Another quick Evidence on Aging and Growth in Fra, Den, Nor

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A simple very preliminary guess of how much aging can influence growth in Denmark, France and Norway, using the longest series available on Eurostat

This RN describes another 'back of the envelope' computation of the impact of aging across Europe. It is the third of the series published on the website of Reforming. It should be accompanied by the same precaution: it is only a simple guess without any particular claim of conclusion.

This time, we pick up three countries - Denmark (DE), France (FR) and Norway (NO) - because they have the longest time series available on Eurostat. The basic idea is the same as before, but now we try to investigate longrun relationships ageing-growth at the cost of concentrating on three country cases. For DE and NO real per-capita GDP (*rGDPpc*) and aging ratios (*65over*, *DepRatio*, *ODepRatio*) are available since 1975 to 2017; for FR the availability is restricted to the horizon 1991-2017 that means, anyway, some four years more than the generality of statistics for European countries (normally starting from 1995).

We develop set of log-log regressions with the log of real per-capita Gdp (*LNrGDPpc*) as dependent variable, alternatively regressed on the first lag of the log of three aging explanatory variables: the incidence of people aged 65+ on total residents (*LN65over*[1]), the incidence of youngsters aged 14- and elders aged 65+ on active citizens aged 15-64 years (*LNDepRatio*[2]), and the incidence of elders aged 65+ on active citizens aged 15-64 years (*LNODepRatio*[3]). Lags help soften problems arising from the characteristic of endogeneity and simultaneity of regressors.

Regressors are completed with observation unit dummies catching structural long persistent differences across countries (*i.Country*), and sets of temporal dummies (*decade** and *crisis**) trying to capture historical and conjuncture events that had repercussions in all countries. Time dummies have also the function to construct the period specific background against which to detect contributions given by aging processes.

Unfortunately, Eurostat series on employment and activity rates start only from 1995 and are not useful for this exercise. They have been already used as

[1] Commonly called Aging ratio.
[2] Structural dependency ratio.
[3] Old structural dependency ratio.

control variables in a previous panel covering 11 European countries[4].

Given the very long horizon (more than forty years) temporal dummies cover a crucial role in defining estimation results. Even after adopting yearly dummies (one dummy for every single year[5]), coefficients of the three aging variables come out significative and of the expected signs as well: a **1% increase** in the incidence of 65+, or in the structural dependency ratio, or in the structural old dependency ratio can be respectively associated with a **0.392%, 0.443%, 0.331% decrease** in real per-capita Gdp.

Tab. 1 -- Regressions with 3 country dummies and 43 year dummies; 1975-2017

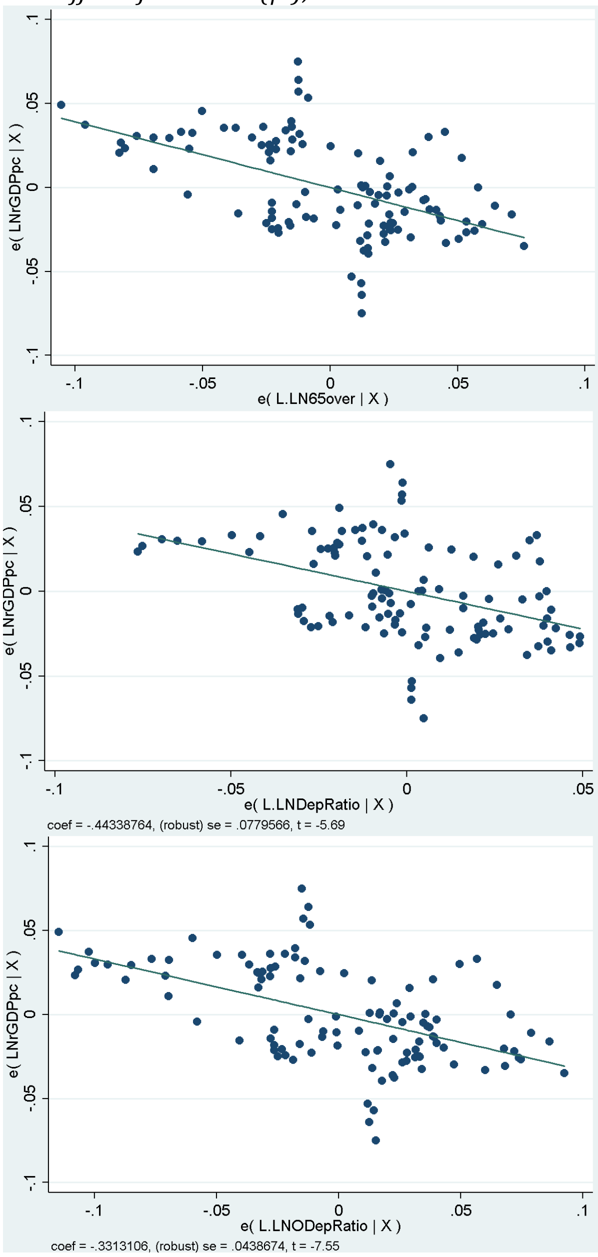
Variable	FIRSTtotal	SECONDtotal	THIRDtotal
LN65over L1.	-.39227853***		
LNDepRatio L1.		-.44338764***	
LNODepRatio L1.			-.3313106***
F	1005.5444	559.534	1037.2825
r2	.99351057	.99272615	.99360784
r2_a	.98911773	.98780231	.98928084

legend: * p<.05; ** p<.01; *** p<.001

All in all out, using the widest set of dummies, and in particular the most granular set of temporal dummies, does not prevent aging explanatory variables to reveal significative.

