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AUSTRALIA

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February 6, 2020

Approved By
Asia and Pacific Department

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CONTENTS

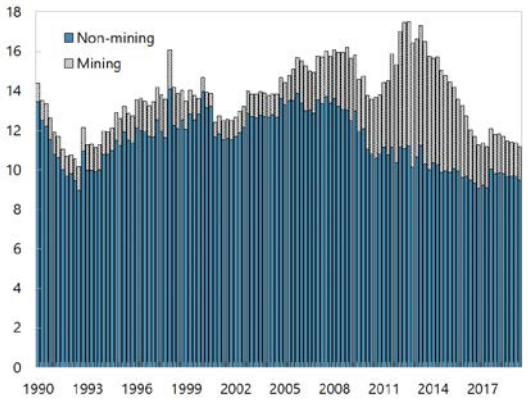
WHY HAS BUSINESS INVESTMENT SLOWED DOWN IN AUSTRALIA?[1]

As in many advanced economies, non-mining business investment in Australia has slowed down since the global financial crisis, weighing on productivity growth. Long-term empirical and simulation-based analyses suggest that global factors such as rising policy uncertainty and weaker commodity prices have been key drivers of the slowdown, while in the short term, a renewed escalation in U.S.-China trade tensions could spill over to investment and growth in Australia. Yet, domestic factors are also at play, including domestic policy uncertainty and financial constraints, especially for smaller and younger firms. The pace of product market reforms can also impact business investment. Australia can promote business investment by reducing domestic policy uncertainty (for example, in energy policy), easing credit constraints for small- and medium-sized enterprises (SMEs), incentivizing R&D, and continuing with product market and tax reforms.

A. Introduction

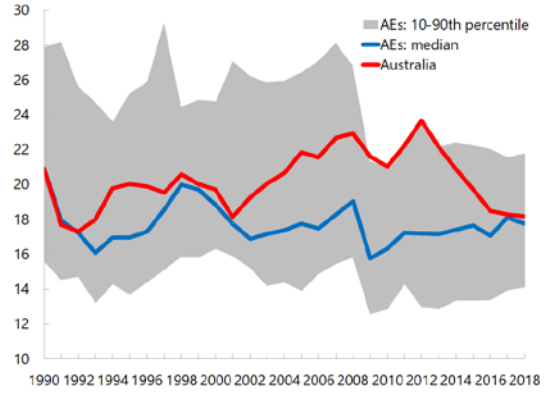
1. Business investment has slowed down in Australia over the last decade. Investment by the mining sector experienced a prolonged downward adjustment after a boom in 2012-14, driven by a commodity price cycle. Non-mining business investment—the focus of this paper—started declining as a percent of GDP earlier, around the time of the global financial crisis (GFC).[2] The post-GFC slowdown in business investment has been observed in many advanced economies, which likely reflects the weakness of economic activity, uncertainty, and financial constraints (IMF, 2015; European Commission, 2017).

Private Business Investment by Sector
(Percent of GDP)



Sources: ABS and IMF staff calculations.

Non-Residential GFCF for Advanced Economies
(Percent of GDP)



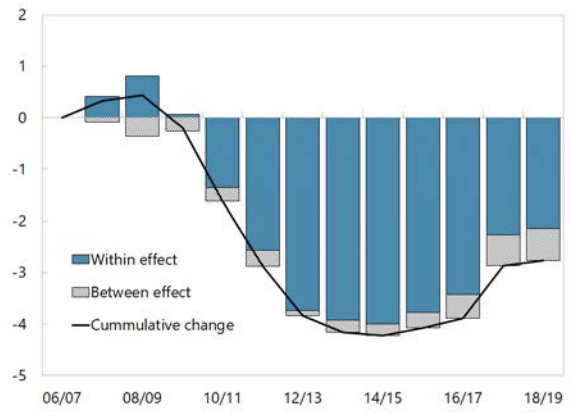
Sources: IMF WEO, OECD, and IMF staff calculations.

[1] Prepared by Yosuke Kido, Dirk Muir, Masahiro Nozaki, Yu Ching Wong, Yong Sarah Zhou (all APD), and Sandile Hlatshwayo (SPR). The chapter benefited from valuable comments by seminar participants at the Reserve Bank of Australia and the Commonwealth Treasury of Australia.

[2] Van der Merwe and others (2018) analyzed factors contributing to the decline in non-mining investment in the longer term in Australia.

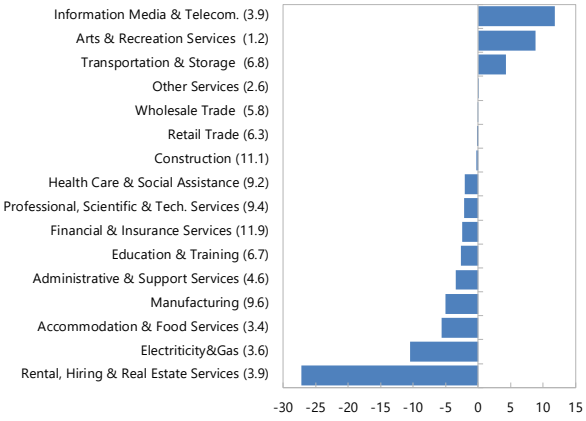
2. The investment slowdown in Australia has been broad-based. Sectoral decomposition shows that the slowdown in non-mining business investment was not driven by a shift from high- to low-investment-intensive sectors, while the ratio of investment to gross value added declined in many sectors including manufacturing. This result is consistent with Hambur and Jenner (2019), who analyzed firm-level data and found that the decrease in investment-to-output ratios of non-mining firms has been broad-based across firms. The decline has been more focused in machinery and equipment, rather than non-residential structures (Van der Merwe and others, 2018).

Ratio of Non-Mining Business Investment to Gross Value Added
(Percentage points change from FY2006/07)



Sources: ABS and IMF staff calculations.
Note: Within effect indicates contribution from within-sector changes. Between effect indicates contribution from reallocation of sectors.

Ratio of Non-Mining Business Investment to Gross Value Added by Sector
(Percentage points change from FY2006/07 to FY2018/19)



Sources: ABS and IMF staff calculations.
Note: Weights of the sector's gross value added (average for FY2006/07-2018/19) are shown in parenthesis.

