Intangibles, markups, and the measurement of productivity growth

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Question

Since late 90’s, measured TFP growth has declined

The decline in TFP growth

	1947-1996	1997-2018	Change
GDP growth (p.p.)	3.62	2.68	-0.93
TFP growth $\widehat{dZ/Z}$ (p.p.)	1.36	0.86	-0.50

Fernald (2014)

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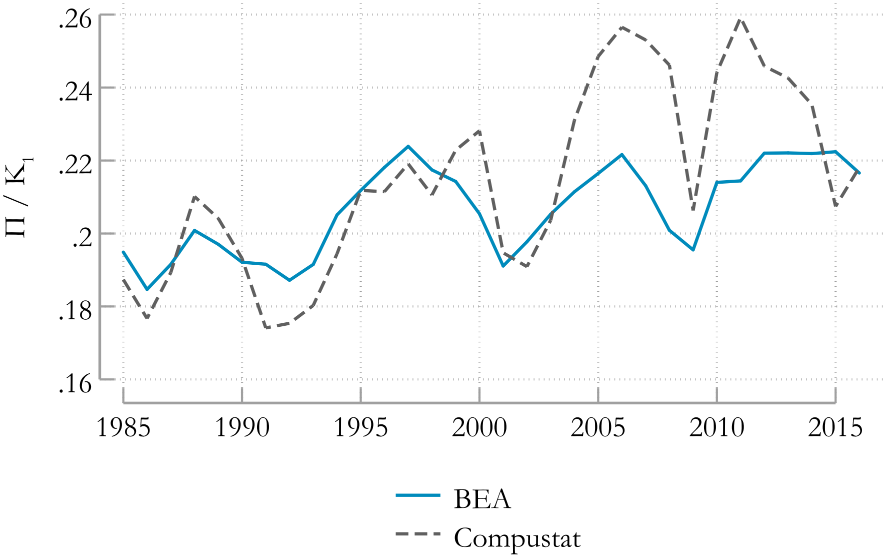
Rising profits



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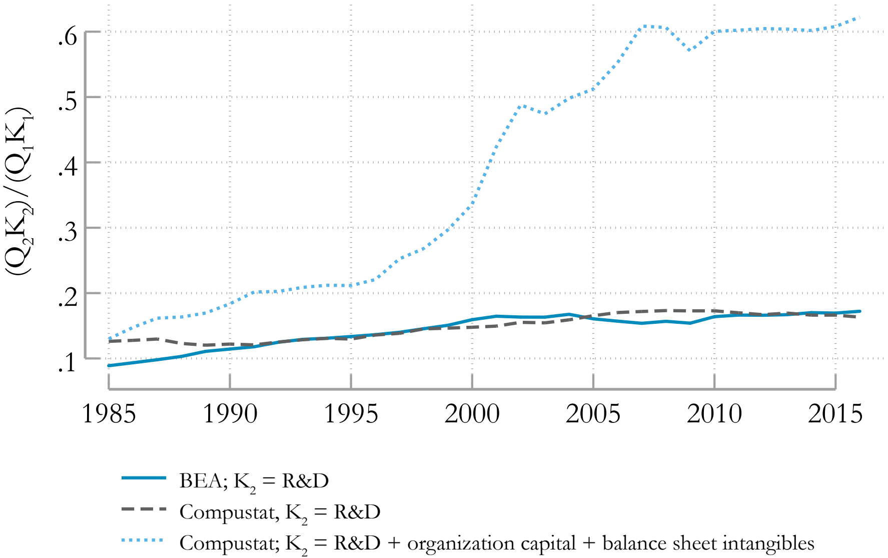
The growing importance of intangible capital



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- ... by affecting its <u>measurement</u>?
- $\neq$ declining pace of innovation (Gordon, 2017)

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Related literature

1. Measurement of productivity growth:
   - Solow (1957), Jorgenson and Griliches (1968), Basu and Fernald (2001), **Corrado et al. (2009), Cette et al. (2016), Byrne et al. (2017), Fernald et al. (2017)**

   This paper : bias in input shares and capital growth; organization capital

2. Investment-specific technical change:
   - Greenwood et al. (1997), Greenwood et al. (1998), Basu et al. (2013), **Gourio and Rognlie (2020)**

   This paper : markups+intan $\rightarrow$ overestimate contrib. of g_Q to growth

3. Macroeconomic implications of rising rents and rising intangibles:
   - Gutiérrez and Philippon (2017,2018); Farhi and Gourio (2018); Barkai (2020); De Loecker et al. (2020); Crouzet and Eberly (2020); **Edmond, Midrigan and Xu (2020)**

   This paper : aggregate technical change, not allocative efficiency

1. Theory

The simple Solow residual approach

$$\widehat{\frac{dZ}{Z}} = \widehat{\frac{dY}{Y}} - (1-\hat{s}_L)\widehat{\frac{dK}{K}} - \hat{s}_L\widehat{\frac{dL}{L}}$$

<u>A1 :</u> Constant returns to scale in production $\qquad \frac{dZ}{Z} = \frac{dY}{Y} - (1-\epsilon_L)\frac{dK}{K} - \epsilon_L\frac{dL}{L}$

<u>A2 :</u> Variable cost minimization $\qquad \epsilon_L = \frac{WL}{MCY}$

<u>A3 :</u> Price $=$ Marginal cost $\qquad \hat{s}_L = \frac{WL}{PY} = \frac{WL}{MCY} = \epsilon_L$

<u>A4 :</u> $\widehat{dX/X} = dX/X \qquad \widehat{\frac{dZ}{Z}} = \frac{dZ}{Z}$

Measurement bias from markups

$$\cancel{A3}: \quad P = \mu MC, \quad \mu > 1$$

Result 1 :

$$\frac{\widehat{dZ}}{Z} - \frac{dZ}{Z} = \hat{s}_L (1 - \mu) \left(\frac{dK}{K} - \frac{dL}{L} \right) < 0$$

$\hat{s}_L$ under-estimates ϵ_L:

$$\hat{s}_L = \mu^{-1} \epsilon_L < \epsilon_L$$

Basu and Fernald (2002), Fernald and Neiman (2011)

Measurement bias from markups

		1947-1996	1997-2018	Change
$\hat{s}_L$		0.68	0.62	-0.04
$\widehat{dZ/Z} - dZ/Z$	$(\epsilon_L = 1.00)$	-0.73	-0.84	-0.11
$\widehat{dZ/Z} - dZ/Z$	$(\epsilon_L = 0.68)$	0.00	-0.09	-0.09

9bps, vs. 50bps observed decline in $\widehat{dZ/Z}$.