To give an immediate idea of the relevance of aging processes on the dynamics of real per-capita GDP, it is possible to make use of *AVPlot Stata command*. It depicts (Graph. 1 and following Graph. 2) the relationship between the dependent variable and a specific independent variable, adjusting for the effects exerted by the other independent variables (*|X*).

Graph. 1 -- Scatterplot of relationship between aging regressors (x-axis) and real per-capita Gdp (y.axis), adjusting for the effect of dummies (|X); 1975-2017



In scatterplots here above, slopes of linear interpolations are nothing but the estimates already shown in Tab. 1.

If the exercise is restricted over the horizon 1991-2017[6] (all three countries have full

[4] See: http://www.reforming.it/articoli/aging-and-growth-europe.

[5] Performing the following regression: *<reg LNrGDPpc l1.LN65over i.Year i.Country, robust>*, *<reg LNrGDPpc l1.LNDepRatio i.Year i.Country, robust>*, *<reg LNrGDPpc l1.LNODepRatio i.Year i.Country, robust>*.

[6] Performing the following regression: *<reg LNrGDPpc l1.LN65over i.Year i.Country if Year>= 17, robust>*, *<reg LNrGDPpc l1.LNDepRatio i.Year i.Country if Year>= 17,*

time series), results are shown in Tab. 2. Again, coefficients of the three aging variables come out significative and of the expected signs as well: a **1%** increase in the incidence of 65+, or in the structural dependency ratio, or in the structural old dependency ratio can be respectively associated with a **0.239%, 0.249%, 0.198% decrease** in real per-capita Gdp.

Tab. 2 -- Regressions with 3 country dummies and 27 year dummies; 1991-2017

Variable	FIRSTshort	SECONDshort	THIRDshort
LN65over L1.	-.23916299***		
LNDepRatio L1.		-.24949756***	
LNODepRatio L1.			-.19878141***
F	3001.4721	1506.7625	2608.2745
r2	.99875298	.99830917	.99874317
r2_a	.99802971	.99732848	.99801422

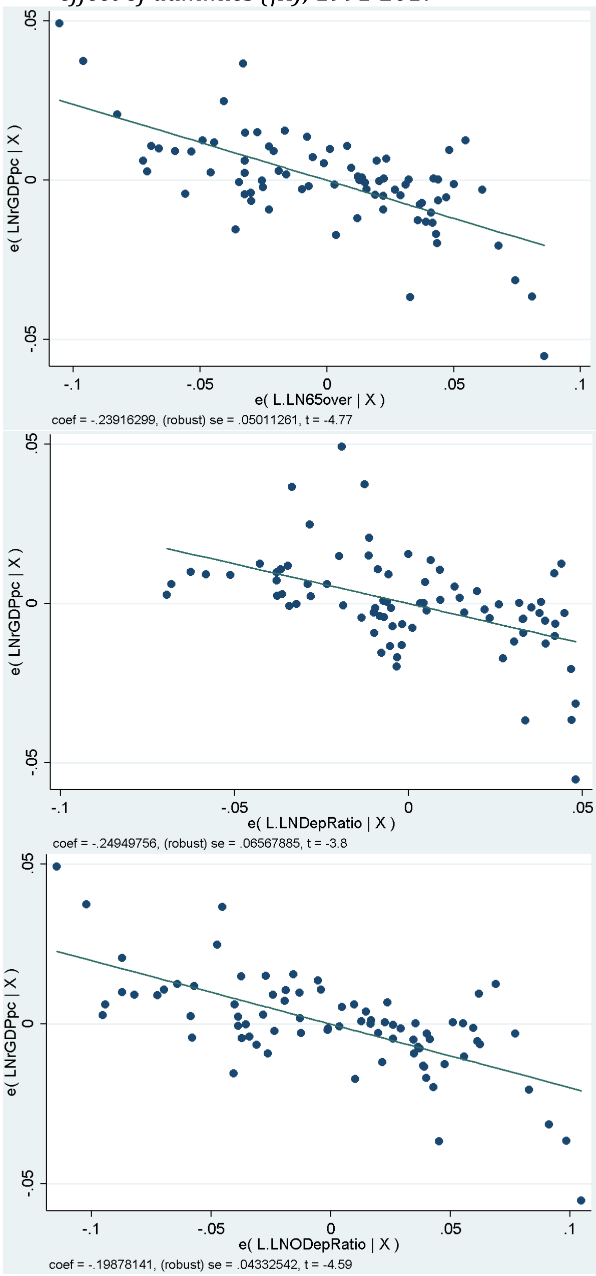
legend: * p<.05; ** p<.01; *** p<.001

Over this shorter horizon (27 year instead of 43), the negative and significative impact of aging on real per-capita GDP dynamics is confirmed but to a lesser scale.

It is not easy to argue about the reduced absolute values of estimated coefficients. This may depends upon the fact that, even if aging (demography per se) is revealing some exponential characteristics, elasticity of productivity and growth can follow a decreasing path from period to period[7].

But explanations can be also of different nature, for example pointing to some huge breaks that hit World and European economies over a more than 40 years long period (oil shocks, technical changes, political and economic integrations, other political and economic turmoils, etc.).

Graph. 2 -- Scatterplot of relationship between aging regressors (x-axis) and real per-capita Gdp (y.axis), adjusting for the effect of dummies (|X); 1991-2017



In conclusion, either over the longer or the shorter horizon here investigated for DE, FRA and NO, the negative aging-growth relationship finds another 'back of the envelope' confirmation, and also around estimates not so dissimilar from those already presented [in previous RNs.](#)

robust>, <reg LNrGDPpc l1.LNODepRatio i.Year i.Country if Year>= 17, robust>.

[7] Behind this curbed relationship, it is possible to recognize also improvements in human capital or in health conditions in old ages that may counteract aging.

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