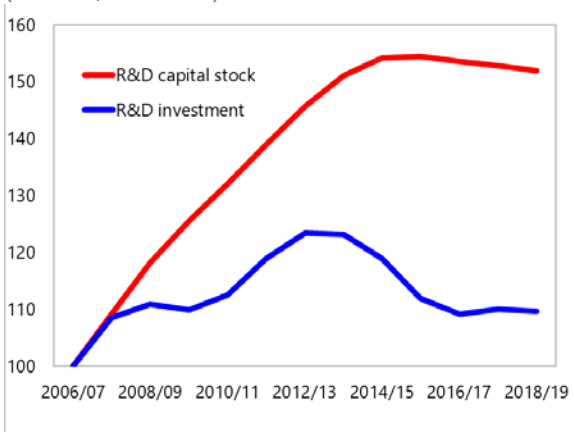
3. The investment slowdown contributed to a decline in labor productivity growth. The investment slowdown hindered capital accumulation in private non-mining sectors, resulting in a slower increase in the capital-labor ratio in the post-GFC period ("capital shallowing"). The capital shallowing accounts for almost two-thirds of the observed decline of 1.2 percentage points in labor productivity growth between the pre- and post-GFC periods. R&D investment has declined in real terms in recent years, causing the stock of R&D to depreciate and likely contributing to the decline in multifactor productivity growth**.**

Decomposition of Labor Productivity Growth
(Annual percent change)

	Average: 1995-96 to 2007-08	Average: 2012-13 to 2017-18	Difference
(EXCLUDING MINING)			
Labor productivity growth	2.3	1.1	-1.2
Contributions from:			
Capital deepening	1.2	0.5	-0.8
Multifactor productivity	0.9	0.4	-0.5
Other	0.2	0.3	0.0
(INCLUDING MINING)			
Labor productivity growth	2.3	2.0	-0.2
Contributions from:			
Capital deepening	1.3	1.2	-0.1
Multifactor productivity	0.8	0.6	-0.2
Other	0.2	0.3	0.1

Sources: ABS and IMF staff calculations.

Real R&D Investment and Capital Stock
(FY2006/07 = 100)



Sources: ABS, Productivity Commission, and IMF staff calculations.

4. This paper investigates the drivers of business investment in Australia, focusing on the non-mining sectors. Section B identifies aggregate-level drivers for non-mining business investment by looking at long-term trends. Section C delves into firm-level investment behavior and assesses the role of credit availability and uncertainty in different types of firms. Section D considers the role of structural reforms from a cross-country perspective. Section E analyzes near-term risks related to trade policy uncertainty. Section F concludes by distilling policy implications.

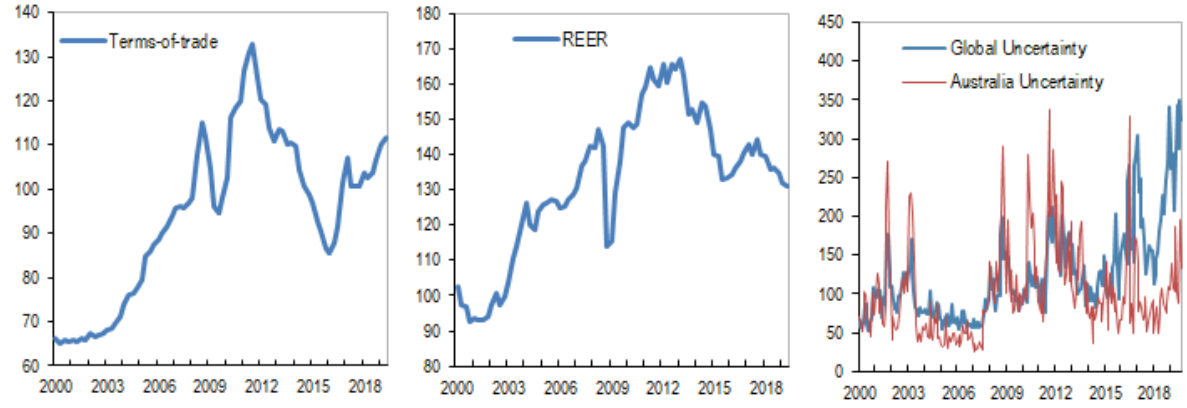
B. Long-Term Drivers of Business Investment: Growth, Uncertainty, Commodity Prices and the Exchange Rate

5. This section analyzes the determinants of non-mining business investment in Australia at aggregate level, using an "accelerator" model. This model assumes investment is driven by previous economic activity, and the empirical literature has found strong support for this model (e.g., Oliner and others, 1995; Lee and Rabanal, 2010). Augmenting this approach, IMF (2015) and Barkbu and others (2015) found that non-output drivers also play a role in the post-GFC slowdown of private investment in advanced economies. In this section, following their approach, the benchmark accelerator model is augmented by other potential explanatory variables, including global and Australia-specific economic policy uncertainty indices developed by Baker and others (2016), the terms of trade, and the real effective exchange rate (REER).[3] Economic policy uncertainty can adversely affect investment as it makes firms more cautious in investment decisions as it induces wait-and-see behavior. The terms of trade can be positively associated with non-mining business investment because mining sector activities are likely to spill over to non-mining investment in sectors such as construction and services. On the other hand, exchange rate appreciation as the

[3] See Annex I for details of the specifications and parameters estimated.

result of a commodity price boom could affect export competitiveness of non-mining sectors, possibly discouraging investment in these sectors.

Terms of Trade, REER, and Global and Australia-Specific Uncertainty Indices

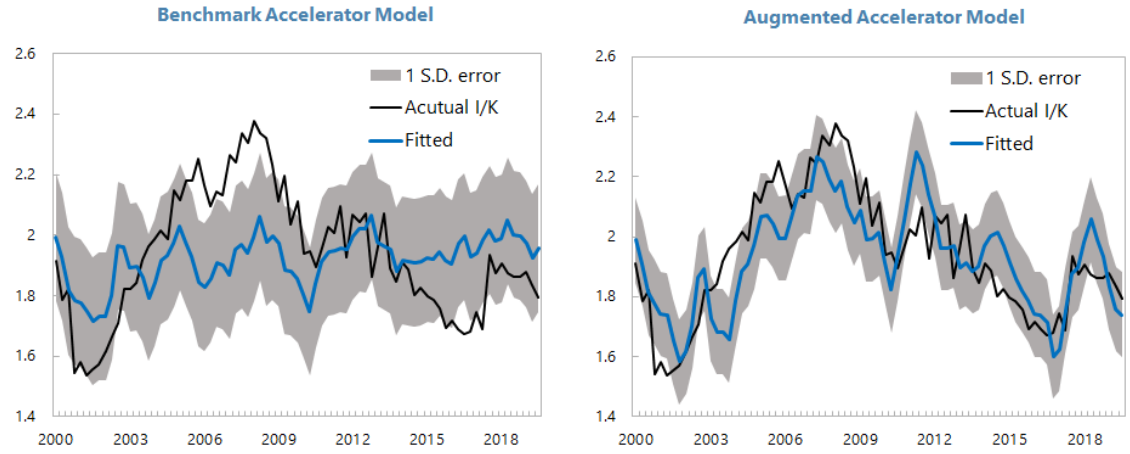


Sources: ABS and Economic Policy Uncertainty

6. Results suggest that economic activity, policy uncertainty, the terms of trade, and the REER are key determinants of non-mining business investment in Australia. The results for the benchmark accelerator model suggest that the slowdown in non-mining business investment cannot be explained by past economic activity alone. Although past economic activity has a statistically significant positive impact on investment with a lag, the fit of the model is relatively poor (see left chart below). This suggests that other factors play a role in the investment slowdown. The fit improves dramatically under the augmented accelerator model (see right chart below). The fitted investment-to-capital ratio exhibits a secular decline during 2012-16, with a brief pickup around 2017, and a decline since, tracking actual investment relatively well. The estimates suggest that global and domestic policy uncertainty as well as the REER appreciation negatively affect investment, while the terms of trade has a positive impact (Annex Table I.1).[4]

