \beta_5 \delta_1) \frac{d\dot{I}_{it}}{\dot{I}_{it}} + (\beta_4 + \beta_6 \delta_1) \left\{ \frac{d\dot{Y}_{it}}{\dot{Y}_{it}} \ln \dot{I}_{it} + \frac{d\dot{I}_{it}}{\dot{I}_{it}} \ln \dot{Y}_{it} \right\} + \alpha_t \right)$$

Market clearing demand is found solving the following equation, which is a function of market clearing prices:

$$D_{ik} = D_{ik}^* \left( \frac{P_{ik}}{P_{ik,-1}} \right)^{\delta_{ik}}$$

# Forecasting Internet Adoption Rates

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Country specific rates of per capita Internet adoption would continue growing along their current path, and converge towards full adoption (100% of population) under two scenarios:

- a) full adoption by 2100, or
- b) more rapidly by 2050.

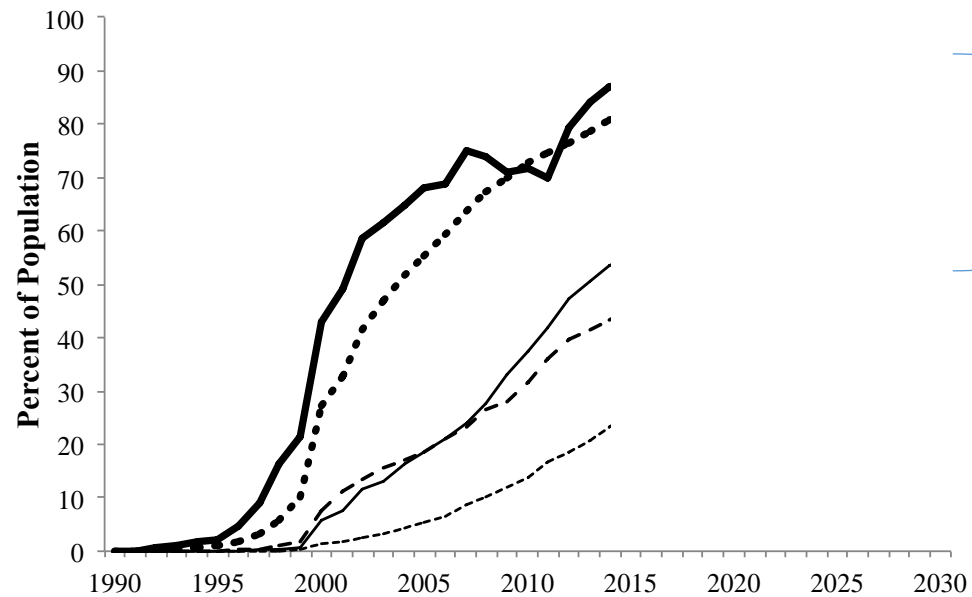
$$I_{i,t} = \alpha_i + \beta_i \log(t)$$

Where  $I_{i,t}$  is per capita Internet use in country/region  $i$  at time  $t$ .  $\alpha_i$  and  $\beta_i$  are country/regional specific parameters adjusted to solve for the two convergence rate scenarios.