Measurement bias from intangibles

$$\cancel{A4}: \quad \widehat{K} \neq K$$

$$\widehat{P}\widehat{Y} = PY - B$$

Some capital is omitted from the measured stock $\hat{K}$

The corresponding investment B is treated as intermediate purchases in GDP

Measurement bias from intangibles

$\cancel{A4} \implies$ Capital growth might be mismeasured:

$$\frac{\widehat{dK}}{K} \gtrless \frac{dK}{K}$$

Measurement bias from intangibles

$\cancel{A4} \implies$ GDP growth might be mismeasured:

$$\frac{\widehat{dY}}{Y} = \frac{dY}{Y} + \left(\frac{1}{b} - 1\right)\left(\frac{dY}{Y} - \frac{d\tilde{B}}{\tilde{B}}\right) \qquad \tilde{B} \equiv \left(\frac{B}{P}\right)\left(\frac{P}{\hat{P}}\right)^{\frac{b}{1-b}}$$

$$b = \frac{\hat{P}\hat{Y}}{PY} \leq 1$$

Measurement bias from intangibles

$\cancel{A4} \implies \hat{s}_L$ over-estimates ϵ_L:

$$\hat{s}_L = \frac{WL}{\hat{P}\hat{Y}} = \frac{WL}{PY}\frac{PY}{\hat{P}\hat{Y}} = \frac{\epsilon_L}{b} > \epsilon_L$$

Measurement bias from intangibles

Result 2:

$$\frac{\widehat{dZ}}{Z} - \frac{dZ}{Z} \equiv \Delta = \Delta^{(1)} + \Delta^{(2)} + \Delta^{(3)}$$

$$\Delta^{(1)} = \left(\frac{1}{b} - 1\right)\left(\frac{dY}{Y} - \frac{d\tilde{B}}{\tilde{B}}\right) \qquad \text{(GDP growth bias)} \quad \gtrless 0$$

$$\Delta^{(2)} = \hat{s}_L \left(1 - b\right)\left(\frac{\widehat{dK}}{K} - \frac{dL}{L}\right) \qquad \text{(labor share bias)} \quad > 0$$

$$\Delta^{(3)} = \left(1 - \epsilon_L\right)\left(\frac{dK}{K} - \frac{\widehat{dK}}{K}\right) \qquad \text{(capital growth bias)} \quad \gtrless 0$$

But : $\hat{s}_L = \frac{\epsilon_L}{b}$ should be high/growing

Measurement bias from intangibles+markups

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And : $\hat{s}_L = \frac{\epsilon_L}{b\mu}$ could be low/falling

A model to help with the measurement

$$
\begin{aligned}
U &= \int_0^{+\infty} e^{-\rho t} \frac{C_t^{1-\sigma}}{1-\sigma} dt \\
Y_t &= Z_t K_t^{\alpha} L_t^{1-\alpha}, \quad \frac{dL_t}{L_t} = g_L dt, \quad \frac{dZ_t}{Z_t} = g_Z dt
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A1 , A2 , ~~A4~~, ~~A3~~

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$$Y_t, \quad Q_{2,t}I_{2,t}, \quad \hat{Y}_t = Y_t - Q_{2,t}I_{2,t} \quad \text{all grow at same rate on the BGP}$$

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3. $\Delta^{(3)}$ = labor share bias still has an ambiguous sign ...

   ... but (generally) negative when $g_{Q_2} > g_{Q_1}$, $b < 1$, and $\mu > 1$

Derivations

2. Data

Methodology

Given estimates of $\hat{b}$ and $\hat{g}_{Q_2}$, and $\{\hat{g}, \hat{g}_K, \hat{g}_L, \hat{s}_L\}$, construct:

$$
\begin{aligned}
\eta &= \frac{1-\hat{b}}{\hat{b}\hat{s}_L}\frac{1-\alpha}{\alpha}\frac{\hat{r}+\delta_2-\hat{g}_{Q_2}}{\hat{g}+\delta_2-\hat{g}_{Q_2}} \\
g_Z &= \hat{g}-(1-\alpha)\hat{g}_L-\alpha\hat{g}_K+\alpha\eta(\hat{g}_{Q_2}-(\hat{g}-\hat{g}_K)) \qquad \text{[adjusted Solow residual]} \\
\mu &= \frac{1-\alpha}{\hat{b}\hat{s}_L}
\end{aligned}
$$

Data

Data on $\hat{b}$

Commodity Use tables, 1997-2018: 61 different commodities and services.

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61 deflators from GDP-by-industry tables, 1997-2018 (minus PCE deflator).

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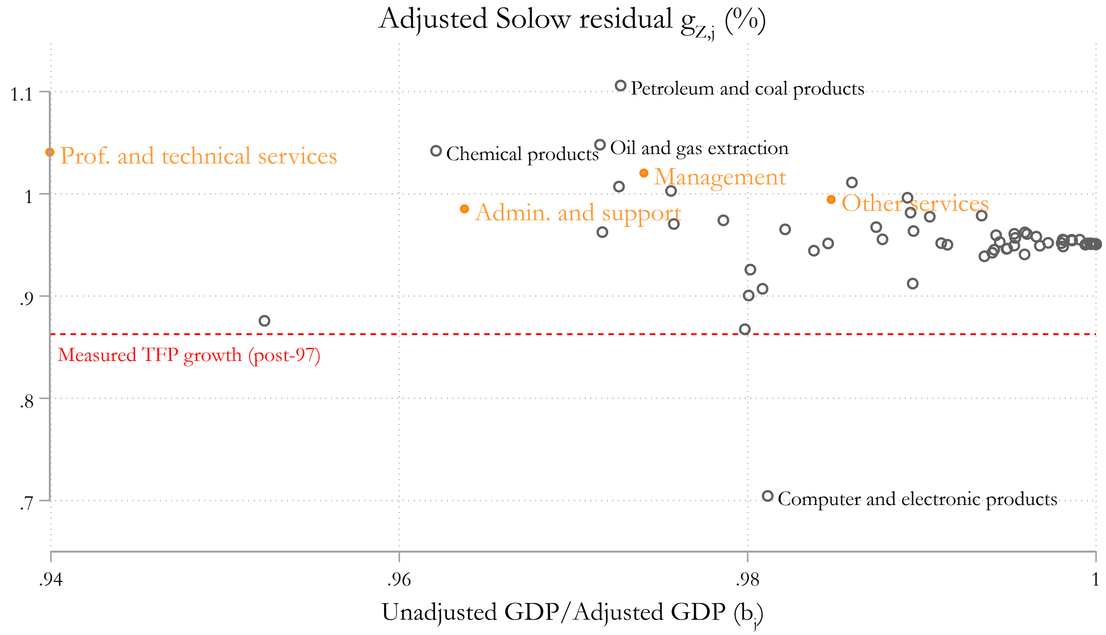
need commodity/service $\leftrightarrow$ industry

