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BELOW-MARKET FINANCE

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Measuring Distortions in International Markets: Below-Market Finance

The support that governments provide to their industrial producers has been a growing source of concern. Much of that support is provided by governments through the financial system, either in the form of below-market borrowings or below-market equity. To better understand the nature and scale of this support, this report uses publicly available information for 306 of the largest manufacturing firms in 13 industrial sectors, covering the period 2005-19. It finds that below-market borrowings tend to be relatively large in heavy industries, including some that reportedly suffer from excess capacity, while below-market equity returns appear to be more common in high-tech industries such as aerospace and semiconductors. Below-market borrowings also appear to benefit firms with more than 25% government investment relatively more. These findings on below-market finance raise a number of important issues for trade rules, including in relation to transparency and the scope of subsidy disciplines.

Key words: Trade, government support, subsidies, loan subsidies, government equity, excess capacity, state-owned enterprises

JEL Codes: F13, F23, G32, H25, H81, L33, L52, L60, O25

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Any finding of this work is without prejudice to any reviews that may be conducted by investigating authorities or under the WTO dispute settlement procedures on subsidies and countervailing measures.

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Key messages and findings

- Below-market finance can take the form of either below-market borrowings – where governments provide support through debt financing – or below-market equity – where governments provide equity finance on terms that are inconsistent with market principles. In both cases, below-market finance serves to lower companies' cost of capital.
- Based on a sample of 306 firms in 13 industrial sectors, analysis in this report estimates below-market borrowings at around USD 66 billion over the five-year period 2014-18. In relative terms, below-market borrowings average about 3-4% of recipient firms' revenue in sectors such as aluminium, cement, glass and ceramics, and semiconductors.
- Below-market borrowings appear to be more frequent in firms that have at least 25% government investment. Among the sectors analysed, support also seems to be more prevalent in industries subject to excess capacity such as aluminium, cement, and solar panels, as well as glass and ceramics.
- Below-market equity returns were found to be more prevalent in high-tech sectors that rely on intangible assets and equity financing. This is particularly the case for semiconductors, where the creation of government investment funds has increased government ownership of semiconductor assets in China.
- Empirical analysis finds that below-market borrowings are correlated with larger investments in fixed tangible assets at the firm level. This suggests that below-market finance may have been a contributor to excess capacity in a number of sectors. Support also appears to be negatively correlated with firm productivity.
- Findings in this report raise significant concerns about a lack of transparency in relation to below-market finance. This is related to both the ability to determine market benchmarks for identifying below-market finance and to insufficient information on government ownership of companies.
- Another concern arises from the fact that government-invested firms are not only recipients of below-market finance, but can also be providers of support themselves (e.g. state banks and government guidance funds). Existing trade rules do not fully capture the support provided by or through government-invested firms.
- Finally, existing trade rules do not entirely address the complex nature of below market equity: while they discipline below-market equity infusions, they may not cover the support conferred to government-invested firms in the form of persistent below-market equity returns.

Executive summary

The support that governments provide to their industrial producers has been a growing source of trade tensions amid reports of excess capacity and unfair competition. While much light has already been shed on support to agricultural producers and fisheries, the scope and scale of government support in manufacturing remains opaque and poorly documented. Recent OECD evidence for the aluminium and semiconductor value chains indicates, however, that producer support in manufacturing can be of real concern for trade and competition.

Government support can come in many shapes and forms, including government grants, tax concessions, inputs provided to companies at below-market prices, or even targeted exemptions from regulatory requirements. Available evidence suggests that considerable support also appears to be provided by governments through the financial system. Whether it is in the form of below-market borrowings (e.g. preferential interest rates and government loan guarantees) or below-market equity (e.g. government equity infusions and below-market equity returns), below-market finance has been found to play a major role in favouring certain aluminium and semiconductor producers.

To better understand the scope and scale of below-market finance, the OECD has used public sources to collect and analyse detailed information for 306 of the largest manufacturing firms in 13 industrial sectors over the period 2005-19. These sectors are: aerospace and defence; aluminium; automobiles; cement; chemicals; glass and ceramics; rolling stock; semiconductors; shipbuilding; solar photovoltaic panels; steel; telecom network equipment; and wind turbines. In most sectors, the firm sample thus assembled covers at least two thirds of global sales or capacity to the extent possible. Geographical coverage is balanced to closely track countries' respective weight in global manufacturing.

Government-invested firms make up a significant portion of all 306 companies included in the sample, and by extension a significant portion of all top industrial groups in the 13 sectors considered. In sectors such as aluminium, shipbuilding, and steel, governments are estimated to own more than 40% of all company assets covered by the sample. Government-invested firms on average earn lower returns on these assets than private firms, especially where state entities own more than 25% of a company's shares. These firms also obtain relatively more government grants in proportion to their revenue and face lower risk spreads, and hence lower interest rates on their debt.

Below-market borrowings – which enable companies to obtain debt financing on terms that are more favourable than available on the market – appear to be concentrated both in terms of sectors and countries. Some sectors that have suffered from excess capacity in recent years count among the largest beneficiaries in relative terms, including aluminium, cement, glass and ceramics, and solar photovoltaic (PV) panels. In other sectors such as steel and shipbuilding, more than half of all sampled firms have benefitted from some amount of below-market borrowings. Most support was found to benefit industrial firms based in the People's Republic of China (henceforth "China"), although some firms based in other jurisdictions (e.g. India, the Russian Federation – henceforth "Russia"–, and OECD countries) also benefitted from below-market borrowings.

Measuring the benefits conferred through below-market equity is more complex since government ownership of industrial firms does not in and of itself constitute support. Instead, the benefits derive from government owners acting in a manner that is not consistent with market principles, i.e. when they behave differently from private shareholders or investors. In such cases, firms benefit by not being subject to the same market discipline as their competitors, domestic or foreign. Just as for below-market borrowings, this lowers companies' cost of capital, enabling them to invest more or to tolerate greater losses.

To examine this, instances where the performance of government-invested firms in the sample deviates significantly and repeatedly from an industry-specific target rate of return were considered. This was found to be particularly prevalent in semiconductors and aerospace, which are both R&D-intensive sectors that rely relatively more on equity finance. The results are strongest for semiconductors, the sector in which specialised government investment funds for acquiring shares have been created in China.

The implications of below-market finance for trade are both manifold and difficult to assess, partly due to the complexity of supply chains in manufacturing. Analysis shows, however, that below-market finance tends to correlate with increases in manufacturing capacity, so that beneficiaries of support likely use their lower cost of capital to invest more in productive capacity than they would otherwise. Capacity increases can in turn depress global prices where they are not matched by a comparable increase in demand. Below-market borrowings are also found to be negatively correlated with firm productivity, which implies that the recipients of support are generally less productive.

Overall, OECD findings underscore the need for better rules governing below-market finance and government support more generally. A first issue relates to the lack of transparency on below-market finance. Many governments fail to disclose the subsidies they provide, but this problem is exacerbated in the case of below-market finance as demonstrating the existence of such support requires comparison with a market benchmark, detailed methodologies for which have yet to be established or agreed. Information is also sometimes lacking on the ownership structure of firms, which can hide the true extent of government ownership of industrial producers.

The findings also highlight the role that government-invested firms play as not only recipients of government support, but also providers themselves. Below-market borrowings are generally intermediated or offered by state banks while government equity infusions can originate from state investment funds. In both cases, the provision of below-market finance involves a corporation acting as the intermediary between the government and industrial producers. This creates a number of challenges for current trade rules, which can fail to discipline such support.

Below-market finance poses other challenges for trade rules, including the lack of disciplines on certain aspects of below-market equity. While current rules discipline government equity infusions that are not provided on market terms, they may not account fully for the possibility that once they have become investors, governments may not act as regular shareholders and instead tolerate below-market returns. This tolerance, and the maintenance of investment under non-market conditions, constitutes a source of ongoing benefit to the firm in question. Another issue concerns the need under current trade rules to demonstrate specificity of subsidies, which could make it harder to discipline some instances of below-market borrowings at the WTO.

The COVID-19 pandemic has caused great health, social, and economic damage and has pushed governments around the world to support citizens and firms. Much of this support has taken the form of below-market finance, notably government-guaranteed loans for small businesses and equity infusions into distressed companies (e.g. airlines). This suggests that below-market finance should not necessarily be banned altogether from the policy toolkit, but rather be reserved for emergency situations and subject to disciplines to ensure that the support introduced in a crisis does not result in distortions to trade and competition. Design of such emergency support, for example in relation to transparency, non-discrimination, targeting, and duration, can be important in ensuring that it does not become structural.

1. Why should decision makers care about below-market finance?

While there are many reasons behind current trade tensions, the support that governments offer to their industrial producers is contributing to concerns that global competition is not "fair". This support comes in many forms, including through the provision to firms of government grants, tax concessions, cheaper inputs, soft financing, guaranteed sales prices, targeted exemptions from regulatory requirements, and even the assumption by governments of risks that should normally be borne by the private sector. The particulars of each support instrument may vary depending on their fiscal cost and their design (Table 1), but they all share the common trait of undermining competition at home and abroad.

The present report is concerned with government support provided in the form of financing offered to companies on below-market terms (henceforth 'below-market finance'). The main reason for this focus is the scale and opacity that appear to characterise below-market finance – especially when judged against other forms of support that tend to be better documented and understood, such as government grants and investment tax incentives. This report thus departs from earlier OECD work by looking at one particular set of government support policies across many industrial activities, while earlier reports focussed on the whole range of support policies for individual value chains (e.g. aluminium and semiconductors).[1]

While this report on below-market finance is foremost a continuation of OECD efforts to improve the understanding and measurement of government support – and trade distortions more generally – it is also relevant for the design and evaluation of the support policies that governments have adopted in response to the COVID-19 pandemic. Many of the policy responses announced to date include the provision of financing on preferential terms: e.g. bridging loans to businesses by public investment banks and government agencies, government equity injections, and government loan guarantees. While these measures proceed from the urgent need to prevent a catastrophic economic collapse, care should be taken to ensure that today's stimulus does not sow the seeds of enduring market distortions.

1.1. Below-market finance is not transparent but possibly large

Early OECD efforts to identify and quantify government support focussed on primary industries, starting with agriculture, and continuing with fisheries and fossil fuels. As a result, initial emphasis was often placed on measures affecting output prices (e.g. guaranteed sales prices) and the affordability of intermediate inputs such as fertilisers and fuel. Comparatively little attention was devoted to measures that could affect the cost of capital, besides targeted schemes offering subsidised loans for the acquisition of farm machinery and fishing vessels.[2] One important exception was the work undertaken in the 1990s by the Industry Committee of the OECD, which sought "to improve international transparency and to compare, OECD-wide, the trends and patterns of public support to manufacturing industry" (OECD, 1998[1]).

1 See OECD (2019[2]) and OECD (2019[3]).

2 Recent OECD work on measuring government support for fossil fuels has addressed the question of below-market lending benefitting energy infrastructure but did not measure it systematically (OECD, 2018[24]).

Table 1. Indicative OECD matrix of support measures, with illustrative examples

			Statutory or formal incidence (to whom and what a transfer is first given)							
			Production							Consumption
			A. Output returns	B. Enterprise income	C. Cost of intermediate inputs	Costs of value-adding factors				
						D. Labour	E. Land and natural resources	F. Capital	G. Knowledge	H. Unit cost of consumption
Transfer mechanism (how a transfer is created)	**1. Direct transfer of funds**		Output bounty or deficiency payment	Operating grant	Input-price subsidy	Wage subsidy	Capital grant linked to acquisition of land	Grant tied to the acquisition of assets, including foreign ones	Government R&D	Unit subsidy
	2. Tax revenue foregone		Production tax credit	Reduced rate of income tax	Reduction in excise tax on input	Reduction in social charges (payroll taxes)	Property-tax reduction or exemption	Investment tax credit	Tax credit for private R&D	VAT or excise-tax concession
	3. Other government revenue foregone			Waiving of administrative fees or charges	Under-pricing of a government good or service		Under-pricing of access to government land or natural resources	Debt forgiveness or restructuring	Government transfer of intellectual property rights	Under-pricing of access to a natural resource harvested by final consumer
	4. Transfer of risk to government		Government buffer stock	Third-party liability limit for producers		Assumption of occupational health and accident liabilities	Credit guarantee linked to acquisition of land	Loan guarantee; non-market-based debt-equity swap and equity injection		Price-triggered subsidy
	5. Induced transfers		Import tariff or export subsidy; local-content requirements; discriminatory government procurement	Monopoly concession	Monopsony concession; export restriction; dual pricing	Wage control	Land-use control	Credit control (sector-specific)	Deviations from standard IPR rules	Regulated price; cross subsidy
		-- Including advantages conferred through state enterprises			Provision of below-cost electricity by a state-owned utility			Below-market loan by a state-owned bank		

Note: This matrix is a work in progress and may be refined in the future. Some measures may fall under a number of categories (e.g. debt-equity conversions may involve elements of both risk transfers and revenue foregone). GP = Government procurement.

As policy attention increasingly turns to government support benefitting industrial sectors, a growing body of empirical work has emerged that suggests that below-market finance is an issue of significant concern for international trade and competition. Recent studies conducted by the OECD Trade Committee have found that below-market loans and below-market equity account for a large share of all government support identified in the aluminium and semiconductor value chains. In the case of aluminium, below-market borrowings are estimated to represent more than half of all support identified for 17 of the largest firms operating along the aluminium value chain over the period 2013-17 (OECD, 2019[2]). In semiconductors, not only were below-market borrowings found to confer important support to firms operating along the semiconductor value chain, but government equity injections also appear to have had the effect of providing significant amounts of support via below-market equity.[3] Overall, below-market borrowings and below-market equity together accounted for about 20-40% of all government support identified by the OECD for a sample of 21 of the largest semiconductor firms over the period 2014-18 (OECD, 2019[3]).

Although quantitative evidence remains piecemeal, there are indications that below-market finance may have distorted competition not only in the above sectors, but also in several others. Other work by the OECD has noted how preferential lending and credit guarantees for shipyards can exacerbate excess shipbuilding capacity (Gourdon, 2019[4]). Several trade disputes have also centred on the provision of preferential financing for shipbuilders, producers of memory chips, and manufacturers of large civil aircraft. Subsidised loans and other preferential financing were similarly highlighted in the United States' request for consultations at the World Trade Organization (WTO) in relation to subsidies to producers of primary aluminium in China[4], as well as in several domestic countervailing duty cases that have been pursued in recent years (e.g. in relation to steel, aluminium, and solar photovoltaic panels). Academic evidence for the steel and shipbuilding industries has also found government support, including subsidised lending, to have affected competitive conditions in those sectors and certain others (Barwick, Kalouptsidi and Zahur, 2019[5]; Blonigen, 2016[6]).

Systematic evidence on the magnitude of below-market finance, including across countries and sectors, is still lacking, however. This makes it hard to gauge how widespread below-market finance is relative to other forms of support. The OECD's 2019 *Economic Survey* of China notes, for example, that about a third of all bank lending in China attracts interest rates that are equal to or below the country's lending benchmark[5], thereby suggesting below-market lending to be common in the country (OECD, 2019[7]). Other research also suggests that state-owned enterprises (SOEs) are the main providers and recipients of financial support in China, as state banks channel below-market lending toward those industrial producers that are state-owned or otherwise favoured by authorities (Ru, 2018[8]; Harrison et al., 2019[9]; Hsieh, Bai and Song, 2019[10]; IMF, 2019[11]). While much of the research has focused on the role of state enterprises as beneficiaries of below-market lending in China, less attention has been paid to other countries and the true scope of below-market borrowings.[6]

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3 As explained later in this report, below-market equity is defined here as financing costs that are below the cost of capital wherever government-invested firms fail to generate a fair return on equity for taxpayers in addition to covering their interest costs.

4 See www.wto.org/english/tratop_e/dispu_e/cases_e/ds519_e.htm (accessed on 24 August 2020).

5 This refers to the benchmark lending rates that were published by the People's Bank of China before it adopted the Loan Prime Rate in 2019 as a new reference rate for bank lending.

6 Much of the little academic evidence that exists for OECD countries concerns either the effects of subsidised lending on small and medium-sized enterprises (e.g. from a regional development angle) or export credits. Both issues fall outside the scope of the present report. Moreover, export credits are in principle subject to the OECD *Arrangement on Officially Supported Export Credits* and should therefore reflect market terms and conditions for Participants.

Systematic evidence is even more scarce in the case of below-market equity, reflecting in part the lack of a commonly accepted definition of what the concept entails. Numerous studies have found that state-owned enterprises (SOEs) often generate lower returns than private firms.[7] However, it is not clear whether these can be considered as below-market equity returns given the difficulties involved in selecting a market benchmark against which they can be assessed.

Measurement is notably difficult in the case of government equity injections. Some governments have established public funds to acquire stakes in companies they wish to support, providing overt instances of targeted industrial policy using the equity channel. Recent pre-COVID-19 examples include the USD 50 billion China Integrated Circuit Industry Investment Fund, created by the Chinese authorities in 2014 "to promote industry upgrades" by means of injecting new equity into domestic semiconductor firms and using "domestic development banks and commercial banks to continually provide financial support to the integrated circuit industry".[8] Another instance is the USD 22 billion National Manufacturing Transformation and Upgrade Fund established by the Chinese Ministry of Finance in 2019, together with the China Development Bank and several SOEs, in order to invest in growing- and mature-stage companies in new materials, new generation information technology, and power equipment.[9]

Lack of transparency may largely explain the paucity of empirical evidence on below-market finance. Not only does the identification and quantification of below-market finance pose considerable methodological issues, but much of this support is also provided through state enterprises (e.g. development banks, state banks, and government guidance funds) acting as intermediaries. This pivotal role of state enterprises as both providers and recipients of support itself contributes to obscuring the actual extent of government assistance by giving what is in fact government policy the outward appearance of regular commercial transactions between two independent parties. Assessing the prevalence and scale of below-market finance therefore requires detailed information at the company level. Such information may not always be readily available or compiled in a format that lends itself to measurement and analysis.

Another indication of the possible size of below-market finance stems from the outsized role that SOEs continue to play in the global economy. As noted above, academic research has shown state enterprises in certain countries to be more likely to obtain below-market borrowings from state banks than their private peers. Below-market equity is, for its part, tied to partial or full ownership of companies by governments.[10] These two considerations together imply that government ownership may be a necessary, but not sufficient, condition for governments to provide below-market finance. Although as much as 14% of global stock-market capitalisation is currently held by state actors – be they governments themselves, sovereign wealth funds, public pension funds, or other state-owned enterprises (De La Cruz, Medina and Tang, 2019[12]) – this covers a wide range of investment strategies: from the many small portfolio stakes that certain sovereign wealth funds possess, to more active state participation in corporate decisions. In this regard, it is of interest to note that much of the evidence collected to date on below-market finance concerns countries where the state plays a large and active steering role in the economy.

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7 While there are many studies on the subject, recent examples include OECD (2020[15]), Harrison et al. (2019[9]), and IMF (2019[11]).

8 As per the State Council's 2014 Guideline *for the Promotion of the Development of the National Integrated Circuit Industry*. See OECD (2019[3]) and https://members.wto.org/CRNAttachments/2014/SCMQ2/law47.pdf (accessed on 8 September 2020).

9 See https://finance.sina.com.cn/roll/2019-11-19/doc-iihnzahi1790224.shtml (accessed on 8 September 2020).

10 While all government-invested firms do not necessarily benefit from below-market equity, all below-market equity benefits government-invested firms by definition. As explained in OECD (2019[3]) and later in this report, below-market equity returns cannot rightfully be considered government support in the case of fully private firms, given the absence of any government intervention through the equity channel.

The COVID-19 pandemic and its economic consequences are likely to see an expansion of below-market finance, as governments around the world attempt to support their economies through the provision of preferential loans, loan guarantees, and equity infusions. Most policy responses to date have taken the form of job-retention schemes and increased unemployment benefits, but also loan guarantees for businesses (Figure 1). Examples include Germany's *Kurzarbeit* short-time work scheme and France's bank loan guarantees, which cover 70-90% of eligible bank loans depending on the size of recipient companies.[11] Many central banks have also ramped up their outright purchases of corporate bonds to support liquidity in credit markets. This includes, for example, the US Federal Reserve's Primary and Secondary Market Corporate Credit Facilities, as well as the Main Street Lending Program, which supported lending for businesses in the United States before all three programmes lapsed in January 2021. The alarmingly high levels of outstanding corporate debt that predated the pandemic (Çelik, Demirtaş and Isaksson, 2019[13]) could, however, spur additional support in the form of government equity injections should corporate balance sheets prove too fragile for additional loans. Although there have been few pandemic-related injections of public equity to date (as of February 2021[12]), a number of governments have established dedicated funds should the need arise (e.g. Germany's economic stabilization fund).

It is unclear that emergency loan guarantees and other fiscal policy responses to the COVID-19 pandemic will distort international trade and competition in the near term. These measures generally proceeded from the urgent need to prevent a catastrophic economic collapse that could have had dire human, social, and health consequences, including over the longer term. Most of the resulting government support aims to stabilise the economy by preventing job losses and a wave of corporate bankruptcies in otherwise solvent firms. Data from the Banque de France indicate, for example, that very-small-sized enterprises with staff below 10 and revenue below EUR 2 million obtained as much as 89% of all government-guaranteed loans provided by French authorities in response to the pandemic (as of February 2021).[13] It is nonetheless necessary for governments to ensure that this support is designed in a way that minimises market distortions and ensures that it will not become entrenched and outlive its purpose (OECD, 2020[14]; OECD, 2020[15]). Experience from the crisis of 2008-09 suggests that poorly designed stimulus packages can have negative, long-lasting consequences for the global economy, fair competition, jobs, and global trade, in particular through excess manufacturing capacity as a result of governments encouraging redundant industrial investment to boost economic growth (Klein and Pettis, 2020[16]). Policy transparency and monitoring are therefore essential, which further underscores the need for the collection of data as well as analysis on below-market finance, such as that undertaken in this report.

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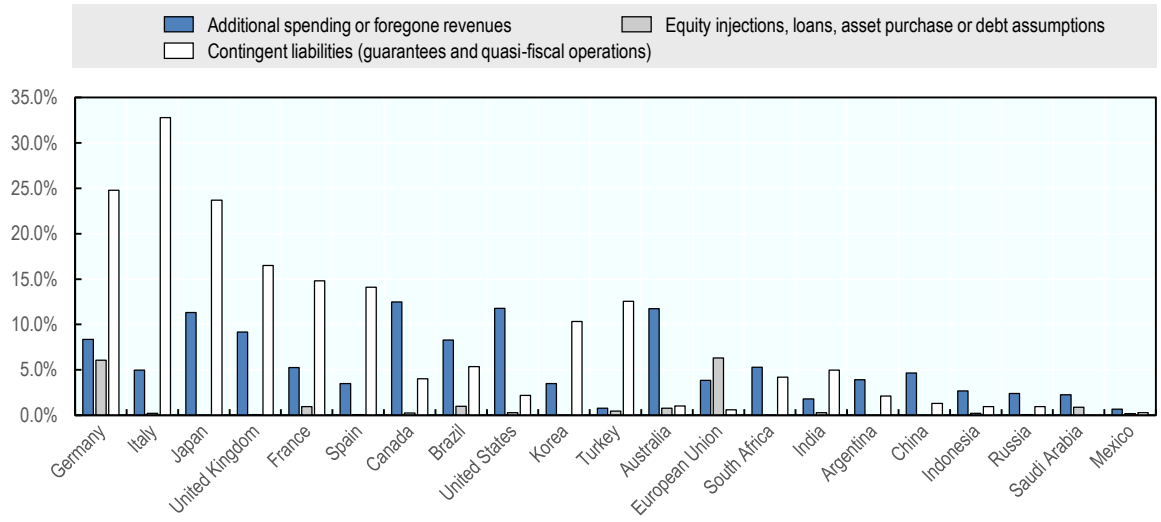
[11] See www.economie.gouv.fr/files/files/PDF/2020/dp-covid-pret-garanti.pdf (accessed on 25 August 2020). Many other countries have similar schemes in place. However, given access to relevant data is uneven, these examples and the data shown in Figure 1 are for illustrative purposes only. Unlike several other jurisdictions, EU Member States and a number of other OECD member countries have notified their economic support to the WTO in the context of the transparency exercise on COVID-19 trade-related measures.

[12] Most cases to date concern the airline industry, e.g. Alitalia and Lufthansa, which are both due to receive capital injections from their home governments at the time of writing. A number of other airlines (e.g. Air New Zealand, Delta Air Lines, and Singapore Airlines) are also slated to receive convertible debt that could potentially lead to partial government ownership. See Christiansen, Sultan and Khavanska (2020[59]).

[13] Many such enterprises are automobile repair shops, hotels, restaurants, and construction companies that do not participate directly to a significant extent in global trade through exports.
See: www.economie.gouv.fr/files/files/directions_services/covid19-soutien-entreprises/Tableau-de-bord-PGE-05022021.pdf (accessed on 19 February 2021).

Figure 1. Policy responses to the COVID-19 pandemic have to date mainly taken the form of additional spending, revenue foregone, and loan guarantees for businesses

G20 Fiscal Measures in Response to the COVID-19 Pandemic, % of GDP, as of September 2020



Note: Quasi-fiscal operations refer to "non-commercial activity of public corporations on behalf of government." The data correspond to the total amounts of support committed by governments but not necessarily the sums effectively disbursed to corporations and individuals. European Union data are distinct from those for individual EU Member States.
Source: IMF, October 2020 Fiscal Monitor database.

1.2. Below-market finance is potentially distortive and counter-productive

Many of the concerns expressed about below-market finance and other forms of government support pertain to the impacts that these measures can have on international trade and competition. Much like doping in sports, government support gives some firms a leg-up on their competitors that is not grounded in economic or market forces, but instead in the generosity of the government supporting them. This undermines the perception of fair competition and the willingness of economies to accept the results of that competition. Support may in turn push other countries to retaliate to the detriment of consumers, taxpayers, and other governments that do not have enough fiscal space, ultimately undermining confidence in an interconnected economy.

Below-market finance is a particular sub-set of producer support that acts to lower companies' cost of capital, thereby encouraging greater investment than market conditions would warrant. While output payments or input subsidies may indirectly result in capacity expansion, below-market finance directly supports the accumulation of capital by producers. As such, it is a likely contributor to the structural excess capacity[14] that has plagued certain industries in recent years (OECD, 2019[2]; WTO, 2018[17]).

In a world of large economies and integrated markets, there does not need to be a lot of bilateral trade for producer support in one country to affect competing producers in another country. Subsidised lending in a large country, for example, may encourage more industrial capacity expansion than would normally be the

[14] Structural excess capacity refers to excess capacity that is due to subsidies and other forms of government support. Cyclical excess capacity, on the other hand, results from normal fluctuations in the business cycle. See Blonigen and Wilson (2010[62]). Both concepts are distinct from redundancy capacity as a risk-management strategy.

case, which can in turn exert downward pressures on global output prices and profits. Faced with lower profits or outright losses, producers that do not benefit from government support may respond by exiting the industry, while cheap loans enable subsidised producers to keep operating at a loss until global capacity adjusts to meet demand. If producers exiting the market are more productive than subsidised producers, this can cause average productivity in the industry to fall. Support may also aggravate environmental pressures where subsidised producers are less energy- or resource-efficient than their competitors, or deny opportunities to access value chains to economies, especially developing ones, that rely on participation in the global economy as a source of growth and jobs.

In response to concerns about the effects that government support may be having on global trade and competition, a number of countries have called for a reform of trade rules to better discipline such practices. One such proposal is for countries to agree on expanding the scope of prohibited subsidies at the WTO to include: "unlimited guarantees; subsidies to an insolvent or ailing enterprise in the absence of a credible restructuring plan; subsidies to enterprises unable to obtain long-term financing or investment from independent commercial sources operating in sectors or industries in overcapacity; and certain direct forgiveness of debt."[15] Although the proposal goes beyond the sole issue of below-market finance, several of the measures listed indicate that support provided through the financial system is of significant concern for policy makers.

The distortions caused by below-market finance can also be of concern domestically where such support alters the allocation of capital between firms and industries, which can in turn slow growth in productivity and living standards. This occurs where capital is channelled to less productive companies and not to those that might make the best use of it, e.g. due to discriminatory access to finance. One way to identify misallocation of capital across firms is to measure total factor productivity (TFP), which indicates how efficiently capital and labour inputs are mobilised in the production process.[16]

Empirical research has generally confirmed that TFP is lower than it could be when capital is misallocated due to strong government involvement in the economy. A study looking at manufacturing sectors in China and India concluded, for instance, that TFP could have been 30% higher in China in 2005, and 59% higher in India in 1994 had labour and capital been distributed more efficiently within sectors (Hsieh and Klenow, 2009[18]). In the case of China, efficiency losses have, to a large degree, been attributed to a misallocation of capital between the state and the non-state sector (Brandt, Tombe and Zhu, 2013[19]; Du, Liu and Zhou, 2014[20]). One reason why misallocation arises is that private companies often face higher hurdles in accessing finance than their state-owned counterparts, despite being more efficient. This is not only a problem for private firms, but also a macroeconomic issue with implications for the overall wellbeing of the population. Another paper calculated for instance that China could achieve the same amount of output with 8% less capital invested, which could instead be used for consumption and raising living standards (Dollar and Wei, 2007[21]). This underscores the important opportunity costs that support can pose in the context of alternative expenditures or investments in public goods.

For all the concerns expressed about below-market finance (and government support more generally), little is known about its actual impacts on trade and welfare. The persistent lack of data on the scope and scale of below-market finance has prevented any meaningful quantitative analysis of its effects. Such analysis is, however, key for understanding how government support functions in the context of the value chains that underpin much of global trade. Prior work on the aluminium value chain has shown, for example, that the effects of government support are at times complex and not always intuitive, as support

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[15] See the *Joint Statement of the Trilateral Meeting of the Trade Ministers of Japan, the United States and the European Union*, available at https://trade.ec.europa.eu/doclib/docs/2020/january/tradoc_158567.pdf (accessed on 8 September 2020).