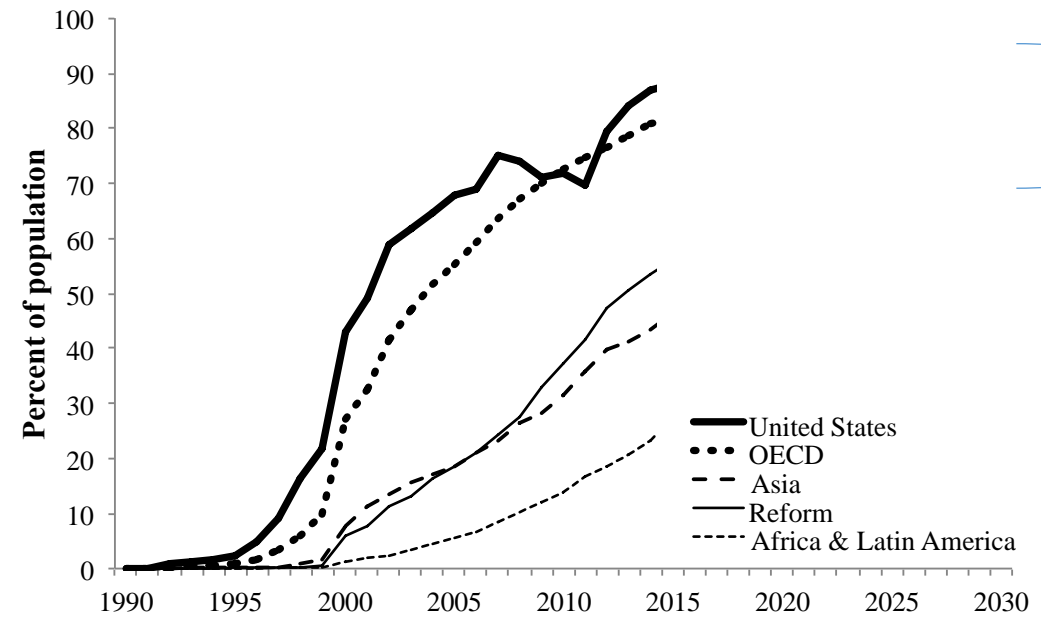
# Forecasting Internet Adoption Rates

**Fig. 2** – Average observed and projected rates of Internet adoption by economic region 1990-2030 for (a) full Internet adoption by 2100, and (b) full Internet adoption by 2050. Values from 1990-2014 from World Bank (2016); values for 2015-2030 obtained from forecasts.

