Productivity in a Changing World: Challenges and Opportunities

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What Is Productivity?

Productivity: How much output (physical units, quality adjusted units, or dollars) producer obtains from each unit of inputs

Many different measures of productivity, but in the end they are all output-input ratios:

$$Productivity = \frac{Output}{Input}$$

- (Read: Efficiency)

What Is Productivity?

Common productivity measures

- Labor productivity: output per unit labor input

$$LP = \frac{Output}{Employee} \quad or \quad LP = \frac{Output}{Hour}$$

- Total factor productivity: output per combined unit of observable inputs

$$TFP = \frac{Output}{F(labor, capital, intermediates)}$$

where $F(\cdot)$ is some appropriately defined function of inputs

Why Does Productivity Matter?

At the macro level, productivity is the “speed limit” on economic growth

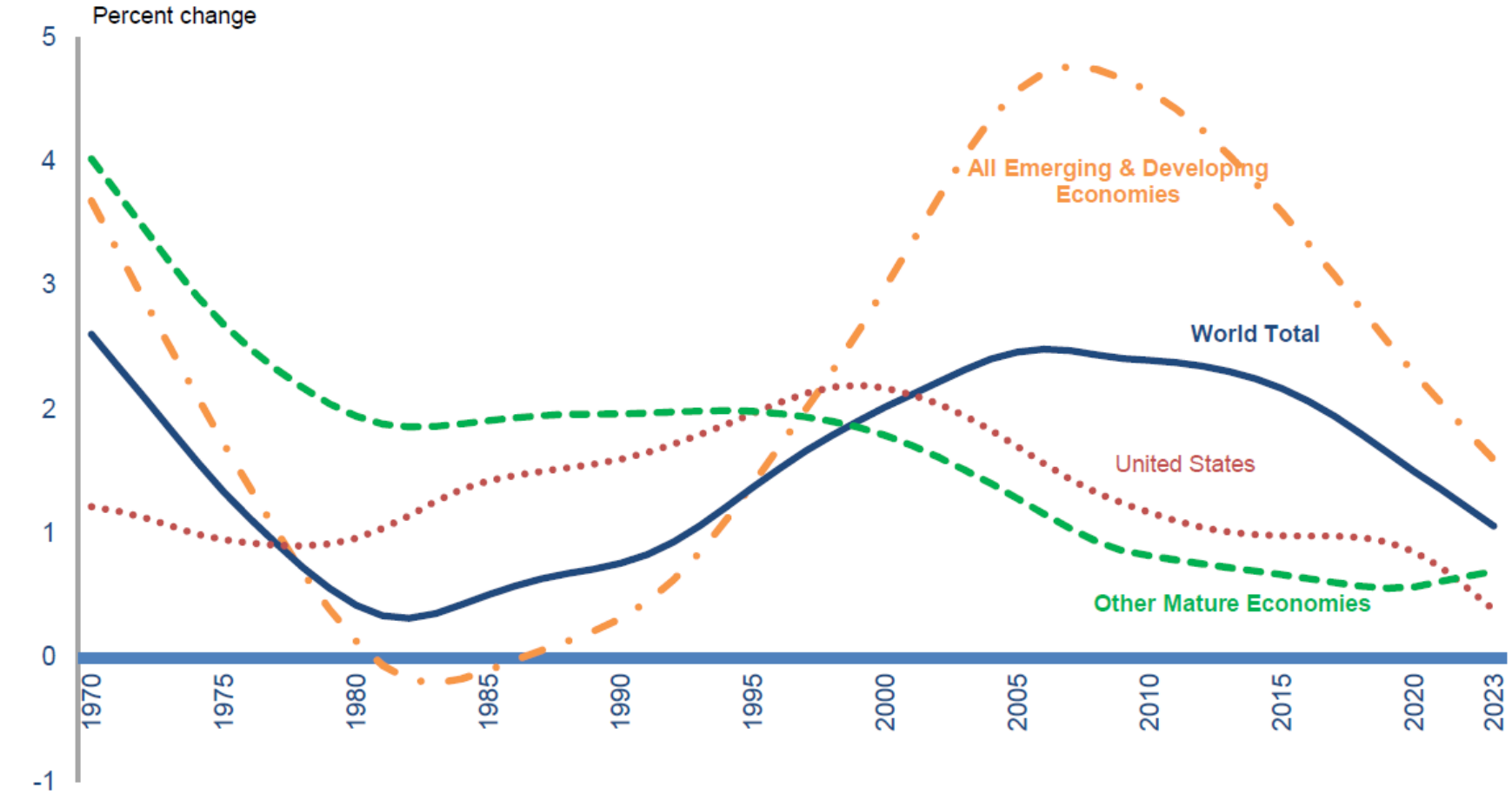
- Only way to obtain sustained growth in GDP per capita and material living standards
- Matters quantitatively too: sustained 1% per year drop in productivity growth translates into sustained 1% per year drop in GDP per capita
- Even small changes in growth rates add up in sustained productivity slowdown

At the micro level, productivity is a main predictor of the success or failure of a business; high-productivity companies:

- Are more profitable
- More likely to survive and grow
- Pay higher wages, charge lower quality-adjusted prices

Productivity Slowdown Is the Economic Problem of Our Time

CHART 1: Trend growth of GDP per Person Employed using HP filter, Major Regions, 1970-2023



Source: The Conference Board Total Economy Database™ April 2023.
Notes: Trend growth rates are obtained using HP filter, assuming lambda=100.

Productivity Slowdown Is the Economic Problem of Our Time

- Productivity as a speed limit:
  - For the world, an extra 1% productivity boost right now is about 1.65 trillion NZD (200 NZD per capita)
  - For New Zealand, an extra 1% productivity boost would be about 730 NZD per capita

- Productivity growth makes *everything* easier
  - Better to loosen a constraint than try to do better within a constraint

