

# Reproducing estimates by Chas-Amil and Buongiorno in "The demand for paper and paperboard - Econometric model for the European Union"

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Chas Amil and buongiorno (2000) estimated demand functions for paper and paperboard products in the European Union (EU15). In a first section, we attempt to reproduce their graphs and estimates for the period 1996-1992, based on FAOSTAT forest products production and trade data and World Bank GDP and deflator data. In a second section we extend the estimation period by 20 years, until 2012. In a third section, we estimate for all EU27 countries but only over the period from 1992 until 2012.

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# 1 Reproducing Chas Amil and Buongiorno estimates for the period 1969-1995

## 1.1 Chart of Paper and Paperboard consumption

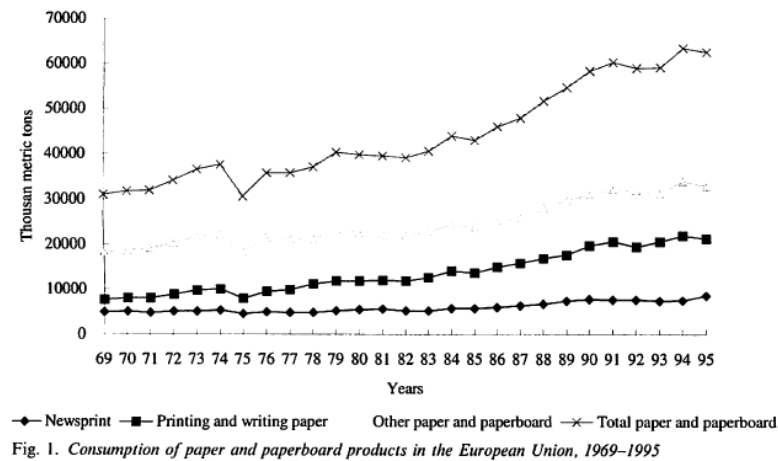


Figure 1: Original chart reproduced from Chas Amil and Buongiorno. Consumption of paper and paperboard products in the European Union (EU15).

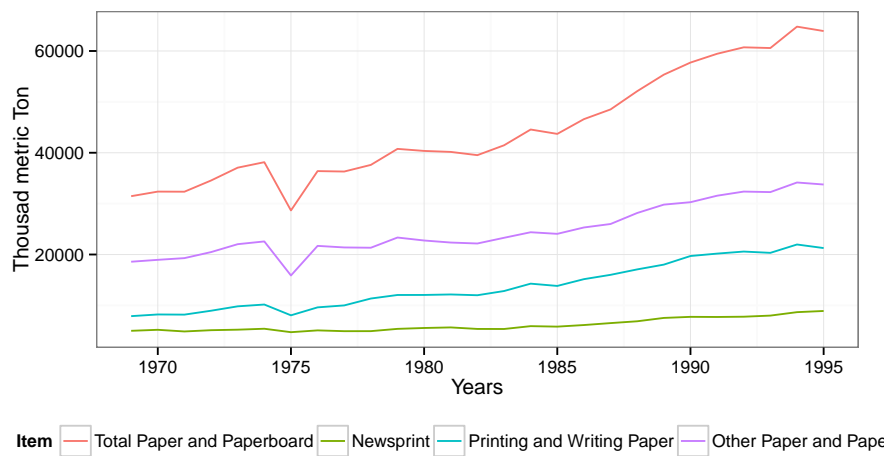


Figure 2: Consumption of paper and paperboard products in EU15, source: FAOSTAT

## 1.2 Chart of paper and paperboard prices

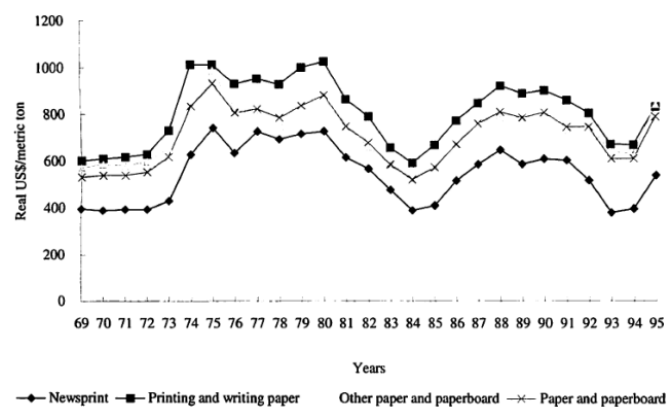


Figure 3: Original chart reproduced from Chas Amil and Buongiorno. Price Evolution of paper and paperboard products in the European Union.

