

### BOX 3.3 Moving together? Investment and potential output

*The recent slowdown in potential growth coincided with considerable investment weakness in emerging market and developing economies (EMDEs). After briefly reviewing the main linkages between investment and potential output, this box documents that investment busts (booms) are often associated with weaker (stronger) TFP and potential output growth.*

#### Introduction

Since 2010, investment growth slowed sharply in emerging market and developing economies (EMDEs), from double-digit rates in the wake of the global financial crisis to a post-crisis low of 3 percent in 2016 (Figure 3.3.1). This slowdown has resulted from a range of headwinds facing EMDEs, including a sharp decline in commodity prices, slower FDI inflows, elevated policy uncertainty, and weaker growth expectations (Kose et al. 2017; Vashakmadze et al. 2017; World Bank 2017). Irrespective of its causes, weaker investment growth can dampen potential growth by reducing the speed of capital accumulation and the rate at which new technologies embedded in investment can increase productivity.

As global growth has firmed in recent quarters, investment growth in EMDEs has begun to bottom out: investment growth stabilized at 4.5 percent in 2017 and is expected to rise to 4.8 percent in 2018. It remains an open question to what extent the benefits of the ongoing investment pickup could offset the adverse effects on potential output growth of past protracted weakness in investment and productivity, and demographic shifts.

Against this background, this box addresses two questions.

- What are the basic linkages between investment and potential growth?
- How do TFP growth and potential output growth change during investment booms and busts?

#### Linkages: Theory and evidence

Investment growth can lift potential output growth through direct and indirect channels. Directly, capital accumulation raises potential output growth and labor productivity growth. Indirectly, investment can raise total factor productivity because of technological improvements embedded in investment in new equipment or research and development.<sup>1</sup>

Note: This box was prepared by M. Ayhan Kose, Franziska Ohnsorge, and Temel Taskin.

<sup>1</sup> Evidence for such investment-specific technological change has been presented in Greenwood, Hercowitz, and Krusell (1997 and 2000); Cummins and Violante (2002); Fischer (2006); Boileau (2002); He and Liu (2008); Levine and Warusawitharana (2014); Doraszelski and Jaumandreu (2013); and Hendricks (2000).

A large literature has provided firm-level evidence in support of the linkages between investment and productivity growth (Syverson 2011).<sup>2</sup> Higher level of investment in research and development, and information and communications technology are associated with particularly large gains in firm productivity.<sup>3</sup> Jorgenson, Ho, and Stiroh (2007), for instance, find that investment in information technology played a dominant role in the U.S. productivity surge in the late 1990s and accounted for about one-third of productivity growth over 2000–2005. In addition to its direct impact on productivity, investment growth also tends to amplify the benefits of other sources of firm productivity, including staff education and experience, managerial skills, and firm structure (Bloom, Sadun, and Reenen 2012; Cirera and Maloney 2017).<sup>4</sup>

Macro-level evidence supports the linkages between investment growth and productivity growth. Investment in machinery and equipment has supported labor productivity growth in advanced economies and EMDEs (Herrerias and Orts 2012; De Long and Summers 1992a and 1992b). Research and development investment has been associated with higher productivity (IMF 2016). Growth of non-military public investment, especially infrastructure investment, has lifted total factor productivity growth (Aschauer 1989; Calderón, Moral-Benito, and Servén 2015; Ramirez 1998a, 1998b). Finally, aggregate investment growth appears to be associated with faster total factor productivity growth in OECD countries (Mourougane et al. 2016; Fournier 2016) and some EMDEs (Fedderke et al. 2005; Hendricks 2000). The slowdown in trend labor productivity growth between

<sup>2</sup> For firm-level evidence, see Faggio et al. (2013); Boeing, Mueller, and Sandner (2015); Commander, Harrison, and Menezes-Filho (2011); and Aw, Roberts, and Xu (2008).