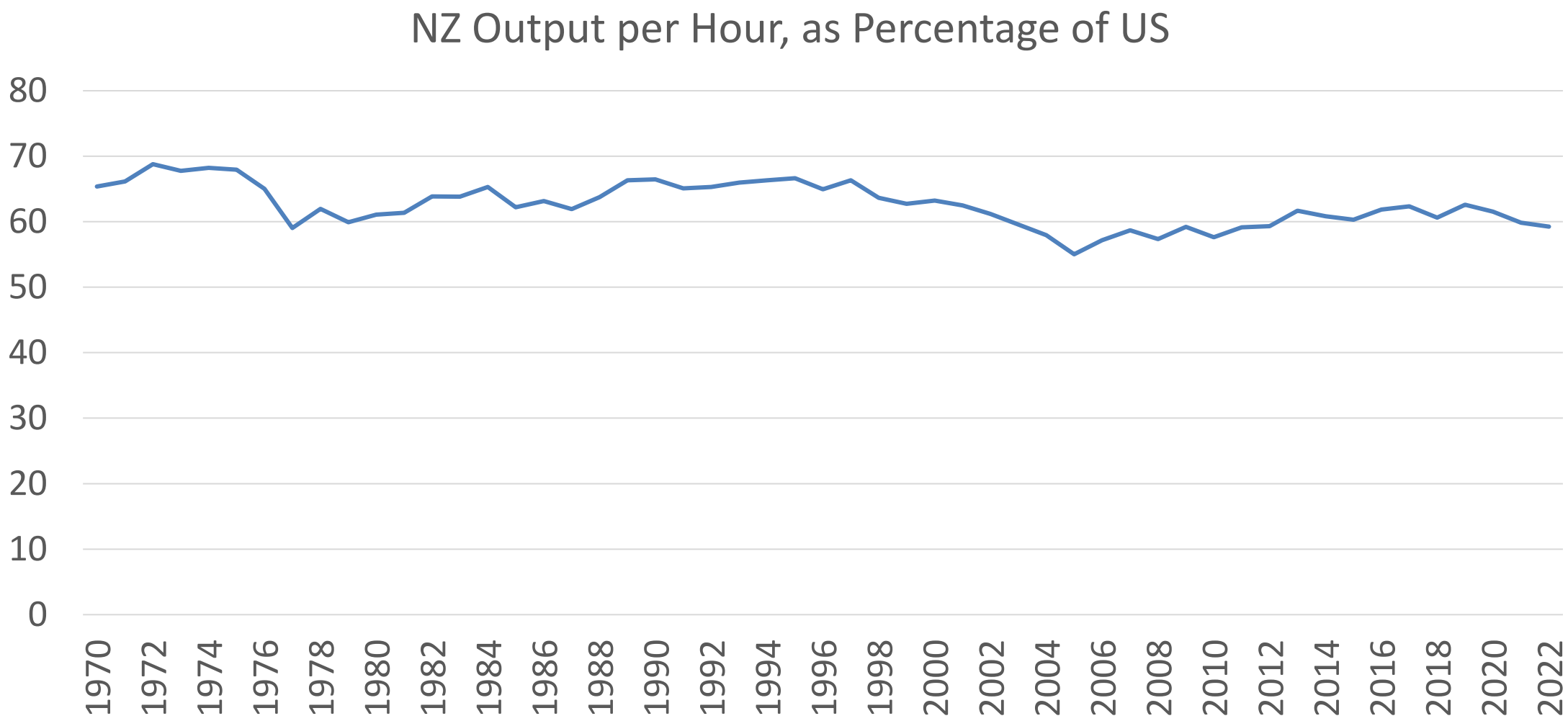
New Zealand Has Struggled with Productivity Growth

New Zealand suffers from the worldwide productivity slowdown, but started from a lower level (though that did made the size of the slowdown smaller)

Average annual growth rate of labor productivity (PPP adjusted output per hour):

	1995-2004	2005-2021	2010-2021	2019-2021
New Zealand	1.2%	0.9%	0.8%	1.2%
G7	2.1	1.0	1.0	1.3
OECD	N/A	1.0	1.2	1.4
EU	1.9	0.9	1.1	0.8
US	2.5	1.3	1.0	2.3

Laggard Productivity Performance Has Kept NZ from Converging to the Global Frontier



How Do We Want to Think about This?

These patterns are not particularly encouraging

How can we think about ways productivity growth might be propelled?

What do we know about what influences productivity?

What Influences Productivity?

Two broad sets of factors:

1. Things that, at least in concept, are within a businesses' control—"levers"

2. Aspects of the operating environment—"external factors"

What Influences Productivity?

“Levers”

1. Managerial practices/talent
2. Higher-quality labor and capital
3. IT and R&D
4. Learning-by-doing
5. Product innovation
6. Firm structure decisions

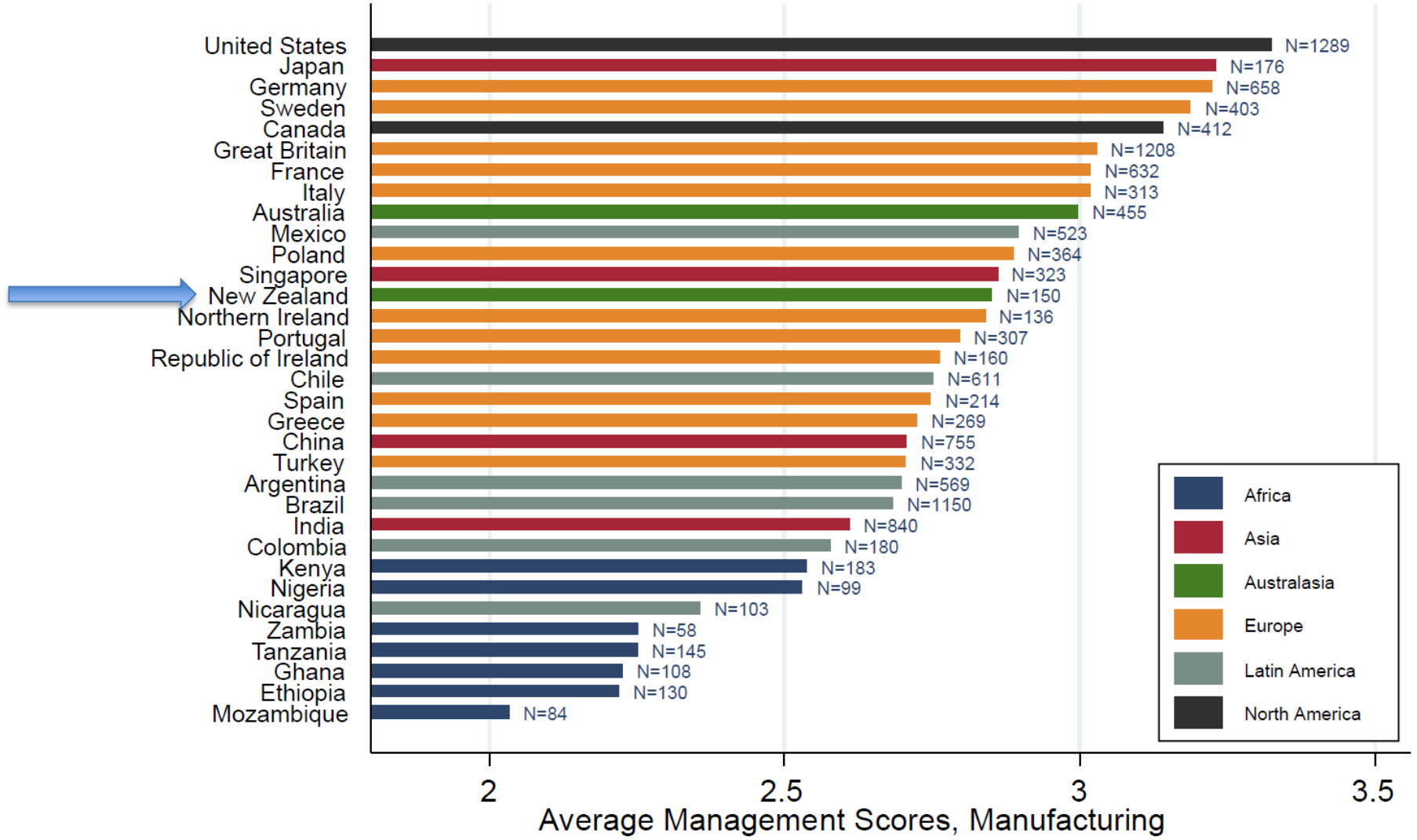
Managerial Practices/Talent

- Recent efforts to collect broad and consistent data on management practices
  - E.g., World Management Survey—detailed discussions with plant managers from around the world, codified into management practice scores

- We've learned a lot! (But of course much further to go)

- Where is New Zealand in terms of management?