10 largest GDP adjustments $\hat{b}_j$

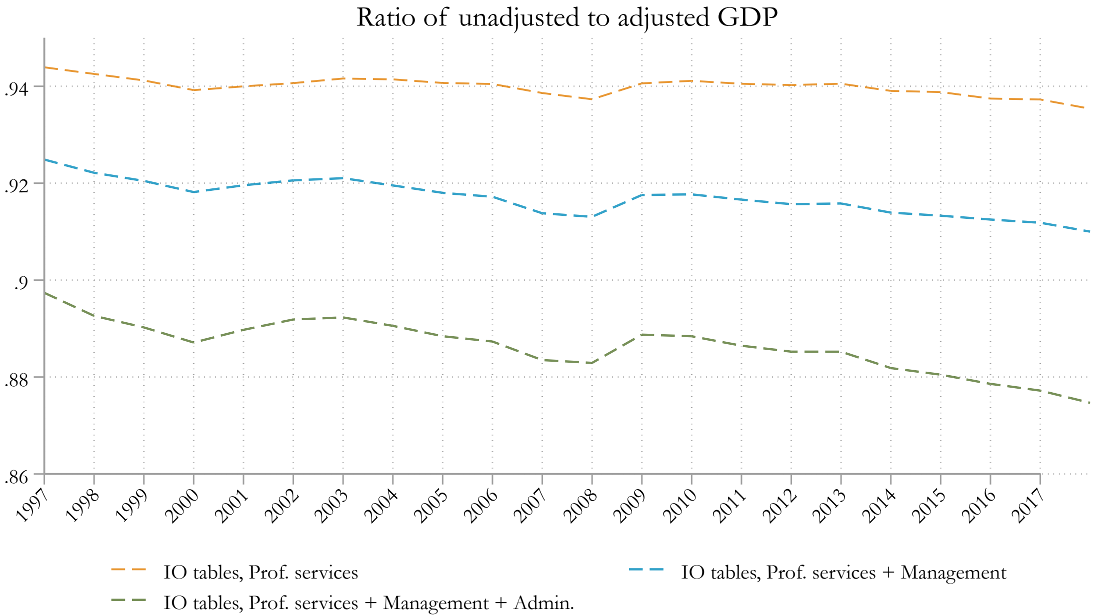
	$\hat{b}_j$	$\hat{g}_{Q_2,j}$ (%)
Services		
Professional, scientific, and technical services	0.940	0.49
Other real estate	0.952	-1.85
Administrative and support services	0.964	0.10
Insurance carriers and related activities	0.972	-0.31
Credit intermediation and related activities	0.973	0.96
Management of companies and enterprises	0.974	1.44
Commodities		
Chemical products	0.962	1.21
Oil and gas extraction	0.972	1.99
Petroleum and coal products	0.973	3.68
Food and beverage and tobacco products	0.976	1.02

Investment in organization capital, misclassified as intermediates?


Adjusted Solow residual $g_{Z,j}$ (%)
1.1
1
.9
.8
.7
Prof. and technical services
Chemical products
Petroleum and coal products
Oil and gas extraction
Management
Admin. and support
Other services
Measured TFP growth (post-97)
Computer and electronic products
.94
.96
.98
1
Unadjusted GDP/Adjusted GDP (b_j)

Cumulative GDP adjustments for business service sector

	Average, 1997-2018	
Service groups	$\hat{b}$	$g_{Q_2}(\%)$
Prof. services	0.94	0.49
Prof. services + Manag.	0.92	0.68
Prof. services + Manag. + Admin.	0.89	0.55


Ratio of unadjusted to adjusted GDP
.94
.92
.9
.88
.86
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
IO tables, Prof. services
IO tables, Prof. services + Management
IO tables, Prof. services + Management + Admin.

Total adjustment to TFP growth

	$\hat{b}$	$\hat{g}_{Q_2}$ (%)	g_Z (%)	μ	η
1947-1996	0	0	1.36	1.00	0
1997-2018					
No adj., no markups	0	0	0.86	1.00	0
No adj., markups	0	0	0.95	1.06	0
Adj. for Prof. services	0.94	0.49	1.04	1.13	0.25
Adj. for Prof. services + Manag.	0.92	0.68	1.10	1.15	0.35
Adj. for Prof. services + Manag. + Admin.	0.89	0.55	1.14	1.19	0.50

Total adjustment to TFP growth

	$\hat{b}$	$\hat{g}_{Q_2}$ (%)	g_Z (%)	μ	η
1947-1996	0	0	1.36	1.00	0
1997-2018					
No adj., no markups	0	0	0.86	1.00	0
No adj., markups	0	0	0.95	1.06	0
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$\Delta g_Z = -22$bps (adjusted) vs. $\Delta g_Z = -50$bps (unadjusted)

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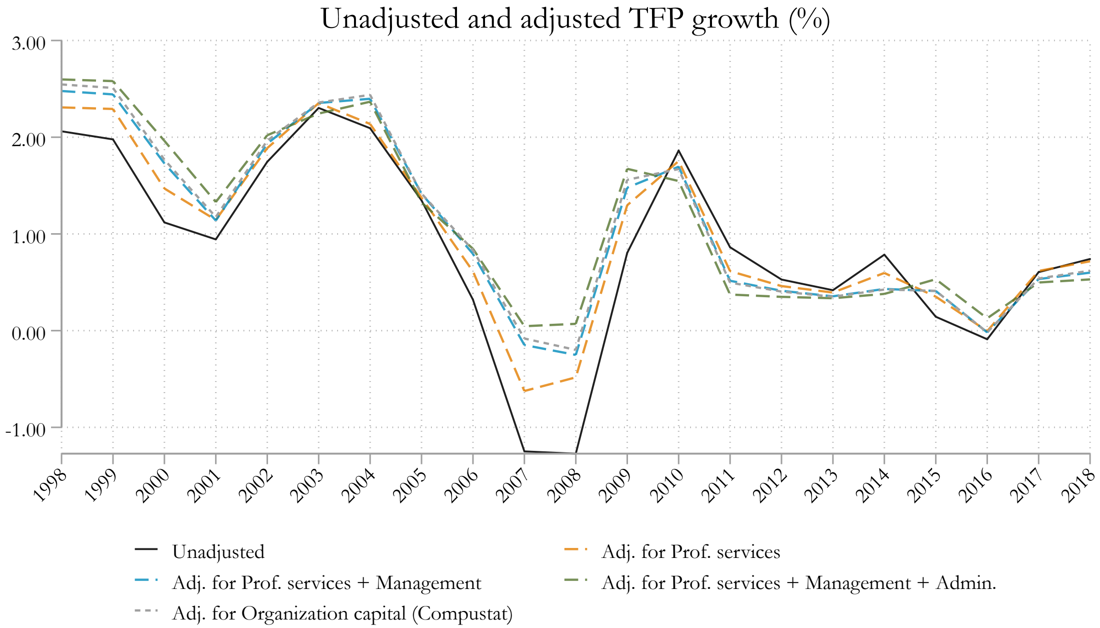
Upper bound on g_{Q_2}



Unadjusted and adjusted TFP growth (%)
3.00
2.00
1.00
0.00
-1.00
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Unadjusted
Adj. for Prof. services
Adj. for Prof. services + Management
Adj. for Prof. services + Management + Admin.
Adj. for Organization capital (Compustat)

Pre- vs. post-1997

Previous analysis assumes **no adjustments** needed before 1997. Reasonable?

