A Comment on: Low Interest Rates, Market Power, and Productivity Growth*

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Abstract

Using an endogenous growth model, Liu, Mian, and Sufi (2022) (LMS) show that a decline in the interest rate can lead to a fall in productivity growth and a rise in leader-laggard productivity gaps and firm profits. We identify two issues in their quantitative analysis of transition dynamics: a time-scale error and the omission of composition terms in calculating productivity growth along the transition to a new balanced growth path. Correcting the time-scale error and including the composition terms, the decline in the interest rate that LMS study leads to a large and protracted productivity boom lasting about 20 years. In addition, the average leader-laggard gap grows much more slowly than reported in their paper. We also point out an issue in their quantitative analysis of steady-state profit shares. These issues are related to the quantitative exercises, and do not affect the key theoretical contributions of LMS.

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Liu, Mian, and Sufi (2022)—henceforth, LMS—link declining interest rates in recent decades to falling productivity growth, rising firm profits, and larger productivity gaps between market leaders and followers. In their theoretical analysis, LMS compare steady states in an Aghion-Howitt endogenous growth model and provide a novel result: As the interest rate approaches zero, long-run productivity growth declines and firm profits rise as leader-laggard gaps increase. LMS then ask, *"How long does it take for the economy to transition from one steady state into another, following an unexpected and permanent interest rate shock?"* In their quantitative analysis, LMS report that productivity growth briefly increases but then extremely quickly approaches its new, lower steady-state rate. In this comment, correcting the main time-scale error in LMS Figure 8, we show that their quantitative model and the same shock studied in their paper imply a protracted productivity boom. The average leader-laggard gap rises much more slowly than shown in their paper. In addition, two composition terms are omitted from productivity growth along the transition. When the initial interest rate is high, these composition terms are quantitatively important and contribute to a larger productivity boom. We also identify an issue with the calculations of steady-state profit shares that, when corrected, implies that the long-run increase in the profit share is smaller in magnitude than shown in their paper. Further research would be beneficial to understand the empirical relevance of LMS's novel theoretical mechanism for explaining trends in productivity growth, business dynamism, and interest rates in recent decades.

1. Low interest rates and persistent productivity booms

The main error we identify is a time-scale error in Section 7.3 of their paper, "Transitional Dynamics and Additional Empirical Predictions." The transition reported in their Figure 8 is 100 times too fast. In addition, productivity growth as reported in Figure 8 omits two terms related to innovation in the most competitive markets. Each of these two composition terms equals zero when the economy is on a balanced growth path (BGP), but, for the transition dynamics exercise in LMS, these terms are quantitatively relevant. When the time-scale error is corrected and the composition terms included, transition dynamics are very different than shown in LMS, which describes convergence to the new balanced growth path as "rapid".[1] LMS's Figure 8 reports transition dynamics when the discount rate falls from $r = 3\%$ to $r = 1\%$. In our Figure 1, the black solid line in each panel corresponds exactly to the transition path shown in LMS's Figure 8. The red dashed line in each panel shows the transition dynamics after correcting the time-scale error and including the composition terms. Our Figure 2 shows a longer horizon. When the time-scale and composition issues are addressed, productivity growth rises on impact and remains above its pre-shock rate for about 20 years (not 0.75 quarters). Due to the omitted composition terms, the initial increase in productivity growth is from 1.10% to 1.64% (not 1.46%). It takes almost 40 years for the productivity growth rate to fall to 0.96%. Average productivity growth over 20 years following the permanent discount rate decline is 1.29%, that is, 0.46 percentage points higher than the 20-year average rate implied by LMS's Figure 8. These results pertain to the one-time, permanent decline in the discount rate from 3% to 1% studied in LMS's Figure 8. The main steady-state comparison in LMS (a decline in the discount rate from 3.6% to 0.33%) is motivated by a decline in the real interest rate that occurred gradually over a few decades. Even though it takes 20 years for the negative growth effect of low interest rates to appear, the reduction in productivity growth eventually becomes relevant over the subsequent decades in a prolonged low interest rate environment.

