A 'back of the envelope' evidence on Aging and Growth in Europe

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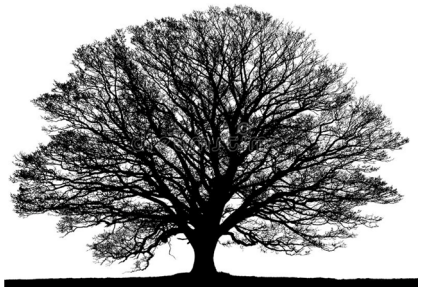
A simple very preliminary guess of how much aging can influence growth across Europe.



It is necessary to start we a premise (identical to that already underlined in the previous RN). This is only a first simple - 'back of the envelope' - guess of the impact of aging across Europe.

This exercise consists of three panel log-log regressions over the period 1995-2017 for 11 European nations: Belgium (BE), Denmark (DE), France (FR), Germany (GE), Greece (GR), Ireland (IR), Italy (IT), Netherland (NE), Portugal (POR), Spain (SP) and United Kingdom (UK).

In the first regression, the log of real per-capita Gdp (LNrGDPpc) is regressed on: the log of the incidence of people aged 65+ on total residents (*l1.LNOver65*), employment rates in the two age brackets 15-64 and over 65 years (*E1564 and E65*), a set of regional dummies (*i.Country*), and a set of yearly dummies (*i.Year*).

Incidence of 65+ is lagged by one period in order to smooth[1] problems of simultaneity and endogeneity with the dependent variable. Yearly dummies are useful to control for cyclical stances influencing all EU members. Country dummies are meant to capture structural differences across EU Members that stay constant over the observation horizon[2].

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. reg LNrGDPpc l1.LNOver65 i.Country i.Year E1564 E65 if Country!=6, robust

Linear regression                               Number of obs     =        231
                                                F(33, 197)        =    1226.12
                                                Prob > F          =     0.0000
                                                R-squared         =     0.9756
                                                Root MSE          =      .0451
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LNrGDPpc	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
LNOver65						
L1.	-.368385	.1134693	-3.25	0.001	-.5921554	-.1446147
Country						
BE	.0520278	.0157754	3.30	0.001	.0209174	.0831382
DE	.1742185	.0134482	12.95	0.000	.1476976	.2007393
FR	-.046997	.0094107	-4.99	0.000	-.0655556	-.0284383
GE	-.0416099	.0145305	-2.86	0.005	-.0702652	-.0129545
IR	-.0353029	.0447761	-0.79	0.431	-.1236049	.052999
IT	-.0368416	.0408591	-0.90	0.368	-.117419	.0437359
NE	-.0142828	.0187681	-0.76	0.448	-.0512951	.0227294
POR	-.7399368	.0345188	-21.44	0.000	-.8080106	-.6718631
SP	-.2895486	.0183027	-15.82	0.000	-.325643	-.2534542
UK	-.1964399	.0077447	-25.36	0.000	-.2117131	-.1811668
Year						
1997	.02941	.0264999	1.11	0.268	-.0228499	.0816698
1998	.0543708	.0252999	2.15	0.033	.0044774	.1042641
1999	.0813442	.0228367	3.56	0.000	.0363084	.1263799
2000	.1094217	.0217624	5.03	0.000	.0665045	.1523389
2001	.1231712	.0215364	5.72	0.000	.0806996	.1656427
2002	.1321586	.0214022	6.17	0.000	.0899518	.1743655
2003	.1400396	.0214909	6.52	0.000	.0976579	.1824214
2004	.1624334	.0213587	7.61	0.000	.1203122	.2045545
2005	.1714464	.0213961	8.01	0.000	.1292516	.2136412
2006	.1921468	.0213868	8.98	0.000	.1499703	.2343234
2007	.2071549	.0218306	9.49	0.000	.1641032	.2502066
2008	.2000019	.0229739	8.71	0.000	.1546956	.2453082
2009	.1736645	.0243862	7.12	0.000	.125573	.2217561
2010	.1994648	.0259491	7.69	0.000	.148291	.2506385
2011	.2172935	.0276818	7.85	0.000	.1627028	.2718843
2012	.2133935	.0299708	7.12	0.000	.1542886	.2724983
2013	.2200227	.0323381	6.80	0.000	.1562495	.283796
2014	.2387098	.0354352	6.74	0.000	.1688287	.3085908
2015	.2696815	.0455696	5.92	0.000	.1798146	.3595483
2016	.2824835	.0464052	6.09	0.000	.1909687	.3739983
E1564	.0094451	.0016239	5.82	0.000	.0062428	.0126475
E65	.0051439	.0021511	2.39	0.018	.0009018	.009386
_cons	10.61659	.2316515	45.83	0.000	10.15976	11.07343

1 Smooth but not completely fix. A complete treatment of this estimation problem would need the recourse to some instrumental variables or to other proper econometric techniques.