Apply adjustments to 47-96, and compare to 97-18. Problems:

1. Expenditure data ($\hat{b}_j$) :
    - 47-96 service and commodity groups **coarser** than 97-18.
    - "Administrative and Waste Management Services" $\supset$ "Administrative and Support Services"
    - use higher 47-96 aggregation level $\rightarrow$ mechanically lower $\hat{b}_j$

2. Price data ($\hat{g}_{Q_2,j}$) :
    - no deflators in GDP-by-industry tables pre-97; no source for service prices
    - use post-97 values as baseline

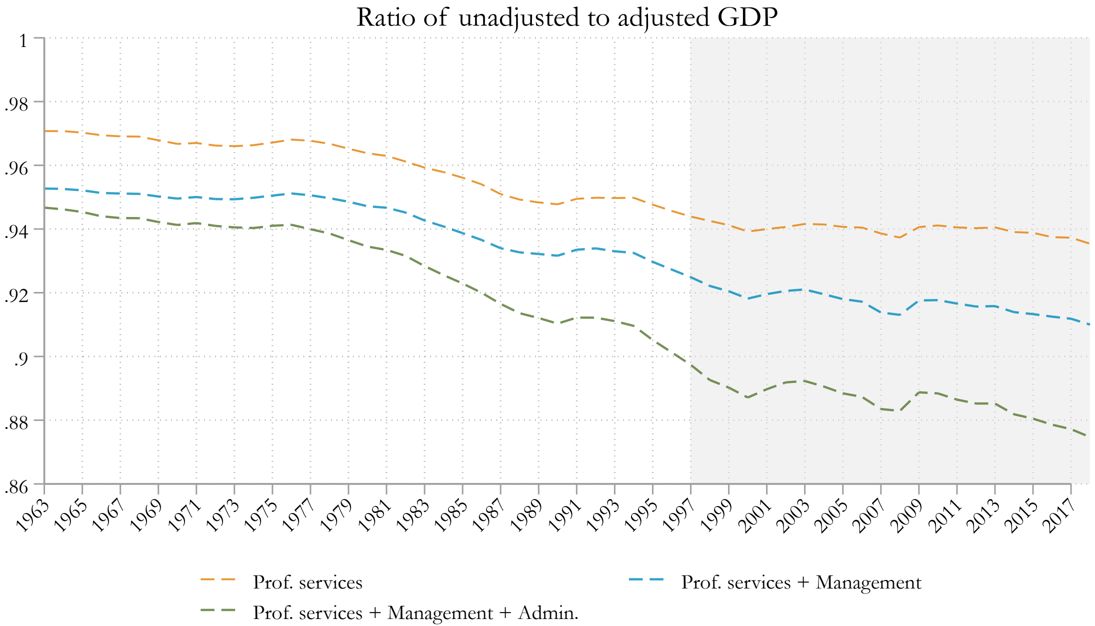
Pre vs. post-97: Cumulative GDP adjustment

	$\hat{b}$ (average)			
	1947-1996	**1997-2018**	$\Delta\hat{b}$	t-stat
Prof. services	0.955	0.921	-0.033^{***}	-15.40
Prof. services + Manag.	0.937	0.899	-0.038^{***}	-18.11
Prof. services + Manag. + Admin.	0.924	0.866	-0.057^{***}	-16.23

$*: p < 0.05$, $**: p < 0.01$, $***: p < 0.001$.

No change in $\hat{b}$ for the average commodity/service group

Detailed commodity/service groups


Ratio of unadjusted to adjusted GDP
1
.98
.96
.94
.92
.9
.88
.86
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
Prof. services
Prof. services + Management
Prof. services + Management + Admin.

Pre vs. post-97: results

	1997-2018	1947-1996	
	g_Z (%)	g_Z (%)	Δg_Z (%)
No markups, no intan adjustment	0.86	1.36	-0.50
Markups, adjustment for Prof. serv.+Manag.+Admin.	1.18	1.43	-0.25

Detailed results

Robustness

Are the magnitudes for $\hat{b}$ reasonable?

Compustat validation

- Compustat expenditures on organization capital
- $\hat{b} = 0.91$, vs. 0.89 in Use tables
- Similar adjustment to $\widehat{dZ/Z}$

Are the magnitudes for $\hat{g}_{Q_2}$ reasonable?

BLS validation

- Price data from BLS, 97-18
- $\hat{g}_{Q_2} > \hat{g}_{Q_1}$
- Smaller adjustment (20bps instead of 28bps)

Are the results robust to alternative values of other parameters?

Alternative parameter values

- lower δ_2 slightly magnifies the mismeasurement; $\delta_2 = 0.05 \rightarrow$ 30bps adjustment
- higher α slightly weakens the mismeasurement; $\alpha = 0.36 \rightarrow$ 27bps adjustment

Conclusion

Main take-aways

Since late 90s, $\widehat{dZ/Z}$ has been declining

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  investment in organization capital, misclassified as intermediate purchases

- caveat: g is not biased ...

  contribution of g_Q overestimated $\leftrightarrow$ contribution of g_Z underestimated

- open questions

  bias off balanced-growth path

  other proxies for g_{Q_2}

More

Reclassifying intermediate expenditures as intangibles

Are the magnitudes for *b* reasonable?

+ *all* service purchases treated as investment
− *only* externally purchased intangibles — no internally generated

Compare to magnitudes obtained using firm accounting data

empirical proxy for investment in org cap (Eisfeldt and Papanikolaou, 2013)

externally purchased + internally generated

back

Validation with Compustat

Compustat, 1997-2018, mapped to the 61 sectors s in the IO tables.