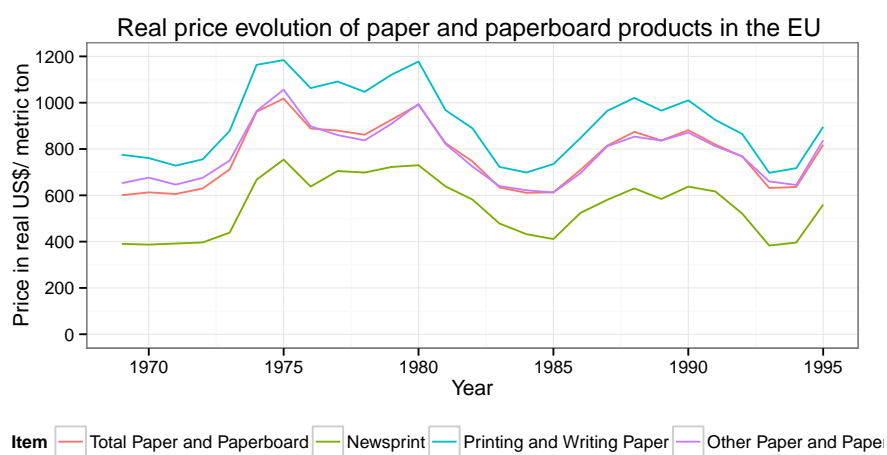


Figure 4: Price evolution of paper and paperboard products in EU15 in USD of 1987, source: FAOSTAT and own calculations.

### 1.3 Charts of GDP and consumption per capita

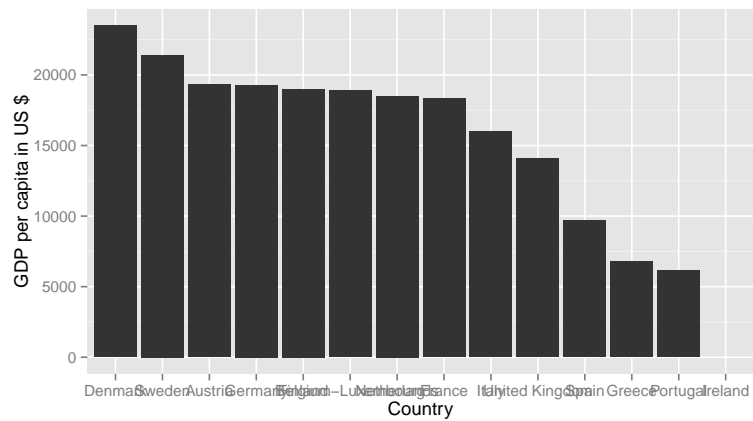


Figure 5: GDP per capita. source: World Bank.

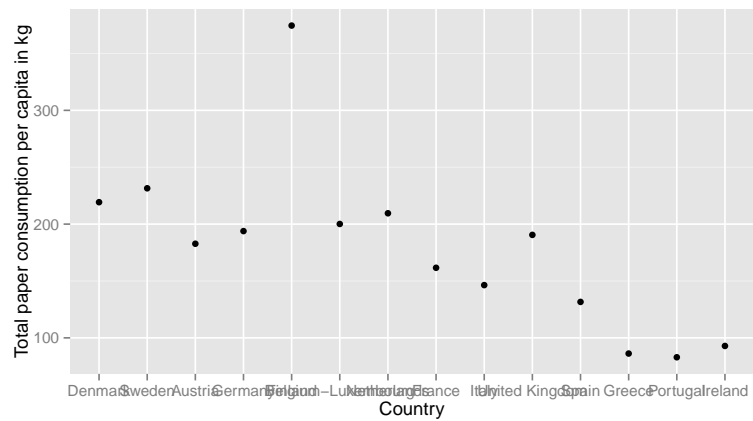


Figure 6: Paper and paperboard Consumption per capita. source: FAOSTAT and own calculations.

