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Comments on unequal growth☆

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ABSTRACT

What is the relationship between income inequality and aggregate growth? Through an ingenious decomposition, Lippi and Perri cast this relationship as a function of simple moments of the distribution of changes in household income. Their study delivers new evidence linking heterogeneous micro-level income changes to macro-level growth outcomes. Faster income growth among rich households has mitigated the slowdown of aggregate growth in the US, especially after 2000. These findings bring forth questions about the origins of unequal growth and its impact on the welfare of different subsets of the population.

1. Introduction

“Unequal Growth” examines the relationship between household income dynamics and aggregate income growth. The latter is cast as a function of simple moments of the distribution of changes in household income. Using data from the Panel Study of Income Dynamics spanning five decades, Lippi and Perri show that the well-known slowdown in the US aggregate income growth (Gordon, 2016) occurred against the backdrop of two concurring episodes: (i) an increase in income inequality (Heathcote et al., 2010a); (ii) a growing cross-sectional correlation between the levels and growth rates of earnings (Guvenen et al., 2021), which suggests weaker mean-reversion in household income dynamics.

This work touches on a recurring question about the impact of inequality on growth and causal statements are hard to make in this context. To make sense of data patterns, the study examines on the impact of exogenous changes in household income processes. The authors parameterize a heterogeneous agents model that accounts for historical shifts in the earnings distribution. By tweaking the parameters that govern income dynamics, growing inequality is modelled as a transitional process from one invariant distribution to another. A more unequal distribution of earnings in the model results in higher aggregate growth in equilibrium (an extra 0.5-1 percent per year). The excess growth is labelled unequal growth.

The quantitative counterpart of the model is useful to gauge the welfare effects of unequal growth under alternative assumptions about consumption insurance. In a bond economy with partial insurance, richer households benefit from unequal growth while low-earnings households lose. The expected welfare drops relative to a baseline scenario without unequal

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growth. The average welfare loss is substantial (just shy of an 8% consumption-equivalent drop if relative risk aversion is set to 2) and point to a potential role for consumption support policies targeted at low-earnings households.[1]

These findings contribute to our understanding of the relationship between inequality and growth and emphasize some of its general but less known features. The analysis complements a large body of empirical research, which often focuses on cross-country comparisons and developing economies.[2] Despite a lack of consistency in data and methods, the inequality-growth relationship is frequently characterized as one in which inequality is detrimental to growth.[3] Whether, and how, the inequality-growth relationship depends on the stage of economic development of a country remains an open question.

A separate contribution of the work of Lippi and Perri is the formal characterization of the link between income volatility and income growth. This is valuable insofar it highlights that higher moments of the earnings distribution play an important role for the evolution of aggregate income. The focus on income volatility is appealing because it emphasizes the welfare costs of micro-level uncertainty during periods of fast aggregate growth. Several ancillary questions may, in the future, be addressed using richer data sources. One such question pertains to the primitive forces shaping unequal growth, whether technological or institutional (Fogli and Guerrieri, 2019; Gallipoli and Makridis, 2018; Moll et al., 2021). Another set of questions concerns whether the relationship between inequality and growth hinges on the initial level of inequality and on the shape of the earnings distribution.

In what follows I begin by reviewing Lippi and Perri's statistical decomposition of aggregate growth. Then, using their same data, I perform counterfactual exercises that explore the relative influence of high income households in shaping aggregate growth patterns. As in the quantitative section of the paper, I assume that causality runs from volatility and inequality to growth. Finally, I discuss the correlation between earnings inequality and earnings volatility and provide a few examples that illustrate how the sign and magnitude of this correlation affect aggregate income growth.

2. Micro vs macro

Consider a sample of households observed in periods t and $t+T$. Let $y_{i,t}$ be the income of household i at t; let Γ_{t+T} denote the growth rate of the aggregate income between periods t and $t+T$. If we denote the cross sectional average operator as $\mathtt{E}(\cdot)$, the following identities hold:

$$\Gamma_{t+T} = \frac{\mathtt{E}(y_{i,t+T})}{\mathtt{E}(y_{i,t})} = \mathtt{E}\left(\frac{y_{i,t+T}}{y_{i,t}}\frac{y_{i,t}}{\mathtt{E}(y_{i,t})}\right) = \mathtt{E}(g_{i,t+T} \times s_{i,t}),$$

where $g_{i,t+T} = \frac{y_{i,t+T}}{y_{i,t}}$ is the idiosyncratic income growth of household i in the $[t, T]$ interval, and $s_{i,t} = \frac{y_{i,t}}{\mathtt{E}(y_{i,t})}$ is the share of aggregate income attributed to the same household i.