2 Among country specific differences there could also be different capabilities to react to cyclical shocks or crises.

Results are significative and with the expected signs. A **1% increase** in the incidence of those aged 65+ can be associated with a **0.368% decrease** in real per-capita Gdp.

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. reg LNrGDPpc l1.LNDepRatio i.Country i.Year E1564 E65 if Country!=6, robust

Linear regression                               Number of obs     =        231
                                                F(33, 197)        =    1739.23
                                                Prob > F          =     0.0000
                                                R-squared         =     0.9810
                                                Root MSE          =     .03977
```

LNrGDPpc	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
LNDepRatio						
L1.	-.8033827	.1344214	-5.98	0.000	-1.068472	-.5382931
Country						
BE	.0877084	.0159426	5.50	0.000	.0562684	.1191483
DE	.250964	.0099615	25.19	0.000	.2313192	.2706089
FR	.0409513	.0187429	2.18	0.030	.0039888	.0779138
GE	-.0652556	.0078997	-8.26	0.000	-.0808345	-.0496768
IR	.1060951	.0217919	4.87	0.000	.0631198	.1490705
IT	-.0854142	.01957	-4.36	0.000	-.1240079	-.0468206
NE	.0423321	.0068143	6.21	0.000	.0288939	.0557704
POR	-.7415171	.0236475	-31.36	0.000	-.7881517	-.6948824
SP	-.3451423	.0119151	-28.97	0.000	-.3686398	-.3216448
UK	-.1151775	.0152905	-7.53	0.000	-.1453316	-.0850233
Year						
1997	.0261782	.015579	1.68	0.094	-.0045449	.0569013
1998	.0488992	.0152516	3.21	0.002	.0188219	.0789765
1999	.0744062	.0134565	5.53	0.000	.047869	.1009434
2000	.1024122	.0127741	8.02	0.000	.0772206	.1276037
2001	.1151686	.0128431	8.97	0.000	.089841	.1404963
2002	.1223705	.012678	9.65	0.000	.0973686	.1473725
2003	.1273462	.0126457	10.07	0.000	.1024078	.1522846
2004	.1479367	.0118789	12.45	0.000	.1245105	.1713629
2005	.1566523	.0121792	12.86	0.000	.132634	.1806706
2006	.1766494	.0120098	14.71	0.000	.1529652	.2003337
2007	.190444	.0123923	15.37	0.000	.1660055	.2148825
2008	.1819852	.0148238	12.28	0.000	.1527515	.2112189
2009	.1502869	.014332	10.49	0.000	.1220231	.1785507
2010	.1754233	.0142292	12.33	0.000	.1473622	.2034844
2011	.1948736	.0143082	13.62	0.000	.1666566	.2230905
2012	.1924002	.0153147	12.56	0.000	.1621984	.222602
2013	.2015628	.0169123	11.92	0.000	.1682104	.2349152
2014	.224557	.0205888	10.91	0.000	.1839542	.2651598
2015	.2579426	.0331067	7.79	0.000	.1926536	.3232317
2016	.2745138	.0342122	8.02	0.000	.2070446	.341983
E1564	.0075092	.0010187	7.37	0.000	.0055002	.0095182
E65	.005441	.0015935	3.41	0.001	.0022984	.0085836
_cons	12.84454	.4939512	26.00	0.000	11.87043	13.81865

The second regression is similar to the former one but, instead of the incidence of 65+, now the aging process is captured by national structural dependency ratios (*l1.LNDepRatio*) that represent the incidence of those aged 65+ and those aged 14- on active people (aged 15-64 years). As for the former case, structural dependency ratios are lagged by one period.

Results continue to appear significative and with the expected signs as well. A **1% increase** in the structural dependency ratio can be associated with a **0.803% decrease** in real per-capita Gdp.