The protracted productivity boom following a fall in the discount rate arises from the mechanism that explains the long-run decline in productivity growth in their quantitative exercise. On impact, aggregate productivity growth jumps up because a low discount rate makes the present value of persistent market leadership very high, spurring a large increase in investment by firms in competitive markets. Productivity growth then remains high for a long period as leaders continue investing to widen their advantage. Productivity growth falls below its pre-shock rate only when leader firms achieve a suffi-

[1] LMS state (based on the uncorrected results), *"Figure 8 shows the convergence is rapid....Panel A shows that it takes 1.5 quarters for the growth rate to decline to 0.96%, closing about half of the steady-state difference. The initial boost in productivity growth lasts only 0.75 quarters, after which the growth rate declines below 1.1%."* (p . 219).

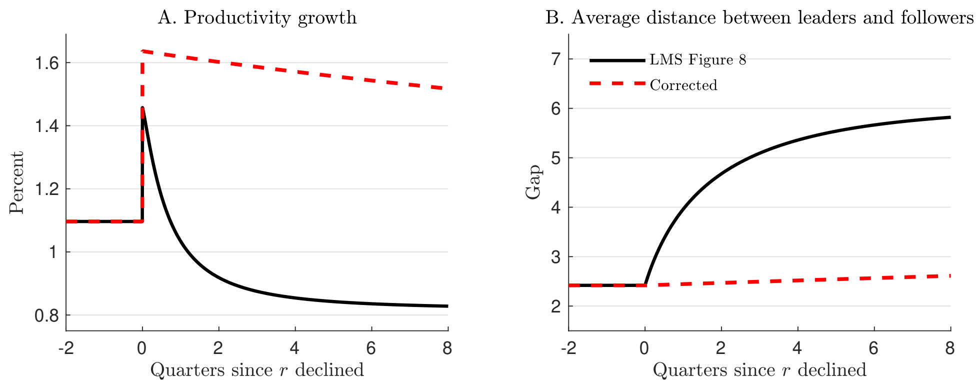

Figure 1: Transition dynamics following decline in discount rate from $r = 3\%$ to $r = 1\%$

cient number of investment successes to discourage their competitors, allowing leaders to remain entrenched while investing little. This process of leaders widening their advantage is only gradual and occurs 100 times more slowly than shown in their paper, as illustrated in the right panels of our Figures 1 and 2. This slow evolution of the market state distribution implies a productivity boom and generates a large and very persistent decrease in the aggregate profit share as defined by LMS.[2]

To understand the composition terms omitted from productivity growth in LMS's Figure 8, define the follower productivity index $Q_F(t)$ as the average of the log of the lowest productivity in each market, or $Q_F(t) = (\ln \lambda) \int_0^1 z^F(t;\nu)d\nu$, where λ is the size of productivity improvements and $z^F(t;\nu)$ is the follower productivity index at time t in market ν. Productivity growth $g(t)$ in LMS's quantitative setting equals the change in the follower productivity index plus two composition terms related to the change in the share of neck-and-neck markets:

$$g(t) = \underbrace{\dot{Q}_F(t)}_{\substack{\text{Change in the}\\ \text{follower productivity index}}} - \dot{\mu}_0(t) \underbrace{\left(\ln \left[(\lambda l_1)^{\frac{\sigma-1}{\sigma}} + (l_{-1})^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} - \ln \left[2(l_0)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \right)}_{\text{Log-increase in market output when a tied firm innovates}}$$
$$+ \dot{\mu}_0(t) \underbrace{\frac{l_1 + l_{-1} - 2l_0}{(1-\mu_0(t))(l_1 + l_{-1})) + 2\mu_0(t) l_0}}_{\substack{\text{Change in production costs when a tied firm innovates,}\\ \text{as a share of average production costs}}}, \tag{1}$$

[2] When the time-scale is interpreted correctly, the profit share falls sharply on impact to -16% of aggregate firm revenue and rises above its pre-shock value only after 86 years.