[4] Sensitivity analysis confirms the robustness of results, in particular for the role of global policy uncertainty and the terms of trade. First, a post-GFC dummy (which takes the value of one for the period after 2008Q4 and zero otherwise) is added as a regressor to the augmented model, in order to examine a potential structural break at the GFC. The coefficient estimate for the post-GFC dummy is negative and significant at a 1 percent level. The coefficient estimates remain significant for global policy uncertainty and the terms of trade, although those for Australia-specific policy uncertainty and the REER become insignificant. Second, when global and Australia-specific policy uncertainty indices are replaced by the policy uncertainty index for the United States (which allows to expand the sample period to 1987Q3-2019Q3), coefficients estimates are statistically significant at a 1 percent level for the U.S. policy uncertainty index, the terms of trade, and the REER, with correct signs.

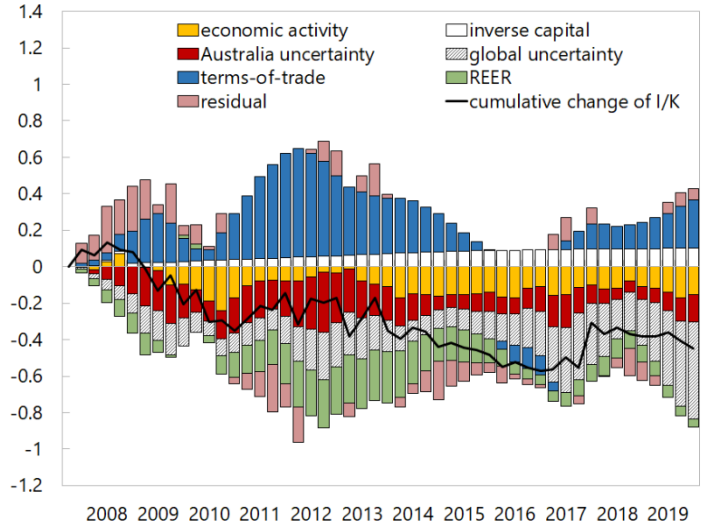
Benchmark and Augmented Accelerator Models for Non-Mining Business Investment
(Ratio of investment to capital stock, percent)



Sources: ABS and IMF staff calculations.
Note: the black line is the actual ratio of non-mining business investment to capital stock in both charts. The blue line in the left and right charts, respectively, shows the fitted value from the benchmark accelerator model (which regresses the investment to capital stock ratio on previous economic activity) and the augmented accelerator model (which adds to the list of regressors: (1) global and Australia-specific economic policy uncertainty indices, (2) the terms of trade, and (3) the real effective exchange rate). Shading indicates confidence intervals for the fitted value with one standard error for each side, based on Newey-West heteroskedastic-and-autocorrelation-consistent standard errors. See Annex I for more detail.

7. Although global factors have been key drivers of the investment slowdown, domestic factors are still at play. The decomposition analysis (see chart) shows that rising global policy uncertainty—mostly exogenous for Australia—has been a drag on non-mining investment since the mid-2010s, partly offsetting the effect of an improvement in the terms of trade. Nonetheless, domestic policy uncertainty has also remained a drag on investment. In the early 2010s, the positive spillover effect from the commodity boom on non-mining business investment has been offset by accompanying REER appreciation.

Drivers of Non-Mining Business Investment
(Contributions to cumulative change from 2007Q2, percentage points)

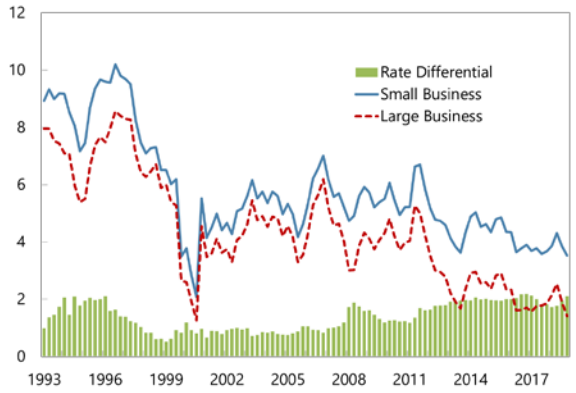


Sources: ABS and IMF staff calculations.

C. The Role of Financial Constraints and Uncertainty: Firm-Level Analysis

8. Financial constraints can be an impediment to investment, particularly for smaller and younger firms. IMF (2015) shows that dependence on external financing and firm cash flow are important drivers of firms' investment behavior in advanced economies. The cost of borrowing to finance investment in Australia has declined since the GFC in line with the global decline in real interest rates. That said, interest rates for smaller firms have not declined as much as for larger firms, with widening rate differentials in recent years, as confirmed by Hambur and La Cava (2018). In addition to borrowing costs, smaller firms are generally thought to face more constraints in accessing finance (Gertler and Gilchrist, 1994). For example, smaller firms are more likely to have lower credit ratings and therefore have limited access to debt markets at low cost. [5] Moreover, Araujo and Hambur (2018) find that younger firms in Australia have less access to credit compared with older firms.[6]

Real Lending Rates for Debt Financing
(Percent)



Sources: RBA and APRA.
Note: Variable, weighted-average rates on credit outstanding. The definition of small business differs between banks but is generally based on annual turnover, number of employees, amount of borrowings or deposits with the particular bank, or some combination.

9. The role of financing constraints on investment in intangible assets also warrants special consideration, given its key role in TFP growth (Corrado and others, 2009; van Ark and others, 2009; Aw and others, 2011).[7] Intangible investment is highly risky for firms: because of long lead times to generate outputs and high adjustment costs, a temporary disruption can permanently reduce projected returns. Further, intangible investment is particularly sensitive to financing conditions external to firms, because of its intrinsic uncertainty, asymmetric information and moral

[5] La Cava and Windsor (2016) also show that smaller firms in Australia tend to have large cash holdings, suggesting they rely on internal financing. Small firms may also obtain some financing by using their owners' housing as collateral (Connolly and others, 2018). Although firm-level data on housing used as collateral are not readily available, potential effects of housing price changes at the aggregate and firm-group levels are controlled for by time fixed effects in the regression which follows in paragraph 10 (also see Annex II).