[16] Higher total factor productivity (TFP) thus implies generating more output with the same amount of inputs.

measures can interact with export restrictions to cascade down the value chain (OECD, 2019[2]). Better understanding of the implications of below market finance for the global economy, for providing countries, and for their trading partners is important in identifying the most egregious practices in need of urgent attention. Yet there cannot be solid analysis without more and better data. It is to this effort that this work aims to contribute.

2. So what is below-market finance anyway?

This section provides the conceptual framework to help define and understand the functioning of below-market finance. It also outlines ways to quantify the support conferred by governments through the financial system, to set the stage for Section 3, which applies these methods in practice to identify below-market finance across a range of sectors.

2.1. The basic intuition behind below-market finance

Companies aiming to raise external funding can seek to do so through either debt or equity. For instance, a company might borrow money (debt) in the form of bank loans or by issuing bonds. Alternatively, it can raise equity by issuing shares and selling them to investors. In return, companies pay interest to lenders and offer a claim on future profits to equity investors. While lenders and equity investors are generally private institutions or individuals, they can also be governments or government-related entities. In many cases, these entities will take risks and demand returns in the same way as their private counterparts. When government entities do not act in the same way, or on the same terms as private investors, however, this may give rise to below-market financing.

Just as a company can obtain external funding through debt and equity channels, below market financing can take the form of *below-market borrowings and below-market equity*. In the former case, governments provide support through debt financing. This happens when loans, which are often provided by state banks or other government-related or -influenced financial institutions, involve contractual terms that are more favourable for borrowers than those that are offered on the market.[17] These favourable borrowing conditions can, for example, arise from longer repayment terms, a longer grace period, or preferential interest rates. In addition, governments or related entities may provide guarantees on private loans, which promise financial support in case the debtor becomes unable to meet its repayment obligations. Loan guarantees can make financing available to companies that are otherwise insolvent or bad credit risks, or ease the terms and conditions of loans. These government guarantees do not always need to be explicit, but can also simply reflect the market anticipation of government support – i.e. an implicit government guarantee, which increases access to financing and lowers interest rates to below-market rates.

The question of what is an appropriate interest rate is crucial when investigating whether or not a particular debt arrangement constitutes below-market borrowings. The interest rate charged to a debtor should ultimately reflect the default risk of the debtor, as well as the opportunity cost to the lender. In practice, commercial lenders customarily analyse the financial standing – including, but not limited to, solvency and profitability – of a company to decide whether to extend a loan and, if so, at what terms and conditions. These considerations aim to compensate for the associated risk of not receiving payment and the foregone

[17] Article 14(b) of the WTO's Subsidies and Countervailing Measures (SCM) Agreement states that "a loan by a government shall not be considered as conferring a benefit, unless there is a difference between the amount that the firm receiving the loan pays on the government loan and the amount the firm would pay on a comparable commercial loan which the firm could actually obtain on the market."

returns that alternative investments might have yielded. Below-market borrowings therefore arise where state banks or government-related or -influenced institutions offer loans at interest rates that are lower than market rates, i.e. a cheaper option for borrowers. This can lead to competitive distortions, e.g. by crowding out other commercial lenders or by giving borrowers an unfair competitive advantage.

Below-market equity is another form of below-market financing that involves the provision of equity finance by governments on terms that are better than the market. This happens when governments provide new equity on non-market terms, i.e. a *below-market equity infusion*, or when government shareholders do not require the same returns on equity than private investors would otherwise demand, i.e. *below-market equity returns*. It is important to note that government investments into (any government ownership of) companies do not in and of themselves constitute a distortion, a subsidy, or government support. They can become one, however, where government investors behave differently from market competitors prior to or after the equity investment, with the effect of reducing the cost of capital for recipients.

There can be a variety of motives behind individual investment decisions[18] but investors will typically aim to maximise returns within the limits of available funds, as well as to ensure that these returns meet some minimum rate (to offset the risk and cost of the investment and meet their own financial obligations, e.g. in the case of pension funds). Investors also have to compare and choose from alternative profit-making investment options.

Governments and their affiliates have become important investors in their own right (De La Cruz, Medina and Tang, 2019[12]). This growing role of public-sector investors does not need to be an issue of concern for competition, in particular where they hold small equity stakes in many different companies for portfolio reasons. If, on the other hand, a government or related entities invest in a firm or a project that private market participants would deem not worthy of investment, or of a risk profile that would require more costly terms to justify investment, competitive distortions in the form of a below-market equity infusion become a real possibility.[19]

Even where a government's initial investment decisions are market-based, it does not follow that the government will subsequently behave as a regular shareholder. Private investors or shareholders typically expect the firms in which they have invested to conduct their business in a manner that maintains or improves financial performance. Failing that, shareholders would normally divest or pressure company management to take steps to resume profitability, or may even vote for organisational or portfolio restructuring (e.g. a change of management or the sale of a particular business segment). Such actions are expected from private investors that have a profit-maximising approach to investment. Although other objectives than profit maximisation can come into play, investors generally shun investments into structurally loss-making companies as more rewarding investment options exist elsewhere.[20] Below-market equity returns can therefore arise where a government shareholder consistently tolerates more losses or lower profit than would a private investor, in the absence of a transparent, offsetting rationale unrelated to competitiveness in the market (as can be the case, for example, where lower profits are tolerated in view of public service obligations imposed on the company but not on its private competitors).

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18 Including, but not limited to, environmental, social, and governance (ESG) principles.

19 Article 14(a) of the WTO's Subsidies and Countervailing Measures (SCM) Agreement states in this regard that "government provision of equity capital shall not be considered as conferring a benefit, unless the investment decision can be regarded as inconsistent with the usual investment practice (including for the provision of risk capital) of private investors."

20 Evidence exists that shows ESG investments to perform relatively well, which suggests that the trade-off between profit maximisation and other objectives is not necessarily a strict one (Friede, Busch and Bassen, 2015[64]).

2.2. How below-market finance fits in the OECD's Matrix of government support measures

In terms of the OECD matrix of government support measures presented earlier in this report (Table 1), below-market finance belongs to the cells under Column F (Capital) and Rows 3 to 5.

Below-market borrowings and below-market equity are both measures that lower the cost of capital and therefore fall under the formal incidence of "Capital" in column F. As for the transfer mechanism, below-market finance shares many of the characteristics of "Other Government Revenue Foregone" (row 3) since it can involve lower interest revenue for state banks (below-market borrowings) or lower investment returns for government shareholders (below-market equity).

Yet below-market borrowings may also give rise to the "Transfer of Risk to the Government" (row 4) as the provision of loans at below-market rates implies that the government – through intermediary institutions like state banks – is shouldering the risk of a borrower, without charging an interest rate that would compensate for actual default risks. Government loan guarantees, whether explicit or implicit, notably fit into this category of "Transfer of Risk to the Government" as they shift responsibility for a debtor's default risk from a private bank to a government guarantor. This category can also include some elements of below-market equity where investment returns do not offset the cost and risk of an investment and the government as an investor consequently bears the associated risk.

Finally, below-market finance could also be regarded as "Induced Transfers" (row 5), especially where the government establishes state-owned financial institutions, such as state banks or investment funds, and directs them to provide financing at below-market rates according to designated state objectives.

2.3. How to quantify below-market finance?

As mentioned above, the provision of loans or equity finance by governments does not constitute by itself government support.[21] It does, however, when government investors behave differently from market competitors with the effect of reducing the cost of capital for recipients. Quantifying this effect and the benefits conferred to firms requires a method to measure any difference between government actions and market terms. Unsurprisingly, this is not straightforward in practice. Unlike government grants, the amount of which normally equals the amount of benefit conferred, there is currently no agreed and generally applicable methodology for estimating below-market financing (Jones and Steenblik, 2010[22]). Earlier OECD work on government support in the aluminium and semiconductor value chains put forward a methodology to distinguish funding costs that could represent 'market practice' from those that might reflect government influence (OECD, 2019[2]; OECD, 2019[3]). This report draws on that earlier work to put forward one possible method for estimating below-market finance across a greater sample covering 306 firms and 13 sectors. In doing so, the work aims to shed further light on the nature of this support by examining its incidence in more than one industry, with a view to widening the evidence base to feed into consideration of how such support should be tackled, including in the context of possible international trade rules.

2.3.1. Constructing benchmark interest rates for estimating below-market borrowings

In a nutshell, the estimation of below-market borrowings seeks to compare the actual interest rates charged to firms against hypothetical benchmark interest rates that could have been charged in a private market,

[21] This also aligns with the definition of a "subsidy" under the SCM Agreement: while a financial contribution by a government or a public body alone does not constitute a subsidy, if a benefit is thereby conferred, the financial contribution is then regarded as a subsidy (Art. 1.1 of the SCM Agreement).

based on the characteristics of the borrower.[22] Since information is not available on every single interest rate charged to all firms covered in this study, this report calculates firms' annual average interest rates by dividing their interest payments in any given year (t) by the average debt outstanding in the same year (t) and the previous year (t-1). Information necessary for performing this calculation is retrieved from the financial statements of each firm for the years 2005-19, wherever available.[23] In cases where firms also report their annual average interest rates or their transaction-based interest rates, these are taken into account as a reference to verify that the OECD's calculation does not significantly differ from the reported rates. Calculating rates in this way ensures consistency across the sample of firms.

The benchmark interest rates are constructed following established finance principles by combining a risk-free base rate and additional spreads that reflect the credit risk of a borrower. Depending on their availability and on each country's practice, risk-free base rates include and are chosen from: six-month interbank rates (e.g. the US London Inter-Bank Offered rates [USLIBOR][24], Euro Interbank Offered Rate [EURIBOR], Tokyo Interbank Offered Rate [TIBOR], etc.); one-year government bond yields; or other commonly used base rates (one year), such as the base rates published by the People's Bank of China. As the currency of benchmark rates should ideally match that of the corporate debt being analysed, the study takes into account a company's funding currency. For instance, if a company is holding debt for which half is denominated in EUR and the other half in USD, the average of USLIBOR and EURIBOR is used as a benchmark base rate.

Risk-adjusted spreads are, for their part, constructed by combining the following items (Figure 2)

- Credit risk spreads (Tier 1 & 2): These spreads are established based on the average spreads observed between corporate bonds and government bonds. Spreads are averaged for each credit rating (e.g. AA or BBB), where lower-rated bonds have a higher spread. The terms of these benchmark spreads should ideally match the weighted-average life of each debt transaction in question. Because this report looks by necessity at corporate-level annual average interest rates, a term of benchmark spreads of one year is applied as a proxy and, in a few cases, is extended to five years where one year rates are not available. Tier 1 benchmark spreads consist of only US bonds while Tier 2 spreads are more diversified to include country-specific bond data.
- Government guarantee (Tier 3): These spreads correspond to the additional spreads that would have otherwise been charged absent government guarantees (explicit or implicit). Accredited credit-rating agencies usually base their standalone credit ratings for firms on corporate performance alone, following which they adjust the ratings to account for additional external factors, including expected government support in case of financial distress. Considering such information, Tier 3 spreads represent the increase in interest rates that would occur absent such government support.

[22] The approach is in many ways similar to that applied by Caballero, Hoshi, and Kashyap (2008[65]).

[23] More information on the firm sample and the data collected is presented in Section 3 and in the Technical Appendix.

[24] While steps are being taken to phase out the LIBOR, they will not be effective until end 2021. The LIBOR remains the appropriate benchmark lending rate for USD-denominated loans for the entire period covered by this report.

Figure 2. Benchmark interest rates combine a risk-free base rate and an additional risk-adjusted spread

Note: In earlier OECD work on aluminium and semiconductors (OECD, 2019[2]; OECD, 2019[3]) results using Tiers 1, 2, and 3 were shown separately. This study uses the benchmark of the third bar (the combination of the risk-free base rate, tier 2 spreads, and tier 3 spreads, where applicable) unless otherwise specified.

2.3.2. Constructing a benchmark for estimating below-market equity returns

To identify below-market equity returns, this report looks at the financial performance of government-invested firms for a period of 5-15 years and compares their actual financial returns against their estimated cost of capital. The comparison indicates in this case whether or not a firm has generated adequate returns to cover the cost of capital that is expected for companies operating in the same sector. By opting for this approach, the report aims to capture the *recurring benefits* that government-invested firms can obtain by virtue of their full or partial government equity participation. Government participation can in turn stem from a recent government equity infusion or could be a longstanding feature of the company. In this sense, the approach does not consider the *one-off benefits* that can come from a government equity infusion. Instead, it intends to observe *ex-post* the behaviour of government-invested firms and their government shareholders, subsequent to an investment.[25]

This empirical approach is similar to that applied in the context of earlier OECD work on government support in the semiconductor value chain (OECD, 2019[3]). It draws heavily on the work of Professor Deborah Lucas, Director of the Golub Center for Finance and Policy at the Massachusetts Institute of Technology (MIT), as reflected in her own work (Lucas, 2014[23]) and in discussions that the OECD Secretariat has had with Professor Lucas.

[25] This is in contrast to an *ex-ante* approach that would aim to predict the expected future returns at the time the government invests in a company. See Section 5 for more discussion of the two approaches in the context of trade rules.

The estimation of below-market equity returns begins by calculating for each firm and year a required rate of return (*RRR*) on the basis of the capital asset pricing model (CAPM):

$$RRR = rf + (\beta \times ERP)$$

where rf is a risk-free rate; β is an asset beta[26] for each industry, averaged globally; and *ERP* is an equity risk premium, i.e. the premium investors receive for holding equity as opposed to risk-free assets. Details on the values and sources used by the OECD for each parameter can be found in the Technical Appendix to this report (Annex A).

The required rates of return thus calculated are then used to estimate below-market equity returns as follows:

$$BME_{it} = \left(RRR_{it} \times 0.5(assets_{it} + assets_{it-1})\right) - adj\_interest_{it} - profit_{it}$$

where *BME* stands for below-market equity returns, calculated for firm *i* in year *t*; *RRR* is calculated as above; $0.5(assets_{it} + assets_{it-1})$ represents firm *i*'s average total assets for the years (t) and (t-1); *adj_interest* is the sum of reported interest expenses for firm *i* in year *t* and that firm's subsidised interest calculated as described in Section 2.3.1; *profit* is profit after tax for firm *i* in year *t*.

The product of the required rate of return (*RRR*) and of the company's average assets essentially amounts to a monetary equivalent of the company's benchmark cost of capital. This represents what market participants might view as a reasonable return on the firm's assets to cover its cost of debt and equity. To remove the debt component and obtain the equity component as a residual, the analysis next subtracts from that amount the sum of reported interest expenses and estimated subsidised interest. What remains is the benchmark amount of profit that should accrue to holders of equity in the company (either as dividends or as retained earnings). The difference between that estimated amount and observed profit after tax is a below-market equity return. A positive amount indicates that the company's actual profits have fallen short of the benchmark cost of capital. Conversely, a negative result implies that the firm has made more than enough profits to cover the cost of equity.

Unlike the above calculation that estimates below-market equity as what remains after deducting the true cost of debt from firms' cost of capital, it is also possible to estimate below-market equity directly by applying the CAPM to companies' equity. This can serve as a useful sensitivity check on the results obtained using the first method. In this case, the calculation becomes:

$$BME_{it} = \left(RRR_{it} \times 0.5(equity_{it} + equity_{it-1})\right) - profit_{it}$$

Crucially, the calculations above are all highly sensitive to the values set for the different parameters, such as the asset beta or the equity risk premium. The approach used in this report is to rely on the literature and on finance experts to obtain reasonable and plausible values for these parameters to the extent possible (Annex A).

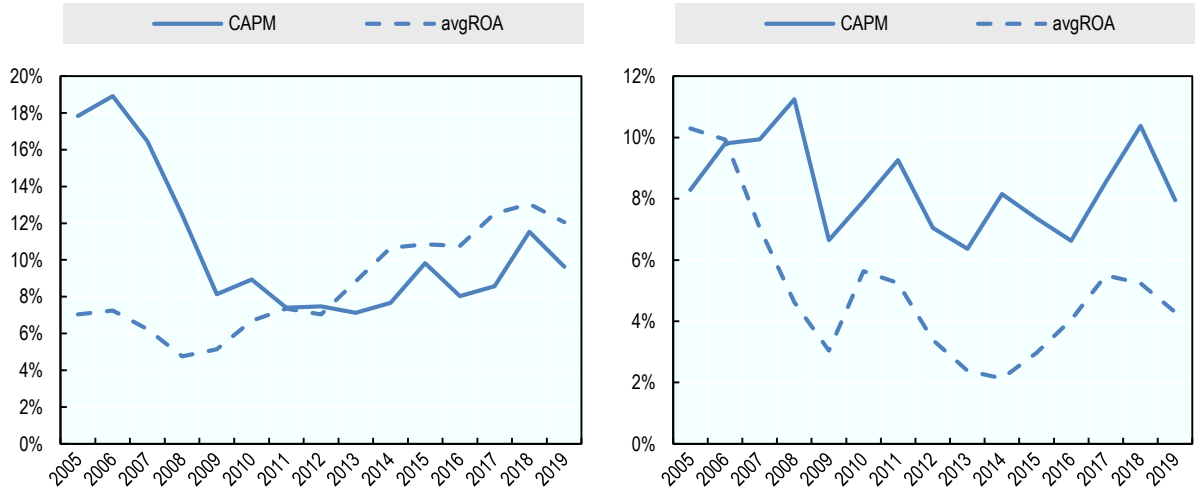
To verify results and assess their sensitivity to the choice of benchmarks, the analysis further compares the average required rate of return (*RRR*) for each sector against that sector's observed average return on

[26] Betas are common financial indicators that measure the correlation between specific stocks (for a firm or a sector) and the overall market. They are formally defined as the covariance between specific stock returns and overall market returns divided by the variance of overall market returns. Using the asset beta (or 'unlevered beta') instead of the equity beta corrects for the effects that debt has on the capital structure of firms and corresponding variations in financial risk. The risk that remains is essentially a business risk associated with a company's assets, which results in a lower asset beta than the equity beta for a firm with debt. A beta value greater (less) than one would indicate that stock for an industry or a firm is more (less) volatile than the broader market.

assets (*avgROA*).[27] The purpose of this comparison is to test for the possibility that the *RRR* calculated based on the CAPM is too demanding a metric for many firms in the sector or in any particular years. Figure 3 shows the comparison for two sectors. In the semiconductor industry (left panel) the *avgROA* appears to satisfy the average *RRR*, especially in the years after 2011.[28] This indicates that the *RRR* is in a reasonable and achievable range for it to be used as benchmark for the semiconductor sector. In the aluminium sector (right panel), however, the *RRR* remains relatively high compared to the sector's *avgROA* throughout the period.[29] A similar situation arises in several of the other sectors included in this report, especially in industries that have faced excess capacity over the period.

Figure 3. While CAPM provides a good return target for semiconductor firms, it may be too demanding for aluminium firms

Left: Semiconductors; Right: Aluminium



Against this background, the analysis uses a sector's *avgROA* as a second, alternative benchmark for companies' required rate of return. This second *avgROA* benchmark is constructed by: first adjusting each firm's profit after tax by adding back its interest expense so as to ensure the consistency and comparability with the aforementioned *RRR*, then calculating returns on assets for each firm by dividing this adjusted profit after tax by average assets of the same year (t) and the previous year (t-1), secondly averaging them by year for each sector, and finally taking their three-year moving average.[30] As each industry has different asset base characteristics, the *avgROA* is averaged for each sector and the constructed benchmark is applied only to that same sector.

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[27] In the remainder of this report, a sector's *avgROA* refers to the second, alternative benchmark used in calculating below-market equity returns while *ROA* refers to firms' returns on assets.

[28] The discrepancy for earlier years is due to a high asset beta of around 3.

[29] This is true also for firms in individual regional categories such as OECD, China, and Others.

[30] Using instead the average ROA by sector provided by FactSet does not materially change the results of the calculations.

2.4. Strength and limitations of the proposed approach

2.4.1. Below-market borrowings and the trade-off between scale and accuracy

The method used here to estimate below-market borrowings makes a number of simplifying assumptions in order to enable the calculation to be performed for a large number of firms across a variety of sectors. Like any broad market indicator, it may be less precise than the method used in earlier OECD reports that have estimated below-market borrowings for specific value chains (OECD, 2019[2]; OECD, 2019[3]), but is more appropriate for horizontal endeavours such as this. Earlier studies included fewer firms all facing similar market conditions. They were thus able to prioritise more granular information on individual loans, debt instruments, or debt categories (e.g. short-term loans, long-term loans, and bonds), wherever possible. This also made it possible to collect more precisely matched information on the currency denomination and tenor of debt. The present report prioritises an approach that is more generalised by calculating annualised interest rates based on each company's total interest expenses and debt.

One of the drawbacks of using a company-wide interest rate could be that specific characteristics of debt instruments, such as currency or maturity, are hidden in the aggregate information collected on debt, thereby complicating efforts to tailor the benchmark. To minimise this problem, the report has sought to reflect roughly the proportion of different currencies in the debt structure of firms and applied corresponding benchmarks to the extent possible.

Whereas the estimates of below-market borrowings in this report are not loan-specific, it is not obvious that a detailed transaction-based analysis would have greatly improved the accuracy of the results. Nor would it have been feasible for all firms covered by this study. Gaps in firms' financial reporting impose constraints on how precise calculations can be: the less information available, the more assumptions the estimates require and the less precise the results become. Not all firms disclose the detailed contractual information necessary to perform a transaction-based analysis. In some cases, the analysis would have needed to calculate annual average interest rates anyway (as is presently done in this report) to complement the missing data. The method chosen for this report thus remains a reasonable proxy for the interest rates that firms face. Moreover, this method has the crucial advantage of being applicable to all firms, as total interest expenses and total debt outstanding (or an equivalent) are disclosed in all financial statements.

An alternative method for estimating below-market borrowings could be to calculate the discounted present value of expected future cash flow of the borrowing (including principal repayment and interest payment), and compare this against the principal amount. This method is based on the concept that money held today is worth more than the same amount of money received tomorrow. Where the discounted present value of the total future cash flow (i.e. repayment of loan principal and payment of interest) is lower than the loan amount disbursed, then this would indicate the presence of below-market borrowings (OECD, 2018[24]). To perform this calculation, however, the following contractual information for each debt instrument is necessary: principal amount, interest rate, maturity, repayment terms and other fees and costs (*ibid*). In addition, as for the method used in this report, market benchmark interest rates would be necessary to calculate a discount rate.

The cash-flow method is widely accepted and has been in use for many years, e.g. for calculating the concessionality level or grant element of loans. It is nevertheless not well-suited to the analysis of a large number of companies given its level of data-intensity, coupled with lack of relevant disclosure by firms. Searching for contractual data and conducting calculations for each debt transaction for each of the firms covered would be highly resource-intensive and, importantly, the required contractual information is not always publicly available. Finally, to avoid particular bumps or outliers in a given period, the present study covers an extended period of the past 10 to 15 years, which exacerbates issues of information availability for past deals. Where terms and conditions of a loan have not been disclosed or recorded systematically

over time, this also presents the risk of overlooking some or many past transactions, thereby hindering efforts to construct a comprehensive picture of below-market borrowings. For all these reasons, the cash-flow method was not deemed to be feasible or suitable for the purposes of this analysis.

2.4.2. Considerations relating to the estimation of below-market equity

The choice in this report to use benchmarks based on the capital asset pricing model (CAPM) to estimate below-market equity returns *ex post* follows from a number of practical considerations.

One alternative method might have been to use a company's stock price prior to a government investment as a benchmark to assess whether the investment was in line with market practice (e.g. did the government pay an adequate price for the company's shares?). A first problem with this approach is that not all firms, including large ones, are publicly listed, so that a stock market price would not be available for the whole sample. Second, a company's stock price is sensitive to news or expectations, which raises the possibility that the stock price moves prior to the investment in anticipation of future government action.

Another consideration is whether a government equity infusion should be seen uniquely as a one-off injection of funds, or also as a delivery mechanism for future support, be it implicit or explicit. The two perspectives lead to different estimation approaches. In the former case, the question asked is whether the investment decision was consistent with market practice *ex ante* at the time it was made. In the latter case, the emphasis is on the presence and actions of a government shareholder, which may confer support to the company in a variety of ways, including by accepting lower returns than private investors. Such support could come any time after the government has taken a stake in the company, and could therefore concern newly government-invested firms and long-time SOEs alike.

Choice of method aside, a further issue is whether the CAPM provides a reasonable approximation of expected firm returns. One concern is that a single variable such as the beta may not be sufficient to assess future risks and returns in financial markets. The multi-factor pricing model (or arbitrage-pricing theory) is one alternative model that was designed to reflect various systemic risk factors and the sensitivity of assets (or portfolios) to those factors in calculations of expected rates of return. This alternative model necessitates, however, detailed analysis and selection of the risk factors to consider in assessing the expected returns of an asset or a portfolio, which makes it less generalizable, replicable, and transparent. Hence, while the CAPM might not perform well empirically in predicting future returns (Fama and French, 2004[25]), it remains to date the workhorse of chief financial officers, analysts, and regulators seeking to benchmark firms' equity returns (Graham and Harvey, 2001[26]). Numerous firms covered by this study (e.g. Daimler and Volkswagen) use the CAPM themselves to estimate their cost of capital and determine performance pay.[31] The Government of Norway also uses CAPM to calculate the required rate of return it expects its own SOEs to achieve over a period of time.[32]

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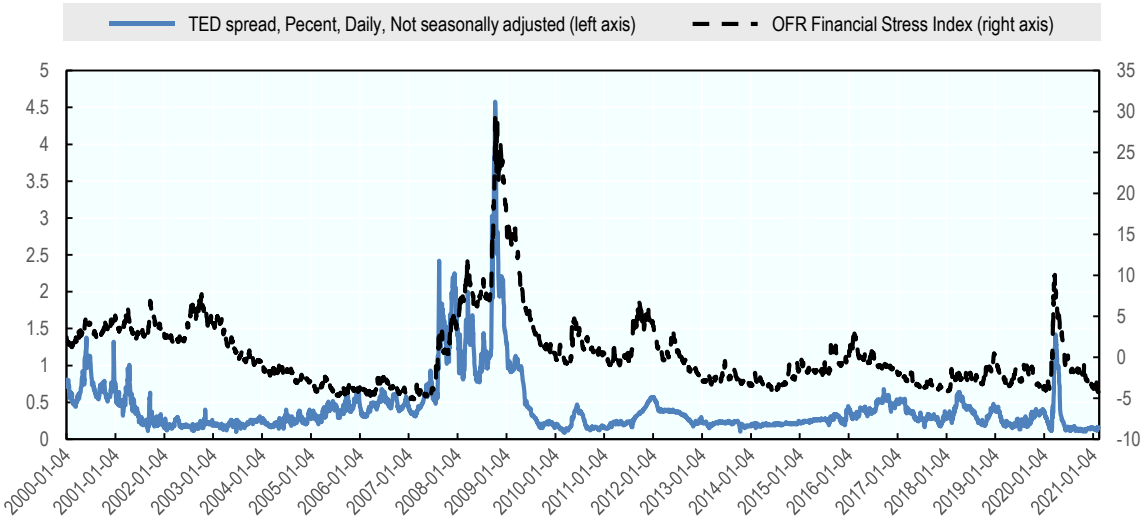
[31] As noted by Daimler in its annual report for 2018, "the performance measurement system used at Daimler is designed to ensure that our investors' interests and expectations are taken into account […]. The required rate of return on net assets, and hence the cost of capital, is derived from the minimum rates of return that investors expect on their invested capital. The cost of capital of the Group and of the industrial divisions comprises the cost of equity as well as the costs of debt and net pension obligations of the industrial business. […] The cost of equity is calculated according to the capital asset pricing model (CAPM), using the interest rate for long-term risk-free securities (such as German government bonds) plus a risk premium reflecting the specific risk of an investment in Daimler shares."

[32] See www.regjeringen.no/globalassets/upload/nhd/statenseierberetning/pdf/engelsk/the_governments_ownership_policy_2008.pdf (accessed on 7 September 2020).

2.5. Challenges in measuring below-market finance in the context of the COVID-19 pandemic

Globally significant and market-disrupting events, such as the COVID-19 pandemic or the global economic crisis of 2008-09, pose additional challenges for defining and measuring below-market finance. Governments often intervene in such times to provide businesses with support in the form of debt and equity, in addition to grants, tax concessions, unemployment benefits, etc. As noted in Section 1, the COVID-19 pandemic is no different, with countries having already lent funds, guaranteed loans, and injected government equity into distressed companies. The difficulty this poses for analysis stems from the fact that these government actions seek to fill a gap in financial markets in a context where normal market conditions no longer apply, e.g. when credit markets freeze (Figure 4). Under such conditions, the provision of finance by governments does not serve to crowd out private competitors, but rather seeks to remedy a generalised market failure that is amplified by imperfect information and lack of trust among market participants.

Figure 4. Normal market conditions do not apply in times of crisis



Note: The TED spread is calculated as the spread between the three-month LIBOR based on US dollars and three-month Treasury Bill. The OFR Financial Stress Index on a given day is the weighted average level of the variables selected by OFR in the market on that day, relative to its history. The index is zero when this average is zero, suggesting that stress is at normal levels. The index is calculated after each US trading day.
Source: Federal Reserve Bank of St. Louis and Office of Financial Research, US Treasury.

Systemic stress in financial markets makes it difficult to derive meaningful benchmarks for estimating either below-market borrowings or below-market equity. The very notion of 'below-market' becomes itself problematic at such times. That said, even under such circumstances, government investors may still wish to exercise caution and continue to recognise firm-specific credit risks and distinguish them from crisis-driven, systemic risks. This will help allocate government funds where they are the most needed, while avoiding supporting firms that were already in financial trouble before the crisis (e.g. zombie firms) (OECD, 2020[27]).

3. How large is below-market finance in industrial sectors?

The limited empirical evidence available to date suggests that below-market finance is both opaque and not well understood, underscoring the need for further work to assess the nature and magnitude of this support. Persistent data gaps on government support are important obstacles to reform efforts aiming to address the most egregious practices through improved trade rules in the WTO and elsewhere. This is especially the case in the area of below-market finance, where information and analysis are sorely lacking.

This section provides a first empirical assessment of the scope and scale of government support provided through the financial system for a large set of sectors and countries. Given the unprecedented nature of this exercise, some degree of caution should be exercised when interpreting the results, in particular due to the imperfect coverage of the data and the difficulty of fully accounting for interactions between different forms of government support. These caveats notwithstanding, the information collected nonetheless represents a unique contribution to understanding the nature and scale of support provided by below-market finance, and thus to current policy debates on a possible revision of subsidy disciplines.