(a) Convergence by 2100

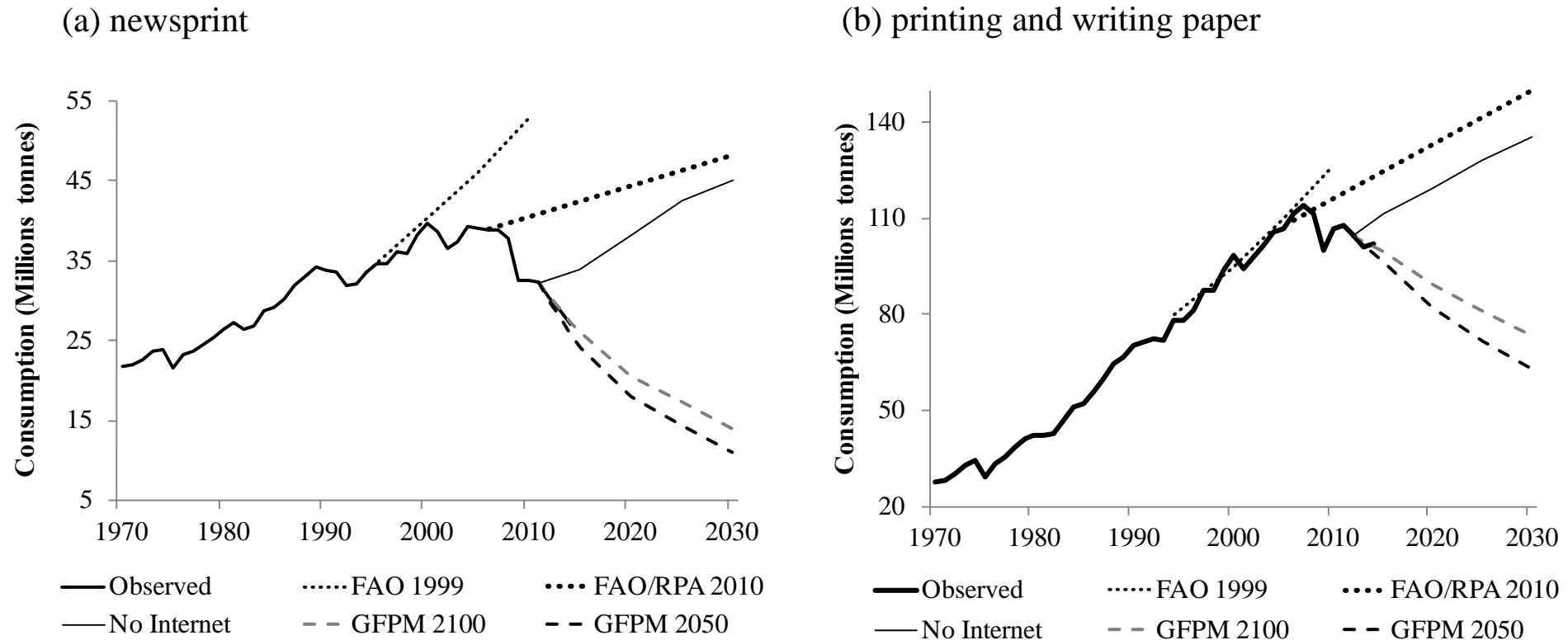


(b) Convergence by 2050



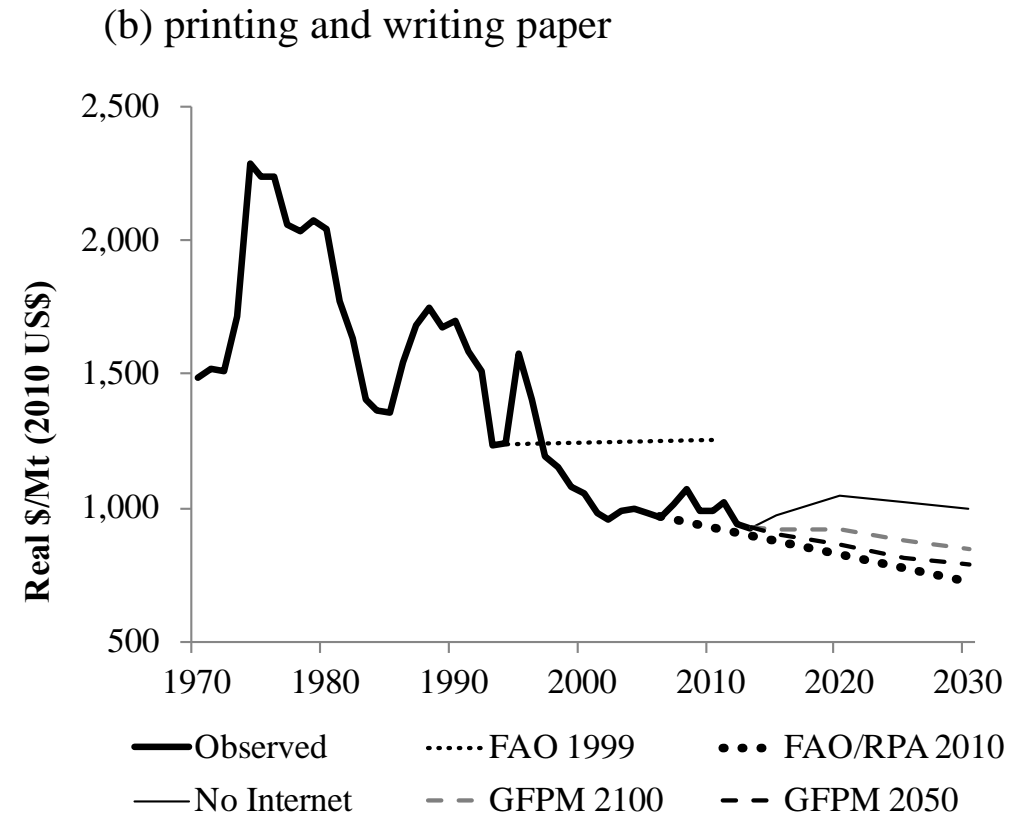
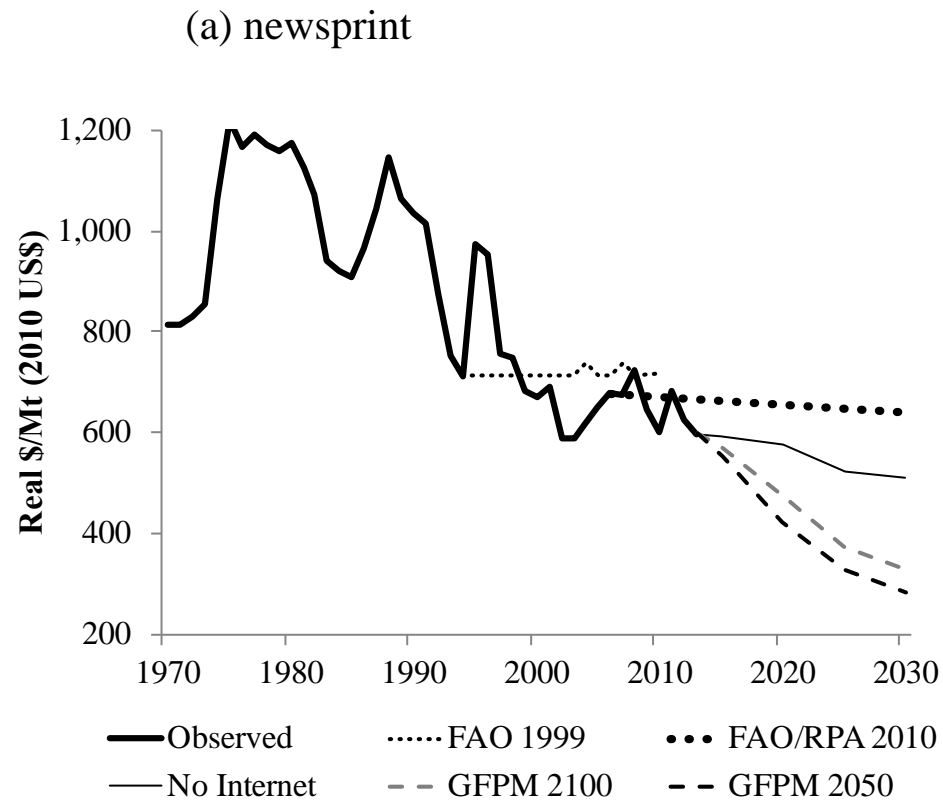
# Results Global Consumption