Managerial Practices/Talent



Source: Bloom, Lemos, Sadun, Scur, and Van Reenen (2014)

What Influences Productivity?

"External Factors"

1. Productivity spillovers
2. Competition—both intra-market and through trade
3. Regulatory environment
4. Input market flexibility

While these external factors aren't manipulated by companies, they do influence an economy's productivity level by shaping:

- Companies' incentives to improve productivity
- Which companies grow and survive (the more productive) and which shrink and exit

The Micro of Macro Productivity Growth

Note that productivity at an aggregate level (industry- or economy-wide) can grow in three different ways:

- Companies in the industry/economy raise their productivity levels
  - Sometimes called “within” growth
- Economic activity systematically shifts toward higher-productivity companies
  - Sometimes called “between” growth
- New, more efficient companies enter the market and replace less efficient exiting companies
  - Sometimes called “net entry” growth

Can all be driven by different mechanisms, and may be affected by different policies

The Micro of Macro Productivity Growth

Example with two companies:

- Company 1: Produces 6 units of output with 6 units of input (productivity = 1)
- Company 2: Produces 6 units of output with 3 units of input (productivity = 2)
- Industry-level productivity = (6 + 6)/(6 + 3) = 4/3 = 1.3

“Within” productivity growth:

- Company 1: Produces 6 units of output with 3 units of input (productivity = 2)
- Company 2: Produces 6 units of output with 2 units of input (productivity = 3)
- Industry-level productivity = (6 + 6)/(3 + 2) = 12/5 = 2.4

The Micro of Macro Productivity Growth

"Between" productivity growth:

- Company 1: Produces 2 units of output with 2 units of input (productivity = 1)
- Company 2: Produces 10 units of output with 5 units of input (productivity = 2)
- Industry-level productivity = (2 + 10)/(2 + 7) = 12/7 = 1.7

"Net entry" productivity growth:

- Company 1 goes out of business and is replaced by Company 3, which produces 6 units of output with 3 units of input (productivity = 2)
- Company 2: Produces 6 units of output with 3 units of input (productivity = 2)
- Industry-level productivity = (6 + 6)/(3 + 3) = 12/6 = 2.0

Resource Reallocation within Industries

Fact: Enormous dispersion in productivity, even within narrowly defined markets

- E.g., typical to see businesses that obtain 2X output from same inputs as other businesses in same industry and time period

Fact: Enormous churn within industries

- E.g., gross job flows are an order of magnitude larger than net job growth

Fact: Churn usually interacts with productivity differences to raise average productivity in an industry through “between” and “net entry” effects

- High-productivity businesses more likely to grow; low-productivity businesses more likely to shrink and exit
- Creates average productivity growth even without within-business productivity hikes

Resource Reallocation within Industries

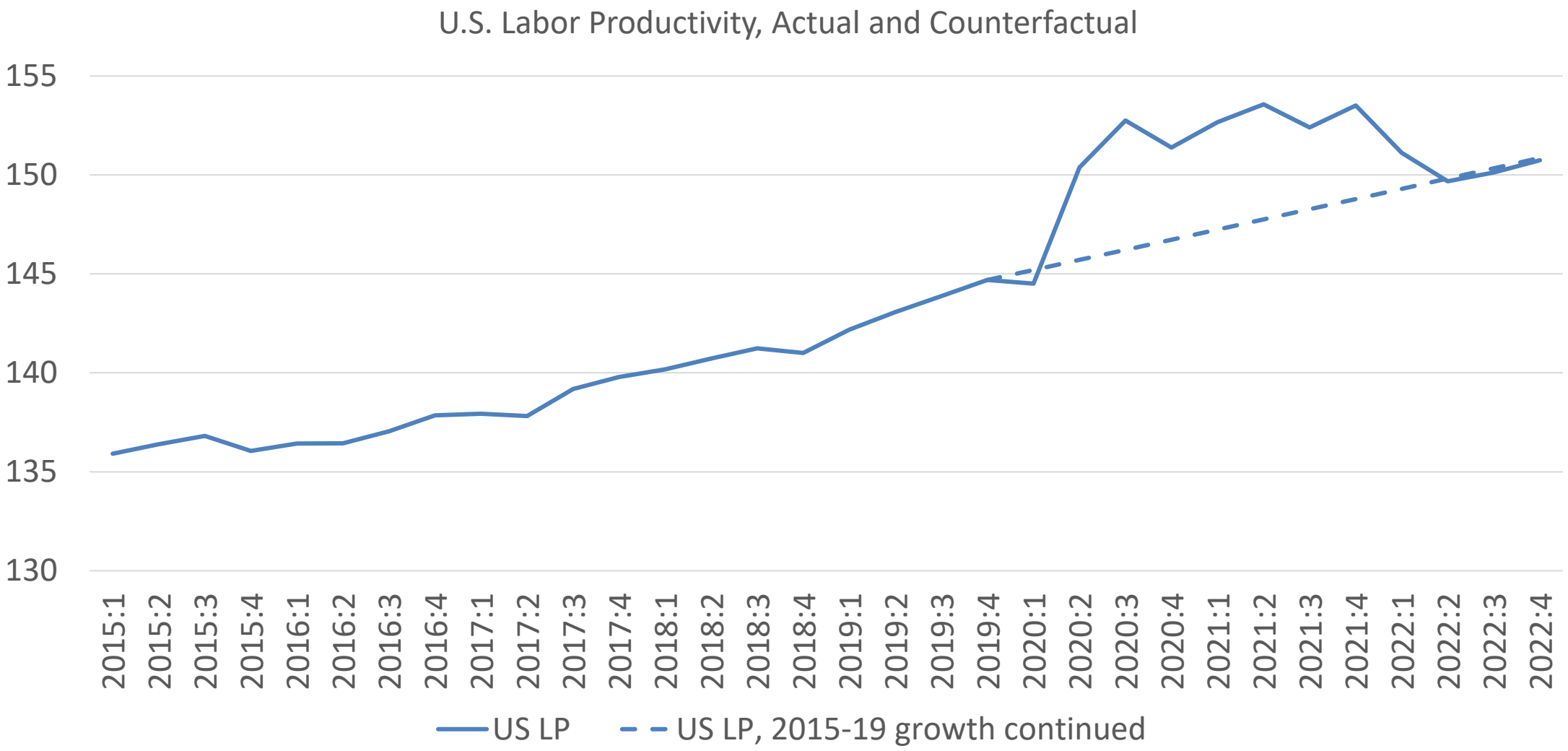
COVID-19 pandemic raised important questions about churn-productivity interaction

- Did churn slow with the level of economic activity?
- Did the productivity-enhancing effect of churn (productivity $\Rightarrow$ growth) continue during the pandemic?
  - Or was the shock so large or arbitrary as to break the usual connection?
- Did new businesses replace supply lost due to bankruptcies?
  - Especially important given decades-long downward trend in business formation
- Was there a tradeoff in job-saving policies?
  - Save intangible capital otherwise lost to bankruptcy
  - Reduce productivity-enhancing churn and create zombie firms

Is There an Optimistic Case to Be Made?