[6] While beyond the focus of this paper, there is evidence that hurdle rates—the minimum rate of return on investments required by investors—have remained relatively high exceeding 10 percent in Australia and other countries despite the lowering of interest rates. This could be due to a rise in the required risk premium against uncertainties offsetting the reduction in the cost of borrowing and firms' inherent stickiness in altering the hurdle rates (see Lowe, 2019, and Lane and Rosewall, 2015).

[7] Only a few intangible assets are currently capitalized in the national accounts (SNA 2008): R&D; mineral exploration; computer software and databases; and entertainment, literary and artistic originals. Expenditures for design, branding, new financial products, organizational capital, and firm-provided training are currently treated as intermediate costs.

hazard, and limited pledgeability as loan collateral (Aghion and others, 2010; Aghion and others, 2012; Duval, Hong, and Timmer, 2017).

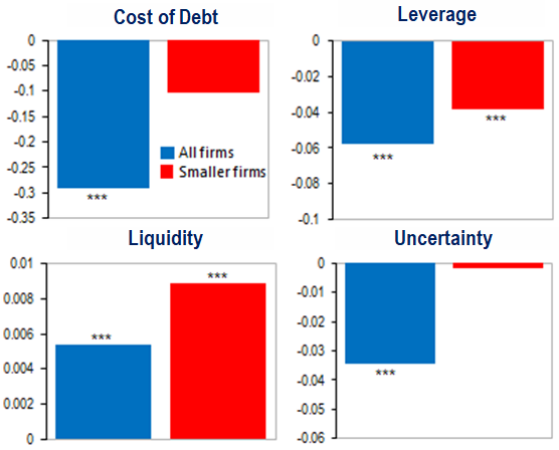
10. Against this backdrop, this section analyzes the role of financing constraints on business investment, using firm-level data. In a world of imperfect competition and asymmetric information, wedges can arise between external and internal financing costs for firms, making the availability of internal funds an important determinant of investment. In this context, firm-level panel regressions are used to estimate how firms' investment-to-capital ratios are associated with indicators of financial conditions, expected future returns, and uncertainty on firms' business. The financial indicators are: the cost of debt, measured by the interest rate on debt; leverage, or the debt-to-asset ratio, as a proxy for the financial structure; liquidity, or the ratio of current assets to current liabilities, which measures the internal funds available to finance investment projects; the ratio between a firm's assets' market value and their replacement value, Tobin's Q, reflecting the firm's expected future returns; and firm-level uncertainty, measured by the standard deviation of weekly stock prices. The analysis is based on panel regressions using firm-level data for publicly-listed non-mining corporations, from 1994 to 2018.

Firm-Level Determinants of Investment

	(1)	(2)
Dependent Variable: Investment-to-Lagged Capital		
Cost of Debt (-1)	-0.2908***	-0.3204***
	(0.0934)	(0.0966)
Leverage (-1)	-0.0575***	-0.0508***
	(0.0128)	(0.0116)
Liquidity (-1)	0.0054***	0.0055***
	(0.0018)	(0.0018)
Uncertainty (-1)	-0.0343***	-0.0373***
	(0.0102)	(0.0105)
Expected Profits (-1)	0.0064**	
	(0.0027)	
Sales (-1)		0.0103*
		(0.006)
R-squared	0.0361	0.0363
Sample Period	1994-2018	1994-2018
Number of Observation	8,019	8,024

Source: IMF staff calculations.
Notes: All explanatory variables are lagged, and firm and time fixed effects are included. Clustered robust standard errors are reported in parentheses.

Comparing Determinants of Investment for Smaller and All Firms



Source: IMF staff calculations.
Note: The charts display coefficients of variables significant at the 1, 5, or 10 percent level (*, **, or ***, respectively). Smaller firms are defined as firms with below-median asset size.

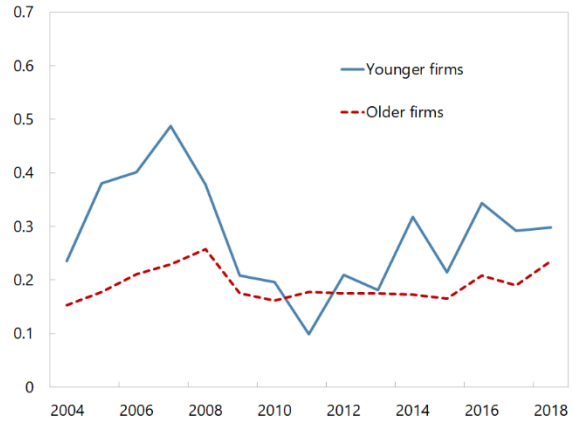
11. Estimation results indicate that firms with high leverage and low liquidity tend to invest less, suggesting that financial constraints play a key role constraining investment.[8] As anticipated, investment is associated positively with expected future returns and negatively with the cost of debt and uncertainty. That said, in addition, firms with high debt-to-asset ratios and/or low

[8] See Annex II for more on the methodology used and for more detailed results for all, smaller and younger firms.

levels of liquid assets tend to invest less. These findings are consistent with a view that firms with high leverage may face borrowing constraints due to financial frictions, while, in addition, low liquidity constrains firms that aim to tap their own resources to finance investment.[9]

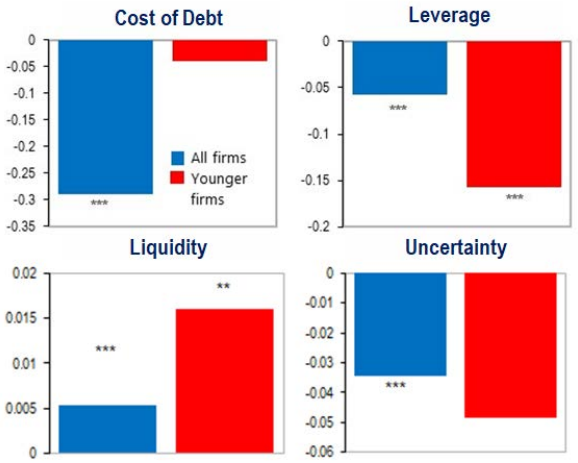
12. Sub-sample analyses suggest that financial constraints could be more binding for smaller or younger firms. Panel regressions conducted for smaller firms suggest that liquidity is a more important factor for these firms than for the overall firm sample, indicating that smaller firms may indeed face more severe financial constraints than larger ones.[10] Similar results are obtained when sub-sample regressions are conducted for younger firms (defined as 5 years or less after establishment), with the sizes of coefficient estimates for liquidity and leverage larger than in the full-sample results. This implies that the dependence of investment on internal finance is stronger also for younger firms which tend to have limited access to external finance.

Investment-to-Capital Ratios
(Share of capital)



Source: IMF staff calculations.
Notes: Younger firms are defined as firms that are 5 years old or younger. Older firms are defined as firms over 5 years old. Median of each group is displayed.

