Paper Discussion: Galor and Zhang (1997)

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November 23, 2021

1 Introduction

It is popular among grwoth theory to think about the impact of population growth or human capital growth on the dynamics of per capita output growth. Galor and Zang (1997) introduce demographic parameters such as the size of families and income distribution to account for economic growth. According to their findings, empirical observations of global cross-country data between 1960 and 1988 explain the predictions of their overlapping generations model - approach well. Across their findings, the estimators of income distribution and family size show stronger and more significant partial effects than those of population size growth and human capital growth. The next chapter briefly describes the theoretical model that Galor and Zhang established to understand the predictions for the empirical observations which are discussed in the chapter thereafter.

2 Theoretical framework

Galor and Zang (1997) consider an overlapping generations model for a small, open economy where one good is produced in a constant returns to scale fashion. In the first period, individuals do not work and consume but only decide whether or not to invest in human capital. In the second period, descendants of each individual are born and the individual receives either low or high education which affects the productivity and with it the labor income of their labor supply. Due to perfectly competitive markets, labor productivity directly translates to labor income. In their framework, economic growth can be viewed as a variable that is dependent on initial per family output, family size, the income distribution across households, the average stock of human capital and the required cost to obtain high education. The growth rate is affected negatively by the number of children, because the family has to carry the cost for education for more children. As long as countries are not very poor, the growth rate is positively related to the equally distributed incomes because then a higher share of workers become high-skilled. If the country is very poor, the effect is reversed: more inequality might have a positive effect on growth rates because at least some people can afford high education. This result lies on the model assumption that the wealth households pass on to their children remains constant. Therefore, the model establishes dynasties of low skilled and high skilled families.
It is less clear what the effect of the initial value of average household income is. If the growth effect through more people being able to afford education outweighs the diminishing effect on growth rates though high gdp levels, y_t has a positive effect on per capita gdp growth. Finally, a high average stock of human capital and lower education costs through, for example, public investment, positively affects the growth rate of per worker income from one period to the next. The next chapter turns to the empirical part of the paper to discuss the validity of the theoretical predictions. In summary,

$$g_t = G_n n + G_Q Q + G_{y_t} y_t + G_e e + G_h h + u_t,$$

where n is the family size, y_t familiy income in period t, Q the inequality measure, e the initial level of human capital stock and h the required support for education. These variables estimate the growth of per worker and per capita output.

3 Empirical model

In their basic dataset, Galor and Zang (1997) use cross-country data from 73 countries for the time frame from 1960-1988 to estimate the impact on per worker or per capita income growth. They use both the net fertility rate of 1965 (NETFERT) and a dependency ratio, namely the amount of children as a share of working age population (DEPEND) as a proxy for family size. For income inequality, they consider the GINI coefficient and the income share of the poorest 60 percent of households (BOT60). Initial output is measured as GDP per worker in 1960 (GDPW60), the proxy for the average human capital endowment is primary school enrollment rate (SCHOOL) and the cost for high education is measured by average public education expenditure as a share of GNP between 1960 and 1983 (PUBEDU).

Figure 1 one shows that the results validate the theoretical predictions. Galor and Zang (1997) do the same regression for per worker growth rate and find similar results (not shown here). Both NETFERT and DEPEND, indicators for the family size, show significant negative estimators. Income inequality has a significant negative effect on per capita output growth. Lowering the school attendance cost through higher public education expenditure or decreasing the fertility rates has a positive effect on per capita and per worker output growth. Most importantly, the population and labor force growth estimators are insignificant which supports the importance of demographic variables for per capita/ worker output growth. This has to do with the definition of fertility rates that are unaffected by the population structure, while birth rates are. Therefore, if demographics change, population growth rates change because of the change in birth and death rates, while fertility rates remain constant. Similarly, labor force growth is affected by fertility rates with a lag (because children need to grow up first). The authors mention these factors to explain why population and labor force growth estimators have a weak explanatory power in the context of demographic change.

Furthermore, Galor and Zang (1997) point out that we can see from regression (13) and (15) that excluding the last eight years from measuring population growth significantly weakens the predictive strength. This indicates a reverse causation effect in that economic growth also affects population growth. This bias further proves the strength of demographic variables compared to population size as a measurement tool for output growth.