- The worldwide productivity trends of the past 15 years have been discouraging
- But there is an *data-driven* optimistic case to be made
- Note, however, this is a *case*, not a prediction

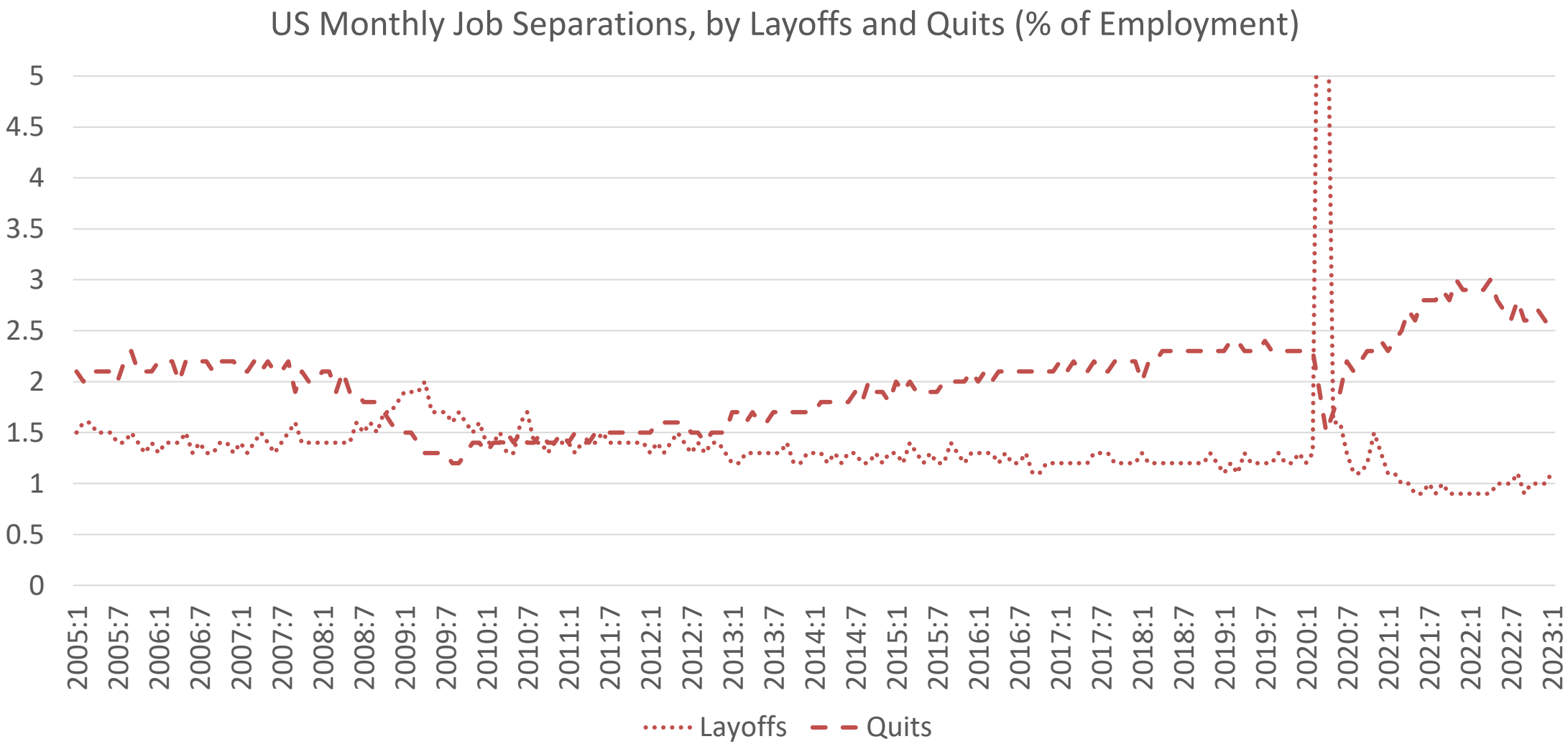
Coming Out of Covid



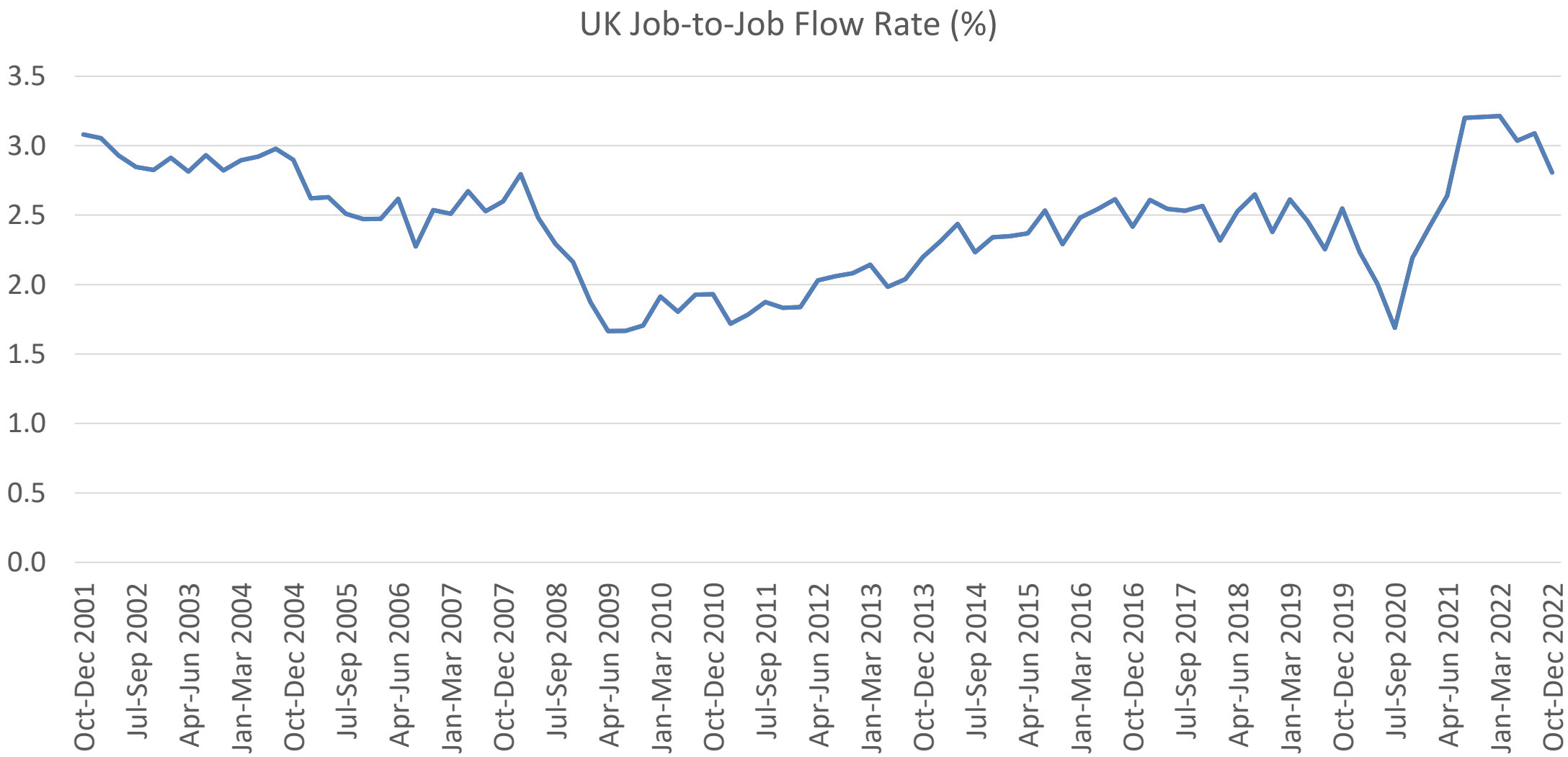
Dynamism: Recent Trends Are Encouraging

	2015-2019	2022
Average hires + separations rate, U.S.	7.4	8.1
Job-to-job flows rate, U.K.	2.5	3.1
Quits per layoff, U.S.	1.8	3.1
Business formations, U.S. (millions)	3.2	5.1
“High propensity” business formations, U.S. (millions)	1.3	1.7
Net business formations, NZ (thousands)	10.7	28.5