3.1. Why use firm-level data?

The analysis that follows necessitated the collection of detailed information for 306 industrial companies worldwide. While this represents a considerable and resource-intensive effort, the full range of data necessary for identifying and estimating below-market finance were not available from existing commercial data providers. This is partly due to the imperfect geographical coverage of many existing databases, which often stems from differences in reporting standards. This usually results in firm-level analysis covering only a subset of OECD countries and only rarely key emerging economies. As much of the (limited) literature on below-market finance concerns emerging economies, a sole focus on OECD countries would likely underestimate the true significance of this support. Another limitation of existing databases is their predominant focus on publicly listed companies, which risks omitting large, unlisted state enterprises that are commercially active in certain sectors of the global economy.[33] Although information for such companies is much less accessible, efforts were made to include them wherever possible by using a variety of sources (e.g. corporate bond prospectuses and sustainability reports).

The choice to focus on individual firms is one of necessity, but also of accuracy. Most governments do not disclose detailed information about which firms and sectors obtain government support, much less the individual financial transactions underpinning below-market finance. Some individual cases may be well publicised in the press, but most will escape public scrutiny. As discussed later in Section 5, this is partly because governments themselves disagree as to what actually constitutes government support. The fact that much below-market finance is channelled through state enterprises acting as intermediaries (e.g. state banks and government guidance funds) only reinforces the necessity of focussing on the recipients, rather than the providers, of support in order to obtain a fuller picture.

Even where governments do disclose some information on government support, the information may not be presented in a format that lends itself to quantitative analysis. While several OECD governments

[33] Commercial data providers often target customers in the financial sector, which explains their primary focus on publicly listed companies. This also explains why the range of data they offer does not always match the needs of policy analysis.

routinely publish detailed budgetary documents that specify the amount of public funds committed under specific grant and loan programmes or tax expenditures, little is known about the recipients, including the industrial sectors in which they operate. For the sake of illustration, one particular loan programme may *de facto* be largely utilised by car manufacturers, even as it nominally benefits *de jure* all producers of durable goods.

Even where it is available, information on the different types of support that governments provide is also generally scattered across different public databases and documents, requiring substantial effort to assemble a unified, harmonised set of data. Moreover, there is no guarantee that the information thus obtained covers all levels of government – from municipal to central (or federal) authorities – or that it captures all forms of financial support provided by these authorities. While firms may likewise vary in the quality of their financial reporting, experience to date suggests that the problem is less significant for information gathered at the company level. This is because financial statements often disclose support irrespective of whether it was obtained from national or sub-national authorities, nor – by and large – do they fail to disclose support selectively depending on the countries that provide it.

3.2. Sample construction and description

The collection of new data at the firm level raises issues in relation to coverage and representativeness. Given the impossibility of covering all companies and sectors, the analysis has sought to strike a balance between the costs of data collection (i.e. time and effort) and the extent of global industrial activity covered by the data. For the purposes of this report, it is neither practical nor necessary to cover every single industrial firm. Many industrial sectors exhibit economies of scale that reward larger companies because of sunk costs (e.g. high R&D intensity or large investments in long-lived fixed assets) or a particular market structure. This has the effect of concentrating global sales and assets for such sectors in the hands of a few dozen firms. In semiconductors, the OECD (2019[3]) has estimated that the top 20 vendors realised more than 80% of global semiconductor sales in 2018. In aluminium, the top 20 companies owned about two-thirds of global aluminium-smelting capacity as of 2018 (OECD, 2019[2]). Similarly, data collected for this study suggest that the top 10 carmakers accounted for more than half of all automobiles sold worldwide in 2017. Given that trade distortions are most likely to be an issue where government support benefits larger firms that are internationally active, the analysis can usefully concentrate on the top companies for each of the selected sectors.[34] One drawback is that the focus on larger firms may overlook government support that benefits smaller, ailing producers and prevents them from exiting the market.

A further consideration in selecting the sample was the need to ensure sufficient geographical diversity. This was necessary to enable the analysis to go beyond OECD countries in sectors in which they dominate the rankings of top companies by size. This has led at times to the inclusion of firms from emerging economies that do not necessarily feature in the top 20 or 30 companies in the sector worldwide, but that nonetheless top their own domestic rankings. While these firms may not always be the largest worldwide, they are generally large enough to affect global competitive conditions, including where their relatively smaller size simply reflects more recent entry into the sector. There are also cases where entire economies are top producers in a given sector but do not necessarily have companies large enough individually to feature in the top 20.

The analysis also sought to avoid overlap with other areas of existing OECD work and to focus on those sectors where support that reduces the cost of capital would be more likely to be both more prevalent and significant in terms of market impact. It thus concentrates on those industrial sectors that produce either

[34] Were the analysis to focus on labour or business demographics, for example, the omission of small and medium-sized enterprises would be a serious issue.

durable goods (e.g. capital goods) or industrial raw materials (e.g. aluminium, steel, and chemicals). Preference was given to products destined for other businesses (B2B), with the notable exception of automobiles, which are purchased by both businesses and final consumers. These criteria exclude primary industries such as agriculture, fisheries, forestry, and most of the mining sector[35], which avoids overlap with other OECD work that measures government support for agriculture, fisheries, and the fossil-fuel industry. Given that below-market finance amounts to a subsidy on the cost of capital, which implies that it may be more pronounced, or of greater concern, in capital-intensive activities (e.g. chemicals, metals, semiconductors, and aerospace), the analysis also avoids retail consumer products such as processed food and drinks, clothing, cosmetics, and consumer electronics. Given the focus of this project on industrial sectors, and the much earlier stage of the debate on government support in services, the analysis avoids services industries to the extent possible (many industrial firms will provide some services attached to or embodied in their products).

The study covers a total of 13 sectors and 306 companies (Table 2). The number of companies is not evenly distributed across sectors, since the latter vary considerably in the extent of competition and concentration. At one extreme is the market for telecommunications network equipment, which is dominated by a few players: Ciena, Cisco, Ericsson, Fujitsu, Huawei, Juniper, NEC, Nokia, and ZTE. At the opposite end of the spectrum is the chemicals sector, which comprises several sub-segments that each include numerous competitors. These sub-segments include basic and intermediate chemicals (e.g. ethylene and propylene), polymers (e.g. plastics, fibres and, rubber), fertilisers, industrial gases, specialty chemicals (e.g. coatings, dyes, pigments, and various additives), etc. As a result, the sample contains nine companies in telecommunications network equipment but 53 in chemicals.

Table 2. The study covers 13 sectors and 306 companies

Industrial sector	Number of companies covered	Approx. combined market share (indicative)
Aerospace and Defence -- AERO	31	~66%
Aluminium -- ALUM	32	~70%
Automobile -- AUTO	24	~70%
Cement -- CEMT	32	~70%
Chemicals -- CHEM	53	~20%
Glass and Ceramics -- GLAS	17	~25-50%
Rolling stock -- TRAN	21	~70%
Semiconductors -- SEMI	29	~75%
Shipbuilding -- SHIP	15	~66%
Solar photovoltaic panels -- SOLA	11	~50%
Steel -- STEE	21	~35%
Telecommunications network equipment -- TELC	9	~75%
Wind turbines -- WIND	11	~75%

Note: Combined market shares are approximations only and depend largely on how the relevant market is defined. These market shares are based on either production capacity, actual production volumes, or sales. See Annex C for a full list of firms in the sample.

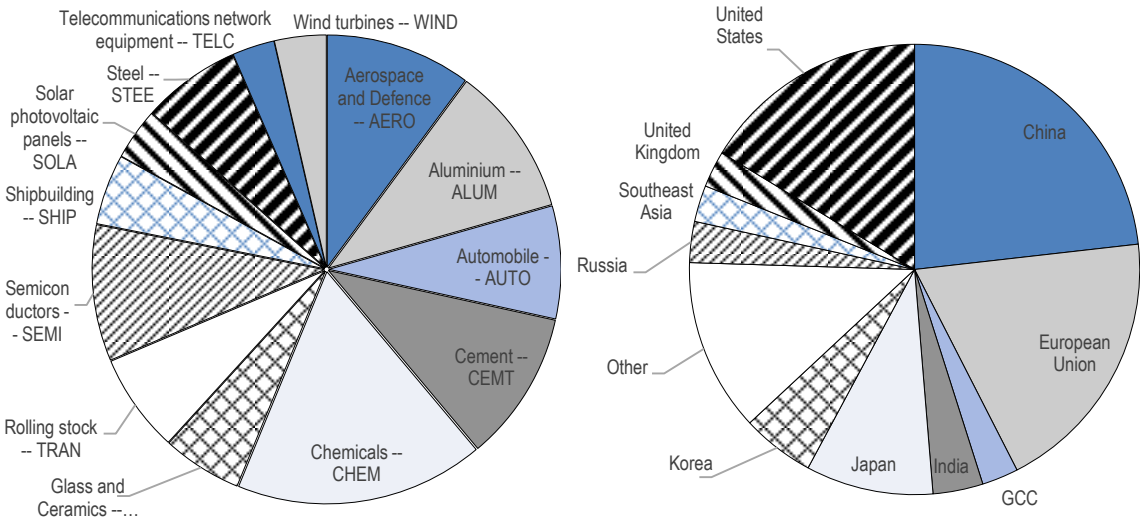
[35] Some mining activities may be included in the case of metals companies (e.g. coal and bauxite mining). To the extent possible, and data permitting, the analysis tries to exclude such activities from the scope of the exercise.

For the majority of sectors included in this sample, the companies covered account for two-thirds or more of global sales or capacity. One exception is the chemicals sector, where the sample only covers about 20% of the global market, but nonetheless includes 60% of the top 50 companies worldwide by revenue. Another is the steel industry, for which the sample covers only 35% of global steelmaking output in volume. Overall, the sample includes sufficient firm coverage from which to provide meaningful economic insights. The analysis is therefore likely to capture a significant proportion of government support, to the extent that data sources enable support benefitting those companies to be measured. The Technical Appendix provides more detail about the data sources and the variables included in the dataset.

Considered as a whole, the firm sample appears to cover a balanced cross-section of countries[36] and sectors (Figure 5) Chemical companies, the largest group by number, represent about 17% of all firms in the sample, followed by firms in cement (11%), aluminium (11%), and aerospace and defence (10%). As noted above, firms offering telecommunications network equipment make up the smallest group with 3% of the sample. Moreover, the sample's geographical breakdown closely reflects economies' respective weights in global manufacturing: China (23%); the EU-27 (19% of all firms); the United States (16%); Japan (9%); Korea (5%); India (4%); the United Kingdom, Russia, Southeast Asia, and countries of the Gulf Cooperation Council (3% each); etc. Some economies may nevertheless be under-represented in cases where they specialise in primary industries (e.g. agriculture and mining) or services. This includes, for example, Australia, Argentina, Chile, Indonesia, and New Zealand. Conversely, some manufacturing-heavy economies tend to be over-represented in the sample, such as Chinese Taipei.

Figure 5. The firm sample provides a balanced cross-section of countries and sectors

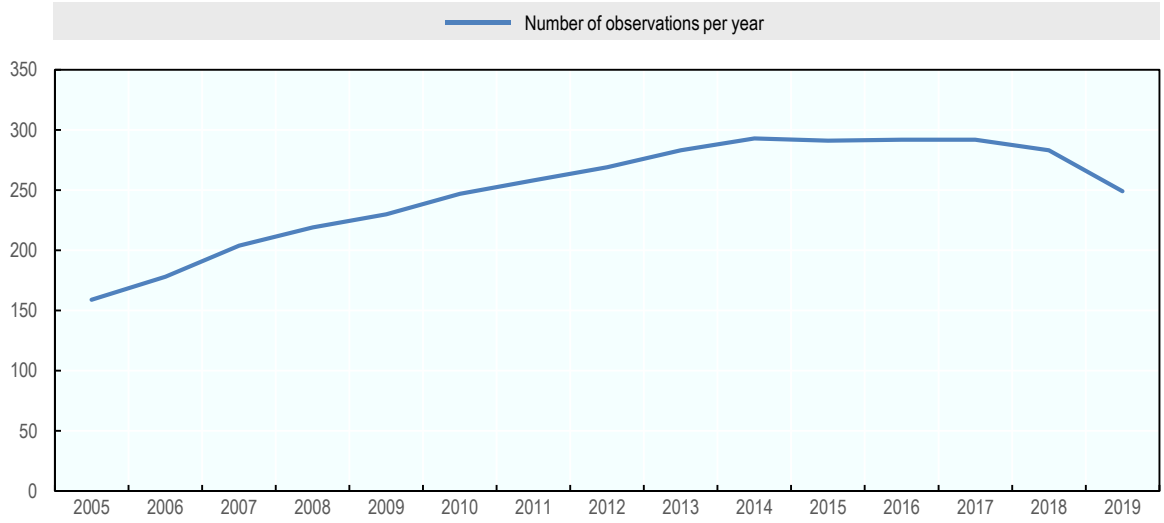
Number of firms in the sample, by sector and home economy



[36] Countries refer here to companies' home economies. That said, most of the firms in the sample are multinationals that operate on different continents. Some are also conglomerates that compete in many different segments.

The report spans the period 2005-19, although not all companies have a full time series of data going back to 2005. This does not always mean that data are missing; it can also indicate that certain companies did not exist for the full period, or that they were not active for the whole period in a given business segment. A small number of companies also exited the sample before 2019, due to bankruptcy, restructuring, or delisting from stock market exchanges. On average, the number of observations per year tends to grow over time, and to peak in 2014, before diminishing thereafter (Figure 6). While the dataset is not a balanced panel, it does manage to achieve reasonable time coverage throughout most of the period.

Figure 6. The dataset manages to achieve reasonable time coverage over most of the period 2005-19



Government-invested firms[37] make up a significant portion of all companies included in the sample, and by extension a significant portion of all top firms in the 13 sectors considered. Among the many pieces of information collected for this project is the ownership structure of the covered companies, as at 2018-19.[38] Depending on the sector, this shows state entities in the sample to own between 0.5% and 67% of total sector assets measured at book value (Table 3). The highest percentage is found for the shipbuilding sector, followed by aluminium, steel, and aerospace and defence. The lowest is in glass and ceramics, where state actors only hold slightly less than 0.5% of all assets. There is, however, great variation in how much of each individual company governments own. Some firms are fully privately owned, some others are nearly 100% privately owned (<10% government ownership), while still others are 100% owned by domestic state entities (Table 4). Many companies also fall in-between the two groups. Significant government ownership appears to be largely concentrated in a few non-OECD economies, namely China

[37] This report uses “government-invested firms” to refer to firms in which governments, as a factual matter, have invested directly or indirectly, but without prejudice to the size of those investments or the implications they have for the effective level of state control. The terminology of “government-invested” thus covers a broader range of state investments in a manner which does not have implications for the legal treatment of such investments. See Box 3.

[38] To the best of the authors’ knowledge, very few of the sampled firms appear to have been privatised or nationalised over the time frame covered in this report.

and GCC[39] countries. In the OECD, France, Italy, and Norway are the three countries with the most government ownership of OECD industrial companies in the sample.

Table 3. State entities own between 0.5% and 67% of total sector assets in the sample

Sector	Total book value of assets in 2018 (USDmn)	Percentage of assets held by governments
Aerospace and Defence -- AERO	860,335	28.9%
Aluminium -- ALUM	446,126	55.5%
Automobile -- AUTO	3,234,765	13.4%
Cement -- CEMT	393,035	15.2%
Chemicals -- CHEM	1,354,185	19.9%
Glass and Ceramics -- GLAS	140,675	0.4%
Rolling stock -- TRAN	140,527	20.4%
Semiconductors -- SEMI	961,208	7.0%
Shipbuilding -- SHIP	208,166	67.4%
Solar photovoltaic panels -- SOLA	44,225	5.5%
Steel -- STEE	823,348	44.0%
Telecommunications network equipment -- TELC	374,598	4.1%
Wind turbines -- WIND	82,376	6.1%

Note: The table above does not show the global amount of corporate assets in any given sector but only the assets of the firms covered by the sample collected by the OECD.

Table 4. There is considerable variation in how much governments own of each company

Number of firms in the sample, by government ownership category

Region	Government ownership <10%	Government ownership ≥10% & <25%	Government ownership ≥25% & <50%	Government ownership ≥50%
China	21	8	19	23
GCC	1	0	1	6
India	8	0	0	3
OECD	155	13	9	4
Other	26	5	1	3
TOTAL	211	26	30	39

Note: "Other" includes Argentina, Brazil, Chinese Taipei, Egypt, Indonesia, Malaysia, Nigeria, Russia, Singapore, South Africa, and Thailand.

3.3. Overview of firm performance over the period and sectors studied

This sub-section provides descriptive statistics of the sample to help set the context for the estimates of below-market finance that are presented further below. It begins with a series of basic financial metrics to illustrate how profitability varies across a number of firm characteristics.

Looking at the average performance of firms across industries, the data indicate that chemicals, cement, aerospace, and semiconductors are the most profitable sectors, followed by telecommunications network equipment and rolling stock[40] (Figure 7). Shipbuilding and solar photovoltaic (PV) panels have the lowest

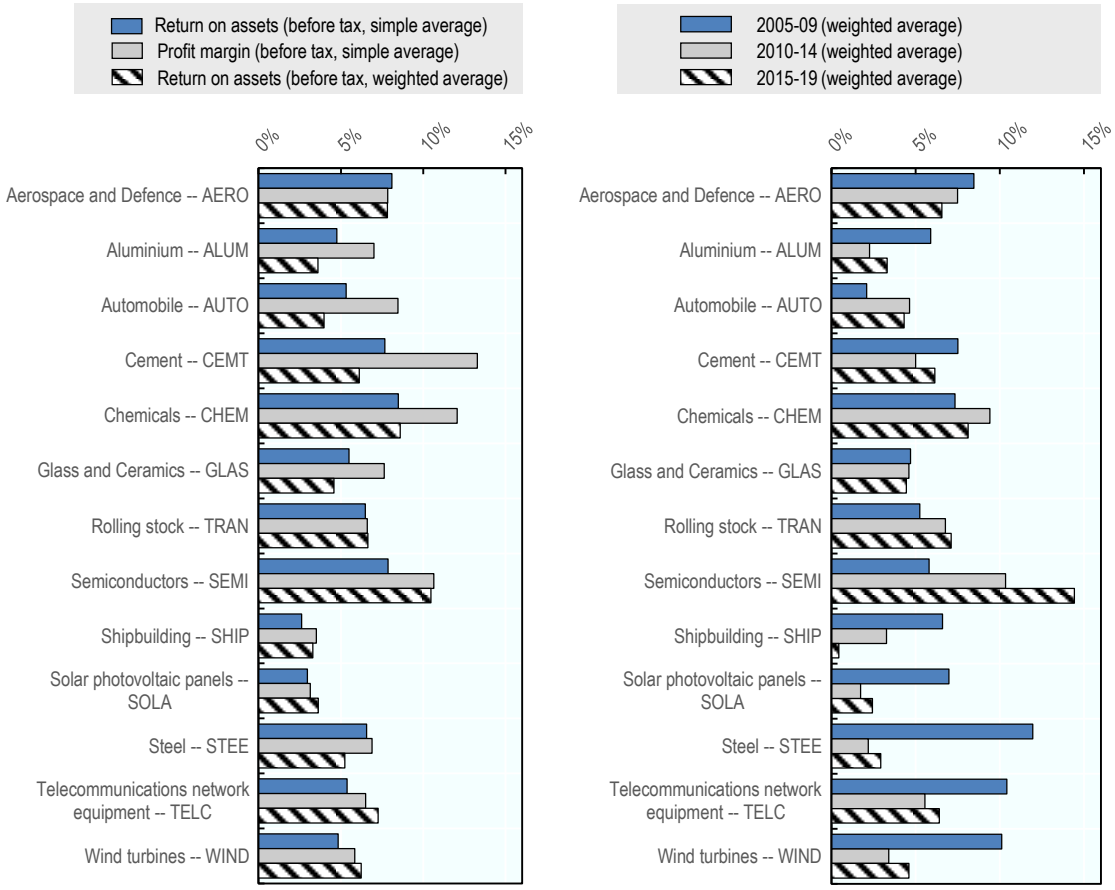
[39] Countries of the Gulf Cooperation Council are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE.

[40] Rolling stock refers to all railway vehicles, i.e. locomotives, railroad cars, and freight wagons. The sector here also comprises some companies that provide railway signalling.

sectoral performance in terms of profitability. Companies' financial performance is measured by returns on assets and profit margins, calculated using income before tax (to account for multi-jurisdictional firms) and using segment-specific data in the case of multi-product firms (e.g. conglomerates).[41] As an example, Samsung Electronics' ROA as measured here concerns only the company's semiconductor segment, thus excluding phones, displays, and other consumer electronics. Likewise, the calculated ROA for General Electric (GE) reported under the wind-turbine sector refers only to GE's Renewable Energy business segment.[42]

Figure 7. Chemicals, cement, aerospace, and semiconductors appear to be the most profitable sample sectors

Left: Returns, before tax, by simple and weighted average
Right: Return on assets by weighted average over different time periods



Note: Weighted averages use (segment-specific) firm revenue as weights.

The relatively strong performance of chemical, cement, and aerospace companies appears to be stable over time, while returns for semiconductors have increased more than for any other industry in the sample (second panel of Figure 7). On the other hand, aluminium, shipbuilding, solar PV panels, steel, and wind

41 Subject to companies disclosing such information, which they normally do.

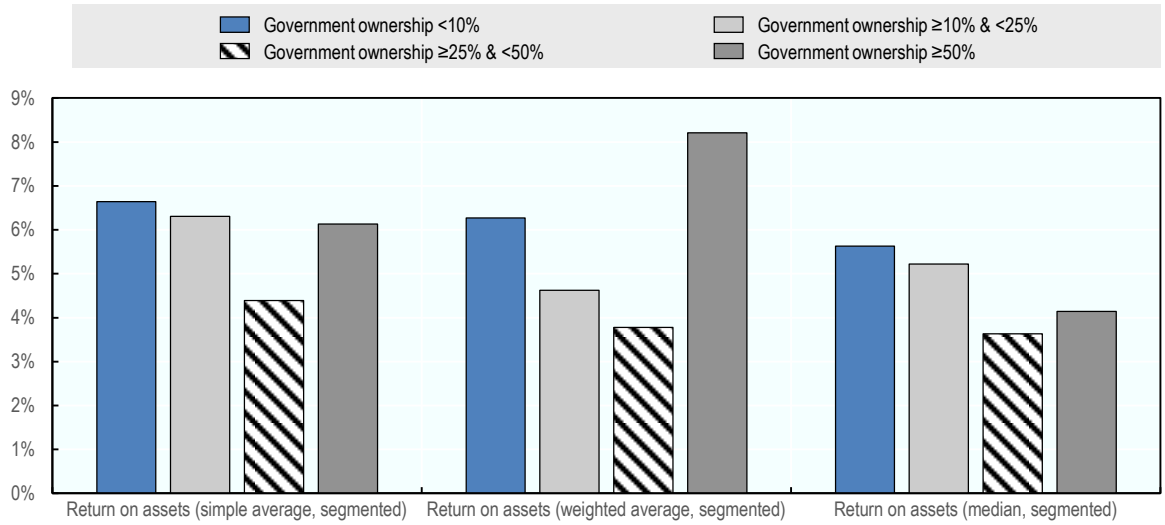
42 Sensitivity analysis shows that using net income after tax from consolidated company data for multi-product firms does not alter the findings, with the possible exception of aerospace and defence.

turbines all exhibit a marked decline in returns over the three periods considered. This appears to coincide with reports of growing excess capacity in some of these sectors, which could partly explain the relatively subpar performance observed over the past decade.

One reason why sectors differ so much in terms of their observed financial performance across the above measures relates to structural characteristics, such as how capital-intensive or innovation-driven they are.[43] On average, semiconductor firms in the sample spend much more on R&D relative to their size (13% of revenue) than companies in other sectors, with the exception of providers of telecommunications network equipment – which themselves are large users of semiconductors. By contrast, cement, steel, and aluminium firms in the sample spend less than 1% of their revenue on R&D. That said, these sectors are also among the most capital intensive in the sample (together with chemicals and shipbuilding), according to their ratio of fixed tangible assets to employees. They are also heavily dependent on energy inputs (e.g. coking coal for steel and electricity for electrolysis in aluminium smelting). Labour costs are, meanwhile, highest for firms in telecommunications network equipment (25% of revenue), aerospace (24%), and semiconductors (20%), which probably stems from these sectors' heavy reliance on specialised skilled labour, such as engineers and programmers.

Another potential reason for the variation in company performance appears to be related to the ownership structure of firms, and in particular the extent to which they are government owned. The data collected suggest that firms with less than 25% government ownership have generally higher ROAs than firms with larger government stakes, although there are clear outliers among firms that are 50% state-owned or more (Figure 8). These outliers are mostly found in chemicals, cement, and in the automobile sector (Table 5). This raises the question of why certain firms with large state ownership in those three sectors are able to perform much better than both their private peers and other government-invested firms. Another related question is why this pattern does not appear to hold in the case of tech-intensive sectors such as aerospace, semiconductors, and telecommunications network equipment, where firms with more than 33% government ownership fare seemingly worse than their more private counterparts.

Figure 8. Firm performance also varies with ownership status



Note: Weighted averages use (segment-specific) firm revenue as weights.

[43] For the same level of profits, capital-intensive firms will show a lower ROA, for example.

Table 5. Firms with 33%+ state ownership appear to perform better than private peers in the automobile, cement, and chemicals sectors

Return on assets, simple average, segmented

	Government ownership <33%	Government ownership ≥33%
Aerospace and Defence — AERO	8.21%	3.16%
Aluminium — ALUM	4.76%	2.61%
Automobile — AUTO	**4.70%**	**8.61%**
Cement — CEMT	**6.23%**	**9.88%**
Chemicals — CHEM	**8.40%**	**9.56%**
Glass and Ceramics — GLAS	5.89%	
Rolling stock — TRAN	6.58%	5.16%
Semiconductors — SEMI	8.25%	3.63%
Shipbuilding — SHIP	2.57%	0.62%
Solar photovoltaic panels — SOLA	2.38%	
Steel — STEE	6.23%	4.67%
Telecommunications network equipment — TELC	5.06%	
Wind turbines — WIND	4.14%	

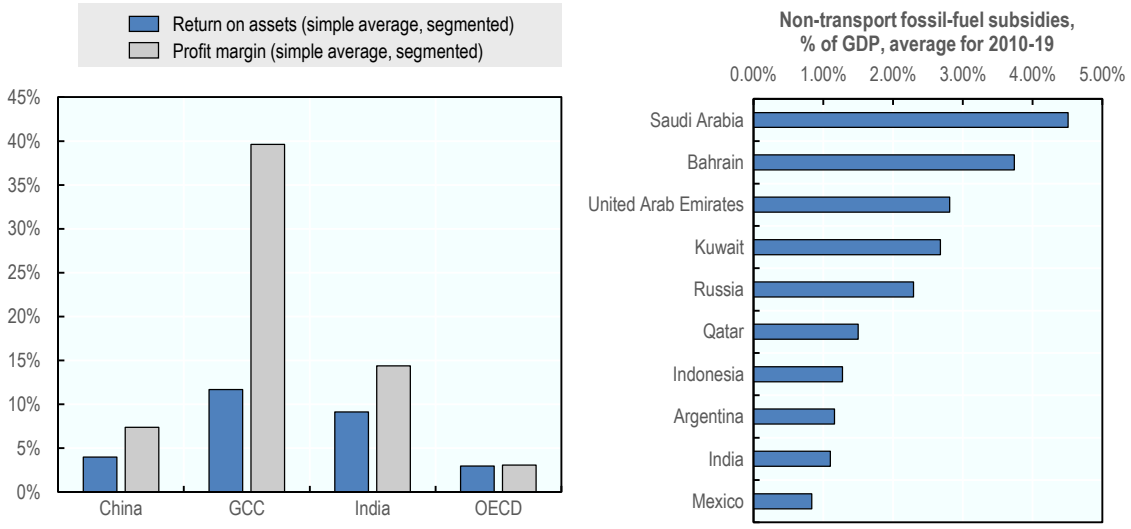
Note: Some cells are left empty to prevent identification of specific firms. For the same reason, the table uses a different government-ownership threshold than other figures and tables shown in this report. Were blank cells in the table above to be filled in, they would also show firms with more than 33% government ownership to perform worse than those with less than 33% government ownership.

Government policy is possibly a key contributor to some of the differences in performance seen across sectors and firms. Outlier firms with 25%+ state ownership in the energy-intensive cement and chemicals sectors, for example, come predominantly from GCC countries (Figure 9) – a region where, according to the International Energy Agency, fossil fuels attract large subsidies (IEA, 2018[28]). Energy subsidies could thus be playing a role in increasing rates of return for energy-intensive companies that use fossil fuels as key inputs. The OECD (2019[2]) has already found below-market energy inputs to have improved the profitability of certain aluminium smelters.[44] In the automobile sector, the presence of mandatory joint-venture requirements in China up until relatively recently may help explain why Chinese firms with 50%+ state ownership appear to perform better than larger, private carmakers operating globally (Box 1).

[44] While energy subsidies are not the topic of the present report, future OECD work will explore this issue further.

Figure 9. Outlier firms with 25%+ state ownership come predominantly from the GCC region, which has had relatively large energy subsidies

Left: Average return on assets and profit margin for firms with at least 25% government ownership
Right: Top 10 providers of non-transport-related fossil-fuel subsidies over the period 2010-19



Source: OECD research (left) and IEA (right).

Box 1. How joint ventures contribute to the profitability of China's state-owned carmakers

Up until their gradual removal initiated by the National Development and Reform Commission (NDRC) in 2018,[1] China had foreign investment restrictions in place that capped foreign ownership of local car factories at 50%. Together with China's tariffs on imported cars and the fast-growing size of the country's car market, these restrictions pushed foreign carmakers to establish joint ventures (JVs) with local car companies (Andrenelli, Gourdon and Moïsé, 2019[29]). In most cases, Chinese JV partner companies were fully or partly state owned: e.g. the Beijing Automotive Industry Corporation or BAIC (majority-owned by the Beijing municipality), the Huachen Automotive Group or Brilliance (>40% owned by the Liaoning province), the Chongqing Changan Automobile Company or ChangAn (>40% owned by the Central Government), the Dongfeng Motor Group (fully owned by the Central Government), and the Shanghai Automotive Industry Corporation or SAIC (majority-owned by the Shanghai municipality).