**Fig. 3** – Forecasts of global consumption for (a) newsprint and (b) printing and writing paper to 2030



# Results Global Prices

**Fig. 4** – Forecasts of real global prices (2010 US\$) for (a) newsprint and (b) printing and writing paper to 2030



# Results Newsprint (detailed)

	Consumption ('000 Mt):			Production ('000 Mt):		
	Observed <sup>1</sup>	Forecast		Observed <sup>1</sup>	Forecast	
		Gfpm 2100	Gfpm 2050		Gfpm 2100	Gfpm 2050
<i>Year</i>	<i>2012</i>	<i>2030</i>	<i>2030</i>	<i>2012</i>	<i>2030</i>	<i>2030</i>
Africa	742	190	164	316	37	21
North/Central America	5,235	978	728	6,952	1,646	1,535
Canada	447	172	134	3,874	1,505	1,467
United States of America	4,216	499	372	2,874	0	0
South America	1,194	492	392	562	86	70
Brazil	519	207	166	132	0	0
Asia	13,974	7,149	5,514	11,280	6,377	4,622
China	4,512	2,408	1,561	3,827	2,185	1,329
Oceania	601	351	273	703	161	148
Europe	8,401	4,550	3,782	10,531	5,385	4,439
Germany	2,131	1,147	865	1,718	542	173
United Kingdom	1,500	790	585	1,184	1,244	1,037
Developed, all	17,384	7,016	5,604	21,536	8,397	7,002
Developing, all	12,763	6,693	5,249	8,808	5,294	3,833
World	30,147	13,709	10,853	30,344	13,691	10,835