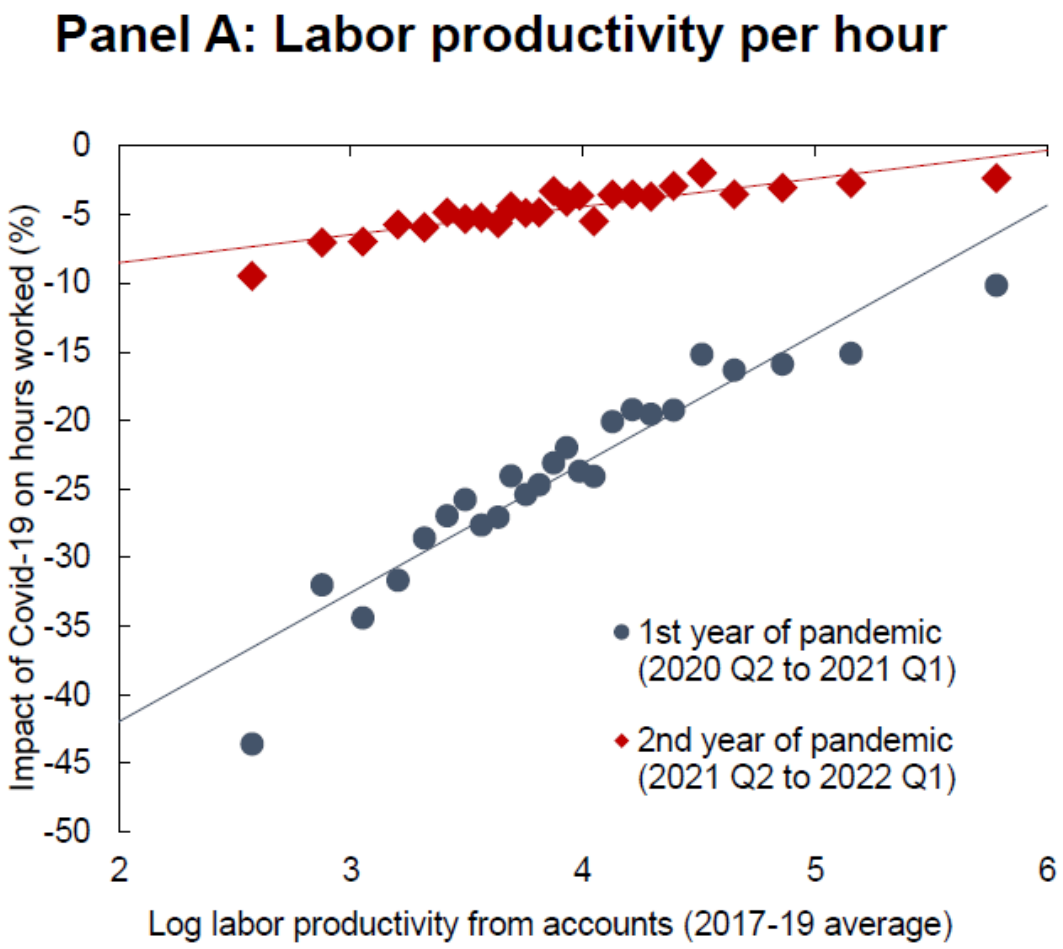
Dynamism: Recent Trends Are Encouraging

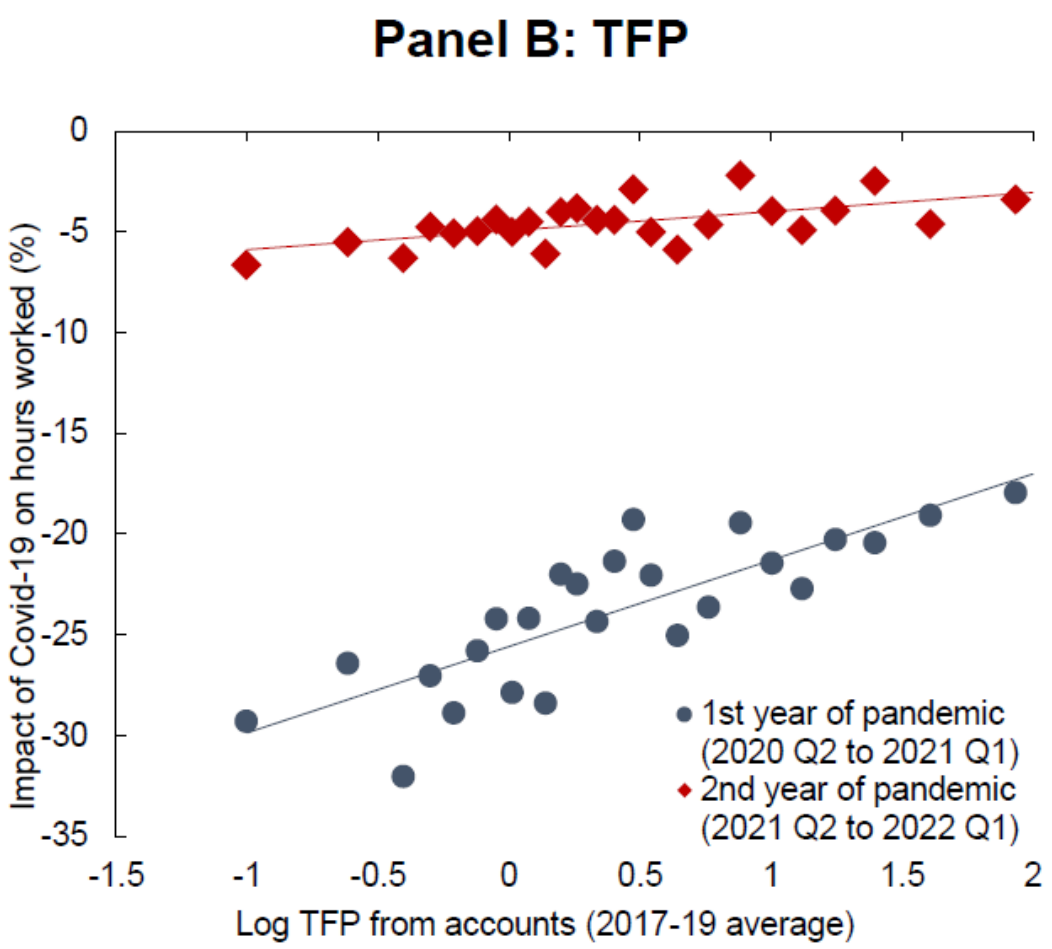


Dynamism: Recent Trends Are Encouraging

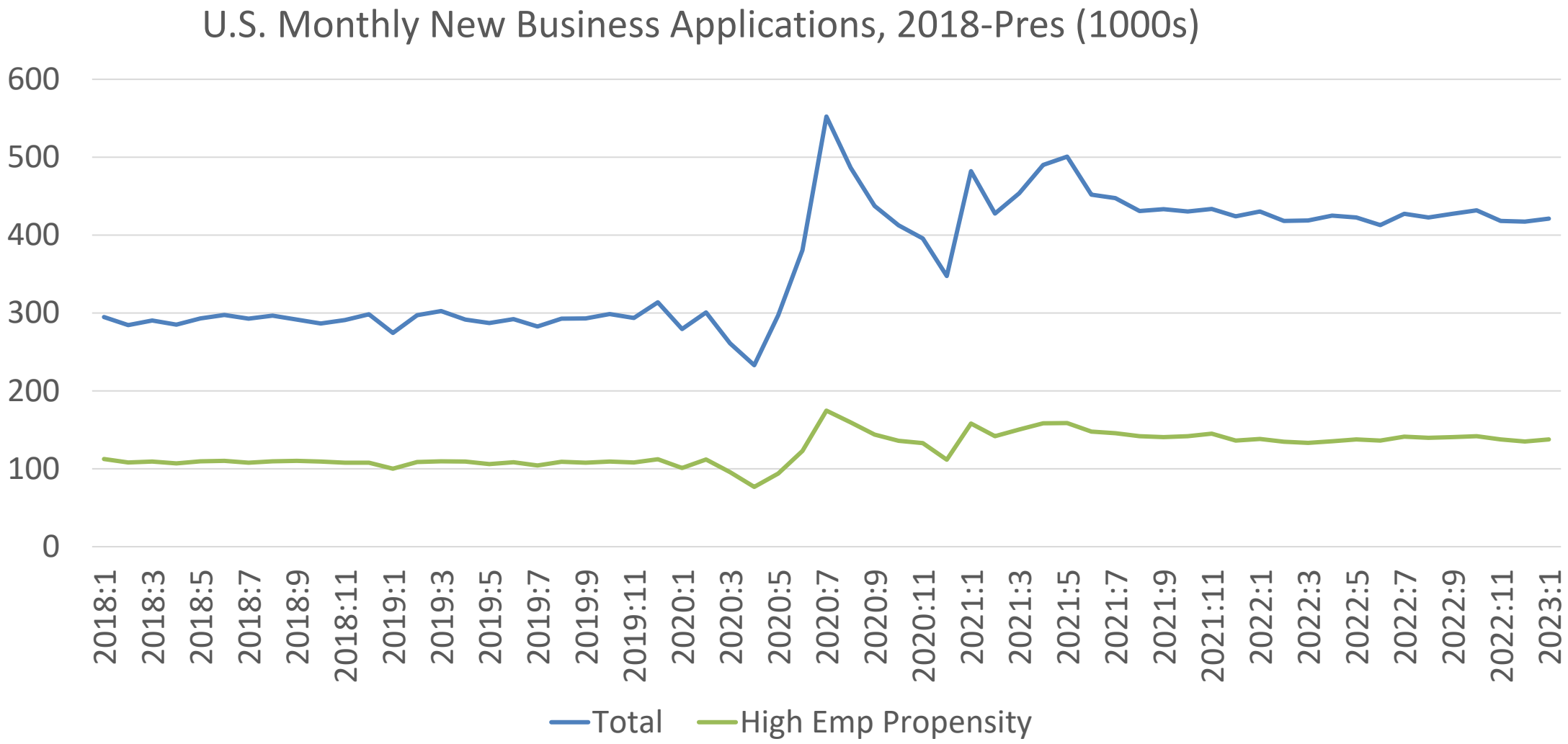


Churn-Productivity Interaction Still "Works"