## 1.4 Estimating demand functions by country

Because the Worldbank databank doesn't contain a deflator for Ireland over the time period of interest, we couldn't calculate the GDP in constant USD for Ireland.

	Short-term elasticities			$R^2$	$\rho$
	$Y_t$	$P_t$	$D_{t-1}$		
Austria	0.48 (0.16)**	-0.45 (0.19)**	0.06 (0.26)	0.61	-0.31 (0.23)
Belgium-Luxemb.	0.27 (0.23)*	-0.25 (0.32)	0.56 (0.19)**	0.52	-0.33 (0.21)
Denmark	0.64 (0.16)**	-0.62 (0.16)**	0.41 (0.15)**	0.83	-0.27 (0.20)
Finland	0.35 (0.17)**	-0.41 (0.21)**	0.27 (0.22)	0.52	-0.04 (0.22)
France	0.25 (0.12)*	-0.28 (0.14)*	0.50 (0.18)**	0.65	-0.31 (0.21)
Germany	0.32 (0.17)*	-0.33 (0.19)*	0.59 (0.18)**	0.81	-0.08 (0.24)
Greece	0.30 (0.21)	-0.22 (0.17)	0.65 (0.12)**	0.76	0.09 (0.22)
Ireland	0.30 (0.11)**	-0.07 (0.14)	0.05 (0.27)	0.45	-0.10 (0.22)
Italy	0.59 (0.14)**	-0.22 (0.10)**	-0.08 (0.23)	0.78	-0.40 (0.18)*
Netherlands	0.46 (0.20)**	-0.46 (0.22)**	0.52 (0.18)**	0.72	-0.48 (0.19)**
Portugal	0.15 (0.18)	-0.03 (0.20)	0.76 (0.18)**	0.72	-0.33 (0.20)
Spain	0.40 (0.11)**	-0.33 (0.10)**	0.45 (0.14)**	0.92	-0.40 (0.21)*
Sweden	0.26 (0.22)	-0.18 (0.25)	0.37 (0.23)	0.34	-0.08 (0.23)
United Kingdom	0.25 (0.13)*	-0.24 (0.13)*	0.34 (0.26)	0.51	-0.24 (0.21)

Note: Standard deviations of the coefficients are in parentheses.

\*\*, \* = coefficients significantly different from zero at 1% and 5% significance level.

$R^2$  = coefficient of determination.

$\rho$  = coefficient of autocorrelation, after Cochrane–Orcutt correction.

Table 1: Original table reproduced from Chas Amil and Buongiorno. Estimates of demand equations for total paper and paperboard by country.

	Country	Y	P	Dt_1	R2
1	Austria	1.52	-0.05	-0.22	0.90
2		(0.3)	(0.09)	(0.22)	
3	Belgium-Luxembourg	1.1	-0.09	0.15	0.88
4		(0.3)	(0.12)	(0.22)	
5	Denmark	0.52	-0.12	0.63	0.83
6		(0.24)	(0.11)	(0.16)	
7	Finland	0.99	-0.15	0.14	0.93
8		(0.25)	(0.08)	(0.2)	
9	France	1.1	-0.49	-0.09	0.57
10		(0.3)	(0.29)	(0.21)	
11	Germany	0.93	-0.11	0.33	0.96
12		(0.24)	(0.06)	(0.18)	
13	Greece	0.64	-0.02	0.66	0.91
14		(0.31)	(0.13)	(0.15)	
15	Italy	0.96	0	0.1	0.91
16		(0.24)	(0.07)	(0.22)	
17	Netherlands	0.9	-0.16	0.26	0.92
18		(0.26)	(0.08)	(0.21)	
19	Portugal	0.69	-0.12	0.56	0.91
20		(0.32)	(0.17)	(0.21)	
21	Spain	1.66	-0.09	0.07	0.98
22		(0.41)	(0.05)	(0.22)	
23	Sweden	1.17	-0.08	-0.17	0.77
24		(0.26)	(0.1)	(0.22)	
25	United Kingdom	0.51	-0.16	0.45	0.80
26		(0.14)	(0.07)	(0.18)	

Table 2: Demand equations for total paper and paperboard by country

Note: Standard deviation of the coefficients are in parentheses. R2: Coefficient of determination.

