APPENDICES

The Hsieh-Klenow Framework

1. Producer-Level Productivity and Distortions

Consider an economy with *S* sectors. In sector s and period *t*, there are N_{st} producers that produce differentiated intermediated goods in a monopolistically competitive market. Denote producer *i*'s output by y_{it}. Sectoral good producers produce output in a competitive market by combining intermediated goods. Their production function is the CES with the elasticity of substitution $\eta_s > 1$:

$$Y_{st} = \left(\sum_{i=1}^{N_{st}} y_{it}^{\frac{\eta_s - 1}{\eta_s}} \right)^{\frac{\eta_s}{\eta_s - 1}} . \qquad (A1)$$

Let P_{st} and p_{it} denote the prices of the sectoral goods and producer *i*'s intermediate goods, respectively. Then, the sectoral goods producers' profit maximization leads to the demand for intermediate goods as

$$y_{it} = p_{it}^{-\eta_s} P_{st}^{\eta_s} Y_{st} . \qquad (A2)$$

Intermediate goods producer i's production function is the following constant-returns-to-scale Cobb-Douglas:

$$y_{it} = A_{it}K_{it}^{\alpha_s}L_{it}^{1-\alpha_s}, \tag{A3}$$

where A_{it}, K_{it}, and L_{it} denote TFPQ, capital, and labor.

Intermediate goods producer *i* faces distortions of τ_{Yit} on output and τ_{Kit} on capital, respectively. She/he maximizes her/his profit (Π_{it}) under the constraints (A2) and (A3), given rental rate R_t, wage rate W_t, and distortions τ_{Yit} and τ_{Kit}:

$$\Pi_{it} = (1-\tau_{Yit})p_{it}y_{it} - (1+\tau_{Kit})R_tK_{it} - W_tL_{it}\ . \tag{A4}$$

The first-order conditions lead to

$$ln(1+\tau_{Kit}) = ln\left(\frac{\alpha_s}{1-\alpha_s}\right) + ln\left(\frac{W_tL_{it}}{R_tK_{it}}\right) \tag{A5}$$

$$ln(1-\tau_{Yit}) = \ln(m_s) + ln\left(\frac{W_tL_{it}}{p_{it}y_{it}}\right) - ln(1-\alpha_s) \tag{A6}$$

$$ln(A_{it}) = \ln(\kappa_{st}) + \ln(m_s) + ln(p_{it}y_{it}) - \alpha ln\,(K_{it}) - (1-\alpha_s)\,ln(L_{it}), \tag{A7}$$

where m_s is the markup ratio, $m_s = \frac{\eta_s}{\eta_s - 1}$, and $\kappa_{st} = (P_{st}{}^{\eta_s} Y_{st})^{\frac{-1}{\eta_s - 1}}$. We can recover producer-level distortions and TFPQ from Equations (A5)–(A7) given the sectoral variable κ_{st}. Equation (A6) shows that the distortion on output can be captured partly by the difference between revenue share and elasticity of input as in PL, but Hsieh and Klenow adjust for markup as well.

2. Sectoral Aggregation

We define producer-level revenue-based productivity as $TFPR_{it} = p_{it} A_{it}$. Then we obtain

$$TFPR_{it} = m_s \left(\frac{(1 + \tau_{Kit}) R_t}{\alpha_s} \right)^{\alpha_s} \left(\frac{W_t}{(1 - \tau_{Yit})(1 - \alpha_s)} \right)^{1 - \alpha_s}. \qquad (A8)$$

Using Equation (A8), we obtain the sectoral TFP, defined by $A_{st} = \frac{Y_{st}}{\left(\sum_{i=1}^{N_{st}} K_{it}\right)^{\alpha_s} \left(\sum_{i=1}^{N_{st}} L_{it}\right)^{1 - \alpha_s}}$, as

$$A_{st} = \left[\sum_{i=1}^{N_{st}} \left(A_{it} \frac{\overline{TFPR}_{st}}{TFPR_{it}} \right)^{\eta_s - 1} \right]^{\frac{1}{\eta_s - 1}}, \qquad (A9)$$

where $\overline{TFPR}_{st} = m_s \left(\frac{R}{\alpha_s} \frac{1}{\sum_{i=1}^{N_{st}} \frac{1-\tau_{Yit}}{1+\tau_{Kit}} \frac{p_{it} y_{it}}{P_{st} Y_{st}}} \right)^{\alpha_s} \left(\frac{W}{(1-\alpha_s)} \frac{1}{\sum_{i=1}^{N_{st}} (1-\tau_{Yit}) \frac{p_{it} y_{it}}{P_{st} Y_{st}}} \right)^{1-\alpha_s}$.[1][2][3]

Without distortions, $TFPR_{it}$ is identical across producers. To the extent that it disperses across producers, allocative efficiency is worse.