Encouragingly Strong Business Formation



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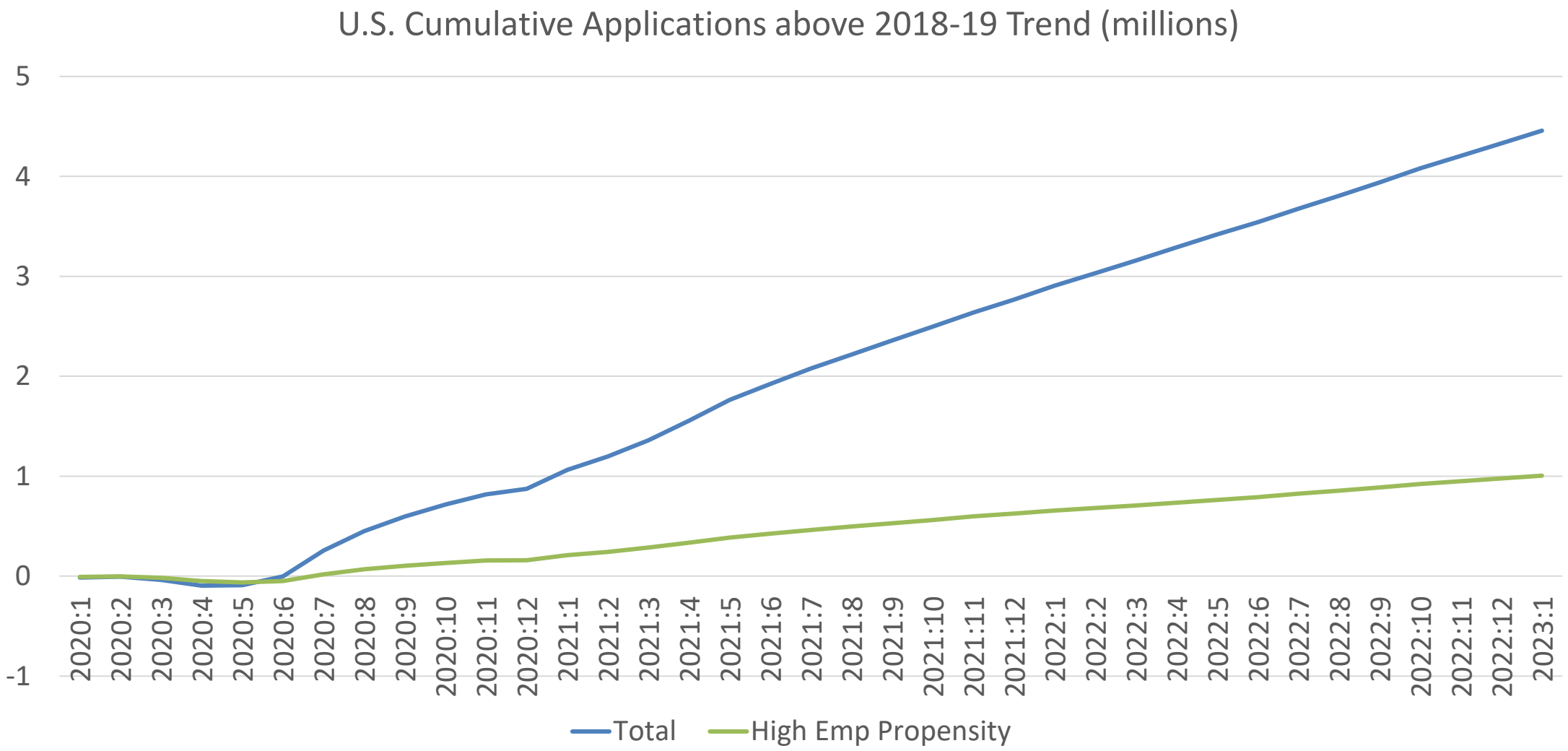
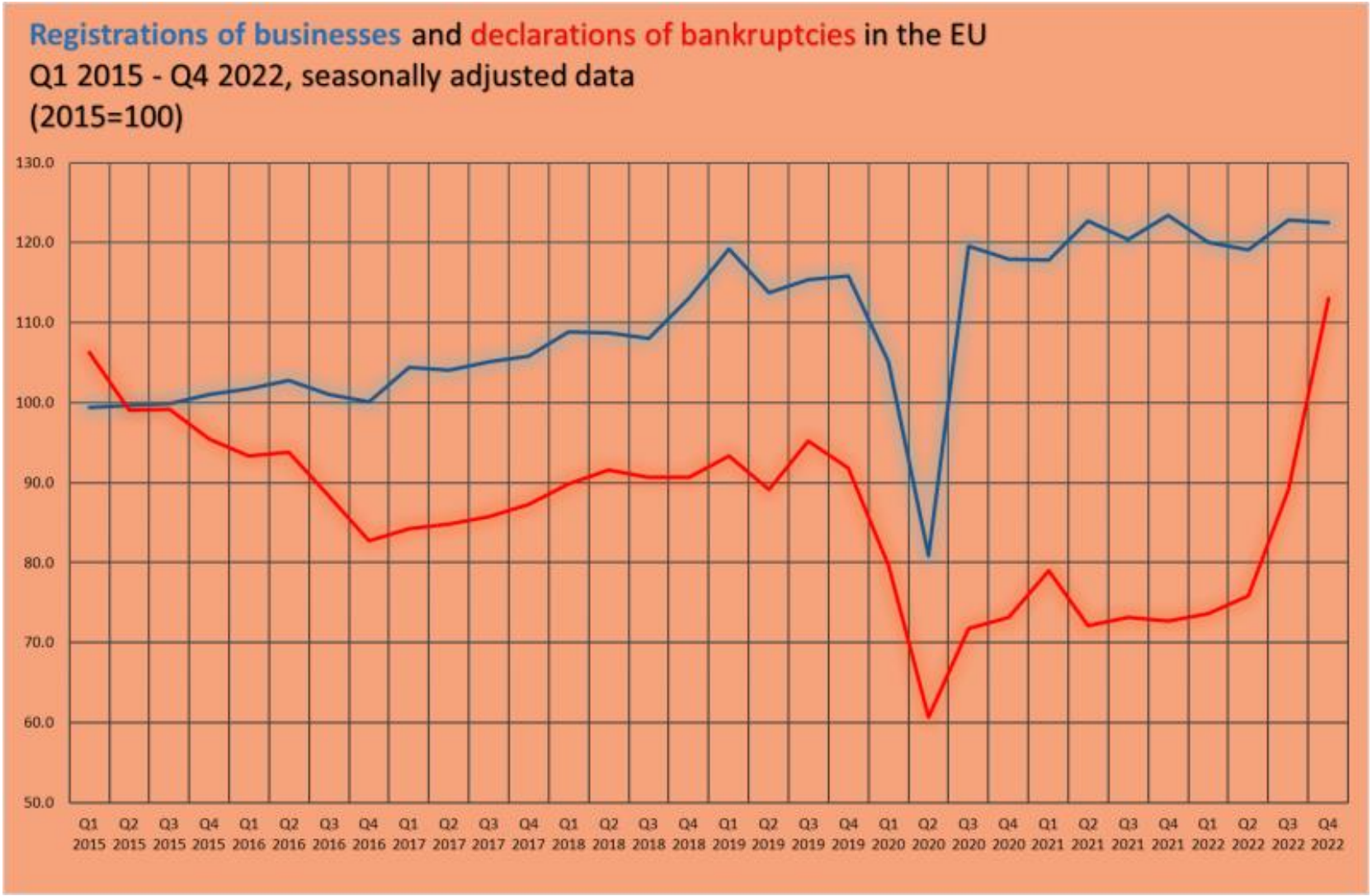