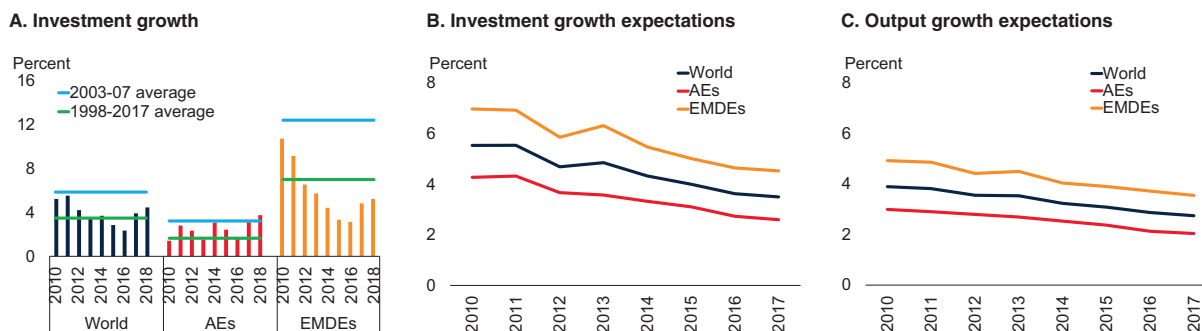
<sup>3</sup> Oliner, Sichel, and Stiroh (2007); Castellani et al. (2016); Raymond et al. (2015); and d'Artis and Siliverstovs (2016).

<sup>4</sup> Van Ark, O'Mahony, and Timmer 2008 document that investment in information and communication technology accounted for about one-third of the contribution of labor productivity to output growth in the European Union and the United States during 1995–2004. De Long and Summers 1992b estimate a 0.2- and 0.4-percentage-point increase in labor productivity growth in response to a 1-percentage-point increase in the investment-to-GDP ratio in a large sample of advanced and emerging market economies. Fournier 2016 finds that a 1-percentage-point increase in the share of public investment in primary government spending is associated with a 5 percent increase in long-term output in OECD countries.

### BOX 3.3 Moving together? Investment and potential output (continued)

#### FIGURE 3.3.1 Potential output growth and investment growth

Investment growth in EMDEs has halved since 2010. Since capital accumulation makes a major contribution to potential output growth both directly, and indirectly via TFP, the slowdown has negative implications for future growth prospects.



Sources: Consensus Economics, Haver Analytics, Penn World Tables, World Bank.

Note: GDP-weighted averages.

A. Investment-weighted averages. Sample includes 37 advanced economies and 145 EMDEs.

B. Based on data for 24 advanced economies and 21 EMDEs. Five-year-ahead *Consensus* investment growth forecasts. Latest data is from July 2017.

C. Based on data for 24 advanced economies and 21 EMDEs. Five-year-ahead *Consensus* output growth forecasts. Latest data is from July 2017.

2007 and 2015 has been entirely attributed to weakness in capital accumulation in OECD countries (Ollivaud, Guillemette, and Turner 2016). Conversely, investment busts may be accompanied by firm closures that reduce average productivity (Campbell 1998).

#### TFP and potential output during investment booms and busts

**Data.** Annual aggregate investment data is available from several sources, including the IMF, Eurostat, OECD, and World Bank. The impact of investment booms on TFP growth and on potential output growth is illustrated with an event study. Potential growth is estimated using the production function approach, but the results are robust to using other measures.

**Definitions.** An investment boom (bust) is defined as an episode during which investment growth is at least one standard deviation higher (lower) than its sample average for at least two consecutive years. The sample covers 94 episodes of investment booms and 32 episodes of investment busts in 40 EMDEs during 1980-2016. About one-half of busts but few booms occurred after the global financial crisis. A typical investment boom and bust episode lasts about 2.7 and 2.3 years, respectively.

**Methodology.** The evolution of TFP growth and potential output growth 3 years before and after the boom and bust episodes are examined. The results derive from simple

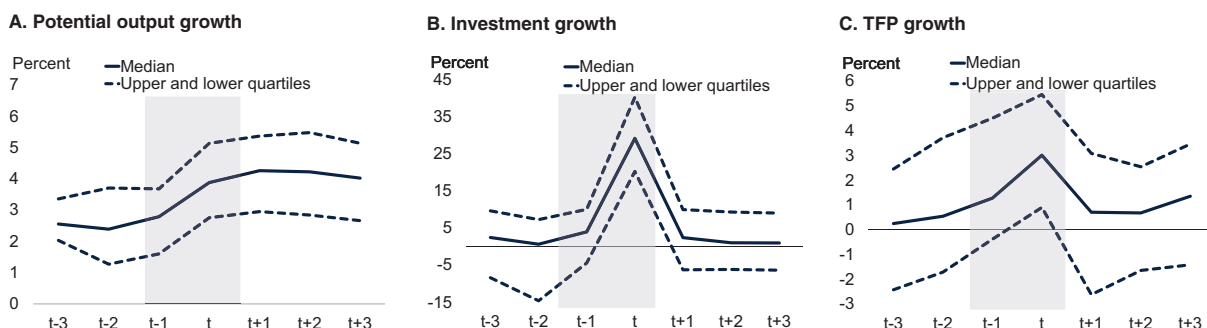
averages of the evolution of both variables and from a panel regression of potential growth on dummy variables for these events, controlling for country and year fixed effects. The two approaches serve somewhat different purposes. Simple averages illustrate the evolution of TFP and output growth during events while the regression approach allows a test of differences between event and non-event years.