## 1.5 Estimating demand equations for pooled countries

	Short-term elasticities			$R^2$	$\rho$
	$Y_t$	$P_t$	$D_{t-1}$		
Total paper and paperboard	0.23 (0.03)**	-0.21 (0.04)**	0.74 (0.03)**	0.98	-0.44 (0.05)**
Newsprint	0.14 (0.02)**	-0.09 (0.05)	0.83 (0.02)**	0.95	-0.28 (0.05)**
Printing and writing paper	0.18 (0.03)**	-0.14 (0.05)**	0.83 (0.03)**	0.97	-0.06 (0.06)
Other paper and paperboard	0.30 (0.09)**	-0.25 (0.13)**	0.48 (0.13)**	0.93	-0.34 (0.05)**

Table 3: Original table reproduced from Chas Amil and Buongiorno. Demand equations obtained by OLS pooling for all observations 1969-1992.

	Product	Y	P	Dt_1	R2
1	Total Paper and Paperboard	0.16	-0.1	0.83	0.99
2		(0.03)	(0.03)	(0.03)	
3	Newsprint	0.19	-0.03	0.79	0.94
4		(0.03)	(0.06)	(0.03)	
5	Printing and Writing Paper	0.11	-0.05	0.9	0.98
6		(0.03)	(0.05)	(0.03)	
7	Other Paper and Paperboard	0.34	-0.12	0.63	0.96
8		(0.04)	(0.05)	(0.04)	