Encouragingly Strong Business Formation (Sort of)



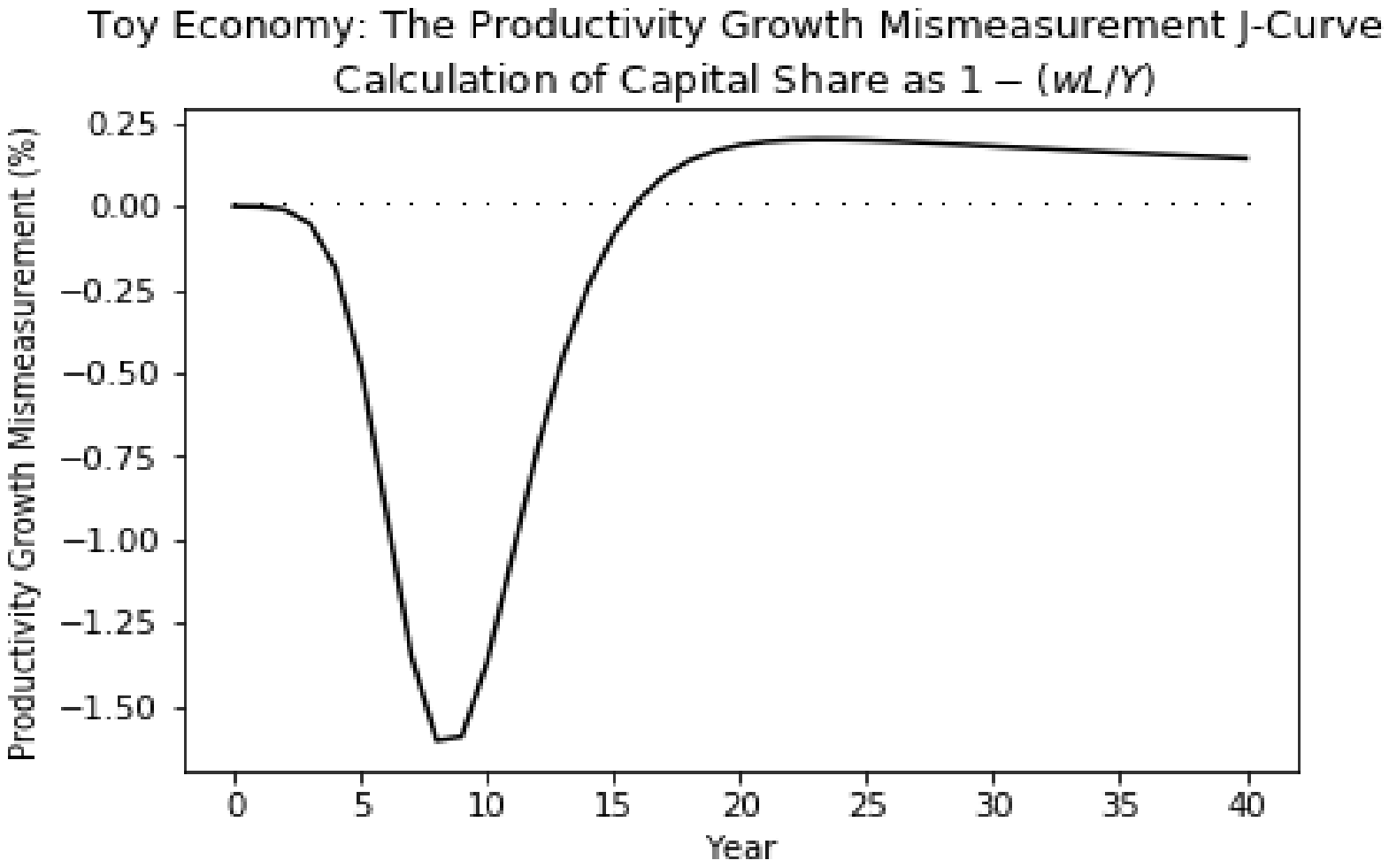
The J-Curve: Intangibles and Productivity Measurement