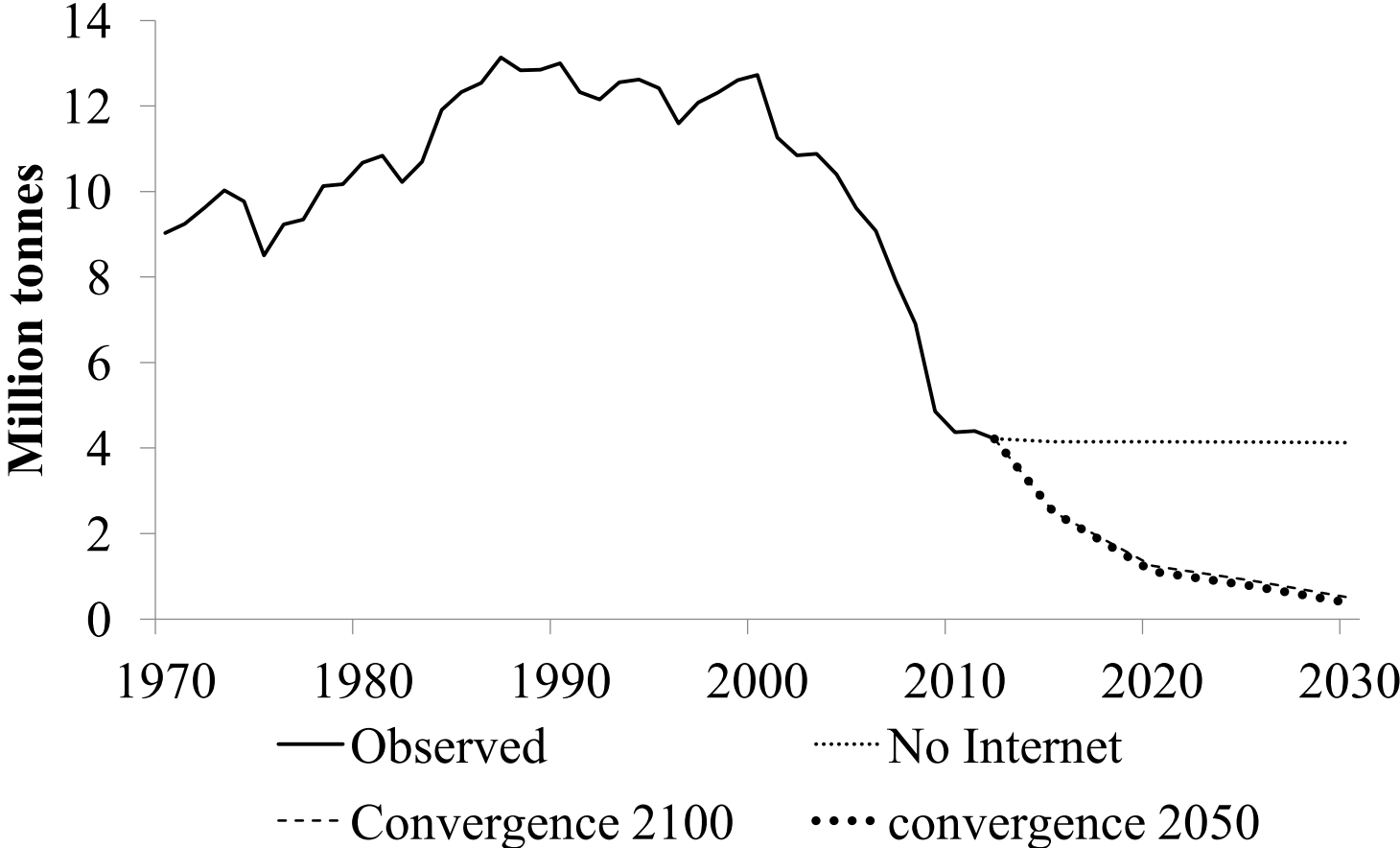
<sup>1</sup> Observations derived from FAO (2014)

