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Miscalling Mismeasurement as Misallocation

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Abstract

There is a vast line of research in misallocation like Hsieh and Klenow (2009), which see its roots in policy distortions. However, papers like Bill, Klenow, and Ruane(2020) argued differences in measured average products might reflect misspecification instead of actual marginal products. By focusing on the Indian and Chinese manufacturing sectors, this paper shows that these results are sensitive to the parameters of the factor accumulation and the production function. In doing so, we estimate the model employed by H.K. to measure misallocation using the moments reported in H.K. for China and India. Then, we produce simulated data using the estimated model and redo the calculation of H.K. by different parameters.Notably, the optimal dispersion depends on the parametrization, so one can't address the misallocation without a country-specific calibration of the model, we observe that the Hsieh and Klenow (2009) results are highly dependent on the measurement of the elasticity of substitution and capital share in production. Therefore, the assumption of the same parameters for all three countries could misguide us to a wrong measurement of the actual effects of misallocation. The findings of this paper call for the proper estimation of parameters when studying the impact of misallocation on aggregate TFP.

Highlights

- This paper shows that the previous findings of misallocation rely substantially on their assumptions of parametrization. In doing so, we estimate the model employed by H.K.
- results show that a slight variation in either the aggregation parameter or the elasticity of output for capital wipes out the efficiency gap reported in H.K. It is likely that there would be no misallocation in China and India. The previous findings rest on the specific choices of parameters.
- We conclude that focusing intensely on calibrations when measuring misallocations as a quantitative exercise is necessary.

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1. Introduction

Hsieh and Klenow (2009) (henceforth H.K.) show resource misallocation can lower aggregate total factor productivity (TFP) using microdata on manufacturing establishments in China and India. They find that moving from China and India to the "U.S. efficiency" could increase TFP by 30%–50% and 40%–60%, respectively. However, this novel quantitative finding is challenged by recent papers. In particular, Bils, Klenow, and Ruane (2020) show that the misallocation measured by the gap between revenue per unit of inputs in the U.S. and India could result from measurement errors in payments and inputs.

This paper shows that the previous findings of misallocation rely substantially on their assumptions of parametrization. In doing so, we estimate the model employed by H.K. to measure misallocation using the moments reported in H.K. for China and India. Then, we produce simulated data using the estimated model and redo the calculation of H.K. by different parameters. The results show that a slight variation in either the aggregation parameter or the elasticity of output for capital wipes out the efficiency gap reported in H.K. It is likely that there would be no misallocation in China and India. The previous findings rest on the specific choices of parameters. We conclude that focusing intensely on calibrations when measuring misallocations as a quantitative exercise is necessary.

The structure of the paper is as follows. We review the literature on the relation between misallocation and input distortion in Section II. Section III focuses on the H.K. model and shows the importance of mismeasurement in parameters. Finally, results and counterfactuals are reported in Section IV.

2. A Review of the Related Literature

Other papers have challenged the robustness of the previously mentioned finding of H.K. In particular, Bils, Klenow, and Ruane (2020) show that identifying mismeasurement in output is crucial in investigating the impact of dispersion on efficiency gain. There are a few papers that show that misallocation is sensitive to modeling. For example, Guan Gong & Hu (2016) show that when the constant return to scale assumption fails, H.K. overestimates the resource misallocation in China. They estimate a new production function by increasing return to scale functional form and finding less drop in aggregate productivity than what was reported by HK.

We think it is evident that reframing the production function would change the results of misallocation, so it is probably not a duly robustness check. The results of the two exercises are not comparable. However, the necessary validation is whether the findings are robust to a variation in underlying parameters, knowing that the actual parameters are different in the two countries. This difference in parameters mainly stems from other technologies and stages of a production chain.

To understand the importance of why we focus on parameter values, consider a Cobb-Douglas production function as employed by H.K. The aggregate

TFP, up to the first-order condition, is a linear combination of misallocations in labor and capital weighted by their elasticity to production. Moreover, suppose firms in a country are more capital intensive than their counterparts in the U.S. In that case, capital should be delivered more to productive firms in this country than in the U.S. If one wrongfully assumes the two countries have the same capital elasticity, she would find distortion in the capital distribution and accordingly concludes the aggregate misallocation. Moreover, the aggregation parameter highlights to what extent a distortion in a sector would affect the aggregate misallocation. This parameter depends on how firms in a country are located vertically in production and the intensity of distortions passes on between them.