How do intangibles affect productivity measurement?

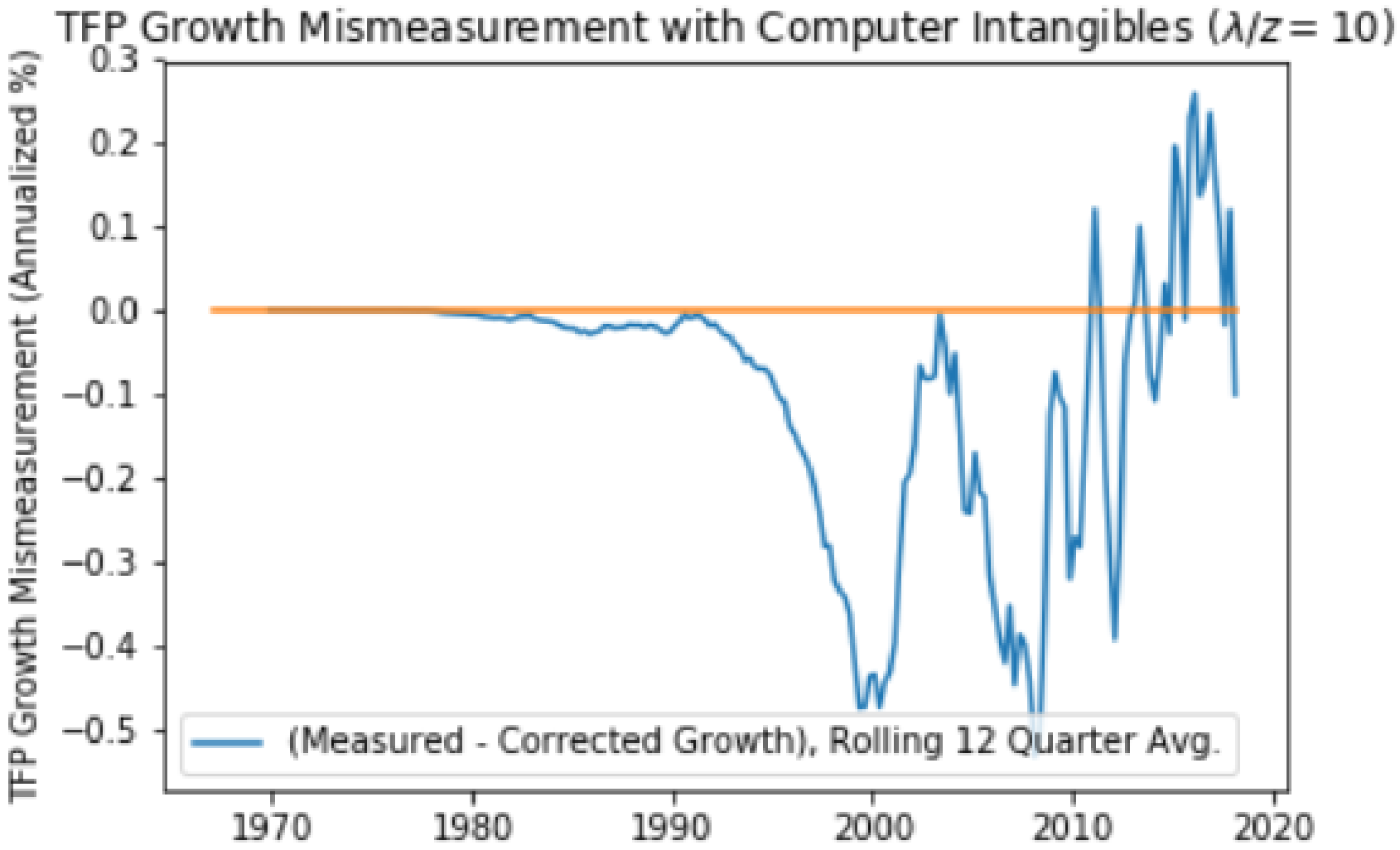
$$Productivity = \frac{Output}{Input}$$

- Intangible capital would be an unmeasured input
  - Will cause productivity to be overstated
- However, intangible capital is also an output (measured as investment flow)
  - Will cause productivity to be understated
- Net effect depends on relative timing of input vs. output mismeasurement

The J-Curve


Toy Economy: The Productivity Growth Mismeasurement J-Curve
Calculation of Capital Share as 1 − (wL/Y)
Productivity Growth Mismeasurement (%)
0.25
0.00
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
0
5
10
15
20
25
30
35
40
Year

The J-Curve: IT Hardware in the U.S.



J-Curve and Covid: Intangibles

- Necessity is the mother of invention: Covid spurred massive experimentation by firms
- Knowledge gained—new processes, new notions of what works and doesn't, new insights about suppliers and customers, etc.—is intangible capital
- Experimenting firms now have two production functions from which to choose
- Outer envelope of the two PFs must be superior to the prior one alone
- This intangible capital production was probably booked mostly as expenses

AI-Related Intangibles Example

- Still very early in AI adoption, but fast investment growth
- Estimated U.S. AI investments about $100 in 2022, 200+% growth since 2016
- Suppose each observed dollar of AI investments were correlated with $2 of additional intangible investments (plausible; see Brynjolfsson et al. 2021)
- This would add $200B (0.8%) to 2022 U.S. GDP
- Real GDP growth declined 0.76% between the 1999-2007 and 2011-2019 periods
- This would explain one year's "lost" GDP
  - Though earlier AI investments probably too small for aggregate effects, so only recent part of story

Wrap-Up

- Productivity is hugely important for determining increases in economic well being
- Worldwide productivity growth has been poor for 15-20 years, and NZ no exception
- Research does offer insights as to what influences might recharge productivity gains, both within producers and across them
- There are some optimistic signs of future productivity performance
  - But nothing is guaranteed, of course