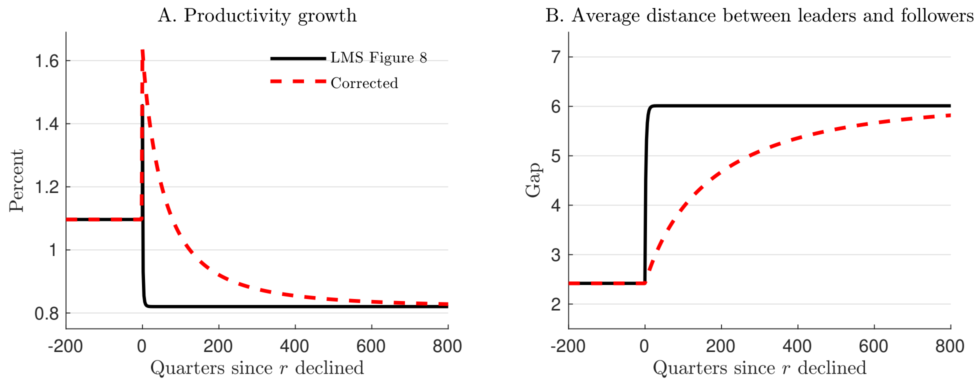

Figure 2: Transition dynamics following decline in discount rate from 3% to 1%—longer horizon

where $\dot{\mu}_0(t)$ is the change in the share of tied markets and (l_1, l_0, l_{-1}) are the production costs of the leader, tied, and laggard firms, respectively.[3] The composition terms capture the implications of the changing state distribution for the growth rates of output and production costs. When the discount rate declines from an initially extremely low level, these composition terms are quantitatively unimportant. However, these composition terms are quantitatively relevant when, as in the exercises in LMS, the initial interest rate is not very low.

2. Investment cost and the profit share

This section discusses comparisons of the aggregate profit share across steady states in LMS's Sections 6 and 7. The profit shares reported in Figures 4 and 6 of their paper use an investment-cost scalar with a different value than that used to calculate BGP investment success rates.[4] The black line in our Figure 3 reproduces the relation of the steady-state profit share with the interest rate reported in LMS's Figure 4, Panel B. The red line shows the corrected relation when the investment cost assumption used to calculate investment success rates is also used to calculate profit shares. As shown in our Figure 3, as the interest rate approaches 1% (i.e., as the discount rate approaches 2 basis

[3] The derivation of Eq. (1) is available from the authors upon request.

[4] This issue is distinct from the time-scale and the composition-term issues described in the previous section. Specifically, this issue arises from a scalar in the Hamilton-Jacobi-Bellman equations in their script gen_eqm_eqns.m that is inconsistent with the scalar used to calculate the profit share in their script calibration_EMA_submit.m.

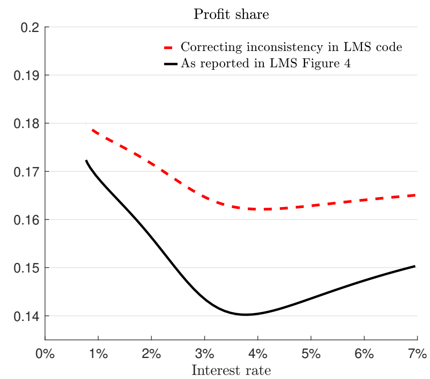

Figure 3: Profit share and interest rate across steady states

points), the profit share rises 1.8 percentage points (from a trough of 16.2% to 18.0%), which is smaller than shown in their Figure 4, Panel B.

Conclusion

Using an Aghion-Howitt model, Liu, Mian, and Sufi (2022) show that a permanent decline in the interest rate can lead, in the long run, to lower productivity growth and higher leader-laggard productivity gaps and firm profits. We identify two issues in their quantitative analysis of transition dynamics: a time-scale error and the omission of composition terms related to the changing share of innovative, highly competitive markets. Correcting the main time-scale error, LMS's quantitative model and the same shock studied in their paper imply a protracted productivity boom lasting about 20 years. The composition terms contribute to a larger productivity boom and are quantitatively relevant when the initial interest rate is not very low. We believe LMS represents a novel and important contribution toward connecting low interest rates with weak productivity growth and diminished market competition. Research to shed further light on these connections would be beneficial.

Reference

Liu, Ernest, Atif Mian, and Amir Sufi, "Low interest rates, market power, and productivity growth," *Econometrica*, 2022, *90* (1), 193–221.