Comparing Determinants of Investment for Younger and All Firms



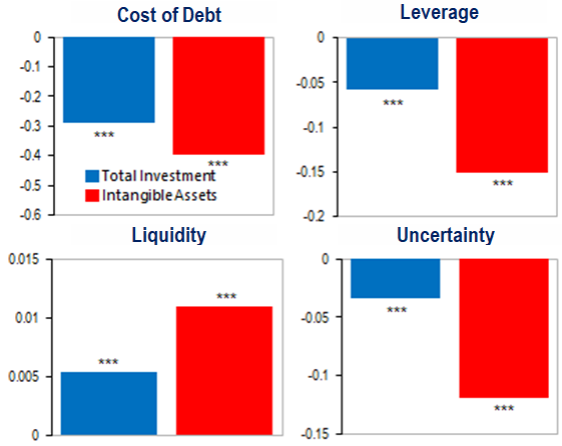
Source: IMF staff calculations.
Note: The charts display coefficients of variables significant at the 1, 5, or 10 percent level (*, **, or ***, respectively). Younger firms are defined as firms that are 5 years old or younger.

[9] The results may be influenced by "survivorship bias", which would bias the analysis against finding evidence of role for financial constraints. Firms that experienced the most severe financial constraints during the crisis and ceased operating are, by definition, excluded from the sample. Despite their exclusion, the analysis still finds significant effects for financial constraints, suggesting that the true effects of such constraints may be larger than reported here. As reported in the table, the role of financial constraints and uncertainty are present even when sales (specified as the ratio of sales to total assets) is used instead of expected profits.

[10] Smaller firms are defined as firms whose assets are less than the median for all firms. Findings presented are unaffected when firms are defined instead based on the amount of sales.

13. The role of financial constraints appears more important for intangible investment. Using the same set of explanatory variables, panel regressions are conducted for intangible asset investment. Coefficients on leverage and liquidity are much larger than in the analysis for overall investment, suggesting that financial constraints may be more binding for intangible investment than for other types of business investment. The coefficient on uncertainty is also larger for intangible assets, which may suggest that firms' wait-and-see behavior under uncertainty is more pronounced for investment in new technologies.

Comparing Determinants of Intangible and Total Investment



Sources: IMF staff calculations.
Note: The charts display coefficients of variables significant at the 1, 5, or 10 percent level (*, **, or ***, respectively).

14. To summarize, the firm-level analysis supports three main conclusions. First, for all non-mining firms, in addition to expected profits and financial conditions (cost of debt), financial frictions (as evidenced by the significance of leverage and liquidity) and uncertainty play key roles in investment decisions. Second, both smaller and younger firms face more difficulties in accessing finance, an important constraint because these firms tend to have less capacity to self-finance than established, larger firms. Third, investment in intangible assets is more sensitive to financial conditions and uncertainty, implying that more restricted access to credit would lead affected firms to cut back investment particularly in intangible assets.

D. Role of Structural Reforms: Cross-Country Analysis

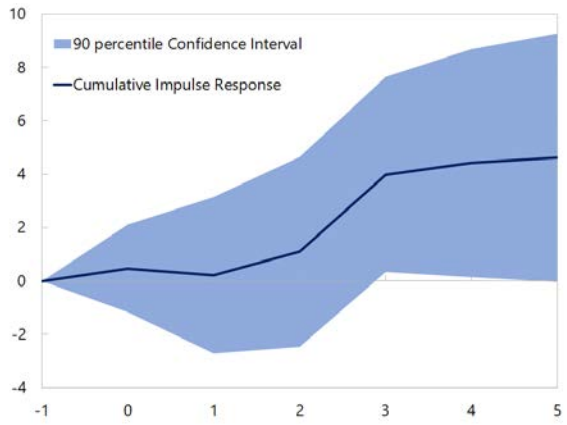
15. Cross-country evidence suggests that product market reform can boost private business investment.[11] Product market reform can: (i) increase the ease of entry of firms thereby increasing the competitiveness of markets and encouraging firms to invest more to remain viable; and (ii) reduce firms' costs of adjusting their capital stock in response to changes in fundamentals (Alesina and others, 2005). In this section, we use a panel regression to estimate the impact of product market reforms in advanced economies on investment. This follows an approach similar to IMF (2016) which considered a large number of significant product market reforms, such as the opening of telecommunications markets to competition in the 1980s in many countries, or the German reforms of the early 2000s. The results from the panel regression suggest that, on average, an episode of significant product market reforms could lead to an increase in the investment-to-GDP ratio of about 4 percentage point after three years.

16. Further efforts in product market reforms can promote business investment in Australia. OECD data on product market regulations show that Australia's product market

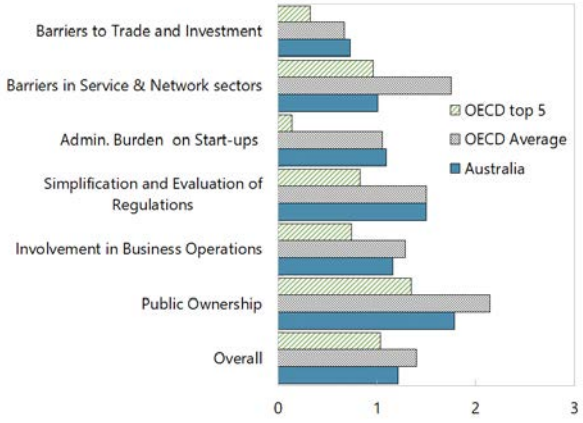
[11] Annex III describes the methodology used.

regulations are less restrictive than the average level for its OECD peers. Nonetheless, there is scope for further improvement in areas including barriers to trade and investment, public ownership, the administrative burden for start-ups, and simplification and evaluation of regulations.

Impact of Product Market Reforms on Private Business Investment for Advanced Economies
(Cumulative percent change in real non-mining business investment in response to product market reform) 1/



Product Market Regulation Indicators
(Indicator, 0 to 3; 0 is best)

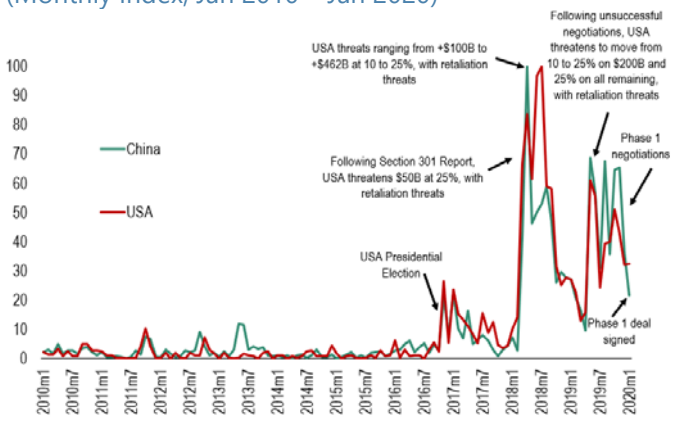


Sources: OECD and IMF staff calculations.
1/ The chart shows the impulse response of real non-mining business investment (in logarithms) to product market reform (dummy variable taking a value of 1 in the years when a reform takes place and 0 otherwise), estimated by a local projection model with a cross-country panel dataset. The horizontal axis indicates years from the reform. See Annex III for more detail.