By definition, $\mathtt{E}\left(s_{i,t}\right) = 1$. It follows that:

$$\begin{aligned}\Gamma_{t+T} &= \mathtt{Cov}(g_{i,t+T}, s_{i,t}) + \mathtt{E}(g_{i,t+T}) \\ &= \mathtt{Corr}(g_{i,t+T}, s_{i,t}) \times \sigma(s_{i,t}) \times \sigma(g_{i,t+T}) + \mathtt{E}(g_{i,t+T}),\end{aligned} \tag{1}$$

where we have used the equality $\mathtt{Cov}(g_{i,t+T}, s_{i,t}) = \mathtt{Corr}(g_{i,t+T}, s_{i,t}) \times \sigma(s_{i,t}) \times \sigma(g_{i,t+T})$.[4]

3. What drives growth?

To examine the forces highlighted in the statistical decomposition, we perform simple exercises in which the samples are modified to exclude subsets of households. This illustrate their influence on aggregate growth.

3.1. Tail effects

Atkinson et al. (2011) show that aggregate growth is sensitive to the inclusion of top income households. Moreover, the difference between the aggregate and average growth rates is largely driven by individuals in the lowest decile of the income distribution. This motivates an exercise where the growth decomposition is implemented after excluding, in turn, the highest and lowest earnings deciles.

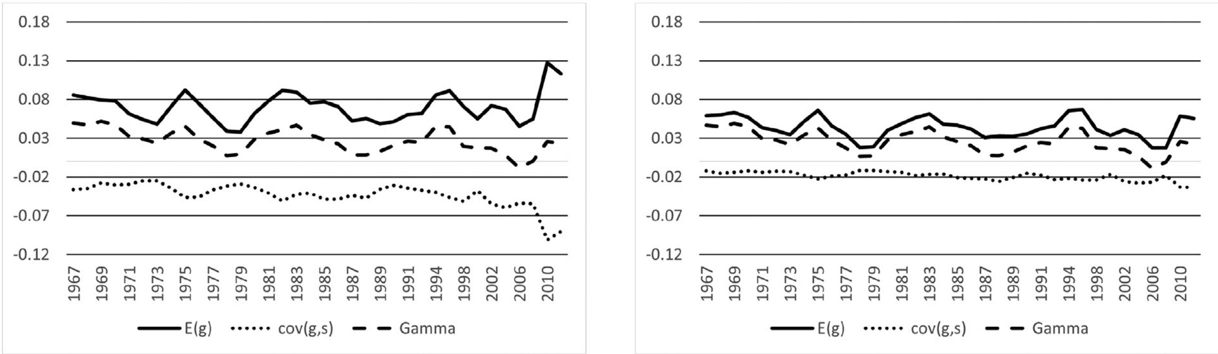
Excluding the bottom income decile. Fig. 1 superimposes the two key components of growth, $\mathtt{Cov}(g_{i,t+T}, s_{i,t})$ and $\mathtt{E}(g_{i,t+T})$, over the plot of aggregate growth. The left panel shows results obtained from the baseline sample in the paper, while the

[1] Such policies may be beneficial when shifts in micro-level earning dynamics induce higher permanent-income inequality (Abbott and Gallipoli, 2022; Bowlus and Robin, 2004; Heathcote et al., 2010b; Krueger and Perri, 2003; Straub, 2018).

[2] Among others, see Alesina and Rodrik (1994); Barro (2000, 2008); Deininger and Squire (1998); Perotti (1996); Persson and Tabellini (1994) and references therein. For an overview, see references in Benabou (1996). Banerjee and Duflo (2003) offer an updated summary of this vast literature and highlight several puzzling findings. For a systematic analysis of the link between wealth, human capital and growth, see Galor and Zeira (1993).

