Productivity Growth in Chile: From Micro to Macro and Back[1]

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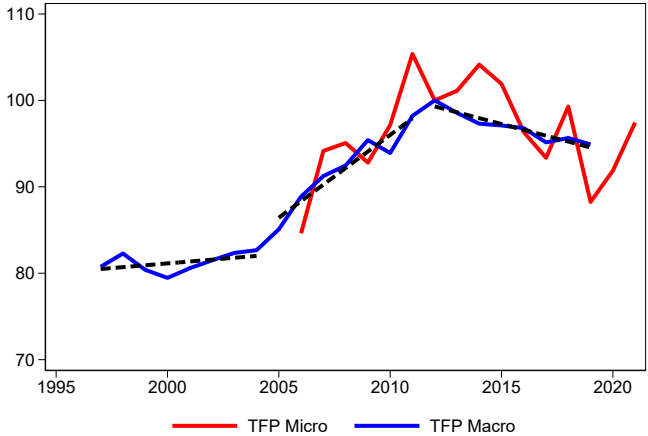
[1] The views and opinions expressed are those of the authors alone and do not necessarily reflect those of the Central Bank of Chile nor its board members.

Motivation: Lost Decade of Productivity Growth in Chile (2011-2019)



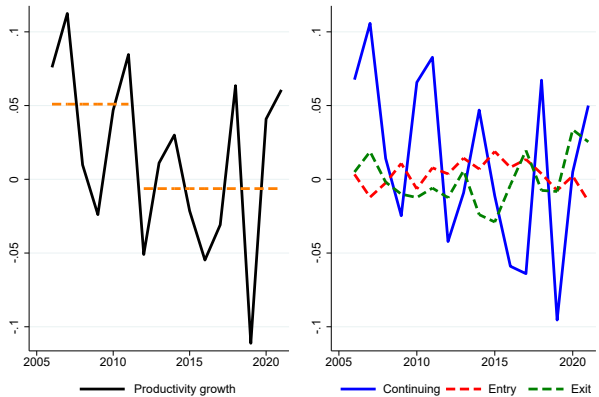
- **Today** Admin tax data to uncover micro origins of productivity growth (including pandemic)
  - And what are the policy implications

Methods and Data

- **Production Function** $\underbrace{Y_{it}}_{\text{Value Added}} = \underbrace{e^{\phi_{it}}}_{\text{Productivity}} \cdot \underbrace{K_{it}^{\alpha}}_{\text{Capital}} \cdot \underbrace{L_{it}^{\beta}}_{\text{Labor}}$
- **Data** Tax VAT and balance sheet forms (2005-2021)
- **Methods** Standard Industrial-Organization methods for estimating ϕ_{it}
  - $\Rightarrow \hat{\alpha} = 0.15$, $\hat{\beta} = 0.81$
  - Very different if one uses cost shares: $\beta^{cost\ shares} \approx 0.2$
  - $\Rightarrow$ Tells us something about market power (later)
- **Aggregate Productivity** $\Phi_t = \sum_i \omega_{it} \phi_{it}$
  - ω_{it}: Depends on the model, today will use value added (=sales-materials)
- **Approach** Highlight different productivity drivers when going from micro to macro TFP

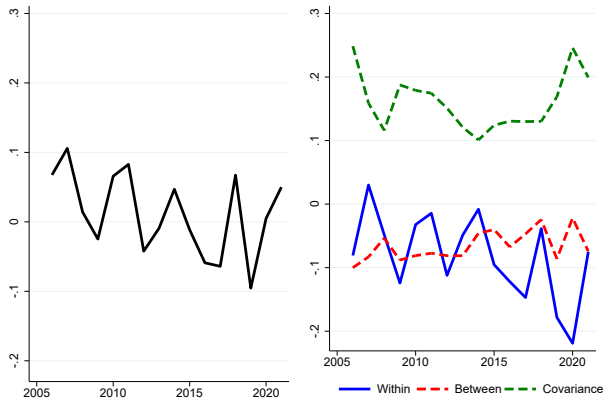
Productivity Decline Driven by Intensive Margin of Continuing Firms

$$\Delta\Phi_t = \underbrace{\sum_{i\in C}\left(\omega_{it}\phi_{it} - \omega_{it-1}\phi_{it-1}\right)}_{\textit{Continuing}} + \underbrace{\sum_{i\in E}\omega_{it}\left(\phi_{it} - \Phi_t^C\right)}_{\textit{Entry}} + \underbrace{\sum_{i\in X}\omega_{it-1}\left(\Phi_{t-1}^C - \phi_{it-1}\right)}_{\textit{Exit}}$$