E. Short-Term Drivers: Trade Policy Uncertainty and Investment

17. Global trade policy uncertainty may be a key near-term risk for non-mining business investment. A major international factor that has been driving global uncertainty are the trade tensions between China and the United States, which are quantified here using Trade Policy Uncertainty (TPU) indices presented in Hlatshwayo and others (2019). The index for trade policy uncertainty and additional indices for monetary and fiscal policy uncertainty are based on news chatter in a database of over 650 million news articles, with individual country indices.

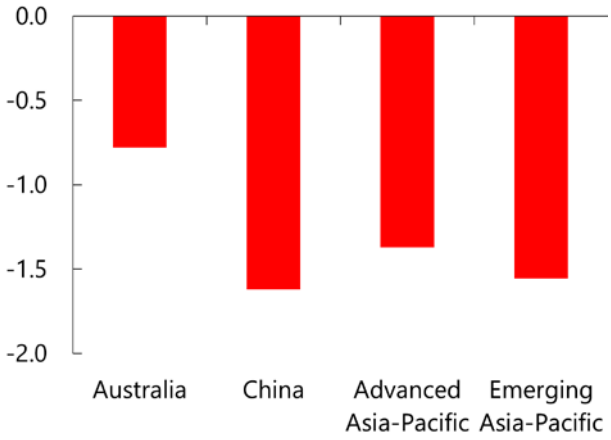
Trade Policy Uncertainty Around U.S.-China Trade
(Monthly Index, Jan 2010 – Jan 2020)



Source: IMF staff calculations.

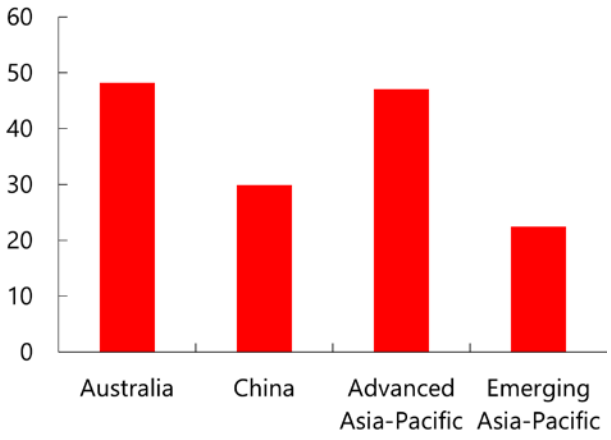
18. Empirical estimation and macroeconomic modeling can be employed to quantify the impacts of trade policy uncertainty on the Australian economy. To illustrate the potential impact of a renewed deterioration in trade policy uncertainty, the impact of a rise in the TPU back to peak levels observed over 2018/19 for a prolonged period is considered. By means of a local projection model (Jordà, 2005), we estimate the impact of such a sustained rise in the TPU on investment and corporate interest rate spreads across Asia and the Pacific (representing the business confidence and financial market effects of trade policy uncertainty, respectively), while controlling for other factors, including fiscal and monetary policy uncertainty.[12] The resulting first-round impacts on investment (for two years) and corporate spreads (for one year) are then used as inputs in one of the IMF's macroeconomic DSGE models, ANZIMF, to simulate the full impact of trade policy uncertainty on investment, including spillover effects from other countries, and quantifying further effects in the rest of the macroeconomy.[13]

Confidence Effect: Cumulative Two-Year Impact of Trade Policy Uncertainty on Real Investment
(Percent)



Source: IMF staff calculations.
Note: Estimated peak effect after two years using country-specific differences in the TPU index between end-2017 and maximum TPU observed (start-2018 through 2019Q3).

Financial Markets Effect: One-Year Impact of Trade Policy Uncertainty on Corporate Spreads
(Basis points)



Source: IMF staff calculations.
Note: Estimated peak effect after one year using country-specific differences in the TPU index between end-2017 and maximum TPU observed (start-2018 through 2019Q3).

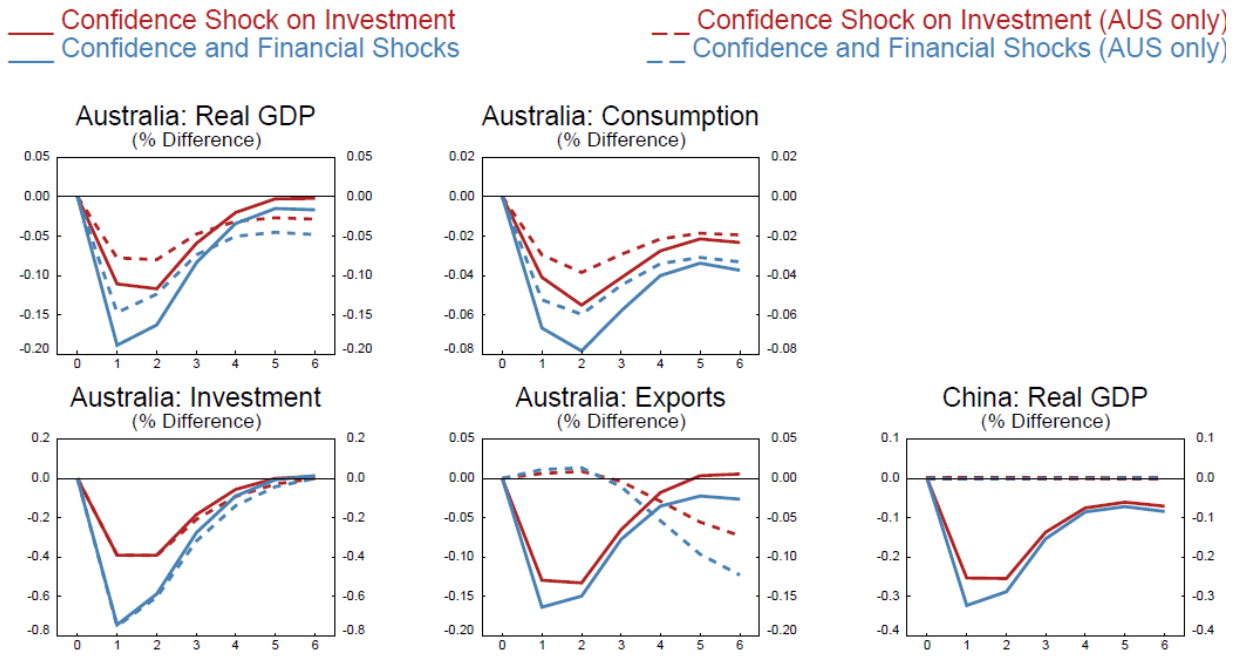
19. Australia would be expected to experience significant impacts on investment from a trade policy uncertainty shock (see figure below). Investment falls overall by over 0.7 percent on

[12] The methodology for computing the TPU index and mapping it into macroeconomic variables can be found in Hlatshwayo and others (2019).