Similarly, for the sectoral TFP for the producers that survive from period *t* to *t+1* is

$$A_{st}^{C_{st}} = \left[\sum_{i \in C_{st}} \left(A_{it} \frac{\overline{TFPR}_{st}}{TFPR_{it}} \right)^{\eta_s - 1} \right]^{\frac{1}{\eta_s - 1}} \qquad (A10)$$

Here, C_{st} denotes the set of survivors.

3. Hypothetical sectoral TFP

Let $\overline{H_{st}}$ denote the hypothetical average TFP that would be achieved without any distortions on all producers in sector *s*. Then, from Eq. (A9),

$$\overline{H_{st}} = \left(\frac{1}{N_{st}} \right)^{\frac{1}{\eta_s - 1}} \left[\sum_{i=1}^{N_{st}} A_{it}^{\eta_s - 1} \right]^{\frac{1}{\eta_s - 1}} . \qquad (A11)$$

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[1] For the sectoral and aggregate productivity, we use "TFP" rather than "TFPQ" following HK, although sectoral (aggregate) "TFP" denotes how much sectoral (aggregate) output can be produced given the sectoral (aggregate) capital and labor.

[2] For the derivation of Equation (A9), see Hsieh and Klenow (2009) or Hosono and Takizawa (2015).

[3] Our measure of sectoral (and hence aggregate) TFP is different from the sectoral (and aggregate) TFP that is based on the System of National Accounts (SNA) (e.g., the Japan Industrial Productivity Database (JIP)), because our sectoral output measure based on the CES function (A1) is different from the aggregate output measure used in SNA. In SNA, sectoral output is the simple sum of value added: $Y_{st} = \sum_{i=1}^{N_{st}} p_{it} y_{it}$. While we assume imperfect substitutes among different products, SNA assumes perfect substitutes among them after controlling for the quality represented by the price.

Similarly, let $\overline{H_{st}^{C_t}}$ denote the hypothetical average TFP that would be achieved without any distortions on survivors. Then, from Eq. (A10),

$$\overline{H_{st}^{C_{st}}} = \left(\frac{1}{N_{st}^{C_{st}}}\right)^{\frac{1}{\eta_s - 1}} \left[\sum_{i \in C_{st}} A_{it}^{\eta_s - 1}\right]^{\frac{1}{\eta_s - 1}}. \qquad (A12)$$

Here, $N_{st}^{C_{st}}$ denotes the number of survivors.

4. Economy-wide Aggregation

A representative firm produces final goods Y in a competitive market by combining the sectoral goods using a Cobb-Douglas production technology:

$$Y_t = \prod_s Y_{st}^{\theta_{st}}, \qquad where \sum_s \theta_{st} = 1. \qquad (A13)$$

Then, the change in aggregate productivity can be represented by the weighted average of the sector-level change in productivities:

$$ln\left(\frac{A_{t+1}}{A_t}\right) = \sum_s \theta_{st} ln\left(\frac{A_{st+1}}{A_{st}}\right), \qquad (A14)$$

where θ_{st} can be represented by $\theta_{st} = \frac{P_{st}Y_{st}}{P_t Y_t}$.

Proof of Equation (A14) is as follows. To derive (A14), we consider the continuous time model. The sectoral output can be represented by

$$Y_s = A_s {K_s}^{\alpha_s} {L_s}^{1-\alpha_s}. \tag{A15}$$

Substituting (A15) into (A13) yields

$$Y = \prod_s \left(A_s {K_s}^{\alpha_s} {L_s}^{1-\alpha_s}\right)^{\theta_s}. \tag{A16}$$

By definition,

$$ln(A) = dln(Y) - \varepsilon_L dln(L) - \varepsilon_K dln(K), \tag{A17}$$

where $\varepsilon_L = \frac{dln(Y)}{dln(L)}$ and $\varepsilon_K = \frac{dln(Y)}{dln(K)}$.