# Results Printing and Writing Paper (detailed)

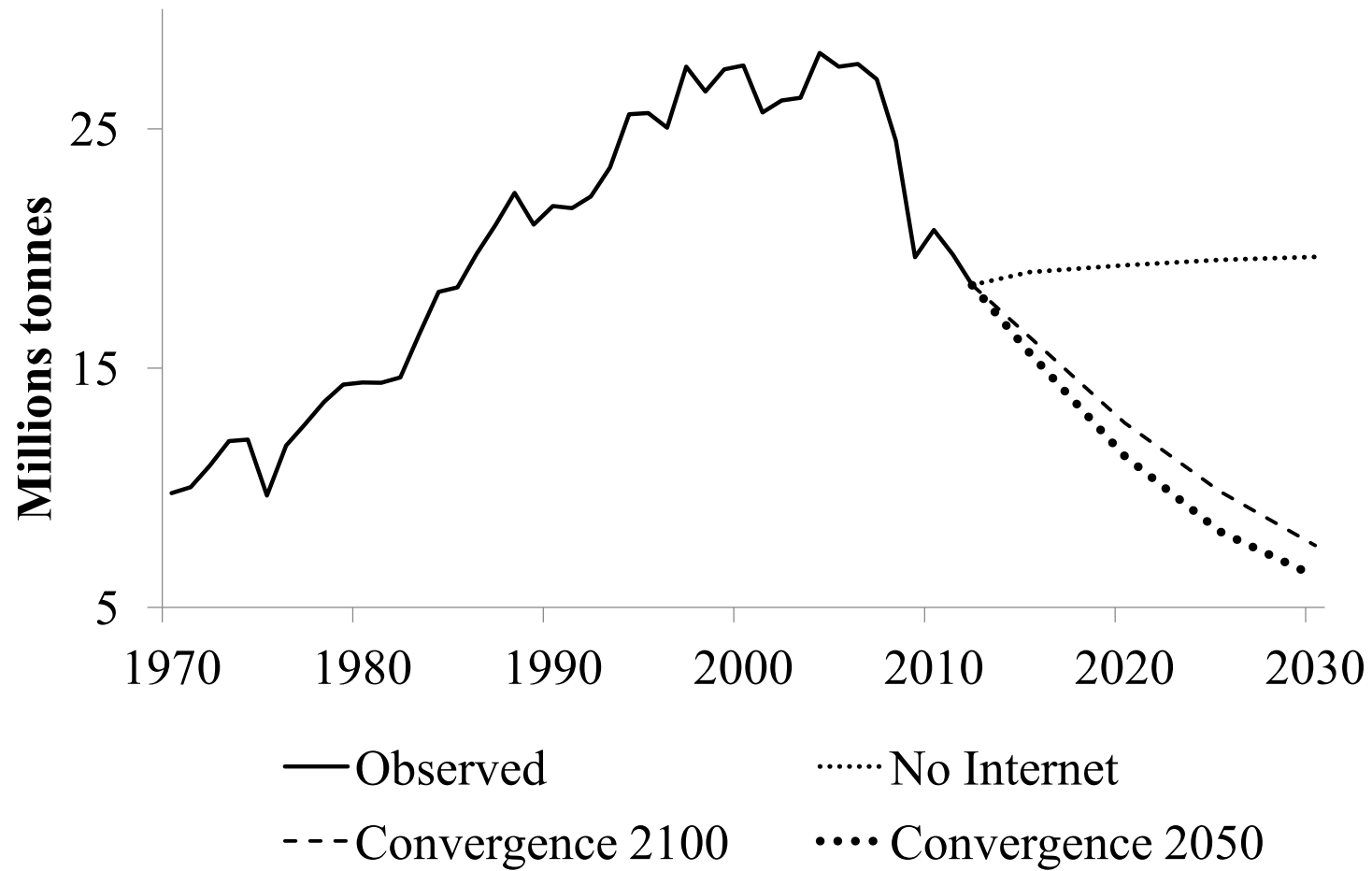
	Consumption ('000 Mt):			Production ('000 Mt):		
	Observed <sup>1</sup>	Forecast		Observed <sup>1</sup>	Forecast	
		GFPM 2100	GFPM 2050		GFPM 2100	GFPM 2050
<i>Year</i>	<i>2012</i>	<i>2030</i>	<i>2030</i>	<i>2012</i>	<i>2030</i>	<i>2030</i>
Africa	2,040	1,257	998	754	145	121
North/Central America	21,566	10,629	9,108	20,081	5,932	4,772
Canada	1,505	1,481	1,432	3,311	1,830	1,596
United States of America	18,467	7,593	6,310	16,139	3,029	2,267
South America	4,118	3,640	3,213	3,484	2,592	2,233
Brazil	2,128	1,845	1,634	2,667	2,097	1,869
Asia	48,562	30,484	23,752	48,785	40,338	33,765
China	24,077	18,293	14,185	25,789	25,368	21,260
Oceania	1,433	1,459	1,407	358	0	0
Europe	27,158	24,012	22,792	33,402	24,475	22,380
Germany	6,707	6,129	5,917	7,675	5,419	5,362
United Kingdom	3,178	3,240	3,119	442	1,780	1,664
Developed, all	59,377	38,480	34,937	62,277	32,712	28,794
Developing, all	45,500	33,000	26,332	44,587	40,769	34,475
World	104,877	71,481	61,269	106,864	73,481	63,270

<sup>1</sup> Observations derived from FAO (2014)