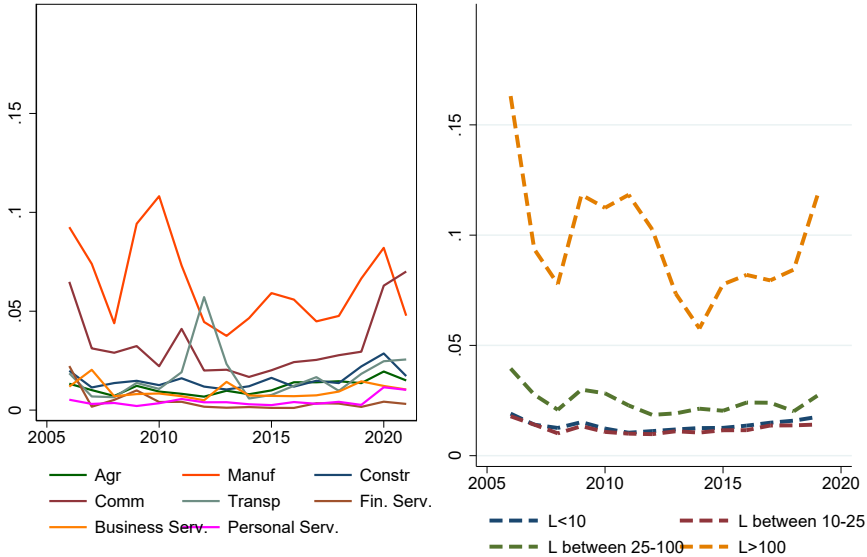


Continuing Firms: Productivity Decline Driven by Lower Reallocation

$$\Delta\Phi_t^C = \underbrace{\sum_{i\in C} \omega_{it-1}\left(\phi_{it} - \phi_{it-1}\right)}_{\textit{Within Firms}} + \underbrace{\sum_{i\in C} \phi_{it-1}\left(\omega_{it} - \omega_{it-1}\right)}_{\textit{Between Firms}} + \underbrace{\sum_{i\in C} \left(\omega_{it} - \omega_{it-1}\right)\left(\phi_{it} - \phi_{it-1}\right)}_{\textit{Efficiency of Reallocation}}$$



Reallocation Efficiency: Driven by Manufacturing, Trade and Large Firms



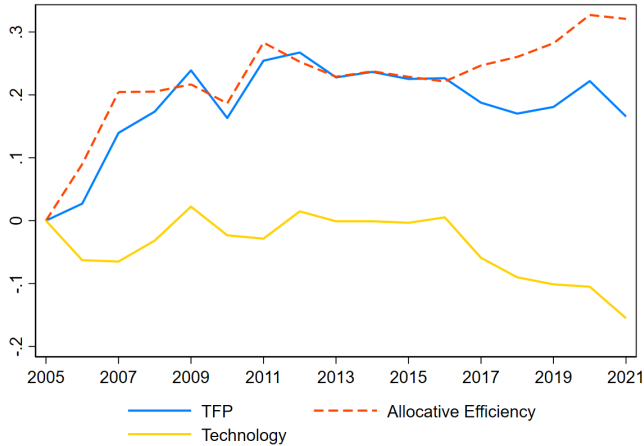
Pandemic Productivity Increase: Driven by Exit and Reallocation