Using (A13) and (A15), we obtain

$$\varepsilon_L = \sum_s \frac{\partial \ln(Y)}{\partial \ln(Y_s)} \frac{\partial \ln(Y_s)}{\partial \ln(L_s)} \frac{\partial \ln(L_s)}{\partial \ln(L)} = \sum_s \theta_s (1-\alpha_s) \frac{\partial \ln(L_s)}{\partial \ln(L)} . \tag{A18}$$

Similarly,

$$\varepsilon_K = \sum_s \theta_s \alpha_s \frac{\partial \ln(K_s)}{\partial \ln(K)}. \tag{A19}$$

Substituting (A18) and (A19) into (A17), we obtain

$$\mathrm{d}ln(A) = dln(Y) - \sum_s \theta_s (1-\alpha_s) \frac{\partial \ln(L_s)}{\partial \ln(L)} \, dln(L)$$

$$-\sum_{s}\theta_s\alpha_s\frac{\partial\ln(K_s)}{\partial\ln(K)}dln(K). \text{(A20)}$$

Meanwhile from (A16),

$$dln(Y)=\sum_{s}\theta_s dln(A_s)+\sum_{s}\theta_s(1-\alpha_s)\,dln(L_s)+\sum_{s}\theta_s\alpha_s\,dln(K_s)$$

$$=\sum_{s}\theta_s dln(A_s)+\sum_{s}\theta_s(1-\alpha_s)\frac{\partial\ln(L_s)}{\partial\ln(L)}dln(L)$$

$$+\sum_{s}\theta_s\alpha_s\frac{\partial\ln(K_s)}{\partial\ln(K)}dln(K). \quad (A21)$$

Substituting (A21) into (A20), we obtain

$$\mathrm{d}ln(A)=\sum_{s}\theta_s dln(A_s). \qquad (A22)$$

The discrete time version of (A22) leads to (A14). From the final goods producer maximization, we obtain $\theta_{st}=\frac{P_{st}Y_{st}}{P_tY_t}$.

Data from the CM

We basically follow Hosono and Takizawa (2015) to construct the data for output and factor inputs at the establishment level. Gross output is measured as the sum of shipments, revenues from repairing and fixing services, and revenues from performing subcontracted work. Gross output is deflated by the output deflator taken from the Japan Industrial Productivity (JIP) Database 2015 and converted to values in constant prices of 2000.

Intermediate input is defined as the sum of raw materials, fuel, electricity and subcontracting expenses for consigned production used by the establishment. Using the intermediate goods deflator taken from the JIP Database, intermediate input is converted to values in constant prices of 2000. Value Added is defined as the difference between gross output and intermediate input.

Capital input is measured as real capital stock, defined as follows:

Capital Input (K_{sit}) = Nominal book value of tangible fixed assets from the Census of Manufactures × Book-to-market value ratio for each industry (γ_{st}).

The book-to-market value ratio for each industry (γ_{st}) is calculated using the industry-level data of real capital stock (K_{st}^{JIP}) taken from the JIP Database as follows:

$$Y_{st}^{JIP}/K_{st}^{JIP} = \sum_{i \in s} Y_{sit}^{CM} / \left(\sum_{i \in s} BVK_{sit}^{CM} \times \gamma_{st}\right).$$

$\sum_{i \in s} Y_{sit}^{CM}$ is the sum of establishments' value added (i is the index of an establishment), and $\sum_{i \in s} BVK_{sit}^{CM}$ is the sum of the nominal book value of tangible fixed assets of industry s in the Census of Manufactures.

Labor input is the number of employees.

<u>Data from the BSBSJA</u>

We follow Hosono et. al (2016) to construct the data for output and factor inputs using BSBSJA. We first use each firm's total sales as the nominal gross output. As for wholesale and retail industries, the nominal gross output is measured as each firm's total sales minus total purchases of goods. Then, this nominal gross output is deflated by the output deflator taken from the JIP Database to convert it into values in constant prices (i.e., real gross output) based on the year 2000.

The nominal intermediate input is defined as the sum of the cost of sales and selling, and the general and administrative expenses, less wages, and depreciation. Using the intermediate deflator in the JIP database, this nominal intermediate input is converted into values in constant prices (i.e., real intermediate input) for the year 2000. The real value added is defined as the difference between the real gross output and the real intermediate input.

The data for capital stock is constructed as follows.