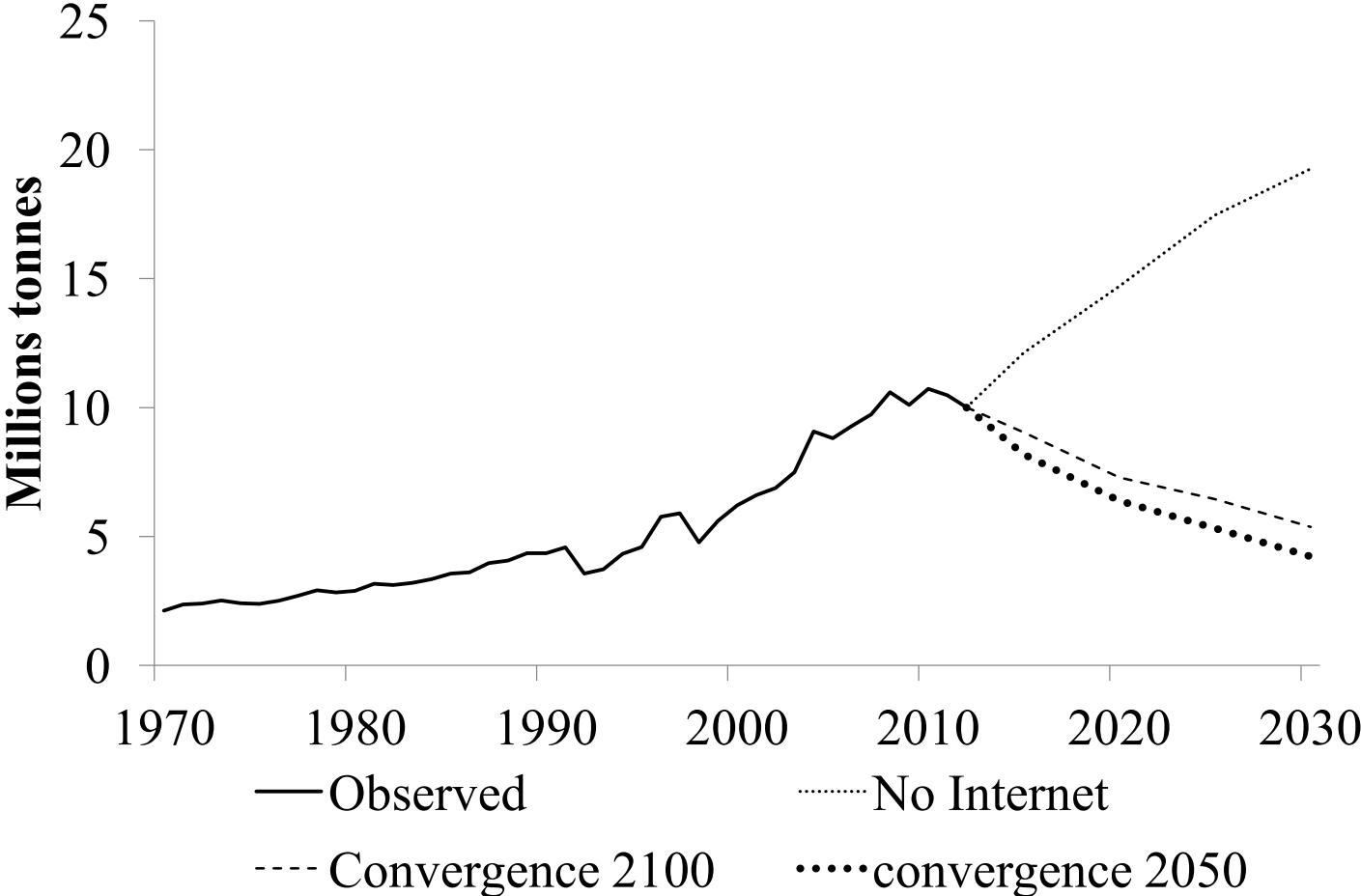
# Results Newsprint Consumption (US)