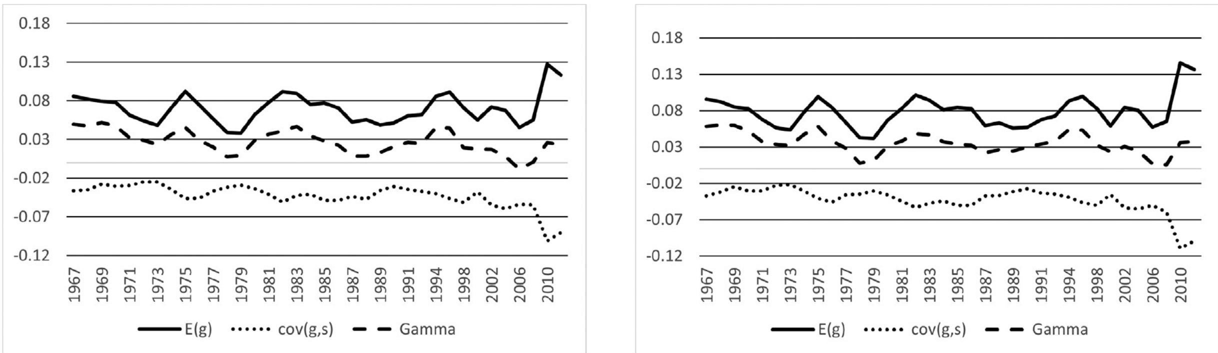
[3] For example, Benabou (1996): "....South Korea and the other East Asian dragons are usually contrasted not to the nearby Philippines, but to Latin American countries. It has long been part of development economists' conventional wisdom that the very equal distribution of income and land in the first group played a significant role in their takeoff, whereas the high levels of wealth concentration in the latter were a serious impediment to growth".

[4] It could be interesting to consider an alternative decomposition that focuses on the covariation between earnings *ranks* and growth rates. Such specification ignores the longitudinal dimension as it does not rely on the identity of households across waves. Rather it leverages income growth by rank (that is, the growth within each given rank across two consecutive cross-sections). One might apply such decomposition to repeated cross-sections without the



(a) Baseline (b) No bottom decile

Fig. 1. Components of growth after excluding the bottom decile: E(g) and Cov(g,s) versus aggregate growth Gamma, by year.



(a) Baseline (b) No top decile

Fig. 2. Components of growth after excluding the top decile: E(g) and Cov(g,s) versus aggregate growth Gamma, by year.

right panel shows results after excluding the bottom income decile. Since households in the bottom decile have the highest growth rates, removing them results in lower absolute values for $\texttt{Cov}(g_{i,t+T}, s_{i,t})$ and $\texttt{E}(g_{i,t+T})$. These changes offset each other and have an overall muted impact (slightly negative) on aggregate growth Γ_{t+T}.

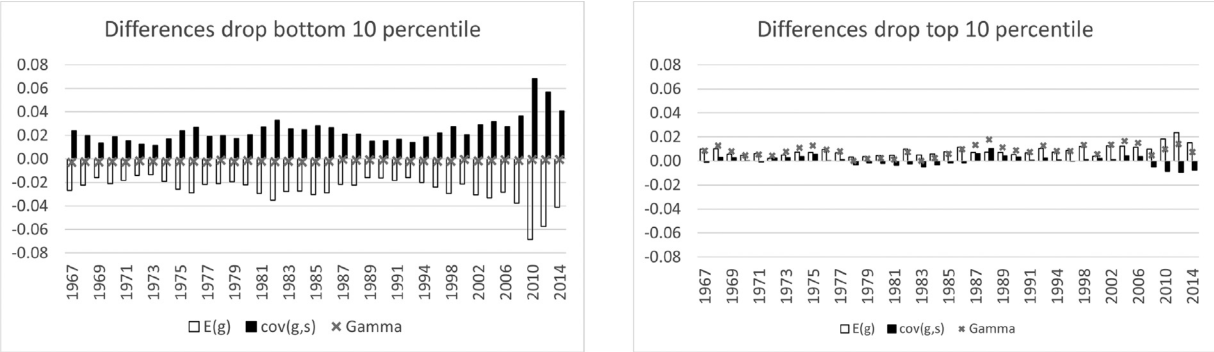
Excluding the top income decile. Fig. 2 shows the impact of removing households in the top income decile. This does not induce large changes in the growth components $\texttt{Cov}(g_{i,t+T}, s_{i,t})$ and $\texttt{E}(g_{i,t+T})$ because the excluded households have low growth rates, Moreover, dispersion is lower at the top than at the bottom of the distribution. However, the impact on aggregate growth Γ_{t+T} is much stronger than the counterfactual where the bottom incomes are removed. This occurs because, while the growth rates of high income households are lower, these households account for a large share of total income. Including them mitigates the negative impact of $\texttt{Corr}(g_{i,t+T}, s_{i,t})$ on aggregate growth. The latter correlation reflects the intensity of the relationship between $g_{i,t+T}$ and $s_{i,t}$, which becomes stronger when we remove top income households.