Capital Input (K_{sit}) = Nominal book value of tangible fixed assets from the BSBSJA × Book-to-market value ratio for each industry (α_{st}). We calculate the book-to-market value ratio for each industry (α_{st}) by using the data of real capital stock (K_{st}^{JIP}) and real value added (Y_{st}^{JIP}) at each data point taken from the JIP database as follows:

$$Y_{st}^{JIP} / K_{st}^{JIP} = \sum_i Y_{sit}^{\text{BSJBSA}} \Big/ \left(\sum_i BVK_{sit}^{\text{BSJBSA}} * \alpha_{st} \right)$$

where $\sum_i Y_{sit}^{\text{BSJBSA}}$ is the sum of the firms' value added (i is the index of a firm), and $\sum_i BVK_{sit}^{\text{BSJBSA}}$ is the sum of the nominal book value of tangible fixed assets of industry s in BSJBSA.

As a labor input, we use each firm's total number of workers.

FHK's decomposition

Let producer *i*''s log of productivity and share at period *t* denote a_{it} and s_{it}, respectively, and A_t denote the set of all producers that are active in period *t*. Then, log of aggregate productivity a_t is defined as

$$a_t = \sum_{i \in A_t} s_{it}\, a_{it}$$

Let S_t denote the set of producers that survive from period *t-1* and *t*, E_t that enter in period *t*, and X_t that exit in period *t*. Then, FHK's decomposition is as follows:

$$\triangle a_t = \sum_{i \in S_t} s_{it-1} \triangle a_{it} + \sum_{i \in S_t} \Delta s_{it}(a_{it-1} - a_{t-1}) + \sum_{i \in S_t} \Delta s_{it} \triangle a_{it} + \sum_{i \in E_t} s_{it}(a_{it} - a_{t-1}) - \sum_{i \in X_t} s_{it-1}(a_{it-1} - a_{t-1})$$

The first term represents the fixed share-weight average of productivity changes among surviving producers (within effect). The second term represents the fixed productivity-weighted sum of the change in shares among surviving producers (between-effect) while the third term represents the covariance effect. These two terms together represent the reallocation effect. The fourth and fifth terms represent the share-weighted average of entering producers' productivity (entry effect) and the share-weighted average of the exiting producers' productivity (exit effect), respectively.

Dynamic Olley-Pakes Decomposition

The definition of aggregate productivity for the dynamic Olley-Pakes decomposition (DOPD), a_t, is the same as that of FHK:

$$a_t = \sum_{i \in A_t} s_{it}\, a_{it}.$$

Let S_t denote the set of producers that survive from period *t-1* and *t*, E_t that enter in period *t*, and X_t that exit in period *t*. Then, DOPD is as follows:

$$\Delta a_t = (a_{St} - a_{St-1}) + s_{Et}(a_{Et} - a_{St}) + s_{Xt-1}(a_{st-1} - a_{Xt-1})$$

$$= \triangle\, \bar{a}_{st} + \triangle\, cov_{st} + s_{Et}(a_{Et} - a_{St}) + s_{Xt-1}(a_{st-1} - a_{Xt-1}).$$

The first line decomposes the change in aggregate productivity into the three groups (surviving, entering and exiting producers). Here, a_{Gt} is group *G*'s aggregate productivity, $a_{Gt} = \sum_{i \in G_t}(s_{it}/s_{Gt})\, a_{it}$ and $s_{Gt} = \sum_{i \in G_t} s_{it}$ is the aggregate market share of a group *G* of producers.

In the second line, the first term $\triangle\, \bar{a}_{st}$ represents the unweighted mean change in the productivity of surviving producers (within effect), and the second term $\triangle\, cov_{st}$ represents the covariance change between market share and productivity for surviving producers (reallocation effect), where the covariance is defined by $cov_{st} = \sum_{i \in S_t} (s_{it} - \bar{s}_{st})\,(a_{it} - \bar{a}_{St})$. Here, $\bar{s}_{st} = \frac{1}{n_{St}}$ is the mean market share of surviving producers, that is, the inverse of the number of surviving producers, n_{St}, and $\bar{a}_{St} = (\frac{1}{n_{St}}) \sum_{i \in S_t} a_{it}$ is the unweighted mean of surviving producers' productivity. The third and fourth terms in the second line represent the contributions of entering and exiting producers, respectively, which depend on the aggregate productivity of entering and exiting producers relative to the period t's and t-1's surviving producers' aggregate productivity (a_{St} and a_{st-1}), respectively.