Although these investment restrictions are being gradually lifted and import tariffs have since been lowered, these measures have had a profound effect on the size and shape of China's car-making industry. One visible consequence can be found in the financial statements of Chinese carmakers, where JV income appears to account for the bulk of all profit earned by those companies. One possible way to look at this is to consider the profitability of these firms with and without their JV, which can help inform the discussion of government investments and equity returns.

Below are a few anonymised, simplified examples that help illustrate the potential role of JV-income in the financial performance of China's government-invested carmakers:

- Company A earned revenue of more than CNY 170 billion in 2019, of which CNY 19.6 billion came from sales under its own brand and CNY 155 billion from sales under a foreign brand. Gross profit under the foreign brand exceeded CNY 42 billion while the company incurred gross losses of CNY 4.7 billion under its own brand.
- Company B's sales under its own brand in 2019 were CNY 3.4 billion while sales under a foreign brand reached CNY 169 billion. Overall, Company B's JVs had the effect of turning a CNY 1 billion loss (before tax) into a CNY 6.3 billion profit, corresponding to a return on assets in excess of 13%.
- Company C reported CNY 7.2 billion of operating profit in 2017, with the majority (CNY 6.9 billion) attributed to its JVs. Conversely, in 2019 Company C's financial performance was negatively affected by a JV's loss of CNY 2.2 billion; Company C reported an operating loss of CNY 2.1 billion for that year.

[1]. See, for example, www.mofcom.gov.cn/article/b/f/201806/20180602760432.shtml (accessed on 22 February 2021).

Management quality could also provide another explanation for why certain firms perform better financially than others. Yet for this explanation to be germane, one would need to demonstrate that outlier firms with 25%+ state ownership are better managed than firms that are majority-owned by private-sector shareholders and other government-invested firms. Available evidence points to the contrary, suggesting that several governments fail to subject their own SOEs to the same market pressures as their competitors and interfere in management (OECD, 2020[15]). This would be especially the case if soft budget constraints (e.g. government guarantees) generate moral hazard and dull incentives for managers to innovate or improve operations.[45]

This leaves government support as a contributing factor to the observed difference in returns. This would be the case in particular where government-invested firms received relatively more support than private companies. The data collected for this study suggest that is indeed the case for government grants, for example (Figure 10). To the extent that government grants feed into income before tax, they would be expected to increase ROAs and profit margins.[46] The cement industry appears to be the largest recipient of grants on average, followed by manufacturers of solar PV panels and shipyards (Figure 11). In general, the government grants that could be identified for this study are relatively larger outside of the OECD,[47] though there is considerable heterogeneity in the situations of particular economies and firms.[48]

[45] See the discussion at the end of Section 4.

[46] Tax concessions (e.g. R&D tax credits and investment tax incentives) do not seem to benefit only government-invested firms but are found instead throughout the sample in roughly similar proportions. However, since returns on assets and profit margins are here calculated before tax, tax concessions cannot explain differences in firm performance.

[47] In Figure 11 and others, this report groups OECD countries together to prevent identification of individual companies coming from smaller member countries.

[48] This is especially true for Russia, where a few SOEs obtain sizable grants while most private firms receive relatively low amounts of support.

Figure 10. Government-invested firms receive relatively more government grants than private companies do

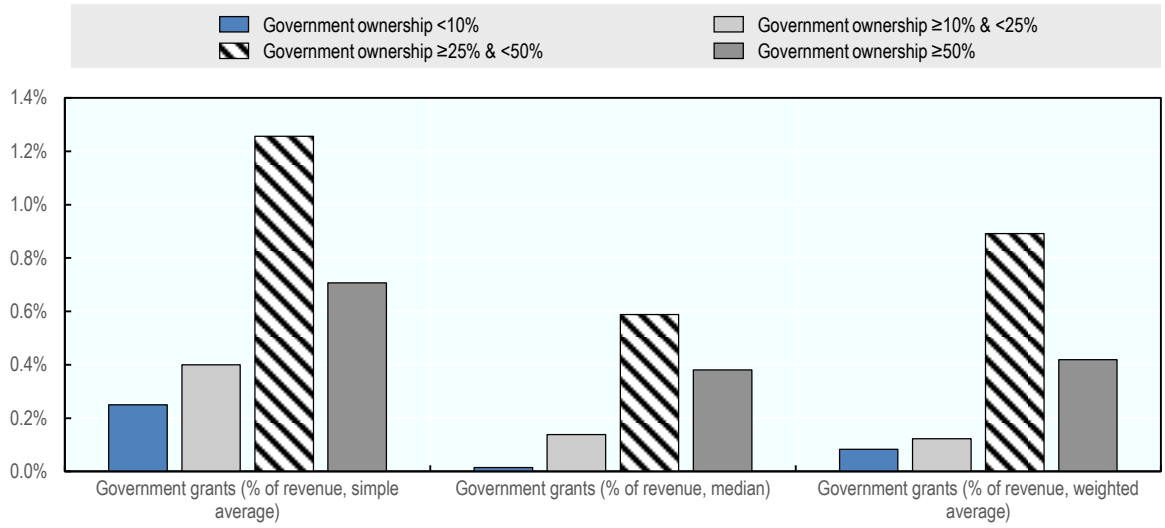
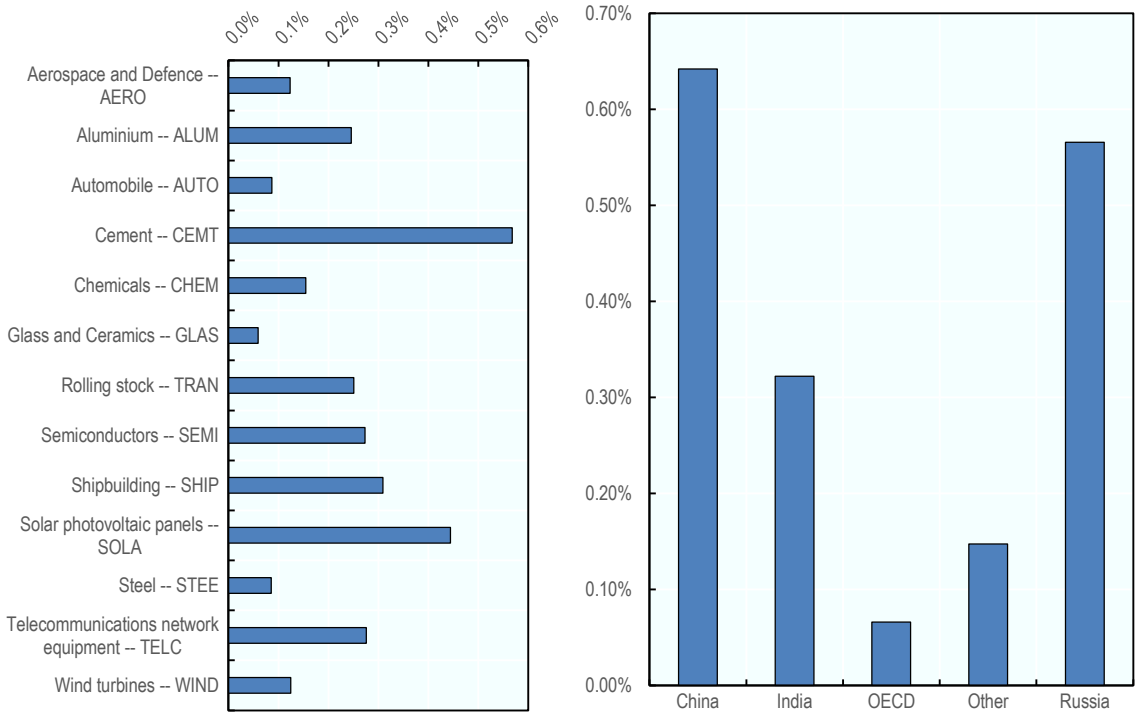


Figure 11. The cement industry is the largest recipient of grants followed by solar PV panels and shipbuilding

Government grants, % of revenue, weighted average



Note: Weighted averages use (segment-specific) firm revenue as weights. Using simple averages instead does not affect the results. Government grants are those grants that could be identified for this study subject to corporate disclosure and availability of other data sources.

This report's findings on government grants are broadly consistent with existing evidence. The IMF (2019[11]) recently noted, for example, that in the case of China, "SOEs receive relatively more subsidies [i.e. grants in this case] than [privately owned enterprises] who are typically smaller in size which can lead to market distortions." This is true in cement, of which China is the largest producer by a very large margin[49], but also in shipbuilding and several other sectors covered in this report. For example, according to calculations for 2018, four of the top 10 grant recipients listed on the Shanghai and Shenzhen stock exchanges were carmakers (Kawakami, 2019[30]).

Government grants form, however, only one part of the total government support that industrial firms receive. While some evidence already exists on the scale and scope of government grants, comparable data are still lacking for below-market finance. This gap makes it difficult to understand how significant below-market finance is in terms of its impact on trade and competition. Little is known, for instance, about which sectors obtain, and which countries offer, the largest amounts of below-market finance. It is also unclear to what extent below-market lending favours government-invested firms to the detriment of their private competitors.

Even before getting into the actual quantification of below-market finance (Section 3.4), the data collected for this study already provide interesting insights into the possible distribution of support provided through the banking system. The capital structure of the firms covered by this report appears to be largely a function of the sectors in which they operate, with heavy industries (e.g. metals, cement, chemicals, and glass and ceramics) relying more on debt finance (Figure 12). Leverage (debt-to-asset ratios) is highest among aluminium, cement, and steel firms but lowest among high-tech firms that rely relatively more on intangible assets (e.g. aerospace, semiconductors, and telecom network equipment) and tend to feature more equity. Interestingly, there does not seem to be a significant difference overall in capital structure between private firms and government-invested enterprises. This implies that sector characteristics are possibly the main driver of firms' capital structure.[50]

Despite the similarity of the capital structure of firms within each sector, large differences exist in the cost of debt that companies incur. Differences show notably in the risk spread that this study calculates for all firms in the sample, and which subtracts from companies' average interest rates the risk-free base component that is currency-specific. This leaves an interest-rate spread that can be considered a measure of company risk. This risk spread is clearly lower for firms that have more than 25% government ownership, and especially for those that are 50%+ state owned (Figure 13). While a lower risk spread does not by itself imply the existence of government support, the very large differences found between firms with different ownership structures raises questions about possible government loan guarantees (explicit and implicit) and preferential interest rates.

What makes government-invested firms' lower risk spreads potentially concerning from a competition standpoint is that they do not seem to stem from lower debt-asset ratios. The International Institute of Finance had noted before the COVID-19 pandemic that "SOE debt now account for over 60% of all non-financial corporate debt across major emerging markets".[51] Especially troublesome are the several companies in the sample that have been able to take on debt at interest rates that are on average below base-lending rates, even with high debt-to-asset ratios. This again points to the likely existence of below-market finance, which Section 3.4 aims to quantify more rigorously.

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[49] See https://pubs.usgs.gov/periodicals/mcs2021/mcs2021-cement.pdf (accessed on 23 February 2021). The US Geological Survey has noted in its 2015 *Minerals Yearbook – Cement* that "China's production [of cement] for 2014-15 was 87% of the total United States output for 1900 through 2015."

[50] Myers (2001[63]) notes, for example: "in general, industry debt ratios are low or negative when profitability and business risk are high. *Intangible assets are also associated with low debt ratios*" (own emphasis). There is a large literature that explores this question.

[51] See the IIF's *Global Debt Monitor* dated 13 January 2020.

Figure 12. Heavy industry relies more on debt finance while high-tech sectors rely more on equity

Debt-asset ration, simple average

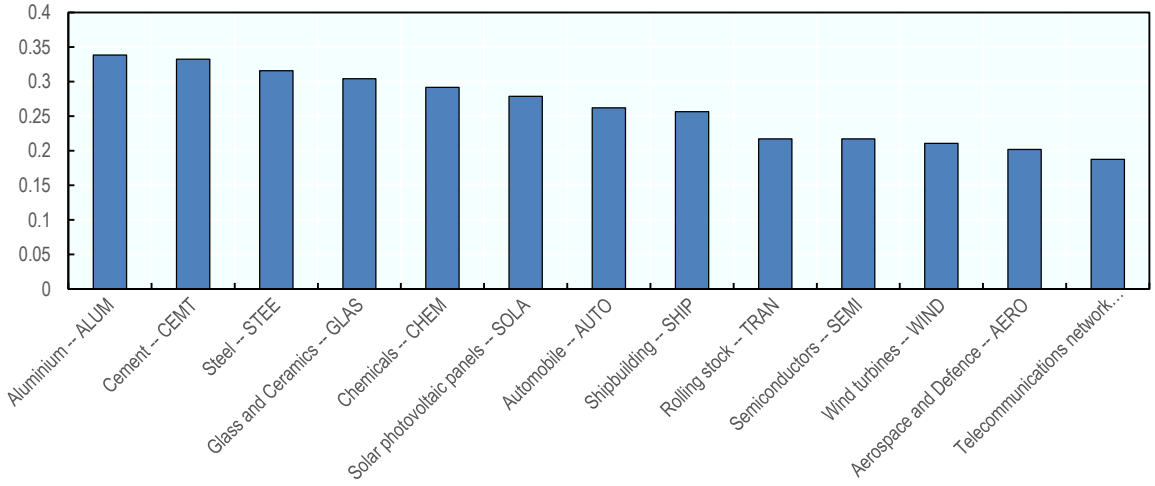
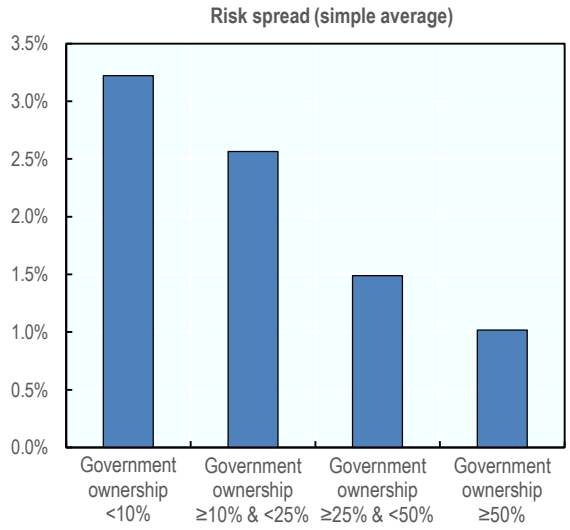


Figure 13. The risk spread is considerably lower for firms that have more than 25% government ownership



3.4. Quantifying below-market finance

3.4.1. Below-market borrowings

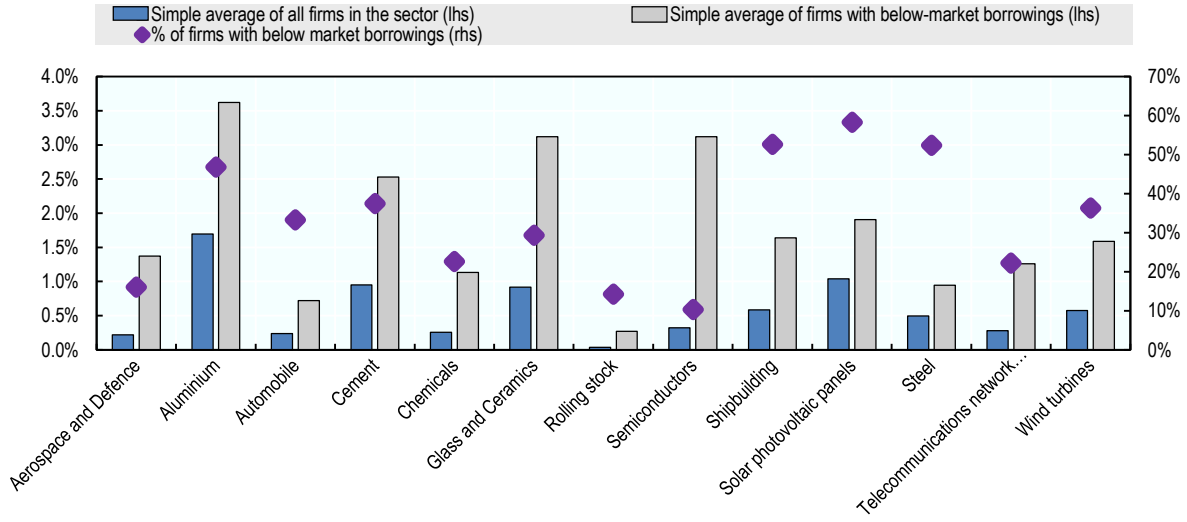
Findings for the sample of 306 firms suggest that there is considerable variation in who benefits from below-market borrowings. Large differences are notable among the 13 sectors studied, with below-market borrowings appearing especially marked in industries that reportedly suffer from excess capacity

(Figure 14).[52] Around half of sampled firms in solar PV panels, shipbuilding, and steel seem to have benefitted from below-market borrowings over the period analysed, followed by firms in aluminium and cement (as indicated by the diamonds in Figure 14).

When expressing below-market borrowings (BMB) as a share of firm revenue, the average for all companies in each sector – beneficiaries and non-beneficiaries (represented by the blue bars in Figure 14) shows aluminium to be the most affected industry, followed by cement, solar PV panels, and glass and ceramics. When averaging only over those firms that actually obtained BMB (indicated by the grey bars in Figure 14), aluminium, cement, as well as glass and ceramics again stand out, along with semiconductors.[53] Unsurprisingly, most of these sectors are heavy industries that have on average more debt relative to their assets (Figure 12), which therefore makes borrowings a more prominent channel of government support. Interestingly, however, sectors in which half or more of companies benefit from BMB have on average smaller support relative to revenue (e.g. shipbuilding, solar PV panels, steel) than aluminium, cement, and glass and ceramics.[54]

Figure 14. More firms in sectors with reported excess capacity tend to benefit from below-market borrowings, and they do so to a larger extent

Average below-market borrowings, % of revenue



Note: Blue bars count below-market borrowings as zero for companies that exceeded this study's benchmark (i.e. companies that paid more interest than the benchmark). These firms are dropped altogether when calculating the grey bars.

[52] Unless otherwise specified, this sub-section presents results that encompass all three tiers of below-market borrowings (Figure 2), thus including the support conferred by government guarantees. See Section 4 for more discussion of excess capacity and how it relates to below-market borrowings.

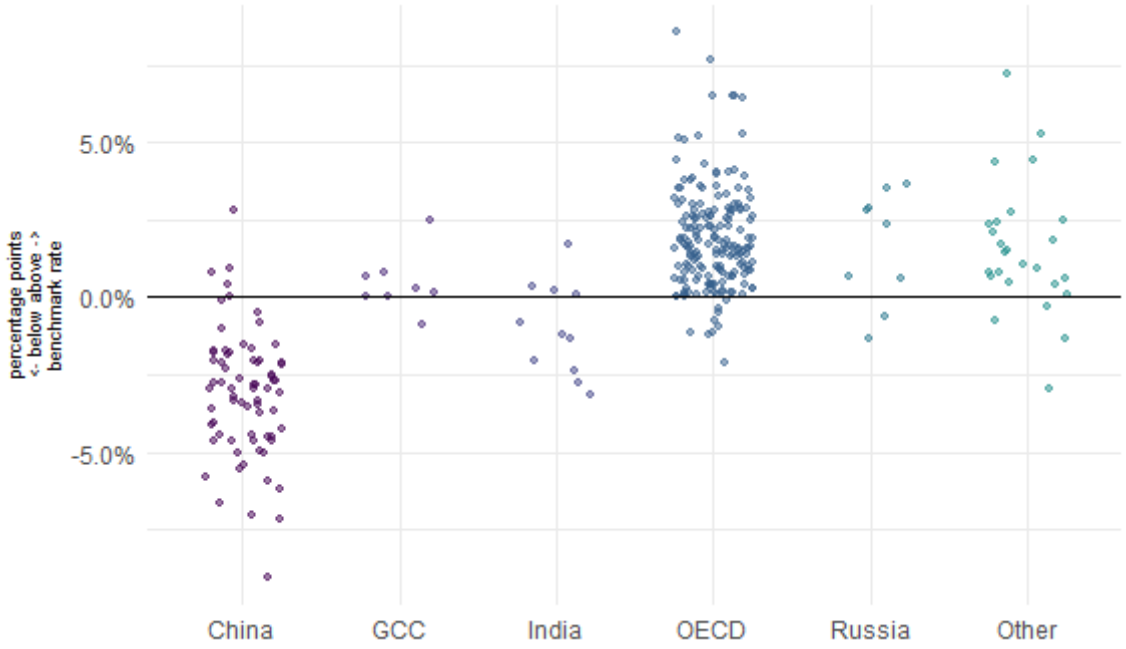
[53] It should be noted that in the case of automobiles, many firms offer a range of financial services to their customers (e.g. car loans and even bank-like services) so that firms' consolidated debt and interest expenses can include liabilities for customers' deposits on their accounts, which could then influence the overall average interest rate of the company.

[54] In the case of steel, a previous study of state enterprises in the sector found that they do not on average benefit from lower interest rates than comparable private firms (Mattera and Silva, 2018[67]). The study did find regional differences, however.

The fact that BMB seem relatively small in some sectors (Figure 14) should not be taken to mean, however, that these sectors did not benefit from support through the lending channel.[55] Since the methodology used to determine BMB in this study is based on a comparison between a firm's overall interest expenses and a company-specific benchmark, it is not designed to identify individual loan transactions that are provided on a preferential or concessional basis. As long as these individual loans do not lower a firm's overall interest expenses below the benchmark, the method will not detect them. Furthermore, as the shortfall in interest rates charged is multiplied by a firm's debt, BMB estimates are affected partly by the capital structure of the companies, such that debt-reliant companies will tend to have a higher BMB amount all other things being equal. The estimated BMB amount is then scaled by firm revenue in order to compare sectors that have a wide range of sampled firms of varying size, maintaining the aforementioned impact of firms' capital structure on the result (BMB/revenue ratio) for similar levels of revenue. The fact that rolling stock does not feature more prominently, for example, is likely because the companies that benefit from below-market financing in that sector have relatively low debt-to-asset ratios compared with firms in other sectors, although the percentage-point difference between their interest rate and the benchmark interest rate might be just as high.

Importantly, the results presented here are conservative in that they rely partly on estimated credit ratings that can overstate the creditworthiness of companies. This effectively makes these results a lower-bound estimate as a lower rating would imply a higher risk spread, and therefore a higher benchmark interest rate against which to assess BMB. The use of total interest expenses to calculate firms' average interest rates further reinforces the conservative nature of the estimates as mentioned earlier.

Figure 15. Below-market borrowings appear to be concentrated geographically



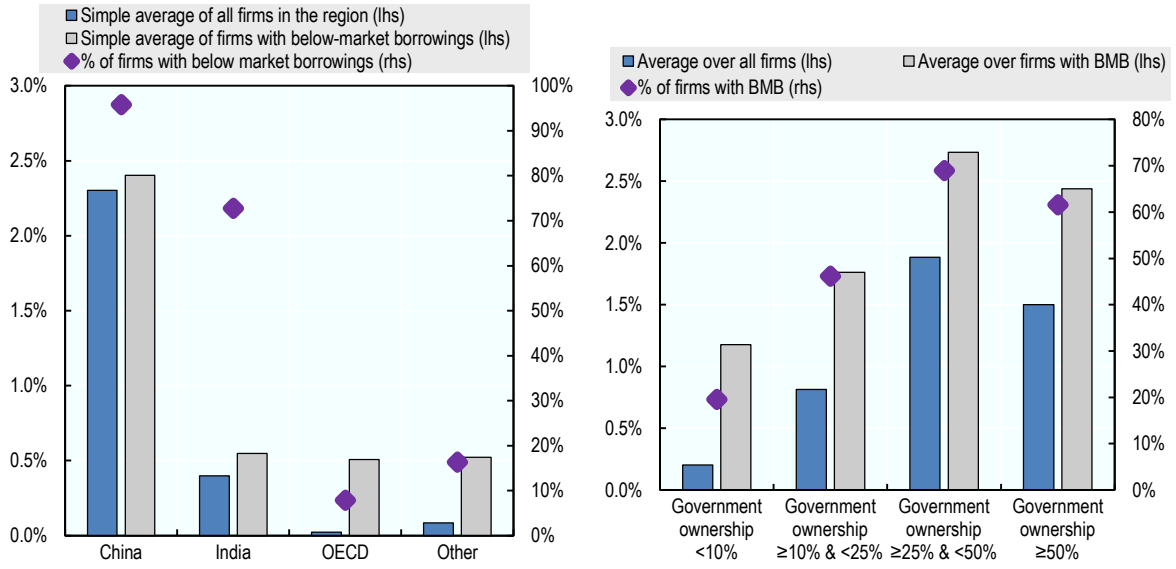
Note: Dots are averages for individual companies and show their percentage-point distance to the benchmark.

[55] Nor does it mean that those firms did not benefit from other forms of government support such as grants, tax concessions, below-market energy inputs, or the provision of equity by governments without adequate, market-consistent returns (see the next part of this sub-section).

More than 90% of companies based in OECD economies tend to exceed their interest-rate benchmark (Figure 15), which shows these benchmarks to be rather conservative.[56] In sectors such as chemicals and semiconductors, many firms are clustered slightly above the zero horizontal line, which could indicate that the benchmark is rather closer to the observed rates in these cases. The geographical split also shows that China-based companies are much more likely to benefit from BMB based on the calculated benchmark rates. This implies that some of the sectoral results shown above stem largely from the geographical distribution of sampled firms in each sector. The relatively large results for the aluminium sector in particular are likely driven by Chinese companies, which tend to benefit more from BMB and account for nearly 40% of the aluminium firms in the sample.[57] That being said, a number of firms in OECD countries and in other jurisdictions would also seem to have received government support through the debt channel. Qualitative information found in financial statements generally supports the idea that some of these firms obtained loans from state banks (e.g. VTB in Russia) or development banks (e.g. the European Investment Bank or the Korean Development Bank).

Figure 16. Chinese companies and government invested firms tend to benefit more from below market borrowing

Average below-market borrowings [BMB], % of revenue



Note: The GCC region is omitted from the left graph as it comprises only one firm that benefitted from BMB.

Chinese companies in the sample tend to benefit relatively more from BMB than their peers in other jurisdictions (Figure 16, left). This finding does not only hold for Chinese firms with 50%+ state ownership, but is true for companies across the government-investment spectrum. In fact, almost all of the Chinese firms covered in this study received some benefit from BMB, averaging more than 2% of annual firm revenue. While three out of four Indian firms in the sample benefitted from better-than-market financing

[56] In principle, firms that do not benefit from any below-market borrowings should have a benchmark exactly equal to their average interest rate on debt. Determining a benchmark with such accuracy is not feasible in practice, however.

[57] This is because China produces about 60% of all primary aluminium smelted globally.

conditions, the extent of this benefit was much smaller than for Chinese firms and similar to that for firms based in the OECD and other jurisdictions.

Looking across the whole sample, there appears to be a relationship between government ownership and BMB. Almost 70% of companies with government stakes greater than 25% received benefits, compared with around 20% of companies with government stakes below 10%. The extent of those benefits was also on average significantly higher for government-invested firms (Figure 16, right).[58] This underscores that BMB concern not only firms with majority government ownership, but also those with lower or minority government stakes.

This pattern of support also mirrors the findings presented above on government grants (Figure 10). Companies with more than 25% government ownership therefore tend to obtain more support in the form of both grants and BMB.

Government loan guarantees for companies with more than 25% government investment account on average for up to half of the calculated BMB in that segment. This sizable contribution from government loan guarantees (i.e. Tier 3 BMB as described in Section 2, Figure 2) to the total estimates, including for firms that have between 25-50% government ownership, serves as another indication that state support is not limited to firms with 50% or greater government ownership, which has implications for the discussion later in Section 5.[59] That said, there can be large differences among firms within the same government-ownership category. These differences again partly stem from variations across regions.

Financial reporting for CY 2020 was not available at the time of writing, so it was not possible for the analysis to cover the period of the COVID-19 pandemic and its economic aftermath. It would, however, be interesting for future work to look into how and to what extent the economic shock resulting from the pandemic and associated crisis-response programmes have affected companies in the sample, including their financing conditions.

3.4.2. Below-market equity returns

As outlined above, there are large differences in the extent to which companies in different sectors have been able to benefit from below-market borrowings. One source of the differences among sectors relates to the capital structure of companies, with companies that rely more on debt finance being, as expected, more likely to obtain below-market borrowings than companies that rely more on equity finance. This typically concerns heavy industries which tend to be characterised by higher debt-to-asset ratios (Figure 12). A study of below-market finance would, however, not be complete without also looking at the equity side of corporate finance in cases where governments are large shareholders in companies.

Figure 17 shows estimates of below-market equity (BME) returns for companies with more than 25% government investment in 10 of the 13 sectors covered by this study.[60] As discussed in Section 2, using

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[58] As this considers all firms in the sample, and there are more chemical companies in the sample due to the lower market concentration of the sector (Figure 5), chemical companies might be given a higher weight in this graph than companies from other sectors. Treating every sector with the same weight, however, does not materially change the findings presented here.