[13] ANZIMF is the Australia-New Zealand Integrated Monetary and Fiscal model, a version of the IMF's GIMF (Global Integrated Monetary and Fiscal Model). For a previous application and broad overview of ANZIMF, see Karam and Muir (2017). For more on the theoretical structure and model properties, see Anderson and others (2013) and Kumhof and others (2010).

impact, 0.4 percentage point of which is the direct impact from reduced business confidence (red lines), and the rest is from higher corporate spreads pushing down investment (blue lines). Lower investment reduces the economy's productive capacity, which not only reduces output but also demand for other factors of production, such as labor. With lower labor demand and lower supply, household income is lower, which reduces consumption. Overall, real GDP would reach a trough at almost 0.2 percent below the baseline (solid blue line), when considering also the spillovers to Australia from the effects of trade policy uncertainty on its trading partners.

Macroeconomic Impacts of Trade Policy Uncertainty in Australia
(Deviation from October 2019 WEO baseline)



Source: IMF staff calculations.

F. Key Findings and Policy Implications

20. The investment slowdown, while not unique to Australia, has been a drag on stronger economic growth. Key drivers in the investment slowdown have been global policy uncertainty (often focused on international trade), domestic policy uncertainty (including around energy policy, taxation, and R&D treatment), the commodity price cycle, the real exchange rate, and financial constraints, especially for smaller and younger firms. Across countries, the pace of product market reforms is also an important driver of investment. While some factors are clearly exogenous, Australia can take action on many other factors with a view to creating strong preconditions for higher private non-mining business investment. Policy actions by the government can focus on reducing domestic policy uncertainty, implementing product market reforms, easing financial constraints, and encouraging investment through tax policy and R&D.

21. Reducing uncertainty should be a priority. While global trade policy uncertainty lasts, keeping domestic policy uncertainty to a minimum can help to foster business investment. This includes setting clear policy directions and dealing with issues identified by the private sector, including more predictability in energy policy and setting out clear paths for tax policy and R&D incentives (below). In addition, continued government actions to encourage multilateralism will be helpful in addressing over time the sources of global trade policy uncertainty.

22. Further product market reform could encourage investment. The 2015 Competition Policy Review ("Harper Review") addressed many issues, and its implementation mainly between 2017 and 2019 implies that positive effects on the economy may still take time to fully materialize. There is competition legislation underway for intellectual property. The new Deregulation Taskforce is considering reforms from the perspective of business users of government services, in order to reduce costs to firms. This includes, for example, the costs for a firm hiring its first worker or exporting abroad for the first time. The so-far limited mandate of the Deregulation Taskforce could be broadened over time into other areas of product market regulation, including to further reduce barriers to trade and investment and the administrative burden for start-ups. Further reforms could be taken in the new fields of online and digital businesses to ensure free entry and reduce or prevent oligopolistic behavior.

23. The government should continue efforts to ease financial constraints on firms, especially for SMEs and younger firms. Some measures are underway, such as the *Australian Business Securitization Fund* (ABSF) and the *Australian Business Growth Fund* (ABGF). Both funds are relatively small (up to A$2 billion for the ABSF and A$1 billion for the ABGF) and could be expanded in size after a trial period and evaluation of their effectiveness. More generally, the authorities could introduce policies and incentives to encourage banks to lend more to businesses (possibly by reducing banks' concentration in mortgage lending). Governments could also promote venture capital investments, as the use of venture capital in Australia is less than half of the OECD average, with the likely additional benefit of stimulating private sector R&D.

24. The government could further promote R&D. The government has introduced legislation to reform the R&D tax credit regime. There has been increased STEM funding in education and medicine through the 2019 budget and the National Innovation and Science Agenda (NISA) starting in 2016. The effectiveness of these programs could be evaluated to allow for their expansion if they are found to be effective. Faster implementation of the government's 2018 review of the science and technology sectors, *Australia 2030: Prosperity Through Innovation*, would also be helpful to promote R&D and innovation. More generally, government R&D support could be refined to more effectively target younger (usually more innovative) firms.

25. Finally, the government could further promote business investment by completing its tax reform agenda. As part of a broader tax reform, it could conclude the stalled corporate income tax reform, reducing SME tax rates fully to 25 percent, and extending tax rate cuts to all firms, to maintain the international competitiveness of the Australian corporate tax system. The government could also consider further support for new investment through tax measures, possibly including targeted investment allowances.

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Annex I. Accelerator Models – Methodology and Detailed Results

Following IMF (2015) and Barkbu (2015), accelerator models are employed to analyze the drivers of non-mining business investment at an aggregate level. To shed light on output and non-output drivers, both benchmark and augmented version of accelerator models are estimated. The benchmark model can be written as:

$$\frac{I_t}{K_{t-1}} = \gamma + \frac{\alpha}{K_{t-1}} + \frac{\sum_{i=1}^{6} \beta_i \, \Delta Y_{t-i}}{K_{t-1}} + \varepsilon_t,$$

where I_t denotes non-mining business investment, K_t denotes the non-mining business capital stock, and ΔY_t denotes private sector non-mining gross value added (GVA). To obtain the quarterly value of capital stock K_t from annual data, the benchmarking method of Chow and Lin (1971) is employed, and private sector non-mining GVA is used as a regressor.

The benchmark model explains the dynamics of investment based purely on output developments. The large residuals in the model estimation indicate that other factors, not explained by output dynamics, must also play a role. To analyze other potential drivers of investment dynamics, an augmented version of accelerator model is estimated:

$$\frac{I_t}{K_{t-1}} = \gamma + \frac{\alpha}{K_{t-1}} + \frac{\sum_{i=1}^{6} \beta_i \, \Delta Y_{t-i}}{K_{t-1}} + \delta X_t + \varepsilon_t$$

where X_t denotes a set of non-output drivers of investment which are: news-based global and Australia uncertainty indices developed by Baker and others (2016); the terms of trade; and the REER. All variables are four-quarter backward-looking rolling averages, and the REER is included with a one-quarter lag.

Both benchmark and augmented accelerator models use data from 1998Q4 to 2019Q3. Since the residuals of both models exhibit serial correlation, Newey-West heteroskedastic-and-autocorrelation-consistent standard estimators are used.