Results from manufacturing firms in the BSJBSA

We show the results from the manufacturing firms that are contained in the BSJBSA. Table A1 presents the averages of the decomposition for the same sub-periods shown in Table 5. The results from manufacturing firms are qualitatively similar to those from all firms in the BSJBSA, although the TFP growth and the TE for survivors tended to be larger while the AE for survivors and the variety effect tended to be lower than the results from all firms. Interestingly, the AE for 1995-2000 was negative and sizable (-6.5%) while the AE for 1996-2000 from the CM was zero. Because the BSJBSA cover relatively large firms, these results may suggest that misallocation was severe among such firms. The exit effect was also negative and large.

Results from non-manufacturing firms in the BSJBSA

We show the results from the non-manufacturing firms that are contained in the BSJBSA. Table A2 presents the averages of the decomposition for the same sub-periods shown in Table 5. The results from non-manufacturing firms are qualitatively similar to those from all firms, although the TFP growth and the TE for survivors tended to be smaller while the AE for survivors and the variety effect tended to be larger than the results from all firms. The AE for survivors in the banking crisis period is slightly negative (-0.1%).

Different Elasticity of Substitution across Sectors

We show the results from applying a different elasticity of substitution to the three categories of the goods based on Rauch's (1999) classification. Specifically, we reclassify the JIP industry classifications to Rauch's three goods categories: commodity goods, reference-priced goods, and differentiated goods, and set η_s to 3.5, 2.9, and 2.1 for each category. These values are taken from the median value of each category for 1990-2001 estimated by Broda and Weinstein (2006). They estimate elasticities of substitution among goods using the U.S. trade data: the Tariff System of the U.S.A. (TSUSA) seven-digit for 1972-1988, and the Harmonized Tariff System (HTS) ten-digit for 1990-2001. Using their estimates, we implicitly assume that elasticities of substitution among goods produced in Japan are the same as those among U.S. imports. See Table A3 for the correspondence between the JIP industry classification and Rauch's classification.

Table A4 shows the averages of the decomposition of the year-on-year changes in aggregate TFP for the same sub-periods as in Table 2. It shows that the movement of each component is similar to the baseline result.

<u>Measurement Error</u>

Using the data from the CM, we run the following regression that is similar to David and Venkateswaren (2019) and Bai, Jin and Lu (2019):

$$\Delta VA_{it} = \Phi \log(TFPR_{it}) + \Psi \Delta I_{it} - \Psi(1-\lambda) \log(TFPR_{it}) \Delta I_{it} + D_{st} + \zeta_{it}$$

where ΔVA_{it} denotes the rate of changes in value added, ΔI_{it} the rate of changes in aggregate input, $I_{it} = {K_{it}}^{\alpha_s} {L_{it}}^{1-\alpha_s}$, and D_{st} the industry-year fixed effects. Bils, Klenow, and Ruane (2020) show that, under certain assumptions, λ is the ratio of the true dispersion in $\log(TFPR_{it})$ to its measured counterpart. The OLS estimation yields $\lambda = 0.90$.

Multi-plant firms

Denoting the variance in the logarithm of TFPR across multi-plant firms and standalone plants by $V(tfpr_m)$ and $V(tfpr_s)$, respectively, and the change in the sales share of the multi-plant firms by Δw_m, the change of variance in the logarithm of TFPR due to the change in the share of multi-plant firms is

$$\Delta V(tfpr) = \Delta w_m \times [V(tfpr_m) - V(tfpr_s)]$$

, which leads to a decrease in the measured allocative efficiency by $\frac{\eta_s}{2}\Delta V(tfpr)$ under the assumption of joint normal distribution of *tfpq* and *tfpr*.[4]

Table A5 in Appendix shows the 5-year period average of $\frac{\eta_s}{2}\Delta V(tfpr)$ under the assumption of $\eta_s = 3$ for all industries.[5]

[4] This equation is similar to the second equation in page 29 of Kehrig and Vincent (2019).

[5] Because data for the number of plants that a firm has are available up to 2010, we calculate $\frac{\eta_s}{2}\Delta V(tfpr)$ up to 2010.