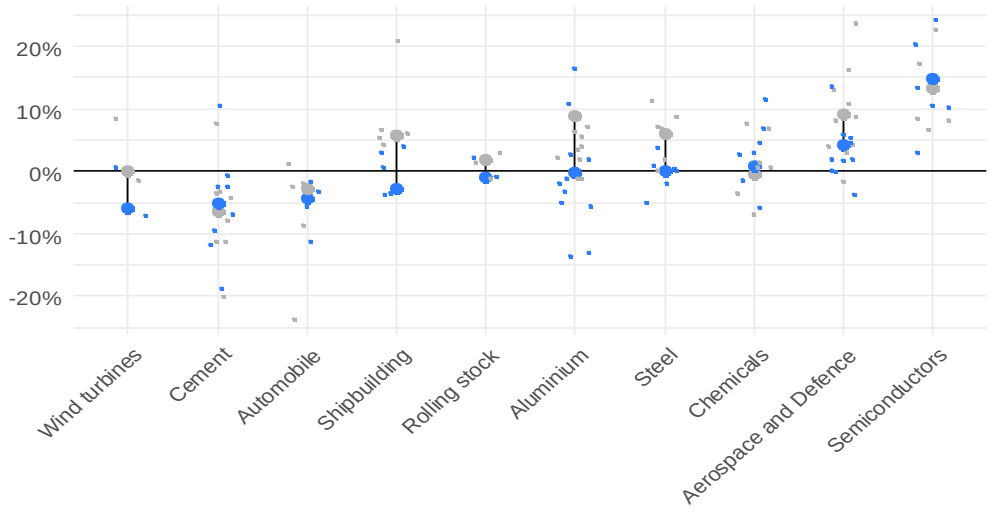
[59] Tier 3 also includes results derived using estimated credit ratings, in which case ratings with government guarantee were unavailable. This only affects the split between Tiers 1 & 2 and Tier 3 while not changing the total estimate for below-market borrowings.

[60] Results are qualitatively similar when using 33% government ownership as a threshold. There are no companies with government investments of more than 25% in the solar PV panel sector, which is therefore omitted from the graph. Glass and ceramics, and telecom network equipment were likewise omitted from the graph, as the sample only included one firm with 25%+ government ownership in each of these two sectors. Results for these companies also indicate some BME returns, however.

CAPM as a benchmark can be rather demanding for some sectors, as evidenced by the fact that only a few firms meet the benchmark (e.g. in aluminium).[61] Estimates based on CAPM, as well as on the *avgROA*, are therefore presented as a range. Grey dots indicate the results obtained using the CAPM benchmark, while blue dots show estimates obtained using the *avgROA* over the sample period. Small points represent individual company averages while the two large dots are the weighted average of those firms in each sector using the two benchmarks. Positive numbers imply that the company in question underperformed relative to its benchmark, i.e. benefitted from BME returns, while negative numbers show that the company has exceeded that benchmark.

Figure 17. Government-invested firms in semiconductors and aerospace benefitted relatively more from below-market equity returns

Average below-market equity returns, % of revenue



Note: Grey dots show average below-market equity returns estimated using the CAPM over the sample period; blue dots show average below-market equity returns estimated using the *avgROA* over the same period. Small dots represent individual companies and large dots sectors' weighted average. Only companies with more than 25% government ownership are represented here. Using a 33% threshold does not qualitatively change the results. Individual firms further than 25 percentage points from the benchmark are excluded from the graph for better visibility of results, but are taken into account in calculating the average. Dropping these outliers and using a simple average does not materially change the results.

The range of estimates and the fact that there is substantial diversity in the results among companies make a clear sectoral interpretation difficult. It is, however, evident that both benchmarks indicate the presence of BME returns for almost all government-invested firms in semiconductors[62] as well as for many such companies in the aerospace and defence industry. Among all the sectors studied for this report, these two are arguably among the most high-tech industries and those that rely relatively more on intangible assets (e.g. intellectual property, brands, etc.). Firms in those two sectors also exhibit smaller debt-to-asset ratios on average, suggesting that equity is a more important source of financing, and therefore also a more

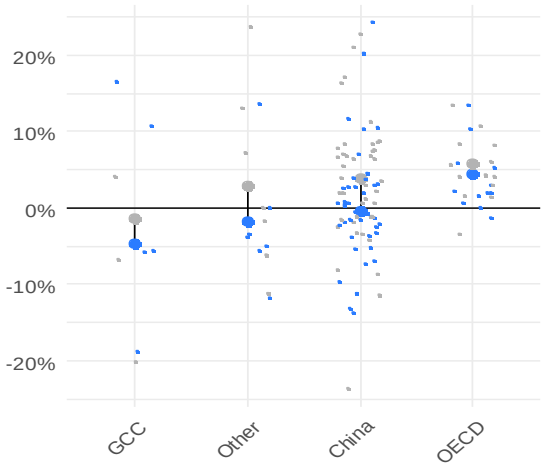
[61] Results using CAPM are also highly dependent on the assumptions made, so that a second, alternative benchmark is used to help verify the results.

[62] Results for semiconductors are very much in line with earlier OECD work on the semiconductor value chain, which also found substantial below-market equity returns for that sector (OECD, 2019[3]).

important channel for potential government support. Indeed, in 2014 the semiconductor industry saw the creation of a specialised government-owned fund (the China Integrated Circuit Industry Investment Fund) and sister funds at provincial and municipal level dedicated to injecting equity into China's semiconductor industry (OECD, 2019[3]).

The remaining sectors do not lend themselves to clear conclusions as there is a wide dispersion among the results for individual companies. Looking at the higher-bound CAPM estimates (the grey dots), several government-invested firms in steel, aluminium, and shipbuilding – all three heavy industries facing excess capacity – seem to have, on average, benefitted to some extent from BME returns. Similarly, there is also a noteworthy number of companies in the chemicals sector that do not meet either benchmark. The average for the whole chemicals sector is furthermore influenced by two highly profitable chemical companies in the Gulf region, which might have obtained favourable prices for energy inputs (Figure 9). This could also explain the relatively high profitability of companies in the cement sector, which is likewise very energy-intensive. Last, it should be noted that results for the automobile sector concern here only government-invested firms based in China, which have seen their profitability significantly affected by mandatory joint-venture requirements for foreign carmakers in the sector (Box 1).[63]

Figure 18. There are no clear geographical patterns concerning below-market equity returns



Note: Grey dots show average below-market equity returns estimated using the CAPM over the sample period; blue dots show average below-market equity returns estimated using the *avgROA* over the same period. Small dots represent individual companies and large dots sectors' weighted average. Only companies with more than 25% government ownership are represented here. Using a 33% threshold does not qualitatively change the results. Individual firms further than 25 percentage points from the benchmark are excluded from the graph for better visibility of results, but are taken into account in calculating the average.

In relative terms, individual government-invested firms in the OECD seem to benefit from BME returns just as much as their peers in China, although this concerns much fewer companies. Whereas the relative benefit per firm seems on average to be comparable, the aggregate effect is larger in China due to its sheer number of government-invested firms. Profits might also be higher for Chinese firms that benefit from other forms of government support that this report does not measure, e.g. a protected domestic market, below-market energy inputs, or mandatory joint-venture requirements as explained earlier for the

63 The three sectors cement, chemicals, and automobiles are those in which, on average, government-invested firms are more profitable than private companies as shown in Table 5.

automobile sector. Finding an accurate equity benchmark for China is also challenging, and the parameter value chosen in this instance could arguably be considered as a comparatively low estimate.[64]

3.4.3. Aggregate results

Over the five-year period 2014-18, government support provided through borrowing amounted to between USD 21 billion and USD 66 billion, depending on whether the results include companies for which ratings were estimated and support provided through government guarantees (Tier 3 BMB). While not directly comparable, support through BME returns ranged from USD 94 billion to USD 258 billion, depending on the benchmark. Government grants and tax concessions that could be identified in this study amounted to USD 48 billion and USD 108 billion over the same time period, respectively. It should be noted, however, that a significant proportion of all grants and tax concessions are related to support for R&D activities of firms, and may therefore be less trade distorting than below-market finance, at least in the short run.[65]

Analysis at the sector level indicates that aluminium companies tend to be supported through below-market lending[66], while others such as manufacturers of rolling stock receive relatively more government help through grants. High-tech industries, such as semiconductors and aerospace and defence companies, benefit substantially from BME returns. For companies supplying telecommunications network equipment, carmakers, and especially semiconductor firms, tax concessions also seem to be important, and in particular R&D tax concessions and investment incentives. It should be noted, however, that these results do not exhaust all forms of government support; other support, such as land subsidies or the provision of cheaper inputs by governments, are not covered by the present report and could be analysed in future research.

4. What can we say about the effects of below-market finance?

4.1. Estimating the trade effects of below-market finance is complex…

Even with better data on government support, assessing the effects that below-market finance can have on trade and international competition remains fraught with technical difficulties. One set of problems comes from possible interactions between below-market finance and other forms of government support (e.g. grants and energy subsidies), but also between government support in general and other trade policies. Earlier OECD work on government support in the aluminium value chain has shown, for example, that export restrictions on primary aluminium could interact with support for aluminium smelting to result in

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64 It is difficult to find an accurate equity benchmark for China. Fernandez et al. (2019[68]) provide survey responses about the required risk premium in several countries, and have found higher values for China than those used in this study. Using this data together with a country-specific risk-free rate would, however, lead to the overall result that most firms in the full sample (both private and government-invested firms) do not meet the benchmark. Others note that "[i]t has been almost impossible during the past few decades to find a credible correlation between the performance of the Chinese stock market and any measure of growth prospects or profitability" (www.ft.com/content/2362a9a0-3479-11ea-a6d3-9a26f8c3cba4). Results based on the CAPM for China can therefore only be indicative. See also the Technical Appendix for more information on the choice of the benchmarks.

65 The question of government support for R&D is discussed in more detail in OECD (2019[3]) in the context of the semiconductor value chain.

66 Energy subsidies are also very significant in the aluminium value chain but fall outside the scope of this study (OECD, 2019[2]).

trade effects further down the value chain, i.e. to the trade of semi-fabricated products of aluminium (OECD, 2019[2]).

The case of aluminium also highlights another difficulty in analysing the trade effects of government support, namely that support can intervene at different stages of complex supply chains. As an example, steel forms an essential input into shipbuilding, representing between 3% and 10% of total ship costs (Gourdon and Steidl, 2019[31]),[67] but Section 3 has shown both industries benefit from government support in the form of government grants and below-market finance. To what extent are sales of ships reflecting support for shipyards versus support for steel mills? And therefore to what extent are the trade effects of steel subsidies reflected in trade in ships versus trade in steel? Far from being an isolated example, this issue is ubiquitous in manufacturing. Glass is an essential input into solar PV panels, representing between 10-20% of the costs of a module. The module's frame is made of aluminium. There are more semiconductors in a modern car than in a smartphone. Semiconductor manufacturing would not be possible without the specialised substances (e.g. helium, photoresist, and solvents) that chemical firms provide. The masts of wind turbines are usually made of steel while their foundations require cement. These are just some of the sectors covered by this study.

Were these identification problems to be solved, there would still remain the issue of establishing causality between government support and existing trade patterns. While econometric estimations of causality have come a long way in recent years, there are special considerations related to government support that these procedures do not yet capture.

Ideally, analysis would seek to measure directly how the exports of firms respond to government support. However, trade data are generally not available at the level of individual companies, especially if such data are to be coupled with hard-to-obtain information on government support. There is also no guarantee that firms receiving support will be exporting more: government support could, for instance, cause these firms to increase their local sales and displace foreign companies that were hitherto supplying the local market.

While these challenges are significant, it may still be possible to look at how firms respond to government support and from there, infer possible effects on trade. This option includes looking at other firm-level indicators, with a view to identifying possible channels for eventual trade effects. The resulting chain of causal effects is long but can be broken down into a series of tractable analytical questions, such as:

1. Are recipient firms increasing their investments (e.g. in manufacturing capacity) in response to below-market finance?
2. Are these investments affecting output prices at the international level?
3. Are these investments benefitting industries upstream (e.g. suppliers of capital goods or raw materials)? Are these benefits local only or global?
4. Are lower output prices affecting the profits and manufacturing capacity of foreign competitors, and therefore their ability to export? Are market shares and ownership structures shifting as a result?
5. Are lower output prices benefitting industries downstream in the form of cheaper inputs? Are these benefits confined to local downstream producers (e.g. due to export restrictions) or are they also benefitting foreign downstream producers?

These are just some of the practical questions that may need to be answered in order to establish a clear link between below-market finance and trade. Answers will obviously vary depending on the structure of the industry (e.g. oligopolistic or atomistic) and on the nature of the products. Responding to these questions may also prove easier in cases where industries produce rather homogeneous products for

[67] OECD estimates suggest that a 1% reduction in steel prices reduces ship production costs by an average 0.5% (Gourdon, 2019[4]).

which prices and characteristics can be more easily compared. In the remainder of this section, the analysis turns to some of these questions using the data sample described in Section 3. The ambition is not to provide a set of definitive answers but rather to show what can be said about the effects of below-market finance with the data currently available.

4.2. …but lessons can be drawn from firms' response to below-market finance

In effect, below-market finance lowers companies' cost of capital below what it would be absent government support. This concerns both below-market borrowings and below-market equity since debt and equity are the two components of a company's weighted average cost of capital (WACC), which companies normally estimate by using the CAPM (Graham and Harvey, 2001[26]). A lower cost of capital should in turn incite firms to invest more than they would otherwise, all other things being equal.

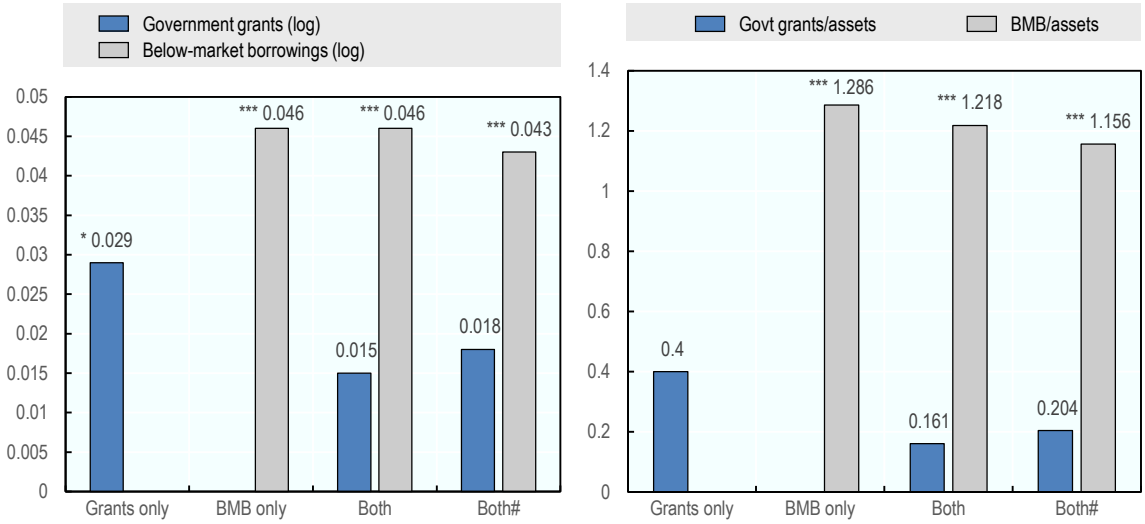
To see whether below-market finance increases firms' investment, this section uses the same sample of 306 firms to assess the correlation between below-market borrowings and companies' net investment in property, plant, and equipment (i.e. fixed tangible assets). While results in Section 3 have shown below-market equity to be a significant source of government support for industrial companies, the analysis only examines below-market borrowings given that the range of plausible values for below-market equity returns is simply too large to enable a central value to be used in econometric analysis. The analysis also concentrates on fixed tangible assets since they constitute the class of assets that best approximates firms' manufacturing capacity. Finally, it should be noted that the results that follow are best understood as correlations rather than causal effects.[68] Additional work would be necessary in order to deepen the analysis and establish clearer relationships between the variables.

These initial empirical findings indicate the potential existence of a statistically significant and positive correlation between below-market borrowings and net investment in property, plant, and equipment (Figure 19). The result holds while controlling for the influence of other variables on investment, such as: firms' revenue growth; their earnings before interest, tax, depreciation, and amortisation (EBITDA); their average interest rates; as well as sector specificities (see Annex A for details). On average for the whole sample, doubling the amounts of below-market borrowings received corresponds to a 4-5% increase in net investment in fixed tangible assets (Figure 19; left). Using a different specification that scales variables by company assets (right panel), the results imply that one additional dollar of below-market borrowings is associated with 1.1-1.3 additional dollars of net investment (Figure 19; right).

[68] The technical appendix contains more details on the variables used and the econometric results.

Figure 19. Unlike government grants, below-market borrowings are strongly correlated with net investment in fixed tangible assets

Left: Estimated marginal effect of a 1% increase in support on net investment
Right: Estimated marginal effect of a one-unit increase in support on net investment, relative to assets



Note: * p<0.1, ** p<0.05, *** p<0.01. "Both#" refers to a model that includes both government grants and below-market borrowings as well as firms' average interest rates as an additional control variable. See the Technical Appendix for detailed results.

Government grants do not appear in general to be as correlated to investment as below-market borrowings, irrespective of the specification used. In most cases, the correlation between grants and investment is small and not statistically different from zero using common confidence intervals. This supports the presumption that below-market borrowings affect investment more directly than other forms of support that do not target companies' cost of capital. It also reflects the fact that many of the grants identified for the companies in the sample are R&D grants that may not have a direct or contemporaneous effect on the acquisition of property, plant, and equipment, especially since much R&D spending goes towards paying the salaries of researchers and ends up capitalised in intangible assets.

While the average correlation found for the whole sample may seem small in magnitude, this largely reflects the fact that most of the 306 companies covered obtained zero below-market borrowings in any given year. The median value of below-market borrowings is thus zero when looking at all firm-year observations. The median value of government grants received by firms is likewise very small, at about 0.05% of their revenue (Table 6). This shows that government support has a highly skewed distribution in the sample, with a few firms obtaining most of the support that could be identified. To account for the possibility that high amounts of government support correlate more strongly with net investment, the analysis next uses a set of binary variables to classify firms according to the proportion of grants and below-market borrowings they obtained relative to their revenue.

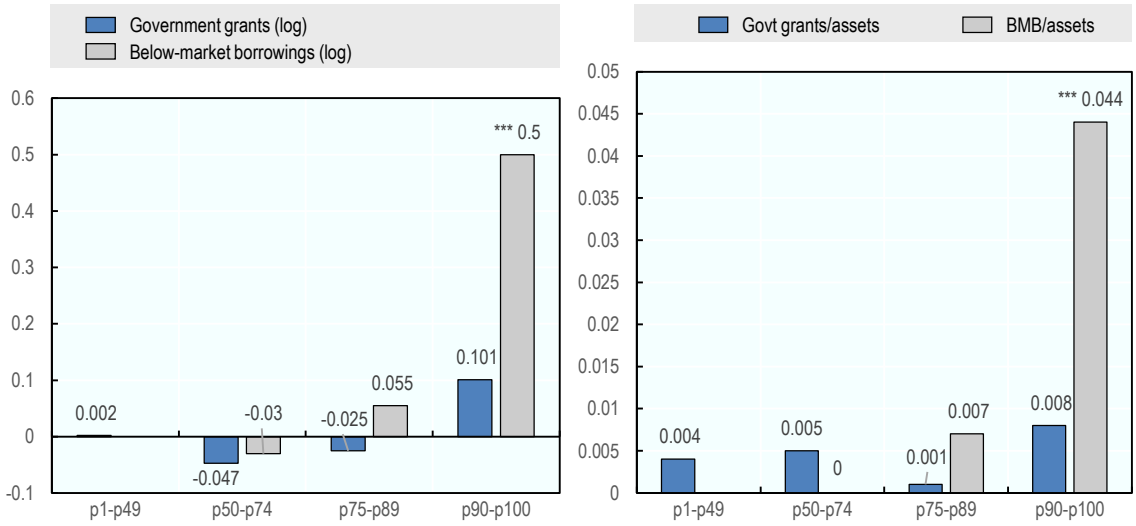
Table 6. Government support has a highly skewed distribution in the sample

	Grants (% of revenue)	Below-market borrowings (% of revenue)
Mean	0.428	0.606
Median	0.046	0
75th percentile	0.379	0.242
90th percentile	1.114	1.827

Results using a set of binary variables indicate that the 10% of companies receiving the highest proportion of below-market borrowings as a share of their revenue invest about 50% more than companies with zero below-market borrowings (Figure 20).[69] For government grants, this corresponds to a smaller 10% that is not statistically significant. When scaling variables by company assets (right panel), the results suggest that the 10% of companies receiving the highest proportion of below-market borrowings have an investment-asset ratio that is on average 4.4 percentage points higher than companies with zero below-market borrowings. As could be expected, however, the correlation does not appear significant and approaches zero for companies with a lower proportion of government support.

Figure 20. The 10% of companies receiving the highest proportion of below-market borrowings invest about 50% more

Left: Dependent variable is net investment [log]
Right: Dependent variable is net investment scaled by assets



Note: * p<0.1, ** p<0.05, *** p<0.01. Categories on the horizontal axis refer to different binary variables that classify firms according to the proportion of grants and below-market borrowings they obtained relative to their revenue. The variable "p50-p74" represents, for example, firms that are between the median and the 74th percentile in terms of how much grants or below-market borrowings they received as a share of their revenue. See the Technical Appendix for detailed results.

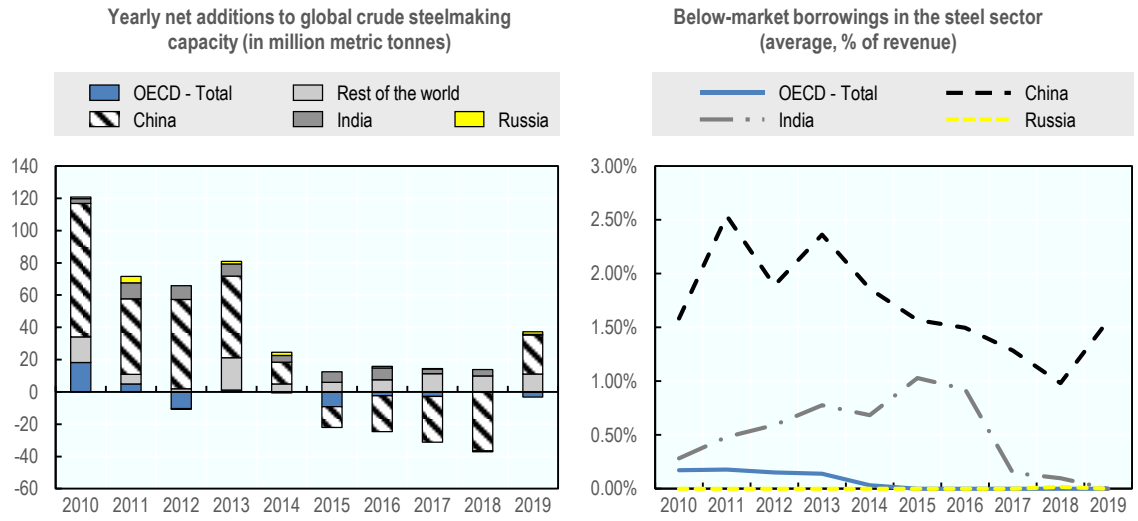
Not only do below-market borrowings appear to correlate with net investment in fixed tangible assets at the aggregate level, but evidence at a more micro level likewise suggests a link between below-market borrowings and investment in manufacturing capacity. While capacity data are not available systematically, nor comparable across firms for all sectors covered by this study, information could be gathered for steel, aluminium, and solar PV panels.

Yearly movements in global steelmaking capacity are largely driven by how much capacity China adds or subtracts from the global total (Figure 21; left) given that the country accounted for nearly 60% of global crude steel output in 2020. Following the large net increases observed between 2010-13, crude steelmaking capacity began to decrease on a net basis in 2015, before finally resuming positive growth in

[69] Coefficients are estimated relative to a control group consisting of firm-year observations with zero below-market borrowings.

2019. While these aggregate numbers mask considerable heterogeneity at the level of individual producers, they appear nonetheless to track the movements seen in the amounts of below-market borrowings that this study has identified for the steel sector. This is particularly evident for China (Figure 21; right). As with the empirical results shown above, however, this is indicative of correlation but not necessarily causality, as many competitive factors could induce new entrants to increase their capacity and seize market share. The patterns do nevertheless provide further indication that there exists a statistical relationship between below-market borrowings and investment in manufacturing capacity.

Figure 21. Movements in steelmaking capacity appear to track below-market borrowings for the steel sector



Note: Caution should be exercised since data for below-market borrowings in the steel sector concern only the companies covered by the sample. The right-hand side graph might differ were data available for more steel companies.
Source: OECD.Stat (capacity) and OECD research.

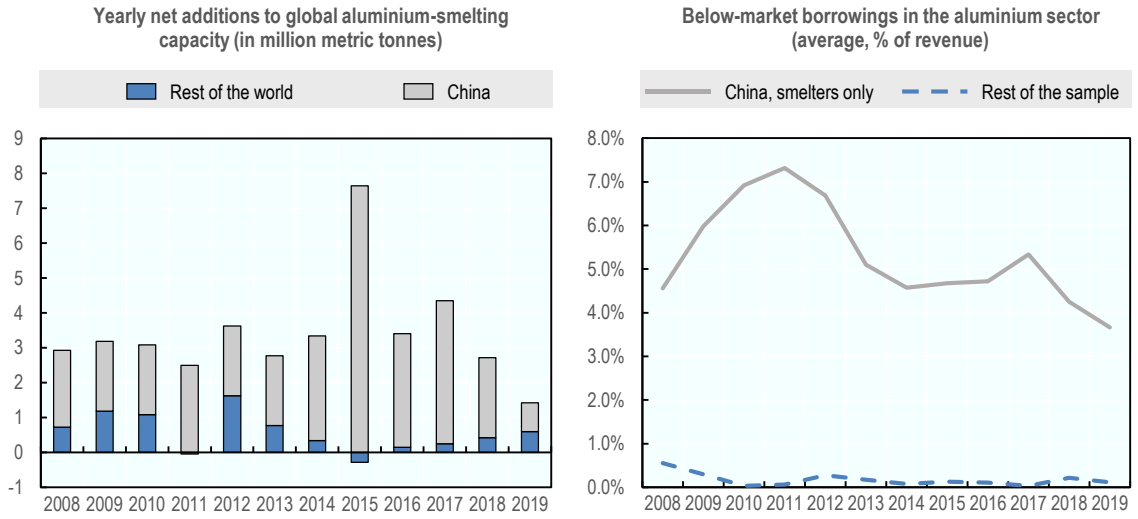
Similar evidence is available for the aluminium sector, which the OECD has already studied in depth (OECD, 2019[2]). Although the correlation is not as clear as for steel, the data nonetheless indicate that China accounts for both the vast majority of all net additions to global aluminium-smelting capacity, as well as for the bulk of all below-market borrowings that benefitted aluminium smelters over the period (Figure 22).[70] That said, there are a number of factors to consider in assessing the overall picture. First, the 2015 peak in capacity additions does not match the profile of below-market borrowings. Moreover, as in steel, other factors than subsidised lending may have affected investment decisions in the aluminium sector around that time, including energy prices (energy accounts for about 40% of the costs of aluminium smelting).[71] Second, the quality of data on smelting capacity is also notoriously poor in China, which in the

[70] Other countries that have increased smelting capacity on a net basis over the period include GCC countries and India. Together, they account for the majority of net additions to smelting capacity outside China. See OECD (2019[2]).

[71] Although econometric evidence for the whole sample does not suggest that government grants significantly affect investment in fixed tangible assets, it should be noted that 2015 was the year when the amount of government grants that aluminium smelters in China received was the highest by far as a proportion of their revenue (1.4% compared with 0.2-0.3% in 2014 and 2016). Meanwhile, China's Qinhuangdao spot price for thermal coal dropped to USD 68 per tonne in 2015, which was the lowest level since 2007 in nominal terms according to BP's Statistical Review of World Energy.

past led the OECD to rely on satellite observations to complement available capacity estimates at the plant level. Third, there could also be gaps in data on below-market borrowings for certain companies that could downplay the significance of subsidised lending.

Figure 22. China accounts for the vast majority of net capacity additions and below market borrowings in the aluminium sector



Note: Data on below-market borrowings shown above for China only concern aluminium smelters and do not include producers of semi-fabricated products of aluminium, which are otherwise counted in total below-market borrowings for the aluminium sector elsewhere in this report. Capacity data for 2018-19 are estimates.
Source: European Aluminium (capacity) and OECD research.

Finally, there does appear to be some evidence of such links in companies' own assessments. A local state-owned smelter in China mentioned, for example, in its 2017 bond prospectus that "[a]s at 31 December 2016, the Group has obtained a credit line of up to RMB 41,887 million from a number of commercial banks including Hua Xia Bank [a government-invested bank], China Development Bank [a policy bank] and China Construction Bank [a state bank]." The same document mentions that bank lending is one of two funding sources the group has used for financing a number of electrolysis projects.[72]

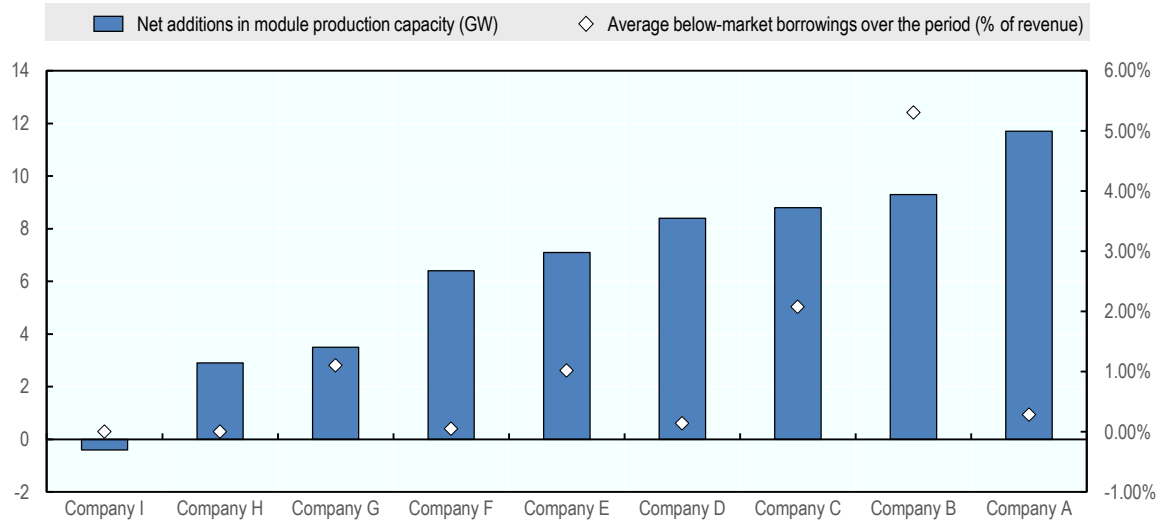
Looking at solar PV panels over the period 2015-19[73], of the three manufacturers in the sample that have increased their module production capacity the most, two are the companies that have also obtained the highest below-market borrowings as a percentage of their revenue (Figure 23). When expressing these capacity additions as a percentage increase, rather than as an absolute number of gigawatts (GW) added, company B and company C top the sample, with +517% and +587% respectively, unlike company A which was already a large producer at the start of the period. The two companies also obtained generous

[72] Electrolysis is the energy-intensive process by which a high electric current is passed through an electrolyte in which alumina has been dissolved in order to produce primary aluminium. One of China's largest state-owned producers of primary aluminium also stated, for example, in a 2016 bond prospectus that "PRC policy banks provide sufficient financial supports to the Group. These banks also provide strong support to the Group […] with interest rate below benchmark."