For each sector s,

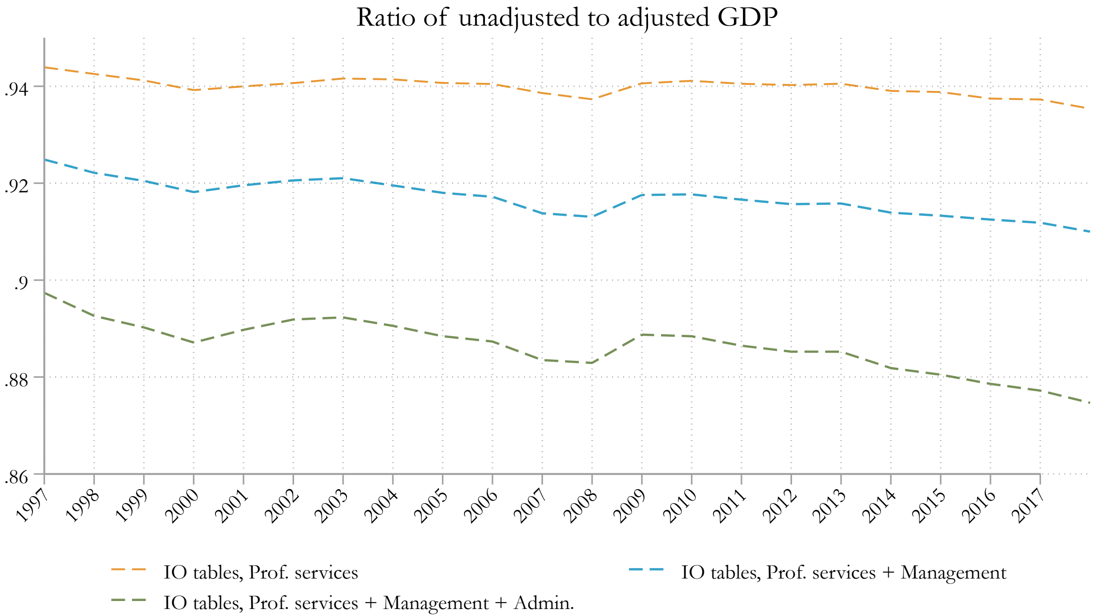
$$
\begin{aligned}
M_s &= 0.3 \times (\texttt{xsga}_s - \texttt{xrd}_s) \\
Y_s &= \text{Adjusted value added} = \hat{Y}_s + M_s \\
\hat{Y}_s &= \text{Measured value added} \\
&= \text{EBITDA}_s + \texttt{xrd}_s + \text{Wages}_s
\end{aligned}
$$

Aggregating:

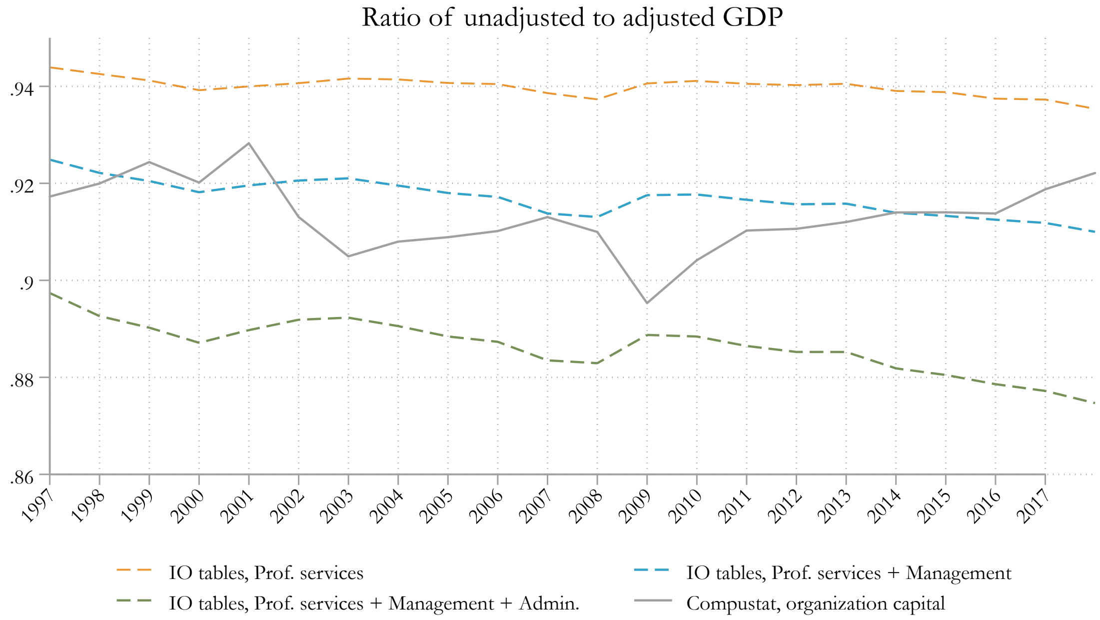
$$
b \equiv \frac{\sum_s \hat{Y}_s}{\sum_s \hat{Y}_s + M_s} = \frac{\text{Unadjusted GDP}}{\text{Adjusted GDP}}
$$

Note : Wages_s estimated using the IO Use tables

back



Ratio of unadjusted to adjusted GDP
.94
.92
.9
.88
.86
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
IO tables, Prof. services
IO tables, Prof. services + Management
IO tables, Prof. services + Management + Admin.