Furthermore, if the sectors are roughly isolated, then the optimal allocation of resources would be treated separately. However, suppose they are linked to each other. In that case, a social planner may consider reshuffling capital to less productive sectors to include the externality they may have on different stages of production. We will discuss these tradeoffs below.

Previous studies stress their concerns on fixing parameters across sectors, countries, and time. For example, H.K. admits that a fixed σ across goods is a simplifying assumption. Noticeably, in developing countries like India and China, we expect a higher capital share than the U.S. Miao and Peng (2011), Chang Lui & Spiegel (2015), and Batini et al. (2010) estimate the share of labor in production from 0.42 to 0.67 in India and China. Notably, Bill et al. (2020) highlight that we will face a declining allocative efficiency in the U.S. if we fix these parameters along times, which shows that we might have a very sensitive framework to upcoming shocks and measurement errors.

3. Estimation and Methodology

We focus on the HK model in which the capital and output distortion lead to aggregate misallocation. The final output is

$$Y = \sum_{i=1}^{M} \left(Y_i^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{1}$$

Where σ is the elasticity of substitution between plants' value-added, Y is the value-added of each firm, and Y_i is the intermediate firm's value-added. Firms compete in a monopolistic competitive market, and the production function for each differentiated product is given by a Cobb-Douglas function of firms as $Y_i = A_i\, k_i^{\alpha}\, L_i^{1-\alpha}$ where α represents the capital share (for our exercise it's constant , L_i shows the labor hired by the firms i, and k_i is rental capital of this firm. HK shows that with regular CES aggregate production and the firm's Cobb-Douglas production function, the ratio of actual production to the efficient one is:

$$\frac{Y}{Y_{eff}} = \left(\sum_{i=1}^{M} \left(\frac{A_i}{\bar{A}} \frac{\overline{TFPR}}{TFPR_i} \right)^{\sigma-1} \right)^{\frac{1}{\sigma-1}} \tag{2}$$

TFPR is the productivity of revenue for each firm, and the bar sign is used to show the averages. As mentioned previously, our goal is to conduct the same exercise as HK but with different values of σ and α to study the robustness of their results. Moreover, we need to simulate what they have because the estimated parameters are not constant. To do so, we need to estimate their model by using moments reported in the paper.[1] After the estimation of their model which replicates the same moments as their paper, we can simulate it and generate firm observations for our exercises. Finally, we use these firm observations to replicate their results, but with different values of σ and α.

H.K. employ three shocks as the distortion of capital, production, and productivity to build their model. These shocks in principal would be characterized by nine coefficients: three for the averages and six for variance-covariance matrixes. We generate the shocks from three standard normal distributions of the Cholesky matrix of the covariance of Σ. Then, we map them to a lognormal distribution for productivity and beta distributions for capital and production distortion. To obtain these coefficients, we benefit from nine moments reported in H.K. for each country.

4. Estimation and Methodology Results

We estimate the nine coefficients in the model using nine moments from HK: dispersion of TFPR (mean and its 75% quantile), a percentage gain of efficient allocation, and correlations between distortions (capital & labor, labor & labor, productivity & labor, productivity & labor, productivity & capital). We employ three different weights for the SMM method: equal weights, high weights on two important moments of TFPR dispersion, and efficient weights equal to the inverse of the variance of the simulated moments. Results of coefficients and moments fit are shown in the online appendix.[2] Having a country-specific estimated model, we simulate data and replicate the HK results using different values of parameters. We are interested in TFP gain due to variations in parameters. Therefore, in each exercise, we keep one parameter as is used in HK while varying the other parameter, and finding the corresponding TFP gains. Results are shown in Fig. 1 (different values of σ) and Fig. 2 (different values of α).

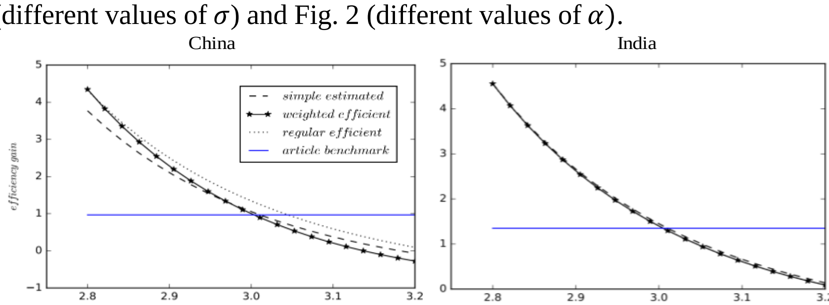

Figure 1. efficiency gains for different values of σ

***source**:this research simulation*

[1] We know the assumed values for σ and α in HK, so we only estimate other parameters in their paper.