[73] These years are those for which data could be collected consistently on module-production capacity, output, and average module prices for companies in the sample, including some that entered the industry in the mid-2010s.

amounts of government grants over the period, averaging about 5% and 2% of their revenue respectively. Company G states explicitly on its website (at the time of writing) that it has "received strong financial support from Chinese state-owned banks."

Figure 23. Two of the three companies that have increased solar-module capacity the most over 2015-19 have obtained the highest proportion of below-market borrowings



Note: The companies in this graph are those included under "solar photovoltaic panels" in the sample for this study (see the list of firms in the Technical Appendix). Together, they accounted for about 55-60% of global module shipments in 2019.
Source: OECD research.

4.3. Why support-driven capacity increases can be a trade issue

Excess capacity need not be a problem for trade and competition if it is purely market-driven, e.g. for risk-management reasons or because of fluctuations in the business cycle ("cyclical excess capacity"). It can be of concern, however, where it is enabled by government support ('structural excess capacity'), including in the form of below-market finance. The existence of a link between below-market borrowings and capacity increases is therefore indicative of a potential issue for global trade, particularly if capacity ends up significantly exceeding demand.

Demonstrating the existence of a trade effect requires additional evidence, however. Recent OECD analysis found, for example, that higher steelmaking capacity had resulted in larger exports of steel and lower export prices over the medium-term in certain economies (Mattera, 2021[32]). Yet large exports may not always be necessary for there to be trade distortions. Much of the crude steel and primary aluminium that China produces does not leave China,[74] and instead feeds into the country's very large property sector, its infrastructure, and its production of transportation equipment to a lesser extent (e.g. railways and cars). This does not necessarily imply that there is no trade effect, but rather that examination of whether such an effect exists may need to consider if it is occurring elsewhere, e.g. in a different part of the value chain

[74] While China only exported about 6% of its steel production in 2019, this still represented 56 million tonnes of crude steel since the country accounted for as much as 53% of global crude-steel production. Such volumes are high enough to potentially affect global prices and markets. In the case of aluminium, China exported about 578 thousand tonnes of primary aluminium in 2019, which represented less than 2% of its production volume in that same year.

or in trade between different countries altogether. Support-driven excess capacity in metals production in country A might, for example, lower metal prices and force non-subsidised metal producers in country B to exit the market. As a result, country B would have to import more of its metals, but these need not come from country A, and could very well come from country C.

While a detailed assessment of the causes and consequences of excess capacity is beyond the scope of this report, the evidence above has shown the existence of a correlation between manufacturing capacity increases and below-market borrowings. These capacity increases also appear to coincide with rapid declines in global prices in the three sectors for which capacity data were collected (Figure 24). Some of these price declines may simply reflect the normal competitive effects of the arrival of new market entrants, as well as the introduction of new or improved technologies. However, to the extent that they result from support-driven additions of new manufacturing capacity, they could also reveal the existence of a problem for trade and competition, including where price declines force the exit of more efficient producers.

The problem of excess capacity in steelmaking and aluminium smelting is well documented and has been the subject of policy discussions in international fora in recent years, including in the context of the Global Forum on Steel Excess Capacity (GFSEC) that the OECD facilitates. Paragraph 15 of the 2017 GFSEC Ministerial Report noted, for example, that "[e]xcess capacity has driven down prices, employment, capacity utilisation rates and profitability for steelmakers, putting at risk the viability of an industry that produces a material which is vital for the functioning of economies and societies."[75] China itself has long recognised the problem and has pledged to take steps to address excess capacity in heavy industries such as cement, steel, and aluminium. In 2009 already, Chinese authorities referred to the need to suppress "overcapacity and redundant construction in some industries", including not only cement and iron and steel, but also "emerging industries such as wind power equipment and polysilicon [that] are also showing a tendency to duplicate construction."[76]

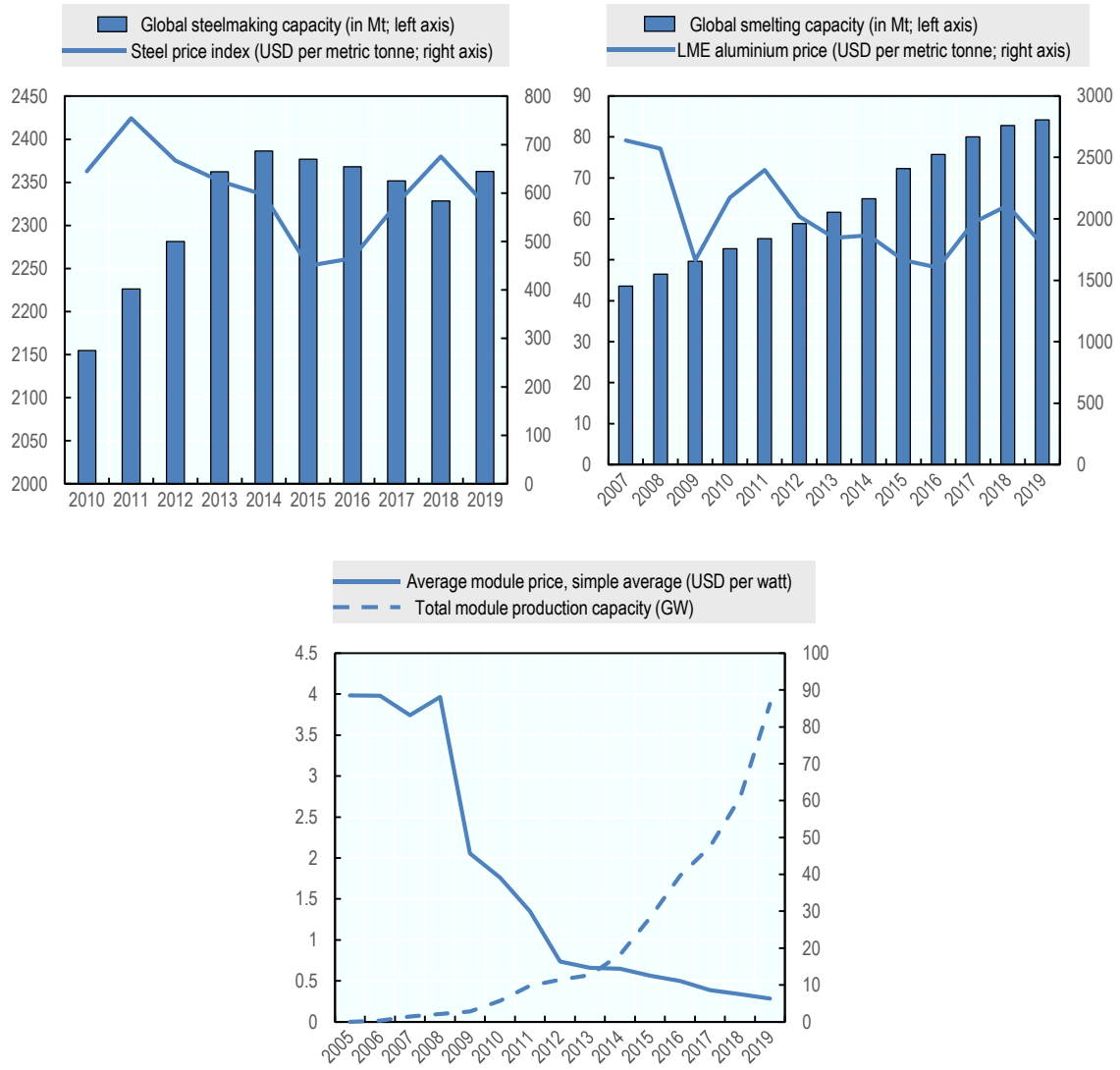
Firms themselves recognise the capacity problem. One Chinese producer of solar modules has noted in its annual report for 2017 that: "[i]n recent years, facing periodical and structural overcapacity in the current industry, as well as dilemma for some backward production capacities to exit, it is possible that countries will adopt price vicious competition […], which results [in] a rapid decline in market prices." Another major China-based manufacturer noted in its 2018 report that "[d]espite the decrease in demand, the global solar module production capacity still increased by over 20%, from 31 December 2017 to 31 December 2018, which further intensified competition over pricing."

[75] See www.bmwi.de/Redaktion/EN/Downloads/global-forum-on-steel-excess-capacity-report.pdf?__blob=publicationFile (accessed on 23 April 2021).

[76] See www.gov.cn/zwgk/2009-09/29/content_1430087.htm (accessed on 4 March 2021). See also the 2013 *Guiding Opinions of the State Council on Resolving the Contradictions of Serious Overcapacity*, which mentions low capacity utilisation rates in steel, cement, electrolytic aluminium, flat glass, and shipbuilding; www.gov.cn/zwgk/2013-10/15/content_2507143.htm (accessed on 4 March 2021).

Figure 24. Steel, aluminium, and solar PV modules all offer the same pattern of falling prices as more capacity is added

Annual production capacity and prices in steelmaking, aluminium smelting, and the production of solar PV modules



Note: Data for prices and production capacity for solar PV modules do not concern the whole solar PV industry but only the companies included in the sample for this study. The steel price index is a simple arithmetic average of regional prices for hot-rolled coil and rebar crude steel. Smelting capacity data for 2018-19 are estimates.
Source: OECD.Stat (steel capacity), Wood Mackenzie (steel prices), European Aluminium (smelting capacity), INSEE (LME aluminium prices), and OECD research.

There can be little doubt that technological progress in solar PV modules has caused per-watt prices to decrease over time, including due to improvements in cell efficiency, larger wafer sizes, and more recently the development of bifacial solar panels. The rapid pace of the price decline and the declarations of major producers themselves suggest, however, that technology alone may not explain all of the decrease. Recent research into the decades-long fall in solar PV prices has found that, unlike the 1980-2001 period when R&D-driven efficiency was the major cause of price declines, declines over the 2001-12 period were

characterised chiefly by increases in the size of manufacturing plants (Kavlak, McNerney and Trancik, 2018[33]).[77] A number of factors have contributed to these size increases; indeed, other researchers (Brandt and Wang, 2019[34]) have noted that:

> *"[Rapid expansion of China's solar-power sector] has been accompanied by persistent problems of excess capacity in nearly every segment of the value chain, including silicon, wafers, and cells. […] The root of these problems likely lies in […] the often-distorted incentives facing individual firms and local governments to expand, but not contract and exit. Firms often compete with each other on the basis of quantity.* ***Easier access to finance and subsidies as a result of government promotion policy encourages this behaviour on the part of firms****; local governments and cadres have their own incentives to promote local champions and economic growth, especially in sectors that national leaders and policymakers identify as strategic such as solar (designated in 2006). Soft budget constraints and weak exit mechanisms for poorly performing firms likely compound the problems […]"* (own emphasis).

In sum, this report has shown that, on aggregate for the whole sample, below-market borrowings often correlate with increases in manufacturing capacity. For three of these sectors there is also evidence that excess capacity is an issue and that it has affected prices. To the extent these price changes have affected producers in other countries and sectors – and provided the correlation between below-market borrowings and capacity expansion indicates a causal relationship –, this can suggest the existence of trade effects associated with below-market borrowings. As explained earlier, however, measuring such trade effects is complex, difficult, and goes well beyond the scope of this report. It will therefore require further work and research at the OECD and elsewhere. The issue is an important one, however; the current risk is that the necessary capacity adjustments do not take place given the presence of government support, or that the adjustments are made not by the least efficient producers, but influenced by which producers benefit from government largesse.

4.4. Firms receiving below-market borrowings tend to be less productive

If firms receiving below-market borrowings invest more than they would otherwise, one might expect them to perform less efficiently than some of their competitors that do not benefit from an artificially low cost of capital. This is because these firms might misallocate their resources on the basis of distorted input prices, causing their total factor productivity (TFP) to be lower than it could be.[78] The argument echoes a finding in the economics literature that soft budget constraints dampen firm performance. Soft budget constraints happen when governments stand ready to bail out failing firms, which creates moral hazard, loosens financial discipline, and can then weaken the price responsiveness of companies while introducing a number of inefficiencies in corporate decision-making (Kornai, 1986[35]; Roland, 2000[36]). In other words, soft budget constraints dull incentives for managers to innovate or improve operations.

Analysis in the remainder of this section uses econometrics to assess the correlation between firm productivity and government support while controlling for other factors that might affect productivity. These factors include the size of firms, their R&D spending, the sectors in which they operate, and government ownership. An additional variable controls for whether firms are 'zombies', in the sense that their earnings

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[77] Earlier research likewise found that "the average manufacturer-sale price of PV modules has declined by over a factor of two [since 2008], coinciding with a significant increase in the scale of manufacturing in China" (Goodrich et al., 2013[69]). The authors then argue that "Chinese manufacturers' access to low-cost capital and ability to rapidly scale technology manufacturing output have contributed to a PV scale advantage and corresponding cost benefits." Lower labour costs were not found to provide a significant price advantage.

[78] As explained in Section 1, TFP shows how efficiently capital and labour inputs are mobilised in the production process, such that a higher TFP means producing more output with the same amount of inputs.

before tax (EBIT) have failed to cover interest expenses for three consecutive years (Adalet McGowan, Andrews and Millot, 2017[37]).

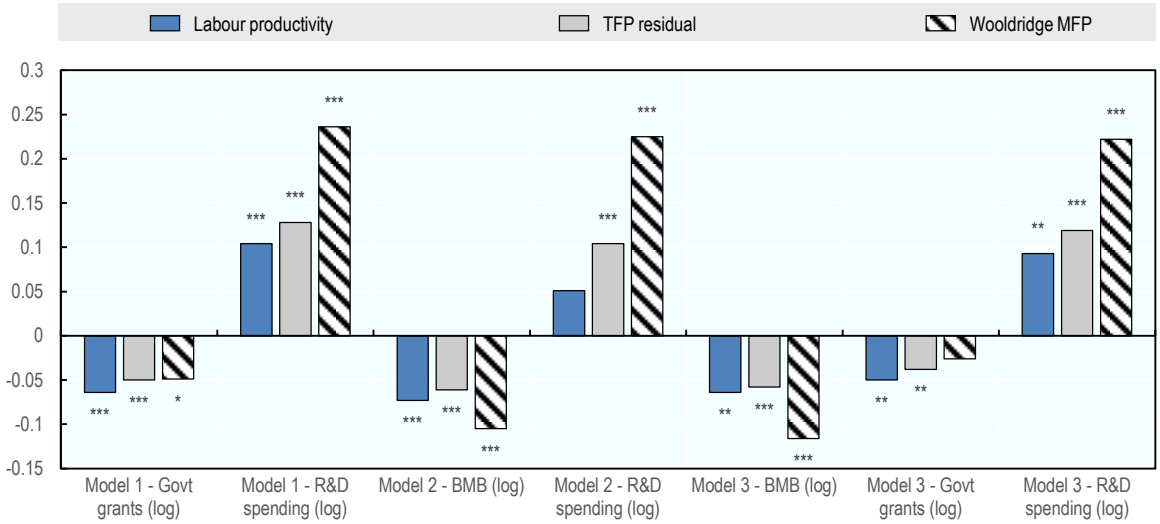
It is important at this stage to note that this analysis does not establish any causality between government support and firms' productivity. It could be that less productive firms attract more government support in a process of self-selection, so that lower productivity results in larger support (e.g. when governments decide to rescue ailing firms). Alternatively, it could be that support makes firms less productive by relaxing their budget constraint and fostering complacency, in which case, larger support causes lower productivity. The limited sample size and the absence of a quasi-natural experimental framework prevent the analysis from answering this question.[79] Instead, it only seeks to identify and measure multivariate correlations.

Different measures of firm productivity exist: from the more basic labour productivity, defined as economic value-added divided by staff numbers, to more refined versions of total factor productivity (TFP) and multi-factor productivity (MFP). Regardless of the measure used, there appears to be a negative correlation between below-market borrowings and firm productivity (Figure 25). This is true while controlling for other factors that might affect productivity, either positively (e.g. R&D and firm size) or negatively (e.g. zombie status and government ownership). A negative correlation is also found with government grants.

Overall, the results suggest that doubling below-market borrowings corresponds statistically to a reduction in firm productivity of 5-10%. For grants, the reduction is more modest at 3-6%, as well as being less statistically significant.

Figure 25. There appears to be a negative correlation between below-market borrowings and firm productivity

Marginal effect on firm productivity of a 1% increase in grants, BMB, and R&D spending



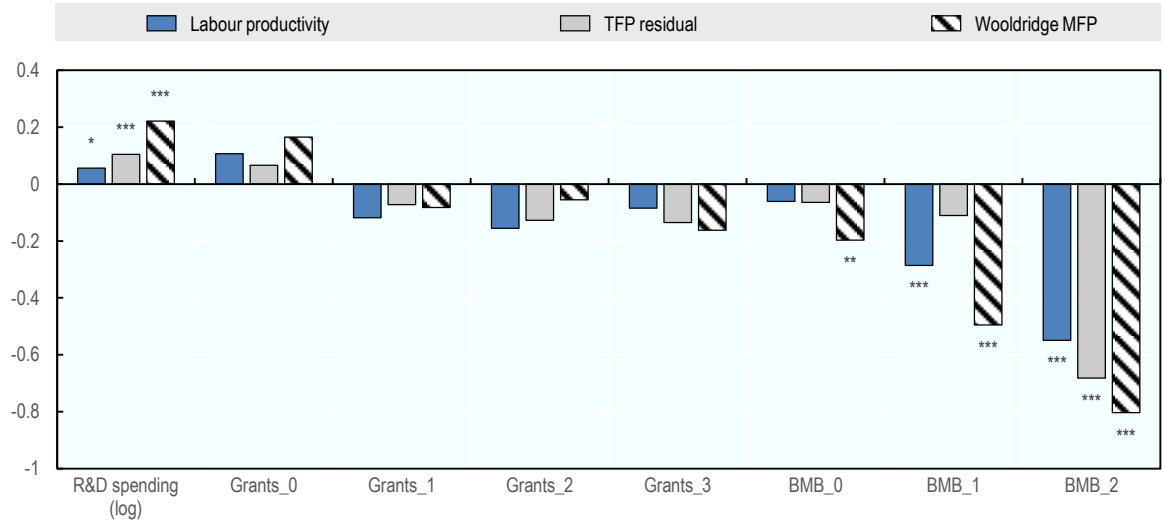
Note: * p<0.1, ** p<0.05, *** p<0.01. See the Technical Appendix for detailed results.

[79] For a recent example of analysis that uses a quasi-natural experiment to look at the causal effects of subsidies on the productivity of SMEs in the United Kingdom, see Criscuolo et al. (2019[38]). While they help identify causal relationships, natural experiments tend, nevertheless, to be highly context-specific, leading to results that cannot readily be generalised.

As was done earlier when studying the correlation between investment in fixed tangible assets and below-market borrowings, the analysis next uses binary variables to classify firms according to the grants and below-market borrowings they received as a share of their revenue. This helps to address the need to take into account the highly skewed distribution of support in the sample. Doing so reveals a stark contrast between firms that have obtained modest amounts of support and those that make up the 10% of firms receiving the highest proportion of below-market borrowings (Figure 26). For the latter group, the negative correlation between below-market borrowings and productivity is very strong, so that belonging to the 10% of firms with the highest proportion of below-market borrowings corresponds statistically to lower productivity of 50-80%.

Figure 26. The negative correlation between below-market borrowings and productivity is very strong for the 10% of firms with the highest proportion of support

Marginal effects on firm productivity of R&D spending and dummy variables representing the proportion of grants and below-market borrowings received as a share of revenue



Note: * p<0.1, ** p<0.05, *** p<0.01. Binary variables on the horizontal axis (Grants_# and BMB_#) classify firms according to the proportion of grants and below-market borrowings they obtained relative to their revenue. The variable "BMB_2" takes, for example, the value of 1 for firms that are between the 90th and the 100th percentile in terms of how much below-market borrowings they received as a share of their revenue. See the Technical Appendix for detailed results.

While it would be unwise to draw strong conclusions from this analysis (especially given the limited sample and the use of simple statistical techniques), the negative correlation observed suggests at a minimum that government support overall may not help recipient firms be more efficient. At worst, it could contribute to reduced productivity. This finding is consistent with what more robust analyses have found when looking at how SMEs react to subsidies in OECD countries. None of the recent studies reviewed for this report seem to find a significant and positive relationship between subsidies and firm productivity, at least in the short-run (Criscuolo et al., 2019[38]; Bernini, Cerqua and Pellegrini, 2017[39]). In the Chinese context, a recent paper has found that reductions in the cost of capital increase firms' capital-labour ratios and profits, but that this did not translate into higher productivity (Berkowitz, Ma and Nishioka, 2017[40]). Productivity was also found to be lower for SOEs than for private and foreign-owned firms. Another study of medium and large Chinese firms over the period 1998-2007 estimated that while grants were positively correlated with firm-level TFP, the correlation was instead negative for cheap loans (Aghion et al., 2015[41]).

Importantly, the fact that firms receiving relatively more support tend to be less productive does not imply that below-market finance has benign or no effects on global trade and competition. Below-market borrowings may, for example, allow less productive firms to stay in business, which, as explained earlier, can contribute to the presence of capacity in excess of demand, which in turn can exert downward pressure on global prices. The finding that government support correlates negatively with firm productivity therefore does not negate the possibility of trade distortions.

Overall, the findings suggest that below-market borrowings might not only cause concerns for trade partners, but may do little to promote the productivity of the firms receiving them. This indicates both that there may be benefits in terms of the efficient allocation of domestic resources in revisiting such support, and also that all countries benefit from each other's reforms in terms of reduced potential distortions in global markets (and of course reduced incentives to engage in granting their own support). In the next section, the analysis turns to what can be done about below-market finance in a trade setting.

5. What can be done about below-market finance?

Having shown some preliminary estimates of the scope and scale of below-market finance, this section provides some observations on existing trade rules in relation to below-market finance, and the extent to which they may be able to provide for effective remedies. It is not the purpose of this section to interpret existing trade rules but rather to highlight gaps in the rules that relate to below-market finance, with a view to informing efforts to revisit those rules.

5.1. Transparency is an even greater challenge for below-market finance than for other types of support

This report underscores the lack of transparency in relation to government support provided through the financial system. The difficulties not only stem from inadequate reporting by WTO Members, but also from lack of publicly available information about the ownership structure of many government-invested firms.

5.1.1. The limitations of subsidy notifications

Although the Agreement on Subsidies and Countervailing Measures ('SCM Agreement') requires Members to report annually the subsidies they provide, this transparency obligation has not been well observed. In 2019, 80 Members out of 164 failed to submit subsidy notifications.[80]

That said, even if all WTO Members were to notify the measures that they themselves view as subsidies[81], gaps would likely remain in relation to below-market finance. Unlike government grants, in order to decide whether a loan or an equity infusion provided by a government falls under the definition of a "subsidy"

[80] WTO, G/SCM/W/546/Rev.12.

[81] Governments are required to notify any subsidy as defined in paragraph 1 of Article 1 of the SCM Agreement that is specific within the meaning of Article 2, regardless of whether it is countervailable or not (Article 25.2 of the SCM Agreement).

under the SCM Agreement, a comparison with a market benchmark is necessary in order to assess whether a "benefit" is conferred to the recipient.[82]

The determination of the market benchmark that is most appropriate to assess whether a loan or an equity infusion confers a benefit can be a very complex exercise (Mueller, 2017[42]). Past WTO cases underscore that comparisons with market benchmarks are generally performed *ex ante*: the terms and conditions for loans or equity infusions are examined at the time these transactions are made, when they are compared to the terms and conditions that could have been offered by the market based on the information available at that particular point in time.[83] However, the SCM Agreement does not provide explicit rules to gauge "the amount the firm would pay on a comparable commercial loan which the firm could actually obtain on the market" or establish the "usual investment practice of private investors".[84] Although past WTO cases lay out some guidance for performing this assessment[85], no detailed methodologies have yet been established. Rather, market benchmarks have been developed on a case-by-case basis.[86]

Assumptions are inevitable in choosing market benchmarks since it is extremely rare to find in the market loans or equity infusions that are supplied on identical terms and conditions (e.g. size, duration, risk profile, currency, jurisdiction, etc.). The analysis is further complicated in cases where markets are distorted by government intervention (Kowalski and Rabaioli, 2017[43]). Moreover, *ex-ante* assessments of government equity infusions may not capture all forms of below-market finance, namely below-market equity returns, as will be explained later in this section. These considerations together suggest that notification gaps for loans and equity infusions will likely persist under the current system, where Members notify only those measures that they themselves perceive to be subsidies. More specifically, Members might not report below-market finance on the grounds that they do not recognise it as a subsidy based on their own assessment and market benchmarks (Bown and Hillman, 2019[44]).[87]

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[82] Art. 1.2 of the SCM Agreement. With respect to a loan, Art. 14(b) of the SCM Agreement stipulates that "a loan by a government shall not be considered as conferring a benefit, unless there is a difference between the amount that the firm receiving the loan pays on the government loan and the amount the firm would pay on a comparable commercial loan which the firm could actually obtain on the market." Meanwhile, as for an equity infusion, Art. 14(a) stipulates that "government provision of equity capital shall not be considered as conferring a benefit, unless the investment decision can be regarded as inconsistent with the usual investment practice (including for the provision of risk capital) of private investors in the territory of that Member". The "benefit" element acts as a screen to filter out commercial conduct (Panel Report, *Korea — Measures Affecting Trade in Commercial Vessels*, para. 7.28, WT/DS273/R (7 March 2005)).

[83] Appellate Body Report, *European Communities and Certain member States — Measures Affecting Trade in Large Civil Aircraft*, paras. 834-838 and para 999, WT/DS316/AB/R (18 May 2011).

[84] Panel Report, *European Communities — Countervailing Measures on Dynamic Random Access Memory Chips from Korea*, para. 7.211, WT/DS299/R (17 June 2005) states that "Article 14(a) of the SCM Agreement does not provide a precise method for calculating benefit."

[85] For instance, the Appellate Body decided that the SCM Agreement, Art. 14 (b) allows "using as benchmarks interest rates on commercial loans that are not actually available in the market where the firm is located, such as, for instance, loans in other markets or constructed proxies." (Appellate Body Report, *United States - Definitive Anti-dumping and Countervailing Duties on Certain Products from China*, para 480, WT/DS379/AB/R (11 March 2011)).

[86] For instance, in the *EC and certain member States — Large Civil Aircraft* case, the US and the EC developed a market benchmark for launch aid or member State financing, which was characterized as "unsecured loans", with a general structure consisting of three basic components: the government borrowing rate, a general corporate risk premium and a project-specific risk premium (Appellate Body Report, *European Communities and Certain member States — Measures Affecting Trade in Large Civil Aircraft*, paras. 860-862, WT/DS316/AB/R (18 May 2011)).

[87] Under the SCM Agreement, a Member may request an explanation of the reasons why another Member deemed a specific measure not subject to the requirement of notification (Art. 25.8). However, unless Members possess enough information about the measure in the first place, the measure may ultimately escape scrutiny.

5.1.2. Information gaps on government ownership

In many cases, the identification of below-market finance hinges on a determination of whether the transactions giving rise to support involve state actors. Below-benchmark borrowings or recurrent below-benchmark equity returns could raise concerns in relation to government support where they originate from financial institutions and companies that are either owned, controlled, invested, or influenced by the state.[88] Determining whether a provider or recipient of below-market finance is a government-invested firm in turn requires sufficient information on companies' ownership structures. Such information is not always readily available, especially where government stakes are indirect and involve a chain of entities masking the government's beneficial ownership of industrial producers (OECD, 2019[3]). WTO notifications currently do not appear to address the ownership structures of the firms in which governments have invested.[89]

5.1.3. No easy solutions?

One solution to these problems might be to update the WTO transparency provisions to expand the scope of Members' notifications. In theory, new provisions could require Members to provide information on all of their direct and indirect ownership of companies (at least those that are commercially active) as well as data on all financial contributions[90] in the form of loans and equity that those firms provided or injected. In practice, however, some governments may consider that such provisions would impose a heavy burden on them, especially those that already struggle to comply with their current reporting obligation due to lack of resources and expertise. It might also be argued to subject government-invested firms to tougher requirements than fully private companies.

Information-request procedures under the SCM Agreement (Art. 25.8) could also be enhanced so that sufficient details about individual loan and equity transactions are provided, upon request, to enable other Members to assess the consistency of the transactions with market benchmarks. For instance, a new provision could lay out the detailed terms and conditions of loans and equity transactions (e.g. size, duration, risk profile, currency, jurisdiction, etc.) that must be provided to another Member if so requested. This assumes, however, that Members making the request are already aware of the existence of the financial transactions in question.

Another solution might be to use soft law to encourage government-invested firms to enhance their corporate disclosure. This was the ambition behind the *OECD Guidelines on Corporate Governance of State-Owned Enterprises* that the Organisation developed in 2005 – and updated in 2015 – to ensure that SOEs operate efficiently, transparently, and in an accountable manner (OECD, 2015[45]). The OECD Guidelines require SOEs to observe high standards of transparency and be subject to high-quality accounting, disclosure, compliance, and auditing standards on par with listed companies (Box 2). While they are legally non-binding, all OECD members and other governments have adhered to the Guidelines. Adherents do not yet include all of the governments that this study has found to be providing below-market finance, however.[91]

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88 Ownership, control, or influence may be exerted directly or indirectly through multiple ownership linkages. Note that below-market equity returns cannot rightfully be considered government support in the case of fully private firms, given the absence of any government intervention through the equity channel.