Ratio of unadjusted to adjusted GDP
.94
.92
.9
.88
.86
1997
1998
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2014
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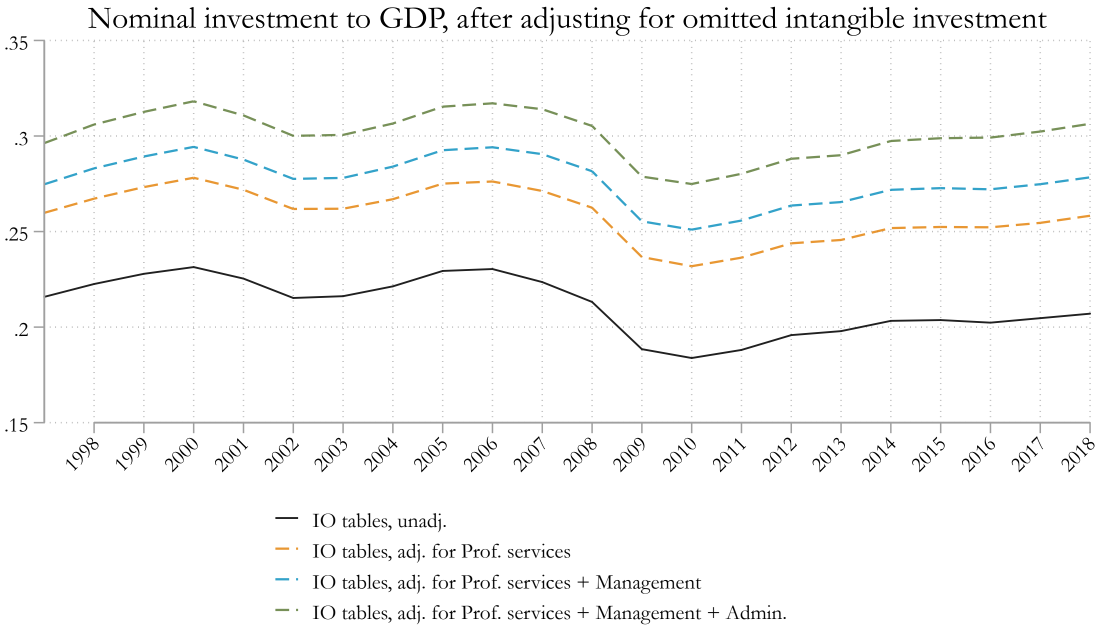
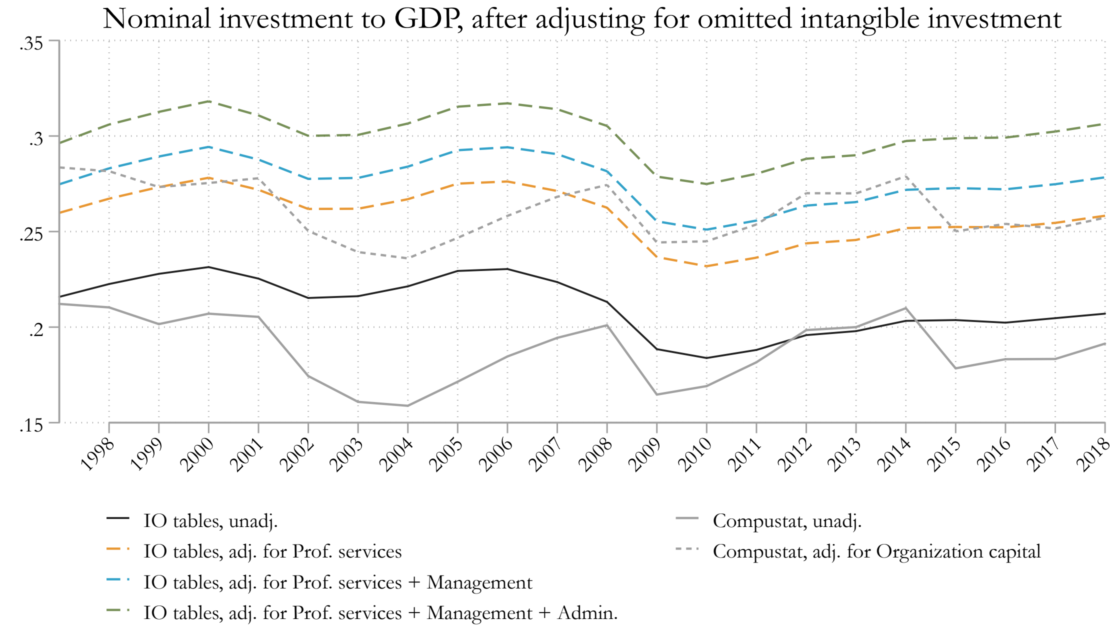
2016
2017
IO tables, Prof. services
IO tables, Prof. services + Management
IO tables, Prof. services + Management + Admin.
Compustat, organization capital

Compustat comparison

	$\hat{b}$	$\hat{g}_{Q_2}$ (%)	g_Z (%)	μ	η
1947-1996	0	0	1.36	1.00	0
1997-2018					
No adjustment, no markups	0	0	0.86	1.00	0
No adjustment, markups	0	0	0.95	1.06	0
Adjusted for Prof. services	0.94	0.49	1.04	1.13	0.25
Adjusted for Prof. services + Manag.	0.92	0.68	1.10	1.15	0.35
Adjusted for Prof. services + Manag. + Admin.	0.89	0.55	1.14	1.19	0.50
Adjusted for Organization capital (Compustat)	0.91	0.68	1.11	1.16	0.38

back


Nominal investment to GDP, after adjusting for omitted intangible investment
.35
.3
.25
.2
.15
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
IO tables, unadj.
IO tables, adj. for Prof. services
IO tables, adj. for Prof. services + Management
IO tables, adj. for Prof. services + Management + Admin.



Nominal investment to GDP, after adjusting for omitted intangible investment
.35
.3
.25
.2
.15
1998
1999
2000
2001
2002
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2004
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2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
IO tables, unadj.
IO tables, adj. for Prof. services
IO tables, adj. for Prof. services + Management
IO tables, adj. for Prof. services + Management + Admin.
Compustat, unadj.
Compustat, adj. for Organization capital

How large can the bias potentially be?

Given (η, g_{Q_2}), match post-97 moments:

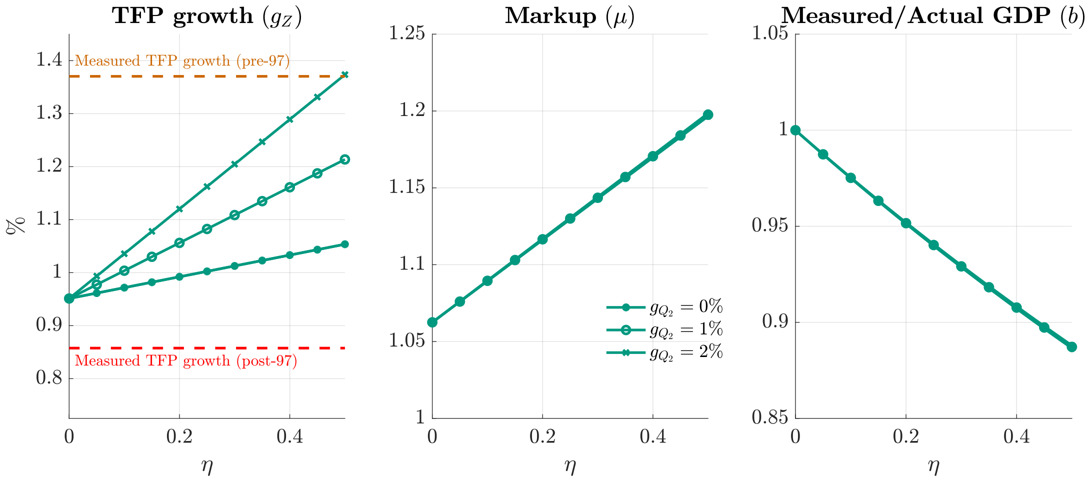
$$\hat{g} = \frac{\widehat{dY}}{Y}, \quad \hat{g}_L = \frac{\widehat{dL}}{L}, \quad \hat{g} - g_{Q_1} = \hat{g}_K = \frac{\widehat{dK}}{K}, \quad \hat{s}_L.$$

Compute and plot implied values of:

$$\begin{aligned}
g_Z &= \hat{g} - (1-\alpha)\hat{g}_L - \alpha\hat{g}_K + \alpha\eta(g_{Q_2} - g_{Q_1}) \\
\mu &= \frac{1-\alpha}{\hat{s}_L} + \alpha\eta\frac{g + \delta_2 - g_{Q_2}}{r + \delta_2 - g_{Q_2}} \\
b &= \frac{1}{1 + \alpha\eta\frac{\hat{s}_L}{1-\alpha}\frac{\hat{g} + \delta_2 - g_{Q_2}}{\hat{r} + \delta_2 - g_{Q_2}}}
\end{aligned}$$

back

Implied moments for $\alpha = 0.32$



back

An alternative source for ommitted capital prices

Producer Price Indices, BLS, 1997-2018.