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TABLE A1

Decomposition of aggregate TFP growth of manufacturing firms in BSJBSA

Period	(1) TFP	(2) TE for survivors	(3) AE for survivors	(4) Entry effect	(5) TE for entrants	(6) AE for entrants	(7) Exit effect	(8) TE for exitors	(9) AE for exitors	(10) Variety effect	(11) (Net entry effect)
1995-2000	2.9%	8.2%	-6.9%	6.0%	-3.3%	9.3%	-4.5%	2.9%	-7.3%	0.1%	1.6%
2001-2005	14.8%	26.4%	0.1%	1.1%	-1.9%	3.0%	-12.6%	-9.5%	-3.0%	-0.3%	-11.4%
2006-2010	5.0%	12.6%	2.0%	7.4%	3.8%	3.6%	-17.0%	-13.2%	-3.8%	-0.1%	-9.6%
2011-2015	2.0%	14.0%	-0.9%	4.9%	2.0%	2.9%	-15.6%	-12.6%	-3.0%	-0.3%	-10.7%
1995-2015	6.0%	14.9%	-1.7%	4.9%	0.0%	4.9%	-12.0%	-7.6%	-4.4%	-0.1%	-7.1%

TABLE A2

Decomposition of aggregate TFP growth of non-manufacturing firms in BSJBSA

Period	(1) TFP	(2) TE for survivors	(3) AE for survivors	(4) Entry effect	(5) TE for entrants	(6) AE for entrants	(7) Exit effect	(8) TE for exitors	(9) AE for exitors	(10) Variety effect	(11) (Net entry effect)
1995-2000	3.2%	3.8%	-0.1%	-0.5%	-8.0%	7.5%	-1.5%	1.3%	-2.8%	1.4%	-2.0%
2001-2005	5.3%	7.1%	8.4%	5.2%	1.6%	3.6%	-15.8%	-3.6%	-12.2%	0.4%	-10.6%
2006-2010	5.3%	-0.8%	4.7%	8.8%	3.8%	5.0%	-8.4%	-3.0%	-5.4%	0.9%	0.4%
2011-2015	1.4%	3.8%	0.6%	6.9%	1.6%	5.3%	-10.2%	-4.0%	-6.2%	0.4%	-3.4%
1995-2015	3.8%	3.5%	3.2%	4.8%	-0.6%	5.4%	-8.6%	-2.2%	-6.5%	0.8%	-3.8%

TABLE A3

The JIP industry classification and Rauch's classification

JIP Classification No.	Industry	Rauch Classification
8	Livestock products	Ref.
9	Seafood products	Dif.
10	Flour and grain mill products	Homo.
11	Miscellaneous foods and related products	Dif.
12	Prepared animal foods and organic fertilizers	Homo.
13	Beverages	Dif.
14	Tobacco	Ref.
15	Textile products	Dif.
16	Lumber and wood products	Ref.
17	Furniture and fixtures	Dif.
18	Pulp, paper, and coated and glazed paper	Dif.
19	Paper products	Dif.
20	Printing, plate making for printing and bookbinding	Dif.
21	Leather and leather products	Dif.
22	Rubber products	Homo.
23	Chemical fertilizers	Homo.
24	Basic inorganic chemicals	Dif.
25	Basic organic chemicals	Dif.
26	Organic chemicals	Dif.
27	Chemical fibers	Dif.
28	Miscellaneous chemical products	Dif.
29	Pharmaceutical products	Dif.
30	Petroleum products	Homo.
31	Coal products	Homo.
32	Glass and its products	Dif.
33	Cement and its products	Homo.
34	Pottery	Dif.
35	Miscellaneous ceramic, stone and clay products	Dif.
36	Pig iron and crude steel	Homo.
37	Miscellaneous iron and steel	Dif.
38	Smelting and refining of non-ferrous metals	Ref.
39	Non-ferrous metal products	Dif.
40	Fabricated constructional and architectural metal produc	Dif.
41	Miscellaneous fabricated metal products	Dif.
42	General industry machinery	Dif.
43	Special industry machinery	Dif.
44	Miscellaneous machinery	Dif.
45	Office and service industry machines	Dif.
46	Electrical generating, transmission, distribution and indus	Dif.
47	Household electric appliances	Dif.
48	Electronic data processing machines, digital and analog c	Dif.
49	Communication equipment	Dif.
50	Electronic equipment and electric measuring instruments	Dif.
51	Semiconductor devices and integrated circuits	Dif.
52	Electronic parts	Dif.
53	Miscellaneous electrical machinery equipment	Dif.
54	Motor vehicles	Dif.
55	Motor vehicle parts and accessories	Dif.
56	Other transportation equipment	Dif.
57	Precision machinery & equipment	Dif.
58	Plastic products	Dif.
59	Miscellaneous manufacturing industries	Dif.