89 A related issue concerns the ownership of domestic companies by foreign government entities, although the trade and competition implications may be more complex in that case.

90 Regardless of whether the transactions were consistent with market benchmarks.

91 Building on these Guidelines, the OECD is currently in discussion about developing a transparency standard for internationally active SOEs and their owners focusing on areas relevant to competitive neutrality.

Box 2. The OECD Guidelines on Corporate Governance of State-Owned Enterprises

The OECD *Guidelines on Corporate Governance of State-Owned Enterprises* provide concrete advice to governments on the management of the companies they own, with a view – among other things – to ensuring a level playing field between state-owned enterprises (SOEs) and their private competitors.

The Guidelines' definition of an SOE

The Guidelines define SOEs as "any corporate entity recognised by national law as an enterprise, and in which the state exercises ownership." This notably includes "enterprises that are under the control of the state, either by the state being the ultimate beneficiary owner of the majority of voting shares or otherwise exercising an equivalent degree of control. […] Also, minority ownership by the state can be considered as covered by the Guidelines if corporate or shareholding structures confer effective controlling influence on the state (e.g. through shareholders' agreements). Conversely, state influence over corporate decisions exercised via bona fide regulation would normally not be considered as control. Entities in which the government holds equity stakes of less than ten percent that do not confer control and do not necessarily imply a long-term interest in the target company, held indirectly via independent asset managers such as pension funds, would also not be considered as SOEs."

Disclosure and transparency

Among other things, the OECD Guidelines require that:

- SOEs report material financial and non-financial information, such as the governance, ownership, and voting structure of the enterprise, in line with internationally recognized standards of corporate disclosure;
- SOEs submit their annual financial statements to an independent external audit based on high-quality standards;
- the ownership entity develop consistent reporting on SOEs and annually publish an aggregate report on their portfolios.

Source: OECD (2015[45]).

Another option to improve transparency on the ownership structure of government-invested firms could be to broaden the information request procedures under the SCM Agreement. Although the SCM Agreement only allows Members to request information on the subsidies granted or maintained by another Member[92], this scope could be expanded to include information on government-invested firms with a view to enhancing transparency. In fact, the CPTPP[93] already stipulates that, at the request of another party, a party shall promptly provide information concerning a SOE, such as the percentage of shares held by governments and the government officials who serve as members of the entity's board of directors.[94] Were countries to pursue such an option, care should be exercised to avoid equating state ownership with government support; a clear separation could be made between information requests pertaining to subsidies *per se* and those relating to government-invested firms more generally.

92 Art. 25.8 of the SCM Agreement.

93 Comprehensive and Progressive Agreement for Trans-Pacific Partnership.

94 Art. 17.10.3 of the CPTPP.

In addition to improving corporate disclosure by government-invested firms – and focussing exclusively this time on the recipients of government support –, countries should strive to improve international accounting and auditing standards (e.g. IFRS and IAS) to better embed subsidy disclosure into companies' routine financial reporting. While many companies (public and private) already disclose the amount of government support they receive, the practice should be better codified and widened to cover below-market finance in all its forms.[95]

Whatever the option pursued by governments, compliance with accounting and auditing standards is key for improving transparency. Not only does this help establish a common format for reporting relevant information, but it also ensures that practices such as off-balance-sheet borrowing (e.g. shadow banking) by state-invested firms are disclosed to other investors and the public.[96] Given that corporate disclosure forms the basis for identifying instances of below-market finance (as undertaken in Section 3), governments could aim to enhance international co-operation for monitoring SOE compliance with internationally recognised accounting and auditing standards, as well as improving these standards where appropriate.

5.2. Government-invested firms can be both providers and recipients of below-market finance

In most cases, the key enabler of below-market borrowings is the ownership by the government of banks and other financial institutions, which then provide industrial producers (state-owned and private) with cheaper loans than they would obtain on the market. Section 3 has shown this type of support to be especially large, accounting for almost a third of all the support measured by this study (i.e. government grants, tax concessions, and below-market borrowings).[97] In the case of below-market equity, governments may also at times rely on state enterprises to provide equity infusions to industrial producers they wish to support, although this is less systematic than for below-market borrowings. In both cases, the state could use corporations it controls to conduct industrial policy and support domestic manufacturers. The implication is that government-invested firms can be both recipients and providers (or vehicles) of support themselves.

Whether existing trade rules cover the support provided by all government-invested or influenced firms is a debated issue. For the SCM Agreement to apply, a financial contribution shall be provided by a government or any "public body".[98] In a past WTO case, the Appellate Body interpreted the meaning of "public body" as "an entity that possesses, exercises or is vested with governmental authority".[99] The same Appellate Body also stated that "[y]et, just as no two governments are exactly alike, the precise contours and characteristics of a public body are bound to differ from entity to entity, State to State, and case to case".[100] In fact, in WTO cases where governments were majority shareholders of the entities in question, the Appellate Body ruled that those entities could not be regarded as "public bodies" based solely on their

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95 Other types of support would also benefit from better disclosure by firms, including property-tax abatements (most companies only report information on income-tax concessions) and measures directly tied to investment in fixed assets (which are often not explicitly accounted for, but instead deducted from the cost of assets on the balance sheet).

96 The bond default in 2020 of state-owned Yongcheng Coal and Electricity Holding Group is a case in point.

97 Below-market equity is not included in this calculation since its quantification is less precise.

98 Art. 1.1(a)(1) of the SCM Agreement.

99 Appellate Body Report, *United States - Definitive Anti-dumping and Countervailing Duties on Certain Products from China*, para 317, WT/DS379/AB/R (11 March 2011).

100 *Ibid.*

ownership by governments.[101] This interpretation of the phrase "public body" has proven to be a matter of debate (Cartland, Depayre and Woznowski, 2012[46]; Miranda and Sánchez-Miranda, 2020[47]).[102] Several OECD members have voiced their concern with the Appellate Body's interpretation and declared that "[t]o determine that an entity is a public body, it is not necessary to find that the entity 'possess, exercise, or is vested with governmental authority'."[103] In order to ensure that the support provided by government-invested firms is captured by the SCM Agreement, it might be useful to clarify and expand the range of subsidy providers to which subsidy rules under the SCM Agreement apply (Figure 27).

Recognising the challenges involved in disciplining government-invested firms, several governments have developed rules on SOEs in the context of their preferential trade agreements (PTAs). This includes, for example, the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), the Agreement between the European Union and Japan for an economic partnership (EU-Japan EPA), and the Agreement between the United States, Mexico, and Canada (USMCA). SOE rules in PTAs often contain, among other provisions, rules on non-commercial assistance[104], non-discriminatory treatment and commercial considerations, and transparency. Although these SOE rules only apply to entities from countries that signed those PTAs, they provide useful examples of ways in which to elaborate disciplines on support provided by government-invested firms.

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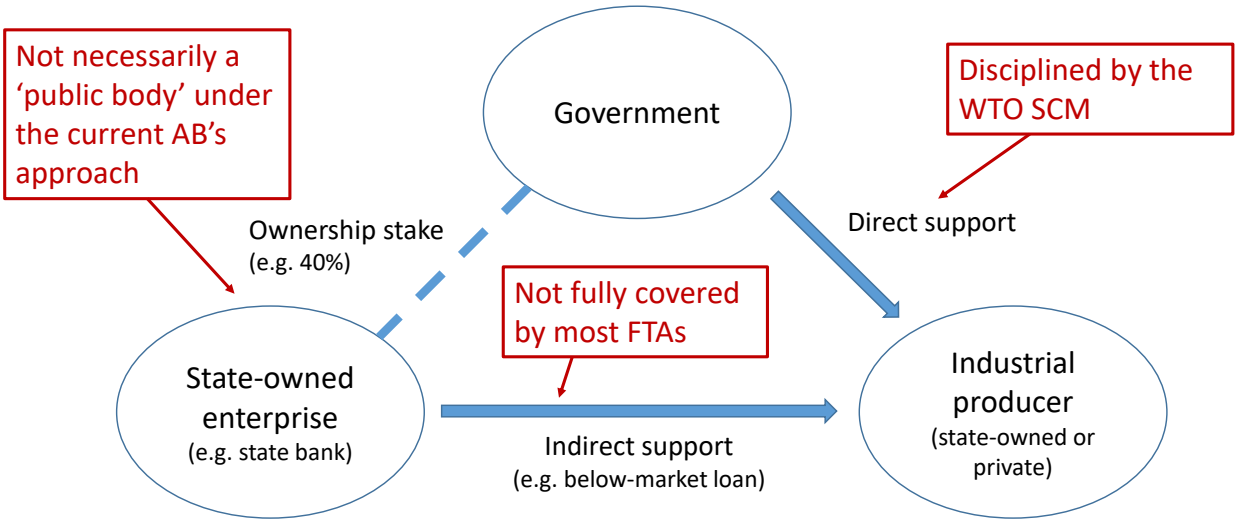
[101] Appellate Body Report, *United States - Definitive Anti-dumping and Countervailing Duties on Certain Products from China*, para 318, WT/DS379/AB/R (11 March 2011) and Appellate Body Report, *United States - Countervailing Measures on Certain Hot-rolled Carbon Steel Flat Products from India*, paras. 4.31-4.55, WT/DS436/AB/R (8 December 2014).

[102] In a more recent report, one member of the Appellate Body Division dissented and stated the Appellate Body's "original mistake" was its attempt to define the term public body as "an entity that possesses, exercises or is vested with governmental authority." See *US – Countervailing Measures (China) (AB) (Article 21.5)*, WT/DS437/AB/RW, para 5.245.

[103] See the *Joint Statement of the Trilateral Meeting of the Trade Ministers of Japan, the United States and the European Union*, available at https://trade.ec.europa.eu/doclib/docs/2020/january/tradoc_158567.pdf (accessed on 8 September 2020), and which states that "[t]he Ministers observed that many subsidies are granted through State Enterprises and discussed the importance of ensuring that these subsidizing entities are captured by the term 'public body'. The Ministers agreed that the interpretation of 'public body' by the WTO Appellate Body in several reports undermines the effectiveness of WTO subsidy rules. To determine that an entity is a public body, it is not necessary to find that the entity 'possesses, exercises or is vested with governmental authority'" (14 January 2020).

[104] These rules often require parties not to cause adverse effects to the interest of another party through the use of non-commercial assistance that is provided from a government or a SOE to another SOE. Some agreements, such as the USMCA, further prohibit certain types of non-commercial assistance (e.g. loan to uncreditworthy SOE, non-commercial assistance to an insolvent SOE or conversion of the outstanding debt to equity inconsistent with the usual investment practice of a private investor) being provided regardless of their effects.

Figure 27. Existing trade disciplines do not fully capture the support provided through government-invested firms



Note: AB = WTO Appellate Body. While this figure highlights ownership linkages between the government and its SOEs for illustrative purposes only, this does not exhaust all the possible ways in which a government might exert control or influence on a company.
Source: Authors' elaboration.

Gaps might nevertheless persist even in the context of the SOE rules negotiated in certain PTAs, especially when considering the full range of support conferred by below-market finance documented in Section 3. For one, definitions of "SOEs" or "state enterprises (SEs)" vary across trade agreements: while the CPTPP adopts a relatively high "50% state-ownership threshold" for the definition of SOEs, the corresponding definition under the USMCA is more flexible (Box 3). Section 3 of this report shows government ownership of industrial companies to vary widely from less than 10% to more than 50% (or even 100% in several cases). The evidence in Section 3 and Section 4 also suggests that companies sometimes behave differently, depending on how many shares governments own, even in cases where governments do not have a majority stake. In theory, a government might hold the power to control a company even if it only has minority ownership of the firm (Kowalski and Rabaioli, 2017[43]) – in cases, for instance, where legal stipulations or corporate articles of association ensure continued state control over an enterprise, or where corporate or shareholding structures confer effective controlling influence on the government (e.g. through shareholders' agreements) (Box 2). Moreover, as mentioned above, complicated shareholding structures might have the effect of masking a government's indirect control over government-invested firms.

Compounding these various problems is the fact that local authorities (be they states, provinces, or municipalities) are sometimes the owners of financial institutions themselves. Provincial and municipal authorities in China control much of the flow of credit through the state banking system (Klein and Pettis, 2020[16]; Hsieh, Bai and Song, 2019[10]). On the equity side, earlier OECD work on semiconductors showed that local governments were often behind the creation of the numerous government guidance funds that have taken large equity stakes in local semiconductor firms (OECD, 2019[3]). Semiconductor investment funds were, for example, created by the provinces of Fujian, Hubei, and Sichuan, as well as by large municipalities like Beijing, Nanjing, Shanghai, and Xiamen (Noble, 2018[48]). With transparency and the WTO definition of "public bodies" already proving challenging at the central government level, their application at the level of individual cities or regions is likely to prove even more challenging and further obscure the true level of support.

Box 3. Definitions of a state-owned enterprise in different legal contexts

While preferential trade agreements (PTAs) often include rules on state-owned enterprises (SOEs) or state-enterprises (SEs), there is no one standardised definition to describe these companies. Below are the definitions of SOEs found in the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), the Agreement between the EU and Japan for an economic partnership (EU-Japan EPA), and the Agreement between the United States, Mexico, and Canada (USMCA), all of which are large PTAs that were recently signed, as well as the EU-China Comprehensive Agreement on Investment (CAI) recently agreed in principle between the EU and China.

CPTPP (Article 17.1): **state-owned enterprise** means an enterprise that is principally engaged in commercial activities in which a Party:

(a) directly owns more than 50 per cent of the share capital;

(b) controls, through ownership interests, the exercise of more than 50 per cent of the voting rights; or

(c) holds the power to appoint a majority of members of the board of directors or any other equivalent management body.

EU-Japan EPA (Article 13.1 (h)): "state-owned enterprise" means an enterprise that is engaged in commercial activities in which a Party:

(i) directly owns more than 50 per cent of the share capital;

(ii) controls, directly or indirectly through ownership interests, the exercise of more than 50 per cent of the voting rights;

(iii) holds the power to appoint a majority of members of the board of directors or any other equivalent management body; or

(iv) has the power to legally direct the actions of the enterprise or otherwise exercises an equivalent degree of control in accordance with its laws and regulations.

USMCA (Article 22.1): **state-owned enterprise** means an enterprise that is principally engaged in commercial activities, and in which a Party:

(a) directly or indirectly[1] owns more than 50 percent of the share capital;

(b) controls, through direct or indirect ownership interests, the exercise of more than 50 percent of the voting rights;

(c) holds the power to control the enterprise through any other ownership interest, including indirect or minority ownership[2]; or

(d) holds the power to appoint a majority of members of the board of directors or any other equivalent management body.

CAI (Section II, Article 3bis.1): **covered entity** means, at all levels of government, the following entities:[3]

(a) Enterprise in which a Party directly or indirectly,

i. owns more than 50 per cent of the share capital;

ii. controls, through ownership interests the exercise of more than 50 per cent of the voting rights;

iii. holds the power to appoint a majority of members of the board of directors or any other equivalent management body; or

iv. holds the power to control the decisions of the enterprise through any other ownership interest, including minority ownership;

(b) Enterprise in which a Party has the power to legally direct the actions or otherwise exercise an equivalent level of control in accordance with its laws and regulations;

(c) Any entity, public or private, including where relevant any subsidiary thereof, or a consortium, which in a relevant market in the territory of a Party is authorized or established formally or in effect by that Party as the sole supplier or purchaser of a good or service, but does not include an entity that has been granted an exclusive intellectual property right solely by reason of such grant;

(d) Two or a small number of enterprises, public or private, including where relevant any subsidiary thereof, designated by a Party, formally or in effect, as the only suppliers or purchasers of a particular good or service in a relevant market in the territory of that Party.[4]

At the national level, although Chinese law, for instance, does not appear to have a clear definition of a state-owned enterprise, the phrases "state-owned and state-holding enterprises" have been in use since the mid-1990s for statistical purposes, where "state-owned enterprises" mean wholly state-funded firms and "state-holding enterprises" mean those firms whose majority shares belong to the government.

Considering that SOEs or SEs are defined differently in different legal contexts, this report uses "government-invested firms" to refer to firms in which governments, as a factual matter, have directly or indirectly invested, but without prejudice to the size of those investments or the implications they have for the effective level of state control. The terminology of "government-invested" thus covers a broader range of state investments in a manner which does not have implications for the legal treatment of such investments.

1. Footnote 7: For the purposes of this definition, the term "indirectly" refers to situations in which a Party holds an ownership interest in an enterprise through one or more state enterprises of that Party. At each level of the ownership chain, the state enterprise – either alone or in combination with other state enterprises – must own, or control through ownership interests, another enterprise.
2. Footnote 8: For the purposes of this subparagraph, a Party holds the power to control the enterprise if, through an ownership interest, it can determine or direct important matters affecting the enterprise, excluding minority shareholder protections. In determining whether a Party has this power, all relevant legal and factual elements shall be taken into account on a case-by-case basis. Those elements may include the power to determine or direct commercial operations, including major expenditures or investments; issuances of equity or significant debt offerings; or the restructuring, merger, or dissolution of the enterprise.
3. Footnote 5: For greater certainty, the listing of such covered entity is for the purpose of defining the scope of application of this sub-section and does not presume its existence in either Party.
4. Footnote 6: For greater certainty, point (d) does not include enterprises to which a Party has granted an authorisation according to objective, transparent and impartial criteria.

Given this, trade rules on SOEs may need to consider not just firms that are majority owned by the state, but also other firms in which public authorities have significant stakes or otherwise are able to assert some degree of control on production and investment decisions. Accordingly, definitions of "SOEs" or "SEs" in the context of trade rules should be designed flexibly to accommodate government-invested firms in which governments are able to exercise substantial influence, even as minority shareholders (Box 3).[105]

Another related issue concerns the support provided by government-invested firms to private firms. Although both the CPTPP and the USMCA contain rules on non-commercial assistance, their scope is limited to assistance provided (a) from a government to a SOE, and (b) from a SOE to a SOE. This leaves out non-commercial assistance from a SOE to a non-SOE, i.e. a private firm. Some of the support identified in Section 3, however, was provided by government-invested firms (e.g. state banks or government guidance funds) to non-government-invested firms or firms with limited government investments. About 20-25% of all below-market borrowings measured by this study thus benefitted firms with less than 25% government ownership. These findings demonstrate that support provided by SOEs to non-SOEs should also be subject to rules on non-commercial assistance (Nemoto, 2019[49]).

Although the focus of this report is essentially on support taking the form of below-market finance, many of the points raised above apply equally in the case of intermediate inputs sold by state enterprises to industrial producers at below-market prices. This would include, for example, state-owned power plants selling electricity to local firms at below-market rates (or below-cost-recovery rates), or state-owned fossil-fuel producers providing feedstock (e.g. natural gas or coal) at cheaper rates to those industrial producers that have their own power-generating facilities.

5.3. Existing trade rules do not capture all forms of below-market finance

As explained in Section 2, below-market finance refers to measures that confer government support to companies through the financial system. This comprises *below-market borrowings* – which cover measures such as interest-rate subsidies and government loan guarantees – and below-market equity – which can include *equity infusions* provided by governments on below-market terms, but also *below-market equity returns* in the case of government-invested firms that fail to cover their cost of capital over extended periods of time.

Below-market equity infusions and below-market equity returns are not mutually exclusive: the former involve one-off equity infusions by governments while the latter are concerned with the recurring benefits that government-invested firms can obtain following an equity infusion. The difference is therefore one of timing and scope. More precisely, the concept of below-market equity infusion evaluates whether a government expected reasonable rates of return at the time it invested in a company, whereas below-market equity returns pertain to an *ex-post* assessment of whether a government-invested firm generates what market participants might view as reasonable rates of return. In the following sub-section, the report discusses in turn how these various forms of support fit into existing trade rules.

5.3.1. Below-market borrowings and below-market equity infusions

The case of below-market borrowings and below-market equity infusions is relatively straightforward, as both sets of measures are in principle covered by the SCM Agreement. Under the Agreement, a loan or an equity infusion would be regarded as a subsidy if it confers favourable terms compared with market benchmarks. As already noted above, however, this comparison is easier said than done as it can be hard

[105] However, the ability of governments to exercise substantial influence over government-invested firms does not necessarily lead to behaviour by firms that is inconsistent with market principles.

to find a loan or an equity infusion that was provided on comparable terms and conditions in the market. Where such transactions are lacking, no large consensus appears to exist yet on the best method to develop the necessary market benchmark (Box 4).

Methodological difficulties are most acute for analysis of government equity infusions, which normally takes the form of an *ex-ante* assessment of the consistency of the transaction with usual market practice. Relevant information for conducting such an assessment would include: current and past indicators of an enterprise's financial performance (including rates of return on equity) calculated from the enterprise's financial statements and accounts; information as to the future financial prospects of the enterprise, including market studies, economic forecasts and project appraisals; equity investments in the enterprise by other private investors; and marketplace prospects for the products sold by the enterprise.[106] Obviously, evaluations and perceptions of these factors will vary greatly, which makes any *ex ante* subsidy determination challenging (OECD, 2019[3]). The use of companies' stock prices as market benchmarks is also problematic for several reasons: not all firms in question are publicly listed; there is a possibility that stock prices reflect investors' expectations of future government assistance; and governments may intervene in the stock exchange to support the value of stocks (Wu, 2016[50]; OECD, 2019[3]).

For these reasons, subsidy identification and measurement are inextricably linked in the case of below-market finance (OECD, 2019[3]). Limited available information on the terms and conditions of a loan or an equity infusion only serve to complicate the analysis even further, making it easier to obscure domestically and internationally any below-market financing that is being provided. By their very nature, these types of support measures might therefore dissuade Members from bringing attention to below-market finance or even cases to the WTO. This could explain in part the heavy reliance on government loans and investments in certain countries and sectors.[107]

One possible way forward could be for countries to form a consultative group mandated to explore best practices in the calculation of market benchmarks in subsidy cases. By seeking advice from relevant experts and practitioners, and on the basis of available evidence, the group could aim to arrive at a set of principles and guidelines in the area of below-market finance, and price-gap calculations more generally. This should help establish a more common approach to the estimation of government support and improve policy transparency.

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[106] Panel Report, *European Communities and Certain member States — Measures Affecting Trade in Large Civil Aircraft*, para 7.1358, WT/DS316/R (30 June 2010).

[107] As Ernst (2015[60]) put it in the case of China's semiconductor industry: "One might wonder, for instance, to what degree the decision to establish an investment equity fund is primarily motivated by an attempt to avoid being accused of violating WTO anti-subsidy agreements." Another reason mentioned by Noble (2018[48]) is that local governments in China are increasingly constrained institutionally and fiscally in the amount of grants and tax concessions they can offer to companies.

Box 4. Evaluating the consistency of government equity infusions with usual investment practice: Examples from OECD countries

In accordance with the rules of the SCM Agreement, many governments have in place domestic rules on countervailing duty investigations that stipulate how to assess whether a government confers a benefit in the context of an equity infusion. However, no common methodology yet exists for analysing whether governments' investment decisions are consistent with the usual investment practice of private investors. The same is true of the methods used to calculate the "benefit" provided through equity infusions in cases where government investments are deemed inconsistent with usual investment practice. Below are concrete examples of the rules currently in place in the United States, the European Union, and Japan.

US (19 CFR § 351.507 Equity)

- An equity infusion is regarded as inconsistent with usual investment practice if the price paid by the government for newly issued shares is greater than the price paid by private investors for the same (or similar form of) newly issued shares.
- If actual private investor prices are not available, it will be determined whether the firm funded by the government-provided equity was equityworthy or unequityworthy at the time of the equity infusion. A firm will be considered equityworthy if, from the perspective of a reasonable private investor examining the firm at the time the government-provided equity infusion was made, the firm showed an ability to generate a reasonable rate of return within a reasonable period of time.
- The factors that may be examined in making the equityworthiness determination include: a) objective analyses of the future financial prospects of the recipient firm or the project; b) current and past indicators of the recipient firm's financial health; c) rates of return on equity in the three years prior to the government equity infusion; and d) equity investment in the firm by private investors.
- If a firm or project is regarded as equityworthy, the terms and the nature of the equity purchased will be examined to determine whether the investment was otherwise inconsistent with the usual investment practice of private investors. If it is determined as inconsistent with the usual investment practice, the amount of the benefit conferred will be calculated on a case-by-case basis.
- If a firm or project is regarded as unequityworthy, a benefit to the firm exists in the amount of the equity infusion.

EU (Guidelines for the calculation of the amount of subsidy in countervailing duty investigations (98/C 394/04))

- If the government buys shares in a company and pays above the normal market price for these shares (taking account of any other factors which may have influenced a private investor), the amount of subsidy is the difference between the two prices.
- In cases where there is no market in freely-traded shares, the government's realistic expectation of a return on the price paid for equity should be considered. In this regard, the existence of an independent study demonstrating that the firm involved is a reasonable investment is the best evidence.

- In cases where the government has not acted according to the usual investment practice of private investors, all or part of the equity provided must be considered as a grant.
- A decision to consider all of the equity a grant would be made only in extreme cases where it is determined that the government had no intention of receiving any return on its investment and was in effect giving a disguised grant to the firm in question.

Japan (The Guidelines for procedures relating to countervailing duty)

- In the case of a government-provided equity infusion, where a benefit is considered to have existed to the extent that the investment decision is inconsistent with the usual investment practice of private investors (e.g. private investors would not be able to invest under such investment conditions), including the practice for the provision of risk capital, the amount of subsidy is the amount of the balance of the government's investment over and above that of private investors under the similar investment conditions.

If actual investment by private investors which is comparable to government investment is not available, an adequate amount of subsidy will be determined after examining the difference between the amount of the investment by the government and the appraised amount of the value of the shares issued by the company, etc.

5.3.2. Below market equity returns

Analysis in Section 3 has shown that government-invested firms in certain sectors often fail to generate as much profit as private firms, yielding returns on assets that fall repeatedly short of companies' cost of capital. This amounts to what this report views as below-market equity returns. Although there are many reasons why government-invested firms may perform relatively poorly,[108] it is likely that persistent abnormal returns stem in part from government shareholders not behaving like regular private investors. This could take many forms in practice: government shareholders exercising undue influence on management, including the composition of the board; corporate decisions that are not founded on commercial considerations but instead reflect public policy; and governments retaining their shares in loss-making companies even as other (private) shareholders divest to seek better returns elsewhere.

Besides raising issues that should be of concern for taxpayers, government involvement in corporate decision-making risks tilting the competitive playing field between private firms and government-invested firms, e.g. by enabling the latter to invest more than market conditions would warrant and sustain heavier losses than would be tolerated by private investors. Simply put, below-market equity returns benefit government-invested firms by relaxing the market discipline that otherwise constrains their private competitors.

Below-market equity infusions and below-market equity returns each capture different aspects of below-market equity using different methodologies. Even in cases where an equity infusion by a government is consistent with usual market practice at the time of the investment, it does not necessarily follow that the government will subsequently behave as a regular (private) shareholder. Instead, the government may be using its partial or full ownership of the company to exercise its influence on the invested company and

[108] One reason may have to do with the public service obligations that certain countries impose on their SOEs (but not on their private competitors), though this does not concern the firms covered in this study, which are all commercially active in manufacturing segments.

fulfil non-commercial objectives. The difference between the two concepts is also one of timing. The assessment of an equity infusion aims to determine *ex ante* whether a government's equity acquisition is consistent with usual market practice. By contrast, the identification of below-market equity returns is performed *ex post*, looking at the returns generated by a company in the years following an injection of capital by the government.[109]

Unlike below-market equity infusions, the below-market equity returns of government-invested firms may not be covered by the SCM Agreement, which normally requires an *ex ante* subsidy assessment. This implies that the existing trade rulebook may not fully address the commercial advantages provided to government-invested firms through the equity channel. While the SCM Agreement does cover the *one-off benefits* that can come from government investments at the time they are made, it may not discipline the *recurring benefits* that may stem from the behaviour of government shareholders, years after the initial government investment was made. For the sake of illustration, a government shareholder may decide to forego returns on its equity investment in a company, which then enables that company to operate within a softer budget constraint.[110] This confers a benefit to the firm that puts competitors (domestic and foreign) at a potential disadvantage, although this benefit may not be covered by existing WTO rules. Importantly, however, the benefit does not exist if it can be shown that governments behave as regular shareholders, acting on the basis of purely commercial considerations.

Updating the SCM Agreement to include below-market equity returns in the scope of subsidies (e.g. in Art 1) might not be the best solution, however. Although below-market equity returns can help detect instances where a government shareholder does not behave consistently with market principles, asserting the existence of government support might still require some interpretation of why company returns were low in the first place.[111] It would surely be excessive to treat any below-average performance by government-invested firms as a subsidy, regardless of the institutional and legal framework in place. Capacity issues in the aluminium, steel, and shipbuilding industries have, for example, affected the performance of all firms, including fully private ones that are not subject to state influence.[112] Placing too strict a set of disciplines on below-market equity returns may therefore thwart predictability and risk-taking by government-invested firms as well as constitute regulatory over-reach. Allowing below-market equity returns to be labelled a "subsidy" would also face difficulties in quantification.[113] This is in large part due to the inability to establish a clear counterfactual for firm profitability, i.e. what would be the level of profit had shareholders behaved in a manner consistent with market principles. This in turn makes it hard to

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[109] As already mentioned, the two approaches do not need to be exclusive, however. Prior evidence of below-market equity returns could help inform new cases involving government equity infusions by the same government. In this regard, the analysis in this report might potentially assist in the *ex-ante* assessment of government equity infusions.

[110] The company in question (e.g. a bank or a power utility) may in turn proceed to sell its output (e.g. bank loans or electricity) at prices that do not cover the full range of costs it incurs, thereby becoming a provider of government support itself.

[111] This could involve looking for aggravating circumstances, such as the existence of an overt industrial policy in relation to government equity participations, or a history of government interference in the management of the company. The age of the company or the maturity of the industry could also be relevant considerations. Start-ups often fail to generate profits years after they were created, as do many large tech-oriented companies (e.g. in ride hailing or autonomous vehicles) despite their having private shareholders.

[112] See, for example, the results presented earlier in Section 2 and Section 4 on industrial capacity in relation to output prices and profits.