Industry classification does not exactly match IO tables

- substantially more detail for certain commodities (e.g. consumer products)
- missing commodities/services (e.g. Management of Companies)

Matching commodities/services, corr. w/ IO tables deflators is high but not perfect

Regression results

back

Commodities or services with the largest GDP adjustments, 1997-2018

	$\hat{b}$	g_{Q_2} (VA)	g_{Q_2} (GO)	g_{Q_3} (BLS)
Services				
Professional, scientific, and technical services	0.940	0.005	0.003	0.002
Other real estate	0.952	-0.019	-0.004	n.a.
Administrative and support services	0.964	0.001	0.001	-0.003
Insurance carriers and related activities	0.972	-0.003	-0.003	0.003
Credit intermediation and related activities	0.973	0.010	0.008	-0.016
Management of companies and enterprises	0.974	0.014	0.007	n.a.
Commodities				
Chemical products	0.962	0.012	0.012	0.013
Oil and gas extraction	0.972	0.020	0.016	0.014
Petroleum and coal products	0.973	0.037	0.034	0.034
Food and beverage and tobacco products	0.976	0.010	0.004	0.004

Implied moments for the different price indices

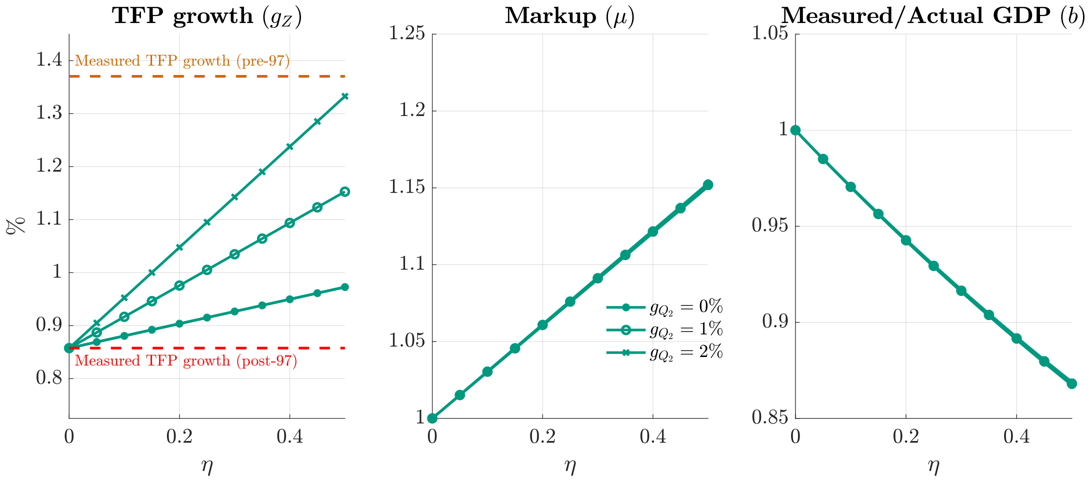
	GDP tables, BEA			PPI, BLS		
	g_Z (%)	μ	η	g_Z (%)	μ	η
1947-1996	1.36	1.00	0	1.36	1.00	0
1997-2018						
No adjustment, no markups	0.86	1.00	0	0.86	1.00	0
No adjustment, markups	0.95	1.06	0	0.95	1.06	0
Adjusted for Prof. services	1.04	1.13	0.25	1.02	1.13	0.25
Adjusted for Prof. services + Admin.	1.08	1.17	0.40	1.04	1.17	0.40
Adjusted for Org. capital (Compustat)	1.08	1.16	0.38	1.04	1.16	0.38

Price deflators in the IO tables vs. BLS PPI deflators

	(1)	(2)	(3)	(4)
$g_{Q_2}^{(BLS)}$	0.97***	0.97***	1.04***	1.05***
	(0.18)	(0.18)	(0.17)	(0.18)
Commodity/service FE	no	yes	no	yes
Year FE	no	no	yes	yes
Clustering of s.e.	commodity + year	commodity + year	commodity + year	commodity + year
R^2	0.603	0.633	0.643	0.673
N	829	829	829	829

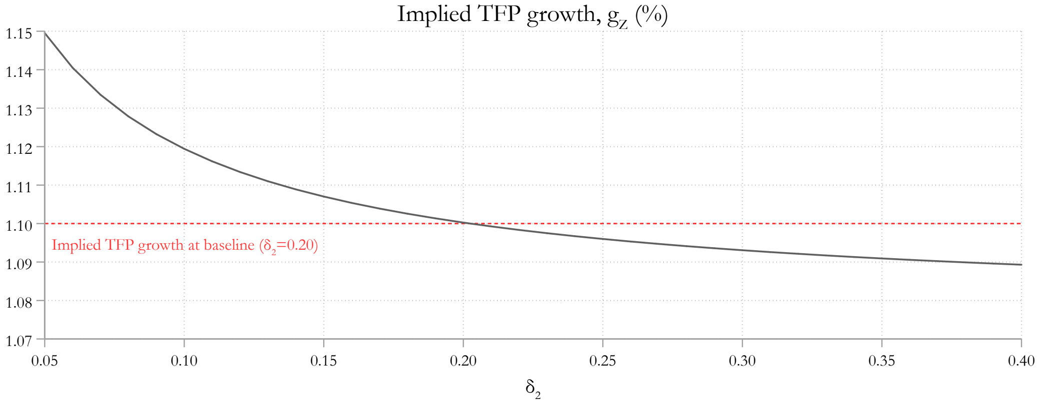
Back

Implied moments for $\alpha = 0.36$



back

Implied TFP growth for alternative values of δ_2



back

Approach 1: methodology and data

Methodology : for intan investment B misclassified as intermediates:

1. Compute $\hat{b} = \frac{\text{Unadjusted GDP}}{\text{Adjusted GDP}} = \frac{\hat{P}\hat{Y}}{\hat{P}\hat{Y} + B}$

2. From model, obtain g_{Q_2} such that:

$$\begin{aligned} b &= \hat{b} \\ g_Z &= \text{pre-97 measured TFP growth} &= 1.36\% \\ \hat{g}_Z &= \text{post-97 measured TFP growth} &= 0.86\% \end{aligned}$$

Solution for g_{Q_2}

Data : Commodity Use tables, 1997-2018: 61 different commodities and services.