Note. Homo., Ref., and Dif. denote commodity goods, reference-priced goods, and differentiated goods, respectively.

TABLE A4

Sub-period averages of aggregate TFP growth and its components: Different demand elasticity based on Rauch classification of goods

Period	(1) TFP	(2) TE for survivors	(3) AE for survivors	(4) Entry effect	(5) TE for entrants	(6) AE for entrants	(7) Exit effect	(8) TE for exitors	(9) AE for exitors	(10) Variety effect	(11) (Net entry effect)
1987-1990	-1.0%	-2.0%	0.0%	11.0%	5.5%	5.5%	-10.6%	-5.6%	-5.0%	0.6%	0.4%
1991-1995	0.6%	-0.3%	1.0%	5.1%	2.5%	2.6%	-4.8%	-1.6%	-3.2%	-0.5%	0.3%
1996-2000	2.7%	3.8%	0.4%	6.2%	3.5%	2.7%	-6.7%	-3.7%	-3.0%	-1.0%	-0.5%
2001-2005	8.3%	16.9%	0.3%	4.8%	2.7%	2.1%	-12.4%	-8.1%	-4.3%	-1.2%	-7.6%
2006-2010	-0.7%	-1.2%	1.6%	11.0%	8.1%	3.0%	-11.5%	-9.3%	-2.2%	-0.6%	-0.5%
2011-2014	5.3%	20.6%	-3.0%	11.6%	9.5%	2.0%	-22.0%	-19.8%	-2.2%	-1.8%	-10.5%
1987-2014	2.6%	6.1%	0.2%	8.1%	5.1%	2.9%	-11.0%	-7.7%	-3.3%	-0.8%	-2.9%

Note. $\eta = 3.5$ for commodity goods, $\eta = 2.9$ for reference-priced goods, and $\eta = 2.1$ for differentiated goods.

TABLE A5

5-year period average of $\frac{\eta_s}{2}\Delta V(tfpr)$ under the assumption of $\eta_s = 3$

	(η s/2) Δ V(tfpr)
1987-1990	0.08%
1991-1995	0.01%
1996-2000	-0.03%
2001-2005	0.05%
2006-2010	0.07%