Annex Table I.1. Accelerator Models

	(1)	(2)
	Benchmark Model	Augmented Model
	Dependent Variable: Private Non-Min. Inv.-to-Lagged Capital	
ΔY(-1)/K(-1)	0.1907	0.2263
	(0.3338)	(0.228)
ΔY(-2)/K(-1)	0.3409	0.3421
	(0.2973)	(0.229)
ΔY(-3)/K(-1)	0.3537	0.3101
	(0.2676)	(0.1883)
ΔY(-4)/K(-1)	0.2175	0.2635
	(0.261)	(0.1802)
ΔY(-5)/K(-1)	0.5453**	0.5677***
	(0.2571)	(0.1936)
ΔY(-6)/K(-1)	0.4602*	0.4944***
	(0.2474)	(0.1697)
1/K(-1)	-8449.604*	-5139.88
	(4349.279)	(7387.49)
Term-of-Trade		0.000175***
		(0.000041)
REER (-1)		-0.000076*
		(0.000038)
Global Uncertainty		-0.000023***
		(0.000008)
Australia Uncertainty		-0.000019**
		(0.000008)
Constant	0.0213***	0.018**
	(0.0018)	(0.0071)
Adjusted R-squared	0.051747	0.571325
Number of Observation	84	84
Sample Period	1998Q4 2019Q3	1998Q4 2019Q3

Source: IMF staff calculations.
Note: Newey-West heteroskedastic-and-autocorrelation-consistent standard errors are reported in parenthesis. In the table, *, ** and *** indicate significant at the 1, 5, or 10 percent level, respectively).

Annex II. Firm-Level Regressions – Methodology and Detailed Results

For firm-level analysis, the following panel regression model is employed to analyze the drivers of non-mining business investment:

$$\frac{I_{i,t}}{K_{i,t-1}} = \alpha + \tau_i + \delta_t + \beta X_{i,t} + \varepsilon_{i,t},$$

where $I_{i,t}$ denotes firm i's capital expenditure at time t, $K_{i,t}$ denotes firm i's capital stock, and $X_{i,t}$ denotes a set of firm-level variables. $X_{i,t}$ includes the cost of debt (interest rate expenditure-to-debt), leverage (debt-to-asset ratio), liquidity (current asset-to-current liability), firm-level uncertainty (firm-level stock volatility), and expected profits (Tobin's Q, measured as the sum of market value of equity and book value debt liability divided by book value of assets). The regression also includes firm-level and time fixed effects. Firm-clustered robust standard errors are estimated. As a robustness check, a specification that includes sales (the sales-to-asset ratio) instead of expected profits is also estimated. All explanatory variables are included with a one-year lag.

The firm-level data are annual and are obtained from IMF Corporate Vulnerability Unit Database, which is based on the Thomson Reuters Worldscope database. Data are from 1994 to 2018, with mining sector and public administration removed. Outliers, such as samples with investment-to-lagged capital of more than 100 percent, or observations with cost of debt of more than 15 percent are also removed.

In the subsample analysis, smaller firms are defined as firms with below-median asset size. Younger firms are defined as firms that are five years of age or younger. In the intangible asset investment analysis, $I_{i,t}$ denotes the change in intangible assets, and $K_{i,t}$ denotes the stock of intangible assets.

Annex Table II.1. Summary Statistics of Firm-Level Variables

	Mean	Overall S.D.	Between S.D.	Within S.D.
Cost of Debt	0.070	0.032	0.026	0.025
Leverage	0.285	0.340	0.270	0.260
Liquidity	1.304	2.101	2.154	1.519
Uncertainty	0.525	0.377	0.338	0.245
Expected Profits	1.548	2.877	2.583	2.100
Sales	1.047	0.932	0.826	0.477
Investment-to-Lagged Capital	0.215	0.208	0.178	0.159
Net Intangible Investment-to-Lagged Intangible Asset	-0.101	0.403	0.415	0.305

Source: IMF staff calculations.

Annex Table II.2. Firm-Level Regressions for All, Smaller, and Younger Firms

	ALL	Smaller Firms	Younger Firms
Dependent Variable: Investment-to-Lagged Capital			
Cost of Debt (-1)	-0.2908***	-0.1042	-0.0397
	(0.0934)	(0.151)	(0.4937)
Leverage (-1)	-0.0575***	-0.0386***	-0.1567***
	(0.0128)	(0.0099)	(0.0342)
Liquidity (-1)	0.0054***	0.0089***	0.016**
	(0.0018)	(0.0026)	(0.0073)
Uncertainty (-1)	-0.0343***	-0.0016	-0.0487
	(0.0102)	(0.0123)	(0.0541)
Expected Profits (-1)	0.0064**	0.0037**	0.0312***
	(0.0027)	(0.0019)	(0.0109)
R-squared	0.0361	0.023	0.0469
Sample Period	1994-2018	1994-2018	1994-2018
Number of Observation	8,019	3,066	573

Source: IMF staff calculations.
Notes: Firm-clustered robust standard errors are reported. In the table, *, ** and *** indicate significant at the 1, 5, or 10 percent level, respectively).

Annex Table II.3. Firm-Level Regression for Intangible Assets

	Total Investment	Intangible Assets
Dependent Variable: Investment-to-Lagged Capital		
Cost of Debt (-1)	-0.2908***	-0.3954**
	(0.0934)	(0.2005)
Leverage (-1)	-0.0575***	-0.1509***
	(0.0128)	(0.0421)
Liquidity (-1)	0.0054***	0.011***
	(0.0018)	(0.0035)
Uncertainty (-1)	-0.0343***	-0.1195***
	(0.0102)	(0.0291)
Expected Profits (-1)	0.0064**	0.0153**
	(0.0027)	(0.007)
R-squared	0.0361	0.0518
Sample Period	1994-2018	1994-2018
Number of Observation	8,019	6,550

Source: IMF staff calculations.
Note: Firm-clustered robust standard errors are reported. In the table, *, ** and *** indicate significant at the 1, 5, or 10 percent level, respectively)

Annex III. Cross-Country Regression – Methodology

Following IMF (2016), a panel local projection model focused on advanced economies is used to estimate the impact of product market reforms on business investment:

$$I_{i,t+k} - I_{i,t-1} = \alpha_i + \gamma_t + \beta_k R_{i,t} + \theta_k X_{i,t} + \varepsilon_{i,t},$$

where $I_{i,t}$ denotes non-mining business investment in country i at time t (in logarithms), R_t denotes the dummy variable for product market reform, which takes a value of 1 in the year(s) when a reform takes place and 0 otherwise. X_t denotes a set of other control variables, including contemporaneous and lagged variables of other structural reforms (such as reforms of unemployment benefits and employment protections), lagged product market reform dummies, and crisis event dummies. The definition of product market reform events follows IMF (2016), which identifies reform events based on *OECD Economic Surveys* and country-specific sources.

The data covers a sample of 18 advanced economies from 1990 to 2016. In the panel regression, both country fixed effects and year fixed effects are included. Clustered robust standard errors are estimated.