The partial effect of primary school is significantly positive but very low: an increase in the share of children attending primary school of one percent is associated with an increase in per capita output growth of only around 0.035 percent. Looking at the data summary, the observed values range between 5 and 144 (Galor and Zang 1997, p.227) even though the ratios should be between zero and one. This is the case because some children are above or below their official age for the official primary school age (*World development report* 1984, p. 169). If for some countries, the value is distorted a lot, the question arises whether this estimator is a good measurement for human capital endowment. What about attenuation bias as described in Greene (2003, p.84)? If we falsely measure human capital because the primary schooling attendance rate is an imperfect estimator, the estimator is biased towards zero. Schooling impact might in reality be higher. Galor and Zang (1997) show in their sensitivity analysis that if there are measurement errors, true results will always be higher than the ones observed. According to their theoretical model, high education should have a strong impact on future income. The question arises whether primary education alone is a sufficient estimator for human capital endowment. The reason for this might partially be the difficulty that Galor and Zhang point out to find common variables across many structurally very different countries.

4 Summary

The contribution of Galor and Zang (1997) to the understanding of economic growth can be summarized as the addition of demographics into growth models. They provide a framework to explain why reducing the family size and increasing public education expenditure has positive effects on per capita or per worker output growth. Their empirical findings show that family size has strong explanatory power on real per capita income in the observed cross-country data. The same is true for the distribution across the population. They build a theoretical framework as a basis for the disentangling of the effects of demographics compared to labor force and population growth. They show that population growth and labor force growth alone is not sufficient to explain differences across countries in the presence of family size.

References

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Table 2
Regressions for per-capita output growth rate 1960–1988 (1)

Reg. no.	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Intercept	2.8598	−0.6834	3.1524	−0.3593	2.3539	−1.6763	2.1227	−3.2203
	(2.571)	(−0.505)	(2.623)	(−0.240)	(2.202)	(−1.653)	(2.027)	(−3.016)
NETFERT	−0.2904	−0.2844	—	—	—	—	—	—
	(−2.060)	(−2.002)						
DEPEND	—	—	−2.1267	−2.0815	—	—	—	—
			(−2.124)	(−2.064)				
GP6088		—	—	—	−0.3039	−0.3026	—	—
					(−1.583)	(−1.574)		
GP6080	—	—	—	—	—	—	−0.1974	—
							(−0.981)	
GPW6088	—	—	—	—	—	—	—	+0.1278
								(0.571)
GINI	−4.5654	—	−4.5176	—	−5.2391	—	−5.5385	—
	(−2.227)		(−2.163)		(−2.668)		(−2.809)	
BOT60	—	0.0582	—	0.0575	—	0.0668	—	0.0800
		(2.299)		(2.232)		(2.775)		(3.300)
GDP60	−0.4897	−0.4888	−0.4981	−0.4969	−0.4616	−0.4630	−0.4412	−0.3820
	(−5.321)	(−5.331)	(−5.246)	(−5.255)	(−4.731)	(−4.767)	(−4.565)	(−4.286)
SCHOOL	0.0367	0.0368	0.0357	0.0359	0.0367	0.0361	0.0377	0.0395
	(5.324)	(5.363)	(5.102)	(5.139)	(5.191)	(5.078)	(5.282)	(5.654)
PUBEDU	0.2289	0.2216	0.2342	0.2269	0.2377	0.2372	0.2346	0.1854
	(2.101)	(2.027)	(2.171)	(2.097)	(2.134)	(2.131)	(2.076)	(1.463)
R^2	0.4239	0.4248	0.4263	0.4269	0.4166	0.4184	0.4094	0.4084
$\hat{\sigma}$	1.3419	1.3409	1.3392	1.3385	1.3505	1.3484	1.3588	1.3599
No. obs.	73	73	73	73	73	73	73	73

Note: *T*-ratios appear in parentheses. The values are based on the White (1980) heteroskedasticity-consistent covariance matrix.

Figure 1: Regression on the per-capita output growth rate to discuss the validity of the theoretical predictions. Taken from Galor and Zhang (1997)