Table 4: Demand equations obtained by OLS pooling for all observations 1969-1992

## 2 Extending time series until 2012

### 2.1 Chart of Paper and Paperboard Consumption (1969-2012)

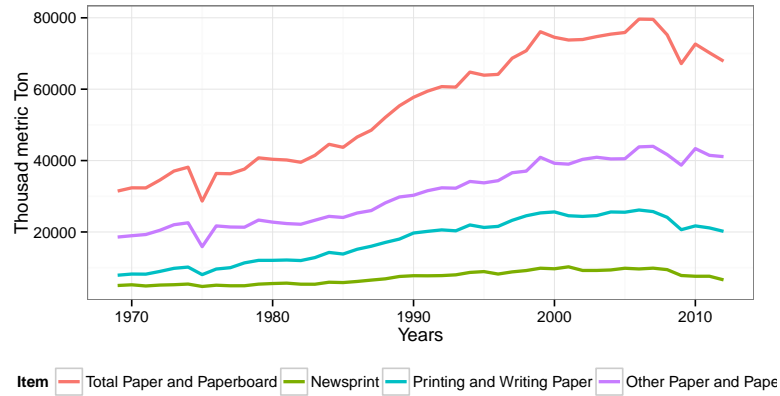


Figure 7: Consumption of paper and paperboard products in EU15, source: FAOSTAT

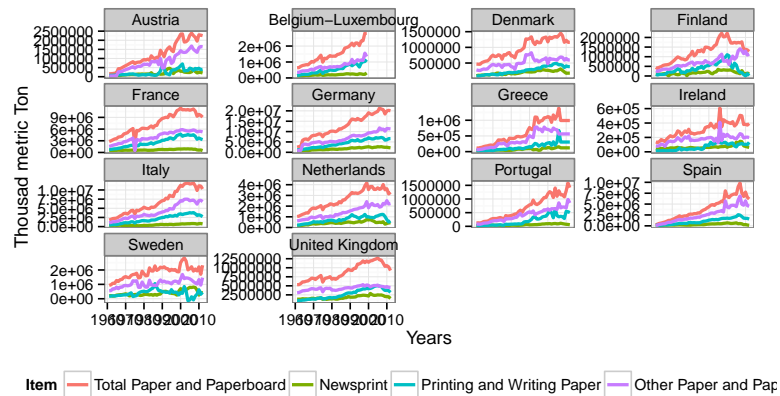


Figure 8: Consumption of paper and paperboard products in EU15, source: FAOSTAT

### 2.2 Chart of paper and paperboard prices (1969-2012)



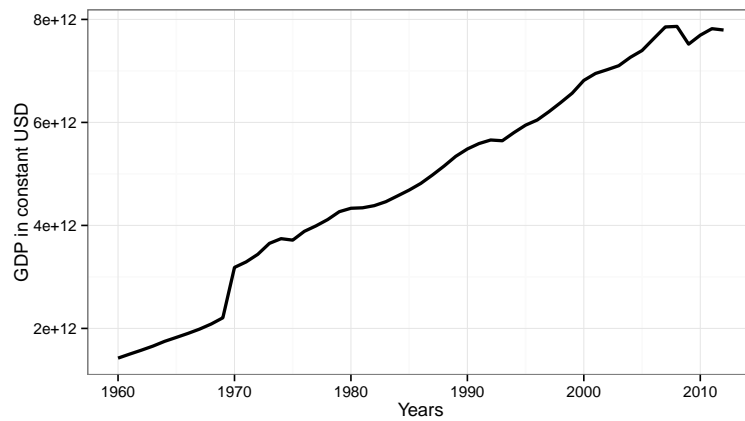


Figure 9: GDP evolution in EU15 in USD of 1987, source: FAOSTAT and own calculations

#### R session info

- R version 2.15.2 (2012-10-26), i386-w64-mingw32
- Base packages: base, datasets, graphics, grDevices, methods, stats, utils
- Other packages: ggplot2 0.9.3.1, knitr 1.2, plyr 1.8, xtable 1.7-1
- Loaded via a namespace (and not attached): colorspace 1.2-2, dichromat 2.0-0, digest 0.6.3, evaluate 0.4.4, formatR 0.8, grid 2.15.2, gtable 0.1.2, labeling 0.2, MASS 7.3-23, munsell 0.4.2, proto 0.3-10, RColorBrewer 1.0-5, reshape2 1.2.2, scales 0.2.3, stringr 0.6.2, tools 2.15.2

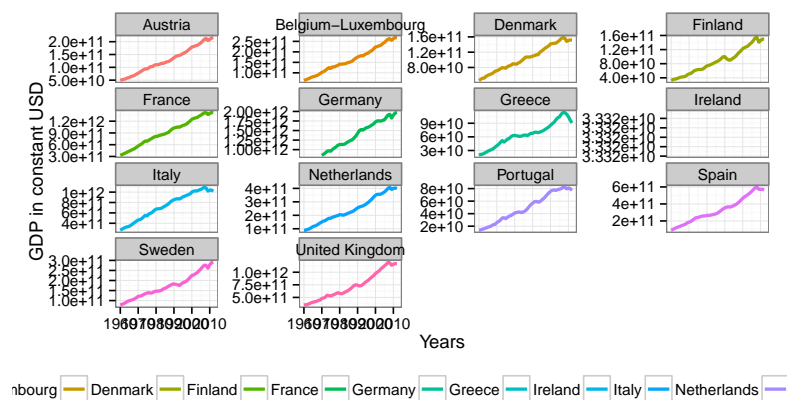


Figure 10: GDP evolution in EU15 in USD of 1987, source: FAOSTAT and own calculations

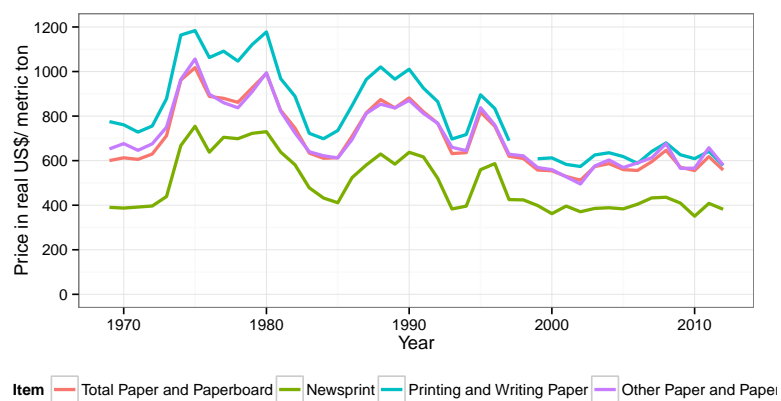


Figure 11: Price evolution of paper and paperboard products in EU15 in USD of 1987, source: FAOSTAT and own calculations