$B_j =$ total *intermediate* use of commodity/service $j \to \hat{b}_j$

back

Approach 1: 10 largest GDP adjustments

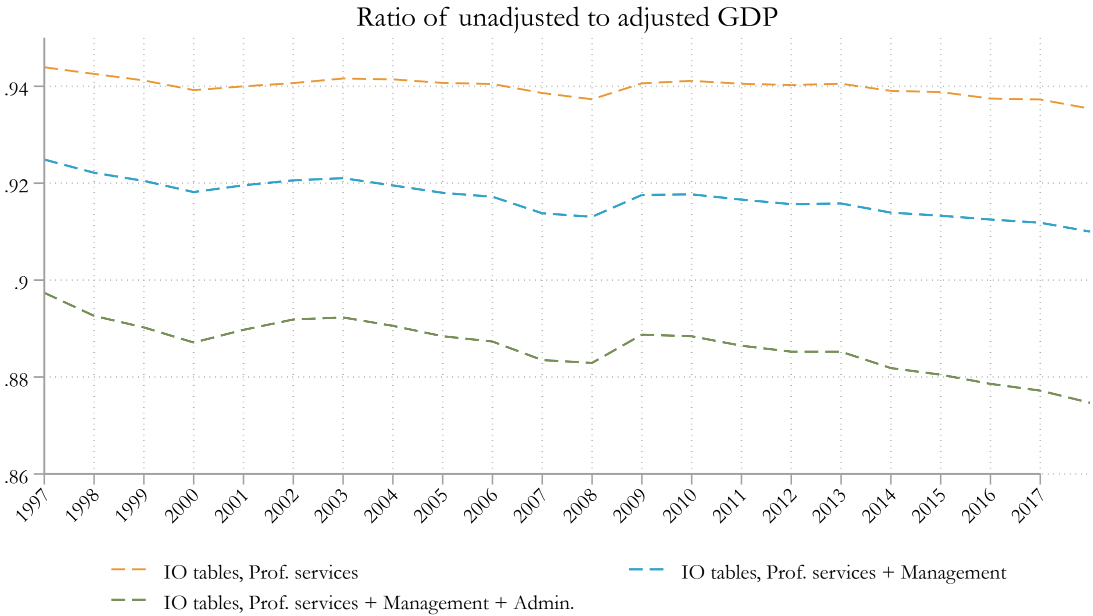
	$\hat{b}_j$ **(average, 1997-2018)**
Services	
Professional, scientific, and technical services	0.940
Other real estate	0.952
Administrative and support services	0.964
Insurance carriers and related activities	0.972
Credit intermediation and related activities	0.973
Management of companies and enterprises	0.974
Commodities	
Chemical products	0.962
Oil and gas extraction	0.972
Petroleum and coal products	0.973
Food and beverage and tobacco products	0.976

back

Approach 1: results

	Average, 1997-2018
Service groups	$\hat{b}$
Prof. services	0.94
Prof. services + Manag.	0.92
Prof. services + Manag. + Admin.	0.89

back



Ratio of unadjusted to adjusted GDP
.94
.92
.9
.88
.86
1997
1998
1999
2000
2001
2002
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2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
IO tables, Prof. services
IO tables, Prof. services + Management
IO tables, Prof. services + Management + Admin.

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Prof. services + Manag. + Admin.	0.89

back

Approach 1: results

	Average, 1997-2018			
Service groups	$\hat{b}$	$g_{Q_2}(\%)$	η	μ
Prof. services	0.94	2.50	0.26	1.13
Prof. services + Manag.	0.92	1.58	0.36	1.18
Prof. services + Manag. + Admin.	0.89	0.93	0.50	1.19

back

Approach 1: solution for g_{Q_2}

The unique price growth satisfying these conditions is given by:

$$\begin{aligned} g_{Q_2} &= \frac{1}{2}\left(r + \delta_2 + \hat{g} - \hat{g}_K + \hat{\xi} - \sqrt{\left(\hat{\xi} + (\hat{r} - \hat{g} - (\hat{g}_K + \delta_2))\right)^2 + 4(\hat{r} - \hat{g})(\hat{g}_K + \delta_2)}\right), \\ \hat{\xi} &= \frac{\hat{s}_L \hat{b}}{(1-\hat{b})(1-\alpha)}\left[g_Z - (\hat{g} - (1-\alpha)\hat{g}_L - \alpha\hat{g}_K)\right]. \end{aligned}$$

When $\hat{b} = 0$, $g_{Q_2} = \hat{g} - \hat{g}_K = g_{Q_1}$.

back

Pre vs. post-97: 10 largest GDP adjustments

back

	$\hat{b}$ (average)			
	1947-1996	**1997-2018**	$\Delta\hat{b}$	t-stat
Services				
Prof., scient. & techn. services	0.955	0.921	-0.033^{***}	-15.40
Finance and Insurance	0.957	0.929	-0.028^{***}	-13.72
Real estate	0.973	0.952	-0.021^{***}	-13.15
Admin. and waste services	0.984	0.959	-0.025^{***}	-13.84
Information	0.979	0.967	-0.013^{***}	-9.89
Management of companies	0.981	0.974	-0.007^{***}	-17.60
Commodities				
Chemical products	0.966	0.962	-0.004^{***}	-9.89
Oil and gas extraction	0.978	0.972	-0.007^{**}	-2.78
Petroleum and coal products	0.980	0.973	-0.007^{***}	-3.48
Food, beverage, tobacco	0.956	0.976	0.020^{***}	6.07
All commodities and services	0.982	0.983	0.001	1.25

$* : p < 0.05$, $** : p < 0.01$, $*** : p < 0.001$.

Pre vs. post-97: detailed results

	1997-2018				1947-1996				
	$\hat{g}_{Q_2}$ (%)	g_Z (%)	μ	η	$\hat{g}_{Q_2}$ (%)	g_Z (%)	μ	η	Δg_Z (%)
No adj., no markups	0	0.86	1.00	0	0	1.36	1.00	0.00	-0.50
No adj., markups	0	0.95	1.06	0	0	1.36	1.00	0.00	-0.41
Prof. serv.	0.49	1.07	1.15	0.33	0.49	1.40	1.05	0.17	-0.33
Prof. serv.+Manag.	0.68	1.14	1.18	0.44	0.68	1.43	1.07	0.25	-0.30
Prof. serv.+Manag.+Admin.	0.55	1.18	1.22	0.60	0.55	1.43	1.08	0.30	-0.25

$\Delta g_Z = 1.18 - 1.43 = -25$bps (adj.) vs. $\Delta g_Z = 0.86 - 1.36 = -50$bps (unadj.)

back