**Results.** The event study suggests that the median investment boom in the sample is associated with a 2.8 percentage point a year increase in TFP growth and a 1.1 percentage point a year increase in potential output growth during the three years leading up to the peak of the investment boom (Figure 3.3.2). As the investment boom subsides, TFP and output growth rates gradually slow. Investment busts are associated with slowdowns in TFP growth of 4.9 percentage points a year and in potential growth of 1.0 percentage point a year during the three years leading up to the trough of the investment bust (Figure 3.3.3). Potential output growth and, especially, TFP growth usually rebound following a trough in investment growth. These events coincide with slower actual output growth. The panel regression confirms that the differences in TFP growth and potential growth during booms and busts from non-event years are statistically significant (Annex 3.3). While these results represent correlations, they are consistent with the results in the literature discussed above.

**BOX 3.3 Moving together? Investment and potential output (concluded)**

**FIGURE 3.3.2 Growth around investment booms in EMDEs**

*Investment booms have typically been associated with increases in potential output growth, followed by gradual slowdowns. Surges in TFP growth during investment booms have tended to be quickly reversed.*



Source: World Bank.

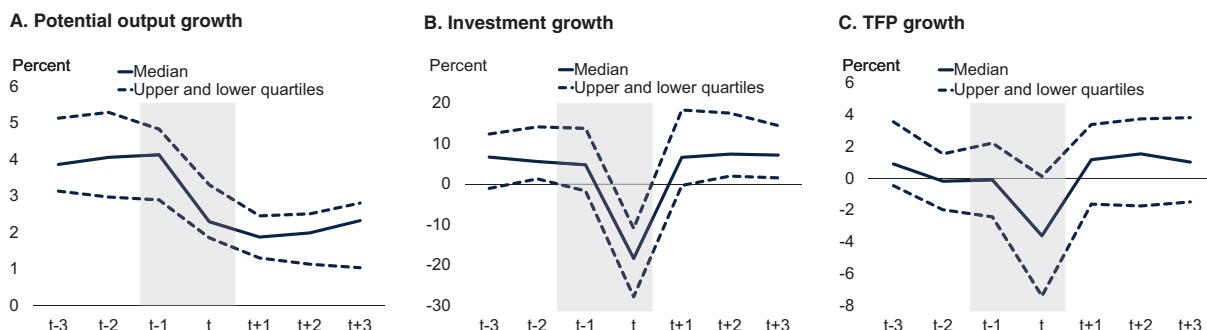
Notes: An investment boom is defined as an episode during which investment growth is at least one standard deviation larger than its long-run (over the sample period) average level. *t* denotes the average of the investment boom. The event studies in this box are conducted using the boom and bust episodes of at least two consecutive years. Shaded area is the peak of the investment boom. Solid lines indicate median, dotted lines indicate interquartile range.

A. Potential growth defined by production function approach.

C. Actual TFP growth as defined in Annex 3.1.

**FIGURE 3.3.3 Growth around investment busts in EMDEs**

*Investment busts have tended to be accompanied by lower subsequent or contemporaneous potential output growth, followed by gradual recoveries. TFP growth has tended to slump during investment busts but to rebound quickly as investment growth recovered.*



Source: World Bank.

Notes: An investment bust is defined as an episode during which aggregate investment is at least one standard deviation lower than its long-run average level. *t* denotes the average of the investment bust. The event studies in this box are conducted using the boom and bust episodes of at least two consecutive years. Shaded area is the trough of the investment bust. Solid lines indicate median, dotted lines indicate interquartile range.

A. Potential growth defined by production function approach.

C. Actual TFP growth as defined in Annex 3.1.

**Conclusion**

Ample evidence supports the existence of multiple linkages between investment growth and potential output growth. By eroding productivity growth, investment busts have adverse indirect effects on potential growth, above and beyond the direct effects of slowing capital accumulation.

The slowdown in investment growth in EMDEs since 2010, therefore, raises substantial longer-run concerns. The association between sharp swings in investment growth and changes in potential output growth suggests that proactive policy measures might usefully support investment, against the risk of investment busts, to avoid an erosion of potential growth.