FIGURE A1

Year-on-year changes in aggregate TFP and its components: Baseline DHKD results

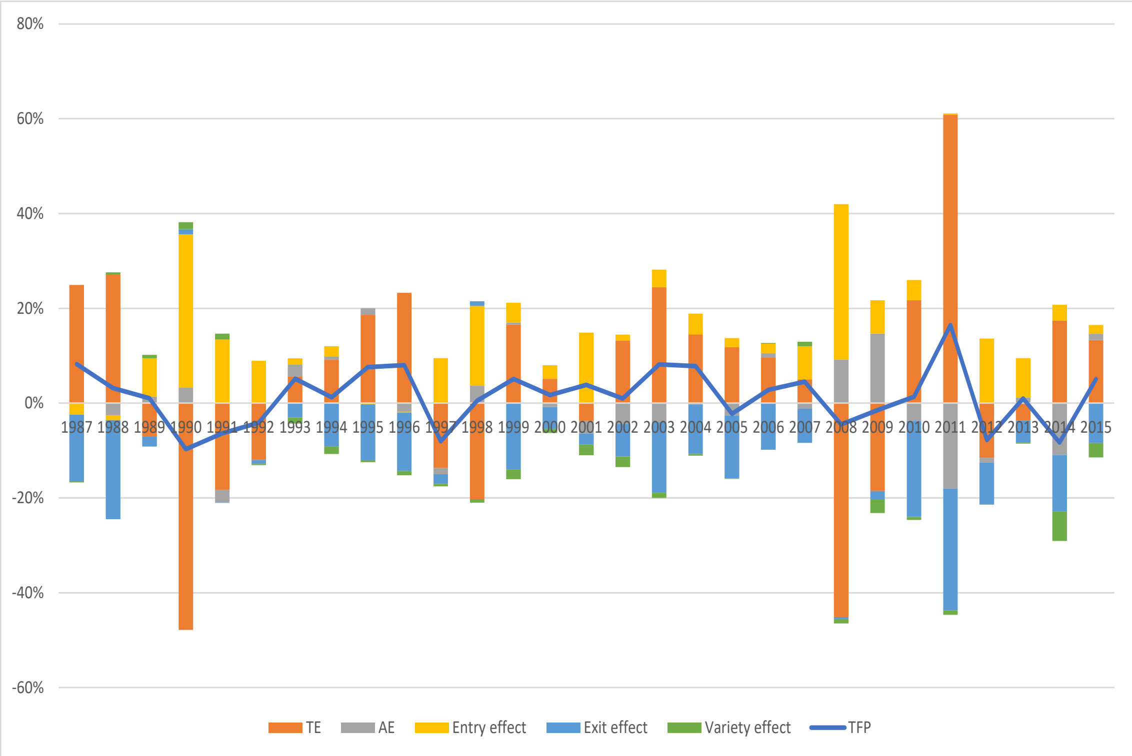
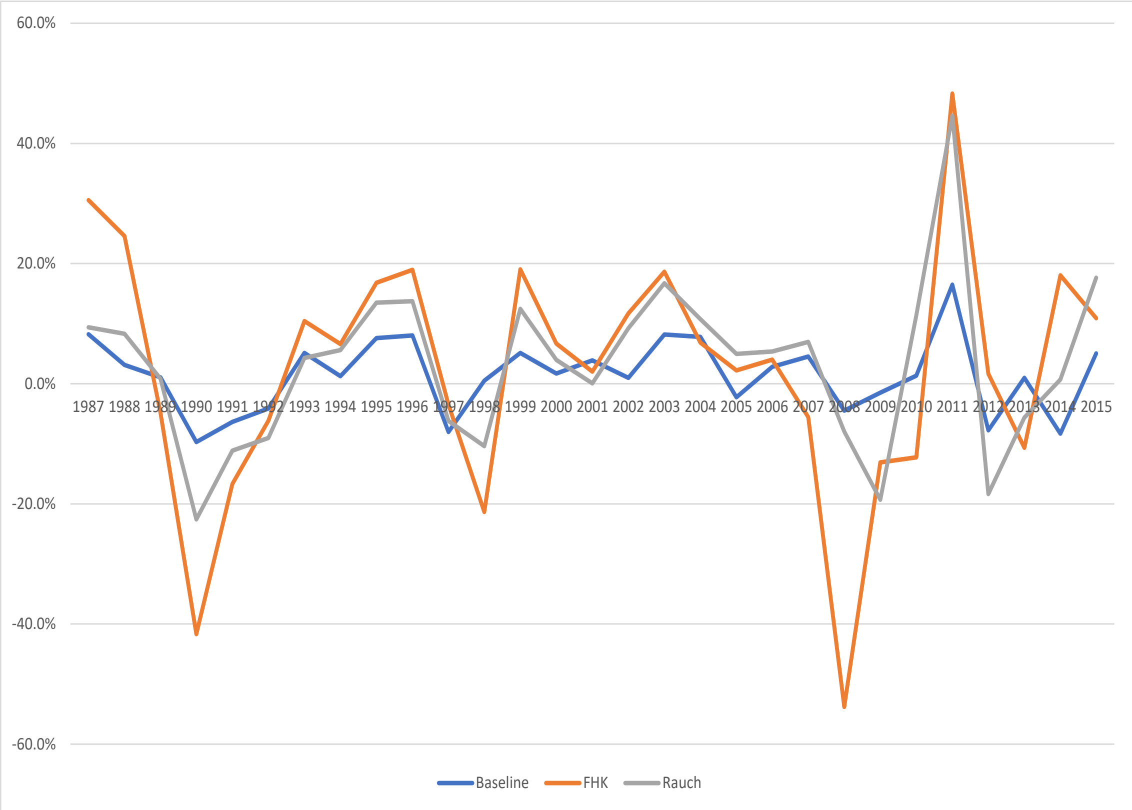


FIGURE A2

Aggregate TFP growth of manufacturing establishments: Alternative aggregation methods



Note. Baseline denotes our baseline DHKD result with $\eta = 3$. Rauch denotes the DHKD result for three sectors each with different η. FHK denotes Foster, Haltiwanger, and Krizan (2001)'s method.

FIGURE A3

FHK decomposition of reallocation effect into within and covariance effects