[2] Codes are available at http://gsme.sharif.edu/~rahmati

***Note**: efficiency gain means how much the value-added of the final good will increase if we equalize all the TFPR across the firms. We see the effect of the elasticity of substitution between intermediate firms. Negative efficiency gain in a higher value of σ in India shows we lost efficiency in higher σ in that country.*

Recall that for the assumption of $\sigma = 3$ and $\alpha = 0.33$, HK find 86.6%, and 127.5% efficiency gains due to the reallocation of resources to efficient distribution in China and India in 2005, respectively. We reach the same results under their assumption of parameters, however when we slightly decrease the elasticity of substitution to $\sigma = 2.8$ we observe that the efficiency gain increases by fourfold. The reallocation gain comes from the fact that when the elasticity of substitution is low, inefficient firms will produce more as their market power enhance so by omitting the distortion, we will get more efficiency. Strikingly, if the elasticity increase to $\sigma = 3.2$ the allocation of resources in two countries approaches zero meaning that there would be no gain in reallocation of resources.

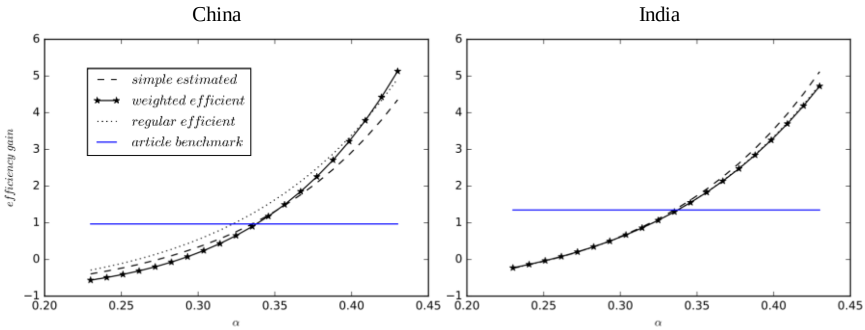

Figure 2. efficiency gains for different values of α

***source**:this research simulation*

***Note**:* efficiency gain means how much the value-added of the final good will increase if we equalize all the TFPR across the firms. We see the effect of the elasticity of substitution between intermediate firms. We see the upward reaction of the efficiency to increase in the share of capital

Fig. 2 indicates that changes in the labor share can alter the efficiency gain even more. To see why the efficiency gain is increasing in α, note that distortion is derived from capital and value-added. By increasing the share of capital, the loss of efficiency caused by capital would increase, and the efficiency gained by equalizing TFPR goes up. Therefore, if the estimates of labor share in production are lower in developing countries as asserted in literature, we expect more efficiency in reallocating resources than what is predicted by HK.

5. Comparison with Indian manufacturing data

in this section, the results are compared with the estimation of the real values of substitution elasticity between inputs and between firms in India to show whether the values obtained in the simulation section are in the acceptable range or not. Since there is small evidence of estimating the Elasticity parameter in the final goods aggregator, the elasticity of output to capital provides a better comparison of the TFP decline. Santana and Peykhan (2014) follow the question of Hsieh and Kelnow (2009) and question the reduction of total TFP in India compared to the United States by the importance of Small-Scale Reservation

Laws (SSRL). Santana and Pikhan (2014) estimated the coefficients of both elasticities (where 0 and 3.3, respectively). However, by which are shown in the simulation diagram of the Indian economy, The aggregate of the final product is very sensitive to the Elasticity parameter in the final goods aggregator and the productivity loss in this range will be underestimated in this way. Perhaps the reason for estimating the low productivity loss in this paper is the sensitivity of the model to the elasticity of final product aggregation. Regarding the elasticity of capital in the production function, the estimation of this elasticity literature in India has vary in a range between 0.28 Upender, M. (2009) to 0.37 (Madheswaran et al. (2007).

6. Concluding Remarks

we observe that the H.K. results are highly dependent on the measurement of the elasticity of substitution and capital share in production. Therefore, the assumption of the same parameters for all three countries could misguide us to a wrong measurement of the actual effects of misallocation. The proper estimation of these parameters leads us to a completely different perception of the dispersion effect on efficiency. The danger of misguiding this sensitivity is also asserted by Bill et al. (2020). Because of the critical policy implication of H.K. results, the finding of this paper calls for the proper estimation of parameters when studying the impact of misallocation on aggregate TFP.

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