I. Productivity Growth	2006-2011	2012-2019	2020	2021
Aggregate Annual Growth	5.0	-1.6	5.5	6.1
II. Intensive vs Extensive Margin				
Continuing Firms	5.1	-1.7	0.4	5.0
Entry and Exit	-0.1	0.1	5.1	1.1
III. Decomposition of Continuing Firms				
Within	-4.1	-9.0	-23.7	-7.6
Reallocation	9.2	7.3	24.1	12.6
IV. Decomposition of Reallocation				
Between	-7.7	-5.9	-1.8	-7.3
Reallocation Efficiency (Covariance)	16.9	13.2	25.9	19.9

Distortions Dominate Productivity Stagnation

AE Details | Markups

$$\underbrace{\Delta \log Y_t - \tilde{\Lambda}'_{t-1}(\Delta \log L_t + \Delta \log K_t)}_{\Delta \text{ Distorted Solow Residual}} \approx \underbrace{\tilde{\Lambda}'_{t-1}\Delta \log A_t}_{\Delta \text{ Technology}} \underbrace{-\tilde{\Lambda}'_{t-1}\Delta \log \mu_t - \tilde{\Lambda}'_{t-1}(\Delta \log Sh_t^K + \Delta \log Sh_t^L)}_{\Delta \text{ Allocative Efficiency}}$$



Conclusion: Allocative Efficiency is Key (but Challenging) for Development

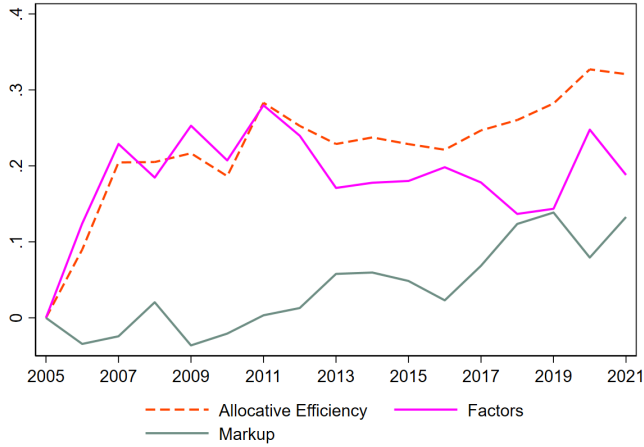
- Reallocating resources to productive activities can be more influential than new technologies
  - Especially for developing economies that are far from the technological frontier
  - And economies with stagnant evolution of technology, like Chile
  - Specially important argument for environmental productivity
- This reallocation might carry (at least in the short run) winners and losers
  - In particular, less (more) productive activities will lose (gain) market shares
  - $\Rightarrow$ Political economy challenges
  - A large shock like the pandemic can help, but maybe transitory if not combined with policy changes?
  - Important to address distributional issues in environmental policies
- Policies that can help: Antitrust $\Rightarrow$ Promote growth of more productive firms
  - Antitrust can also improve innovation incentives
  - $\Rightarrow$ Two birds with one stone: $\uparrow$ Reallocation $+$ $\uparrow$ Incentives for new technologies

Appendix

Factors Dominate Relative to Markups

Return

$$\underbrace{\Delta \log Y_t - \tilde{\Lambda}'_{t-1}(\Delta \log L_t + \Delta \log K_t)}_{\Delta \text{ Distorted Solow Residual}} \approx \underbrace{\tilde{\Lambda}'_{t-1}\Delta \log A_t}_{\Delta \text{ Technology}} \underbrace{-\tilde{\Lambda}'_{t-1}\Delta \log \mu_t - \tilde{\Lambda}'_{t-1}(\Delta \log Sh_t^K + \Delta \log Sh_t^L)}_{\Delta \text{ Allocative Efficiency}}$$



Markup Increase Driven by Between Component

Return

$$\underbrace{\Delta \log \frac{1}{\sum_i \hat{\lambda}_{it} \frac{1}{\mu_{it}}}}_{\text{Harmonic Sales-Weighted Average}} = \underbrace{\frac{\sum_i \hat{\lambda}_{it} \frac{1}{\mu_{it}} \Delta \log \mu_{it}}{\sum_i \hat{\lambda}_{it} \frac{1}{\mu_{it}}}}_{\text{Within}} + \underbrace{\textit{Residual}}_{\text{Between}}$$