What do we learn? The counterfactuals show that the top decile of the income distribution makes a positive and large contribution to aggregate growth. While faster income growth among rich households does not alter micro-level moments significantly, it has a strong influence on aggregate growth. To visualize the differential impacts of removing bottom and top deciles, Fig. 3 plots the deviations of $\texttt{Cov}(g_{i,t+T}, s_{i,t})$ and $\texttt{E}(g_{i,t+T})$ from their baseline values. The figure also shows the cumulative impact of these components, which corresponds to the overall change in aggregate growth Γ_{t+T}. In the "no bottom decile" case (left panel), the two components deviate significantly from the baseline but largely offset each other so that Γ_{t+T} is effectively unchanged. In the "no top decile" case (right panel), micro-level differences are smaller but do not offset each other and their cumulative impact on aggregate growth is larger.

A lesson from these exercises is that faster earnings growth among rich households over the past decades has boosted US aggregate growth by weakening the intensity of the negative correlation between $(g_{i,t+T})$ and $s_{i,t}$.

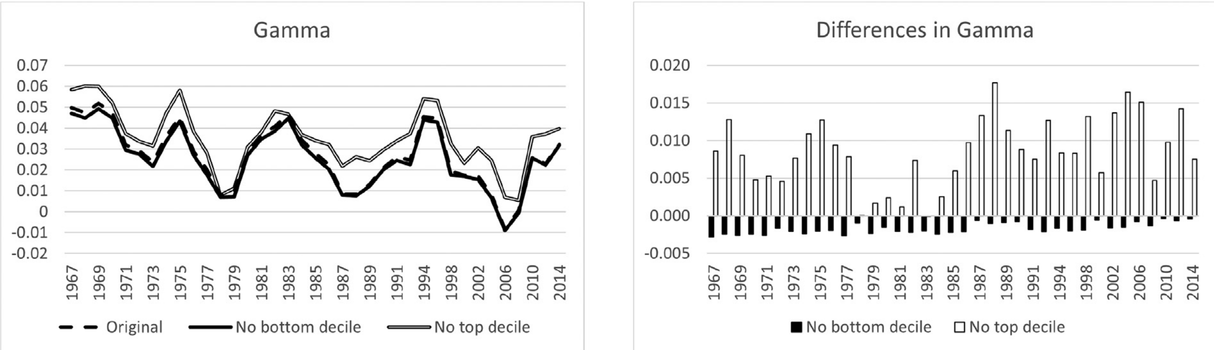
To further illustrate the asymmetric impact of rich and poor households on aggregate growth, Fig. 4 plots the actual growth rates (baseline sample) versus the counterfactuals obtained after removing either the bottom or top deciles. The left panel shows levels, the right panel shows differences relative to the "original" baseline sample.

need for longitudinal data. This would highlight the stretching (or collapsing) of inequality over time irrespective of the extent of household mixing within the income distribution.