```
. reg LNrGDPpc l1.LNOldDepRatio i.Country i.Year E1564 E65 if Country!=6, robust

Linear regression                               Number of obs     =        231
                                                F(33, 197)        =    1202.01
                                                Prob > F          =     0.0000
                                                R-squared         =     0.9768
                                                Root MSE          =     .04396
```

LNrGDPpc	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
LNOldDepRatio						
L1.	-.3764259	.0993075	-3.79	0.000	-.5722682	-.1805837
Country						
BE	.0609206	.0165994	3.67	0.000	.0281853	.0936559
DE	.1826165	.0108034	16.90	0.000	.1613114	.2039217
FR	-.0325999	.0114098	-2.86	0.005	-.0551008	-.0100989
GE	-.0382417	.0138317	-2.76	0.006	-.0655189	-.0109644
IR	-.0349884	.0396874	-0.88	0.379	-.1132552	.0432783
IT	-.0313245	.0374285	-0.84	0.404	-.1051365	.0424874
NE	-.0138859	.0165727	-0.84	0.403	-.0465685	.0187967
POR	-.7341343	.0327791	-22.40	0.000	-.7987771	-.6694914
SP	-.2953854	.0160852	-18.36	0.000	-.3271067	-.2636641
UK	-.184316	.0083709	-22.02	0.000	-.2008241	-.1678078
Year						
1997	.0295256	.0237242	1.24	0.215	-.0172604	.0763115
1998	.0543735	.022837	2.38	0.018	.0093372	.0994098
1999	.0813228	.0206831	3.93	0.000	.040534	.1221115
2000	.1097127	.0197286	5.56	0.000	.0708064	.148619
2001	.1240381	.0196664	6.31	0.000	.0852544	.1628219
2002	.1329801	.0196106	6.78	0.000	.0943066	.1716537
2003	.1408066	.0196416	7.17	0.000	.1020717	.1795414
2004	.1633908	.0193367	8.45	0.000	.1252573	.2015242
2005	.1726203	.0193636	8.91	0.000	.1344338	.2108069
2006	.1940986	.0194774	9.97	0.000	.1556877	.2325095
2007	.2085499	.0198606	10.50	0.000	.1693833	.2477165
2008	.2021751	.0213902	9.45	0.000	.1599919	.2443583
2009	.1755257	.0223718	7.85	0.000	.1314068	.2196446
2010	.2022425	.0236872	8.54	0.000	.1555295	.2489555
2011	.2213154	.0253679	8.72	0.000	.171288	.2713428
2012	.2189087	.0277066	7.90	0.000	.1642691	.2735483
2013	.2272758	.0301377	7.54	0.000	.1678419	.2867098
2014	.2477872	.0334243	7.41	0.000	.1818719	.3137026
2015	.2805586	.0440468	6.37	0.000	.1936949	.3674223
2016	.2947493	.0447513	6.59	0.000	.2064963	.3830024
E1564	.0093451	.0014781	6.32	0.000	.0064302	.01226
E65	.0049932	.0020421	2.45	0.015	.0009661	.0090203
_cons	10.7917	.2423083	44.54	0.000	10.31385	11.26955

In the third regression, aging process is captured by one-period-lagged national old structural dependency ratios (*l1.LNOldDepRatio*) that represent the incidence of those aged 65+ on active people (aged 15-64 years).

Results continue to come out significative and with the expected signs as well. A **1% increase** in the old structural dependency ratio can be associated with a **0.376% decrease** in real per-capita Gdp.

Employment rates help controlling for the capabilities of countries to contrast economic consequences of aging taking advantage of the contribution of the largest number of active citizens. Both rates (*E1564* and *E65*) are significative in all three regressions. Taking their one-period lag would maintain the expected signs but slightly reduce statistical significance.

As for the conclusion of the previous RN dedicated to the same subject, this very rough evidence confirms the widespread idea that aging is associated with slowing down economies.

On average, in this panel of European countries:

1. the share of aged over 65 increased by 28.12% from 1995 to 2017, approximately 1.28% per year, implying an **annual slowing down of 0.47%** in real per-capita Gdp;
2. the structural dependency ratio increased by 9.68% from 1995 to 2017, approximately 0.44% per year, implying an **annual slowing down of 0.35%** in real per-capita Gdp;
3. the old structural dependency ratio increased by 32.24% from 1995 to 2017, approximately 1.47% per year, implying an **annual slowing down of 0.55%** in real per-capita Gdp.

The slowing down can be seen as a guess on that part of growth that was lost (*i.e.* did not concretize) because of aging, that means because population composition did not remained constant but continuously evolved into an older one.

In particular the annual slowing down can be seen as a **mark-down** already incorporated in time series of annual growth rates.

The basic idea for this 'back of the envelope' computation comes from a recent NBER paper by N. Maestas, K. J. Mullen and D. Powell who constructed a complete and in-depth macro-econometric set to investigate growth-aging linkage for Us. Though obtained through a much more simplistic approach, results for Europe are, indeed, not so different from what that NBER paper finds for Us. European elasticities seem to be slightly smaller.

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