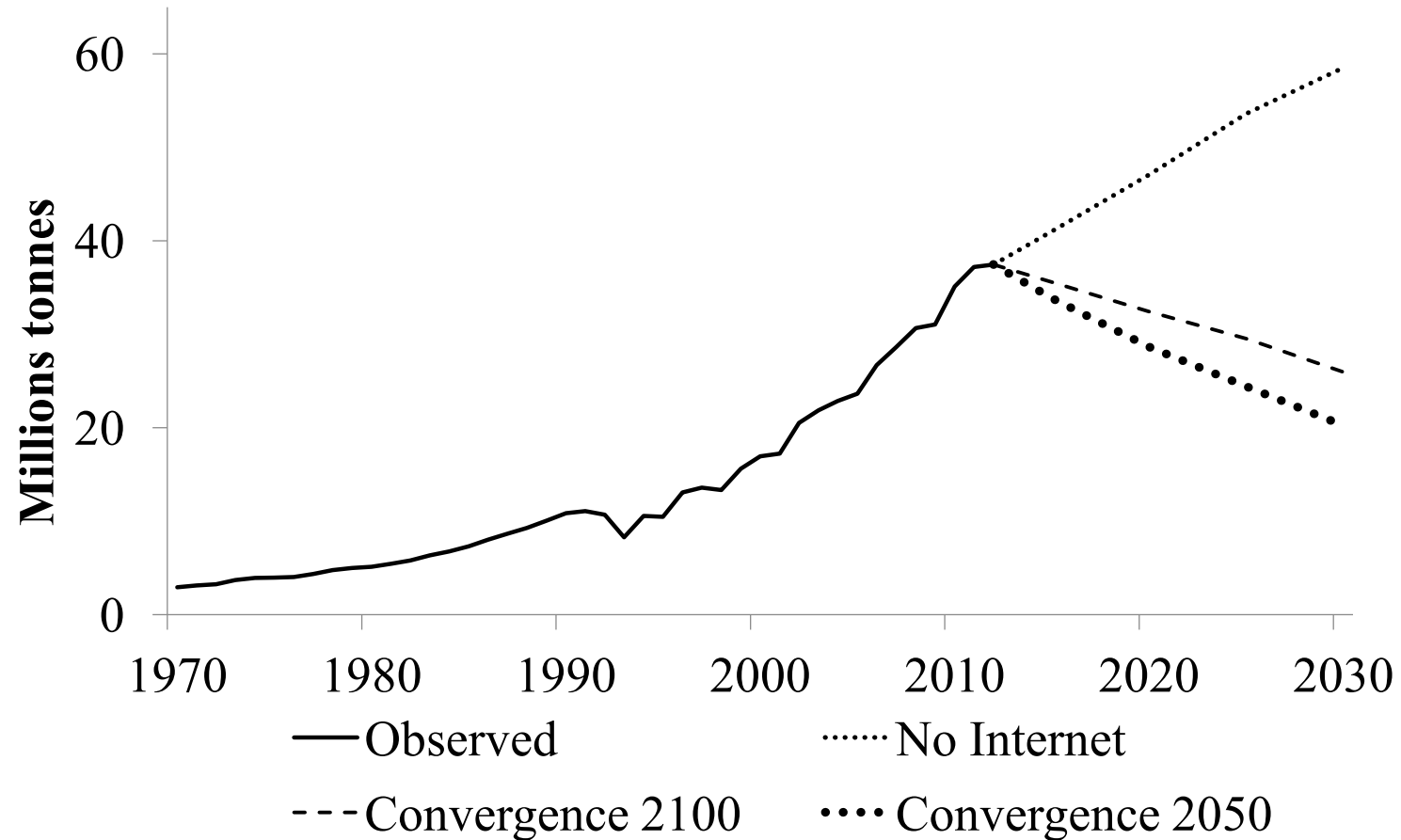
# Results Printing & Writing Paper Consumption (US)



# Results Newsprint Consumption (Asia)



# Results Printing & Writing Paper Consumption (Asia)



# Results Out-of-sample Consumption Forecast

	Newsprint:			Printing & Writing Paper		
	Observed <sup>1</sup> 2014	Forecast to 2014:		Observed <sup>1</sup> 2014	Forecast to 2014:	
		GFPM 2100	GFPM 2050		GFPM 2100	GFPM 2050
Africa	640	631	613	2,388	1,920	1,852
North/Central America	4,431	4,495	4,216	21,293	21,333	20,839
Canada	233	368	358	1,392	1,541	1,536
United States of America	3,585	3,487	3,227	18,143	18,196	17,727
South America	952	1,076	1,037	4,077	3,995	3,943
Brazil	397	455	436	2,056	2,055	2,030
Asia	12,928	12,991	12,283	47,173	46,182	44,727
China	3,680	4,268	4,072	23,445	23,535	22,913
Oceania	479	580	564	1,341	1,452	1,448
Europe	7,708	7,971	7,738	25,543	26,685	26,503
Germany	1,948	2,043	1,982	6,710	6,626	6,605
United Kingdom	1,404	1,484	1,437	3,051	3,256	3,246
Developed, all	15,499	15,914	15,301	57,722	57,560	56,605
Developing, all	11,524	11,832	11,148	44,127	44,004	42,707
World	27,023	27,745	26,450	101,852	101,566	99,312

<sup>1</sup> Observations derived from FAO (2014)

# Conclusions

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Accounting for regional growth rates of Internet adoption resulted in

- Global projections of newsprint consumption that are 34.2 – 37.1 million tonnes lower than previous outlook studies.
- Global Printing and writing paper consumption projections that are 76.7 – 87.1 million tonnes lower than these previous studies.

The results highlight the importance of considering market evolution in long-term global forecasting

- Failure to account for future rates of Internet adoption may result in an upward bias on paper product market forecasts.

Results sensitive to exogenous assumptions

- Shared Socioeconomic Pathways from the IPCC
- Assumed rates of growth of Internet use per capita
- FAO data
- World Bank data

Thank You

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