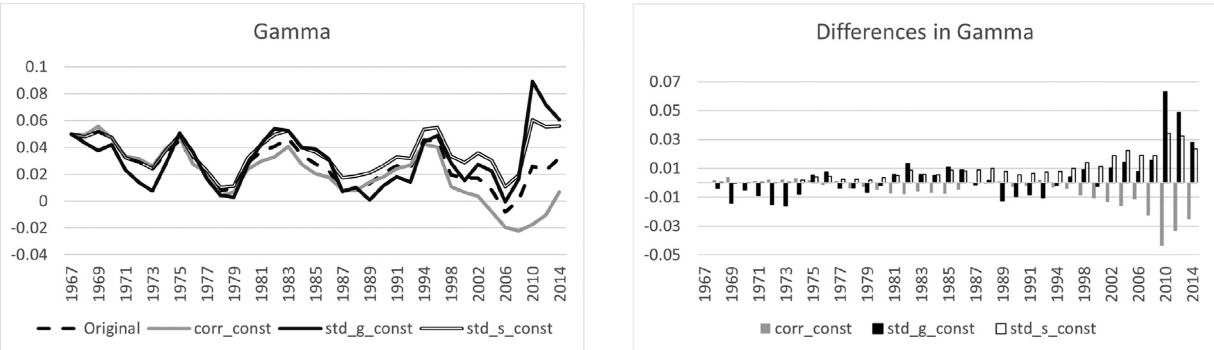
(a) No bottom decile (b) No top decile

Fig. 3. Counterfactual changes relative to baseline: components of growth vs aggregate growth, by year. Left panel: no bottom decile. Right panel: no top decile.



(a) Levels (b) Deviations from baseline

Fig. 4. Aggregate growth rates, by year: actual versus counterfactual.



(a) Levels (b) Deviations from baseline

Fig. 5. Countefactual growth holding constant, in turn, $g_{i,t+T}$, $s_{i,t}$ and $\mathtt{Corr}(g_{i,t+T}, s_{i,t})$ at their 1967 levels.

3.2. Inequality versus volatility

The variances of $g_{i,t+T}$ and $s_{i,t}$ measure, respectively, the volatility and inequality of household earnings. These measures, and their correlation, are key components of aggregate growth, as seen in the identity $\Gamma_{t+T} = \mathtt{Corr}(g_{i,t+T}, s_{i,t}) \times \sigma(s_{i,t}) \times \sigma(g_{i,t+T}) + \mathtt{E}(g_{i,t+T})$.

Earnings inequality and volatility have both a direct and indirect effect on aggregate growth Γ_{t+T}. The indirect effects accrue through their correlation $\mathtt{Corr}(g_{i,t+T}, s_{i,t})$, whose intensity is a net negative for growth. In what follows we ask: how different would aggregate growth be if $g_{i,t+T}$, $s_{i,t}$ and $\mathtt{Corr}(g_{i,t+T}, s_{i,t})$ had stayed at their 1967 levels? Fig. 5 shows the counterfactual growth rates Γ_{t+T}. The left panel of the figure plots historical growth rates vis-a-vis counterfactual rates obtained

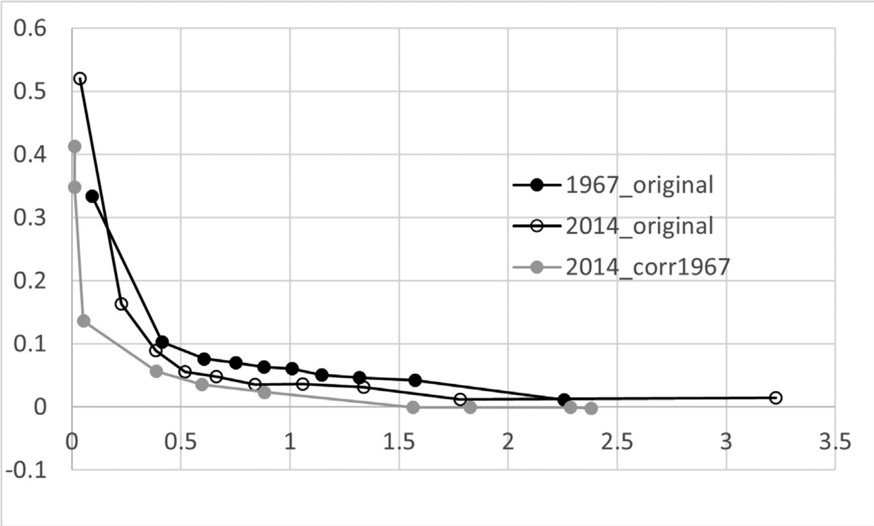


Fig. 6. Inequality vs volatility: 1967, 2014, and counterfactual 2014 with correlation fixed at its 1967 level. Income percentiles reported on the x-axis; four-year annualized income growth rates on the y-axis.

by holding constant, in turn, $\texttt{Corr}(g_{i,t+T}, s_{i,t})$, $\sigma(s_{i,t})$, and $\sigma(g_{i,t+T})$ at their 1967 levels. The right panel of Fig. 5 shows deviations of counterfactual growth rates from the historical ones.

It is apparent that growing income inequality and volatility have been a drag on growth, especially in the last fifteen years of the sample period. These effects have been partly offset by the weakening correlation between inequality and volatility.[5]

3.3. The comovement of inequality and volatility

Over the past five decades both inequality and volatility have grown. This implies lower aggregate growth for any given level of their correlation. However, the correlation itself has decreased in absolute value. This weakening of the correlation has boosted growth.

Interpreting the impacts. The impact of inequality on growth is the object of an extensive literature. Empirical analyses often take the form of cross-country comparisons. Findings vary depending on approach and data. For example, Barro (2000) finds a negative relationship between inequality and growth in a sample of poor countries but a positive one in richer countries. Banerjee and Duflo (2003) argue that most changes in inequality (whether positive or negative) are associated to lower future growth rates.

The nature of the relationship between income volatility and growth is less studied. The decomposition in Lippi and Perri (2022) suggests that higher volatility is associated with lower growth in economies where $\texttt{Corr}(g_{i,t+T}, s_{i,t})$ is negative (and large in absolute value). This observation is consistent with the lower growth observed in several developed economies since the late 1990s and might provide a useful starting point to examine the inequality-growth relationship in economies with different income distributions.

Mean reversion in household incomes. The negative covariance between volatility and inequality is a gauge of mean reversion in household incomes.[6] More intense negative co-movement of volatility and inequality suggests relatively higher income growth among poor households, an observation consistent with robust income mobility.

We can provide an empirical summary of this relationship by plotting growth rates for different deciles of the income distribution. Fig. 6 shows a scatter plot of inequality and volatility in the years 1967 and 2014. The plot illustrates the fanning out of the income distribution and its increased volatility.

Crucially, the graph shows an increase in the negative covariation of income levels and growth rates over time. The larger covariance in 2014 (shown as an increase in the slope of the curve) would be even more pronounced if the $\texttt{Corr}(g_{i,t+T}, s_{i,t})$

[5] Wages are more cyclical when measured from balanced PSID panels (Solon et al., 1994). Future work might focus on subsets of households appearing in each year of the sample period.

[6] This covariance is distinct from, but reminiscent of, the well established relationship between inequality and mobility in cross-country studies (often dubbed the Great Gatsby curve). All else equal, the slope of the curve in Fig. 6 becomes smaller when inequality grows. That is, more inequality is associated with less mobility Abbott and Gallipoli (2016); Corak (2013); Durlauf and Seshadri (2018); Gallipoli et al. (2020); Krueger (2012).

had not weakened over time. This last point is illustrated by the counterfactual curve ("2014_corr1967") in Fig. 6, which shows what the relationship in 2014 would be if $\texttt{Corr}(g_{i,t+T}, s_{i,t})$ were the same as in 1967.[7]

A steeper slope in Fig. 6 (that is, a more negative covariance between $\sigma(s_{i,t})$ and $\sigma(g_{i,t+T})$) is reflected in lower aggregate growth. Therefore, more income convergence between rich and poor households seems to hurt growth when inequality and volatility are sufficiently high. One key reason for this finding is that a steeper slope in Fig. 6 is consistent with lower growth rates for the higher income deciles, which account for much of aggregate growth.

4. Conclusions and future directions

The evidence of unequal growth discussed above suggests that the inequality-growth relationship is nuanced and may depend on initial levels of income volatility and inequality. Differences in the shape of the initial distribution of earnings may account for some of the variation in the way inequality and aggregate income evolve in different places and periods. In the US, over the five decades after 1970, faster income growth among rich households has mitigated, and partly disguised, the slow-down in aggregate growth. The welfare consequences of this slowdown have been very uneven. These findings bring about many ancillary questions. To better understand the inequality-growth relationship it would be important to establish what accounts for the structural changes that drive unequal growth.

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[7] The curve "2014_corr1967" is obtained using an optimization algorithm. The values of s_i and g_i are chosen so that $\sigma(s)$, $\sigma(g)$ and $\mathbb{E}(g)$ are equal to their 2014 levels, while the $corr(s, g)$ is set at its 1967 value.