[113] The same holds true for so-called "regulatory subsidies", which refer to the failure of governments to provide a certain level of regulations on, for instance, environmental protection or labour standards. In the absence of specific guidance on the appropriate benchmark for those regulations, it would be challenging to identify a "benefit" conferred by a government to a company (Coppens, 2014[61]).

determine the existence of a "benefit" conferred from the government to the company.[114] Additionally, it may be argued that *ex post* analysis is not practical or helpful for WTO Members, as it requires them to wait several years after a government has injected equity into a firm to determine the existence of a "benefit". By that time, the damage to trading partners may already be done.

In short, while below-market equity can undermine the playing field in global trade, its elusive nature presents complications for treating it as a subsidy. Yet there may still be room to take below-market equity returns into consideration. For instance, in cases where a government equity infusion is followed by below-market equity returns, government investors may be asked to clarify whether they could not have foreseen the low rates of return at the time they made the investment (i.e. in the context of the *ex-ante* subsidy assessment of the equity infusion), or whether they had exit strategies in place. Members might also consider updating subsidy rules, for instance, by shifting the burden of proof so that additional government investments in firms that have incurred long-lasting below-market equity are regarded as a subsidy by default, unless consistency with a market benchmark can be demonstrated.[115] The rationale is that additional government investments in loss-making firms are likely aimed at propping up uncompetitive producers and preventing their exit from the market.

It might also be worth considering other approaches outside of subsidy rules strictly speaking, such as *ex-ante* rules or guidelines on the governance of government-invested firms more generally. For example, to ensure a level playing field and fair competition in the market, the *OECD Guidelines on Corporate Governance of State-Owned Enterprises* recommend that, among other things: "SOEs undertaking economic activities should not be exempt from the application of general laws, tax codes and regulations"; "SOE's economic activities should not benefit from any indirect financial support that confers an advantage over private competitors"; and "SOE's economic activities should be required to earn rates of return that are […] consistent with those obtained by competing private enterprises" [116] (OECD, 2015[45]). Although several governments covered by this report have not yet adhered to these Guidelines, countries could decide to use them as a starting point in order to strengthen further disciplines on government-invested firms.

5.4. Domestic mechanisms on the governance of SOEs could also be leveraged to address below-market finance

Outside of trade rules, many OECD countries have already put in place domestic policies on the financial governance of their own SOEs in order to ensure a level playing field in their market and guarantee some form of 'competitive neutrality'. In line with the *OECD Guidelines on Corporate Governance of State-Owned Enterprises*, these policies generally include provisions that effectively restrict the provision of below-market finance by governments.

In the case of below-market equity infusions, an OECD survey conducted in 2014 (OECD, 2014[51]) has shown that several member countries seem to have established mechanisms to ensure market-consistent equity costs in connection with recapitalisations. Australia, Estonia, Hungary, New Zealand, and Sweden all reported that capital injections to SOEs from the public budget can only happen if the project financed demonstrates a minimum expected rate-of-return. In Norway, the state will, as a general rule, seek advice

[114] The fact that not all profits the company generated are distributed to shareholders should also be taken into consideration.

[115] The same logic could apply to government-backed loans made to such companies.

[116] In a similar vein, PTAs often require SOEs to act in accordance with "commercial considerations" in their purchases or sales of a good or service when engaging in commercial activities.

from professional financial advisors with regard to the commercial aspects of the transaction in the event of an equity infusion.

In many OECD countries, SOEs are also subject to target rates of return on equity on their commercial activities, which can help address the question of below-market equity returns. These target rates are either established by the government as shareholder or elaborated by individual SOE board members, with some countries having aligned their return targets with those achieved by competing private companies (OECD, 2014[51]; OECD, 2018[52]). In countries where explicit rate-of-return guidelines exist, such as Australia, rate-of-return targets are usually discussed during the annual corporate planning process (Box 5). Meanwhile, in countries such as Estonia, Lithuania, the Netherlands, New Zealand, and Sweden, the government-ownership body and SOE board members communicate specific details on how to identify the cost of capital for calculating rate-of-return targets, using sector-specific benchmarks that are established based on economic models (e.g. the CAPM). Some governments, such as Norway, also take active measures on SOEs that have low rates of return compared with relevant benchmarks and fair expectations. Measures may include, among others, changes to the composition of the board or altering the capital structure (Government of Norway, 2019[53]).

As shown in this report, below-market borrowings stem from the combined effect of direct subsidised lending and government guarantees that are either explicit or implicit. The latter in particular tend to concern mostly government-invested firms, which are often perceived by lenders and some credit-rating agencies alike as benefitting from some backing from central or local authorities. This has led some governments to introduce mechanisms to neutralise the preferential terms of SOE debt financing. In Australia, for example, SOEs are required to pay a debt-neutrality charge if it is found that the interest rate on their borrowings is below market-consistent rates, using an independent credit rating (OECD, 2018[52]). To address the issue of perceived guarantees, New Zealand requires its own SOEs to explicitly stipulate in commercial loan covenants that their debt does not carry a government guarantee (OECD, 2014[51]). In Australia, Estonia, Hungary, Switzerland, and the United Kingdom, there are concrete measures in place to ensure that interest rates on direct loans from government institutions are market-consistent (OECD, 2018[52]).

Box 5. Australian Commonwealth Government Business Enterprises-Governance and Oversight Guidelines

The Federal Government of Australia has developed *Governance and Oversight Guidelines* that apply to so-called “Government Business Enterprises (GBEs)” that are Commonwealth entities or wholly-owned Commonwealth companies (company GBEs). These guidelines also apply to partly-owned GBEs to the maximum extent possible. The guidelines comprise, among others, the following principles on financial governance:

Each GBE and its subsidiaries are expected to target an optimal capital structure (the combination of financial liabilities and equity used to fund the assets of the GBE) that is agreed annually between the board and Shareholder Ministers in the Corporate Plan consultation process.

All GBEs are expected to add to shareholder value in their operations with a view to at least meeting financial targets set out in their Corporate Plan. Increases in shareholder value are achieved when the GBE’s Weighted Average Cost of Capital (WACC) is exceeded, regardless of whether or not the target return is reached. However, where a GBE achieves a return which is less than its financial target, it has not achieved the minimum return acceptable to Shareholder Ministers who expect the adoption of strategies aimed at achieving the target.

GBEs are expected to target a specific WACC. This principal financial target requires the GBE to earn returns sufficient to cover the cost of debt (the expected rate at which the GBE is able to borrow) and the required return on equity (the risk free rate plus a risk premium appropriate to the GBE). WACC is used to estimate the required rate of return on total assets, taking into account the different required rates of return attached to the different components of the GBE's capital structure.

As a general rule the Commonwealth will not provide formal guarantees of GBE liabilities. Accordingly, GBE boards are expected to take this policy into account when making decisions which affect a GBE's operations and performance.

Source: Australian Department of Finance (2018[54]).

Although most of the measures above were introduced mainly with domestic considerations in mind (e.g. protecting taxpayers and the private sector), their benefits can extend to international trade as well by limiting the possibility for local SOEs to obtain unfair advantages that could harm foreign competitors. In that sense, these measures offer useful examples of steps that countries could take on their own to address below-market finance outside of the strict confines of trade rules, with a view to complementing efforts under way at the WTO and elsewhere.

5.5. The question of specificity as it applies to below-market finance

As Section 3 of this report shows, below-market finance is not limited to a few sectors but can instead be found across a range of different manufacturing activities. Although the report has found below-market borrowings to benefit heavy industries relatively more, it is in effect pervasive. Below-market equity was likely found in several sectors, though it appears to be more common in R&D-intensive sectors that rely relatively more on intangibles. This wide availability, coupled with the lack of a clear policy underpinning below-market finance (e.g. a specific law or regulation), can pose a challenge for disciplining such support under current trade rules.

The "specificity" provisions under the WTO SCM Agreement require that a "subsidy" be specific to "an enterprise or industry or group of enterprises or industries" ("certain enterprises") in order for the subsidy to be actionable under the SCM Agreement.[117] Art. 2.1 of the SCM Agreement contains two types of specificity: *de jure* specificity and *de facto* specificity. The former type requires that either the legislation or the granting authority explicitly limits access to the subsidy to "certain enterprises".[118]

A subsidy may also be found to in fact be specific, based on the examination of factors such as the number of enterprises that use a subsidy programme and the amounts of subsidies granted to enterprises.[119] As

[117] Art. 2 of the SCM Agreement. The Appellate Body stated that "the term "certain enterprises" refers to a single enterprise or industry or a class of enterprises or industries that are known and particularized" and "whether a number of enterprises or industries constitute "certain enterprises" can only be made on a case-by-case basis" (Appellate Body Report, *United States - Definitive Anti-dumping and Countervailing Duties on Certain Products from China*, para 373, WT/DS379/AB/R (11 March 2011)).

[118] Art. 2.1 (a) of the SCM Agreement. At the same time, Art. 2.1 (b) of the SCM Agreement stipulates that "[w]here the granting authority, or the legislation pursuant to which the granting authority operates, establishes objective criteria or conditions [footnote omitted] governing the eligibility for, and the amount of, a subsidy, specificity shall not exist, provided that the eligibility is automatic and that such criteria and conditions are strictly adhered to."

[119] SCM Agreement, Art. 2.1 (c) listed four such non-exhaustive factors: use of a subsidy programme by a limited number of certain enterprises; predominant use by certain enterprises; the granting of disproportionately large amounts of subsidy to certain enterprises; and the manner in which discretion has been exercised by the granting authority in the decision to grant a subsidy.

such, in order for a subsidy to be specific, it may be relevant to consider not only actual recipients, but also past and potential recipients of a particular subsidy.[120]

While an *ad hoc* government equity infusion into a certain company can be a typical example of a subsidy that is explicitly limited to certain enterprises (Mueller, 2017[42]), it may be difficult for below-market borrowings to be deemed actionable under WTO provisions, in particular where legislation that instructs state banks or state funds to provide below-market finance to enterprises is opaque or non-existent. Moreover, given that government-invested banks routinely provide a myriad of loans to businesses, it might be challenging to identify how much of all loans provided were directed towards particular companies or sectors in order to demonstrate the *de facto* specificity of below-market borrowings. The challenges related to lack of information noted earlier in this section further compound these difficulties.

The various challenges connected to the specificity provisions again highlight the need for greater transparency. Governments may wish, for instance, to enhance the exchange of information on below-market finance provided by a third government, as well as on the policies underpinning the support. More widely, the specificity provisions raise a number of questions, including with regard to whether or not they hamper action on borrowings and inputs that are broadly available at below-market prices, but which nonetheless distort international markets. Furthermore, this issue would be especially difficult where below-market borrowings are the reflection of broader macroeconomic policies that channel forced savings into the expansion of industrial activities (Klein and Pettis, 2020[16]). These issues could be addressed in future work by the OECD and others.

5.6. Below-market finance in the context of COVID-19

As noted in Section 1, government support provided through the financial system has played a critical role in the emergency policy response to the COVID-19 pandemic. This is partly because such support can often be deployed and utilised by recipients faster than budgetary instruments, such as tax concessions. Government loan guarantees were thus instrumental in helping shield businesses from the impact that prolonged lockdowns and movement restrictions have had on sales, employment, and profit. In doing so, government intervention through the financial channel has helped firms maintain their access to credit at times of crisis, which matters especially for MSMEs that do not have enough cash on hand and are not in a position to issue bonds. Some governments have also injected equity into distressed companies (airlines mostly) and further raised the possibility for states to acquire shares in companies they rescue (OECD, 2020[14]).

This serves to show that below-market finance should not necessarily be banned altogether from the policy toolkit, but rather reserved for emergency situations and subject to disciplines in its use. A useful distinction can be made between below-market finance of a structural nature, which aims to fulfil industrial ambitions, and that of an emergency nature, which provides a rapid response in the context of a wider economic crisis. Although this report is essentially concerned with the former type of below-market finance, efforts to tighten disciplines on below-market finance in a trade context should remain cognisant of the usefulness that it can have at times of crisis.

Care should nonetheless be taken to ensure that the support introduced in a crisis is designed in such a way as to minimise distortions on trade and competition, i.e. that emergency support does not become structural. There is also the risk that governments use crisis relief as disguised support measures to prop up firms that had a poor financial record even before the COVID-19 crisis, such as those identified in this

[120] Appellate Body Report, *United States — Measures Affecting Trade in Large Civil Aircraft*, para 753, WT/DS353/AB/R (12 March 2012). The Appellate Body also states that whether there is an overarching purpose behind the subsidies may also be considered in this context.

report. Government equity injections in particular run the specific risk that, even if their initial purpose was to help companies cope with a systemic challenge (e.g. a pandemic), prolonged holding of their equity by governments might lead to long-run effects on competition, particularly as they are harder to dial back than subsidised loans or budgetary grants (OECD, 2020[55]). Moreover, there is also the possibility that crisis situations are used to introduce wider industrial policy, with support less aimed at addressing emergency stresses than in building longer term productive capacity.

These risks highlight the necessity for emergency below-market finance to obey a set of core design principles. In general, support is most beneficial when it is transparent, time-limited, proportionate, and non-discriminatory (OECD, 2020[14]). Policies notably need to apply objective, transparent criteria for determining firms' eligibility – in particular, to distinguish between transitory liquidity problems at which assistance should be targeted and existing structural issues in relation to corporate solvency or performance. Care should be taken to ensure that idiosyncratic, firm-specific credit risks are distinguished from the more systemic risks that stem from the crisis. Where capital injections are desirable in order to prevent greater harm to the economy, governments also need to have a clear exit strategy to prevent possible long-run effects on competition and effective resource allocation.

Perhaps the most important aspect of implementing government support in a crisis is for governments to be transparent about the measures they choose to adopt. Transparency in particular enables businesses and other governments to assess whether support measures are well-targeted to address the systemic challenges posed by COVID-19 and whether they cause unfair trade distortions. Disclosure of detailed information on the terms and conditions of support provided through the financial system also promotes greater government accountability and public acceptability. Improving transparency would also create a more level playing field in terms of information on support currently being offered in the context of COVID-19: while in some countries it is subject to parliamentary oversight and media scrutiny, in others limited information is available on the nature and extent of measures being taken. As this report has shown, transparency remains fundamental to addressing government support; however, it has also underscored the urgency of addressing the considerable information gaps that persist in relation to below-market finance and government support more generally.

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Annex A. Technical appendix

Data sources

Firm-level data

The vast majority of the data collected for this project were obtained directly from firms' annual reports and consolidated financial statements. In some cases, this was complemented using other firm-specific sources such as corporate sustainability reports, bond prospectuses, or information gathered directly from firms' websites. The variables collected include common financial aggregates (e.g. assets, debt, equity, or revenue) but also R&D spending, labour costs, the currency denomination of debt, capitalised interest expenses, firms' official credit ratings, and the number of employees.

For listed US firms, the analysis estimates labour costs by multiplying the median employee compensation disclosed in proxy filings to the SEC by the number of employees in the corresponding year. Such information is only available starting in 2017, when the Dodd-Frank Act made it mandatory for listed firms in the United States to disclose the ratio between CEO pay and the median employee compensation. Information on labour costs is otherwise missing for US firms. Although a number of other firm-level studies proxy labour costs for specific US firms using average US labour costs by industry, this method may not be applicable in the case of multinationals where total employees include those working in different countries. Some US semiconductor firms have the majority of their staff doing assembly work in Southeast Asia, while US rolling-stock companies and carmakers may be locating many jobs in Mexico. While not ideal, the estimates of labour costs obtained using median employee compensation appear reasonably close to information on average pay that is sometimes available through other online sources.[121] The estimates also appear to be consistent with the geographical breakdown of companies' employees.

As explained in Section 3 of the report, a number of firms in the sample are conglomerates that operate across different, unrelated business segments (i.e. "multi-product firms"). This includes companies like GE (that manufactures, among other things, wind turbines, rolling stock[122], and aircraft engines), Mitsubishi Heavy Industries (shipbuilding, aerospace, etc.), or Samsung Electronics (phones, semiconductors, displays, etc.). Wherever possible, data were collected on the specific business segments in which these firms operate in order to separate relevant activities from those that fall outside the scope of the sample. Firms generally disclose common financial aggregates such as revenue or assets by business segment, which enables the analysis to calculate, for example, a segment-specific return on assets (before tax given taxes are normally company-wide).[123] Segment-specific calculations are, however, not possible nor desirable for aggregates like debt or interest payments, which depend fundamentally on the consolidated company's financial standing with creditors.

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[121] Information on employee compensation is sometimes available in SEC filings for a few US firms in the earlier period of the sample. Partial information can also be retrieved from websites such as Glassdoor in order to verify the plausibility of the median-based estimates.

[122] These activities were sold to Wabtec in 2019.

[123] It should be noted, however, that firms' own definitions of business segments are not unified and may vary from one company to the other. For this reason, it is possible that some of the activities measured here go beyond the strict boundaries of the sectors analysed. Multi-product firms make up less than 16% of all firms in the sample, however, which limits the impact of this data problem. Moreover, and as noted in Section 3, sensitivity analysis shows that using consolidated company-wide data does not change the findings much, except for rolling stock.

Considerable efforts were also deployed to collect information on government grants and tax concessions that firms obtained. Monetary values for those are often found in the non-operating income section and the income-tax section of financial statements, respectively. External sources (e.g. government databases and press reports) were also used at times, either to complement firms' estimates of support or to verify their plausibility. Although there is no assurance that the data collected include every possible grant and tax concession that firms received, best efforts were made to arrive at a comprehensive total number.

For every company covered, information on the ownership structure as of 2018-19 was also collected to identify the shares of governments and government-related entities. This enabled the analysis to classify firms according to government ownership. To the best of our knowledge, very few of the sampled firms appear to have been privatised or nationalised over the time frame that this report considers, which implies very limited changes in the ownership structure of the firms covered.

The period considered covers 2005 to 2019, which is the last year for which a consistent set of company financials are available. Data for some companies start later than 2005 depending on the availability of financial statements online and on whether the companies existed at the time, or were active in the relevant sector. Some companies stopped reporting prior to 2019 due to firms exiting the industry (e.g. bankruptcy) or a delisting event (e.g. when a private-equity fund acquires the company and removes it from the stock exchange).

Financial benchmarks

Below-market borrowings: Data on risk-free rates were retrieved from FactSet and the website of the People's Bank of China. Spreads on corporate bonds by country were obtained from FactSet. Credit ratings were obtained from both FactSet and the websites of credit-rating agencies (e.g. Moody's and Standard & Poor's).

Below-market equity: For risk-free rates in the CAPM calculation, the report uses one-year government bond yields from FactSet. Industry asset betas and country-specific risk premia were obtained from the website of Professor Aswath Damodaran at the Stern School of Business, New York University, which is a widely used source in corporate finance and valuation.[124] This website reports industry asset betas that are calculated based on a large sample of listed firms and averaged globally.

Calculations for the required rate of return based on the CAPM necessitates a required equity risk premium, i.e. a forward-looking measure that indicates the level of risk inherent in an investment in equity over other types of investments. This measure is, however, not consistently available for all countries and years covered, nor is the same for all investors (Fernández, 2004[56]). Moreover, when the required premium consistently exceeds the observed equity risk premium, using the former would lead to the unsatisfactory result that only a few very profitable companies achieved investors' expected rate of return. Therefore, for data-availability reasons and in order to avoid the problem of setting a too demanding benchmark, this study uses the historical country- and year-specific equity risk premia obtained from the website of Professor Aswath Damodaran.

Estimation of missing credit ratings

In order to construct the benchmark interest rates used in the calculation of below-market borrowings (as explained in Section 2.2), companies' credit ratings are used to determine their corporate risk spread. In some cases, however, firms have no official credit ratings, such as when companies did not request a

[124] http://pages.stern.nyu.edu/~adamodar/

rating or when ratings are only obtainable for paying customers of rating agencies. In these instances, the OECD estimates the credit ratings itself based on financial data for those firms. For this, credit ratings are first converted into a numerical scale in order to fit them into a statistical model (e.g. AAA=1 and AA=2). In a second step, available (actual) ratings are regressed on several financial variables, including assets, equity ratio, and interest coverage, while controlling for the sector (with a dummy variable accounting for multi-product firms), the years, and across categories of government ownership.

In order to verify the quality of the results thus obtained, ratings are predicted for the whole sample using a sub-sample that includes 85% of the companies with credit ratings. The out-of-sample estimates are then compared to actual ratings. These comparisons indicate that estimated ratings appear to be precisely correct in more than 50% of the cases, one step above actual ratings in 20% of cases, and one step below in 20% of cases as well. To avoid 'punishing' companies for which ratings are estimated, all ratings estimates are artificially lifted by one step so that almost all companies in question are rated accurately or slightly better, thus making the resulting estimates conservative. These estimated ratings are then manually checked for other outliers before being fed into the dataset and used in the same way as other ratings.

Econometric analysis of government support and investment in fixed tangible assets

To measure the correlation between net investment in fixed tangible assets and government support, simple OLS regressions that control for other firm characteristics that may also affect investment were applied. There are not enough observations to directly add firm-level dummies so the analysis controls for sector and year characteristics by including corresponding dummy variables at this level. All standard errors are clustered by firm.

Net investment in fixed tangible assets (the dependent variable) is calculated as the yearly change in a company's property, plant and equipment (measured at book value) net of the current year's depreciation. Net investment is either expressed in levels (USD millions) – in which case the analysis controls for firm size by adding a variable for total assets on the right-hand side of the equation – or scaled relative to company assets.[125] In the latter case, all other level variables on the right-hand side of the equation are similarly scaled.

The main variables of interest are government grants and below-market borrowings (BMB), and the analysis includes either one of them or both at the same time to contrast their respective correlation to net investment.

A more traditional approach to such estimations would include a measure accounting for the effects of investment opportunities on investment behaviour by using Tobin's Q, calculated using the ratio between a company's stock-market capitalisation and its book value. This option is, however, not applicable here since many of the companies we cover are not publicly traded. Instead, the analysis uses revenue growth as a proxy for investment opportunities, which also helps account partly for the effects that capacity utilisation may have on investment. The analysis also controls for the positive impact that operating profits can have on investment by using EBITDA as a proxy for investment opportunities. Firms' average interest rates are sometimes added as a further control to ensure that the variable for below-market borrowings does not also reflect the effect of companies' broader cost of debt on their investment decisions.

[125] Using revenue instead to control for firm size does not affect the results.

The analysis therefore estimates the following equation (1):

$$inv_{ist} = \beta_0 + \beta_1 support_{ist} + \sum_j \partial^j X^j_{ist} + \gamma_s + \gamma_t + \varepsilon_{ist}$$

where inv_{ist} denotes net investment in fixed tangible assets for firm i in sector s and year t; $support_{ist}$ stands for the government support received by that same firm, which can either be in the form of grants or below-market borrowings (or both, included separately) depending on the specification; X^j_{ist} denotes a set of j control variables at the firm level (e.g. EBITDA and revenue growth); γ_s and γ_t are sector and year dummies, respectively; and ε_{ist} is an error term. Controls also include total firm assets in specifications in which level variables are not scaled by company assets.

In a second set of specifications, the $support_{ist}$ variables are replaced by a set of dummy variables that take the value of 1 (and 0 otherwise) if a firm-year's below-market borrowings as a percentage of its revenue fall: between 0% (the median) and 0.24% (the 75th percentile); between 0.24% and 1.83% (the 90th percentile); or is above 1.83%, respectively. For government grants, the corresponding thresholds are 0.05% (the median value), 0.38% (the 75th percentile), and 1.11% (the 90th percentile), respectively. This helps account for the fact that government support tends to be very unevenly distributed across the sample, with a few firms accounting for most of the support that could be identified.

Table A A.1. Statistical distribution of government support (% of revenue)

	Grants (% of revenue)	Below-market borrowings (% of revenue)
Mean	0.428	0.606
Median	0.046	0
p75	0.379	0.242
p90	1.114	1.827

Table A A.2. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Net investment	3,311	1,215	3,461	-112,951	38,162
Total assets	3,352	32,042	56,978	62	546,339
EBITDA	3,323	3,026	5,751	-22,541	80,274
Govt grants	2,629	33	79	0	795
BMB	3,340	43	252	0	6,318
Average int, rate	3,352	0.052	0.028	0.002	0.261

Table A A.3. Pairwise correlation table

	Net investment	Total assets	EBITDA	Govt grants	BMB	Average int, rate
Net investment	1					
Total assets	0.4471	1				
EBITDA	0.5193	0.8068	1			
Govt grants	0.1646	0.2661	0.1911	1		
BMB	0.1567	0.1141	0.0658	0.226	1	
Average int, rate	-0.0767	-0.1	-0.062	-0.0165	-0.0149	1

Econometric analysis of government support and productivity

The approach involves OLS regressions of three measures of firm productivity on different types of government support and other variables that control for observable firm characteristics. Again, a lack of observations prevents the direct addition of firm-level dummies but the analysis controls for sector and year characteristics by including corresponding dummy variables. All standard errors are clustered by firm.

Besides productivity, the variables used in the analysis are:

- Government grants (USD million).
- Below-market borrowings (USD million), which are similar to the results shown in Section 3 and Section 4.
- Annual revenue (USD million), which helps control for firm size.[126]
- Zombie, which takes the value of 1 (0 otherwise) if a company's interest expenses have exceeded its EBIT for three consecutive years. This definition is similar to that used in Adalet McGowan et al. (2017[37]).
- R&D spending (USD million), net of R&D-related government grants (which are counted in government grants).
- Government ownership, which takes the value of 1 if a firm has less than 10% government ownership, the value of 2 if ownership is 10% or more but less than 25%, the value of 3 if ownership is 25% or more but less than 50%, and the value of 4 if government ownership is 50% or more.

There are three different measures of productivity considered in this analysis, each of which relies in some way on economic value added (EVA), which is defined as the sum of EBITDA and labour costs (Gal, 2013[57]). Estimates of companies' capital stock are derived using the perpetual inventory method, but only considering fixed tangible assets (i.e. firms' property, plant, and equipment) since accounting rules are such that firms do not count or measure intangible assets in a consistent fashion. Firms' own average depreciation rates are used in the calculation.

The productivity measures considered here are as follows, in increasing order of complexity:

- *Labour productivity* is simply the ratio between economic value added (EVA) and staff numbers. This most basic productivity measure can serve as a baseline.
- *TFP residual* is what remains after deducting the contribution of the capital stock and of staff to firms' EVA. Cost shares for each production factor are taken from the firm sample (i.e. by dividing labour costs by EVA) and averaged by sector and year to account for industry specificities in capital intensity.
- *Wooldridge MFP* uses the methodology outlined in Andrews et al. (2016[58]) to estimate a measure of productivity that accounts for the endogeneity problem of input choices. The implementation uses the *prodest* estimation command in Stata with staff and the capital stock as the "free" and "state" inputs, respectively. Intermediate inputs are used as a proxy variable for productivity, where intermediate inputs are simply taken as the difference between firms' revenue and EVA. The production function is estimated separately for each sector but pooled across all firms in any given sector. MFP is then simply the difference between EVA and the contribution of each production factor, using the factor shares just

[126] Using firm assets instead does not change the results.

estimated in the production functions. We also correct for mark-ups, which are calculated as the ratio between the labour coefficient estimated earlier and the share of labour costs in EVA.[127]

The analysis therefore estimates the following equation (2) across the above three measures of firm productivity:

$$\omega_{ist} = \beta_0 + \beta_1 support_{ist} + \sum_j \partial^j X^j_{ist} + \gamma_s + \gamma_t + \varepsilon_{ist}$$

where ω_{ist} denotes a measure of productivity for firm i in sector s and year t; $support_{ist}$ stands for the government support received by that same firm, which can either be in the form of grants or below-market borrowings (or both) depending on the specification; X^j_{ist} denotes a set of j control variables at the firm level (e.g. R&D spending); γ_s and γ_t are sector and year dummies, respectively; and ε_{ist} is an error term.

In a second set of specifications, the $support_{ist}$ variables are replaced by a set of dummy variables that take the value of 1 (and 0 otherwise) if a firm-year's below-market borrowings as a percentage of its revenue fall: between 0% (the median) and 0.24% (the 75th percentile); between 0.24% and 1.83% (the 90th percentile); or is above 1.83%, respectively. For government grants, the corresponding thresholds are 0.05% (the median value), 0.38% (the 75th percentile), and 1.11% (the 90th percentile), respectively. This helps account for the fact that government support tends to be very unevenly distributed across the sample, with a few firms concentrating most for the support that could be identified.

While most firm-level studies use industry-year deflators to account for the effects of inflation on nominal variables (e.g. capital stock and value added), the analysis does not use any deflators and relies instead on year dummies to capture price changes that affect all firms in the same way (e.g. changes in oil prices). The reason is that the firms covered are large multinationals that operate in many different countries and are sometimes involved in different industries. For example, it is not obvious that using a US deflator (e.g. a producer price index) for the metals sector is appropriate in the case of a US aluminium firm that has smelters in Brazil, Iceland, and Spain, while also having bauxite mines in Guinea. Or that using a deflator for the US electronics industry accurately reflects price changes in the case of a California-based semiconductor firm that has most of its production done in Asia, especially since Moore's Law will massively skew deflators for the electronics and computer industry downward.[128] Given all this, introducing broader year dummies is likely a better approach when attempting to capture the effects of price changes.

Table A A.4. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Labour productivity (log)	2,232	-2.31800	0.85373	-7.926798	1.102923
TFP residual (log)	2,125	2.16220	1.32403	-1.889895	34.47458
Wooldridge MFP (log)	1,771	3.84816	2.49140	-1.897144	11.00856
BMB	3,674	42.07390	242.88230	0	6318.426
Govt grants	2,881	31.09016	76.80968	0	794.6728
Revenue	3,744	20124.78000	34104.21000	18.3238	282792.3
Zombie	3,763	0.03030	0.17142	0	1
R&D spending	3,169	972.03770	2026.41200	0	19057.86
Govt ownership	3,763	1.59979	1.02199	1	4

[127] A prediction of firm value added should ideally be used and estimated using a polynomial function of observable inputs (Andrews, Criscuolo and Gal, 2016[58]) but this was not possible at the time of writing. The analysis therefore uses actual value added.

[128] This is a very real concern as analysed in Houseman (2018[66]).

Table A A.5. Pairwise correlation table

	Labour productivity (log)	TFP residual (log)	Wooldridge MFP (log)	BMB	Govt grants	Revenue	Zombie	R&D spending	Govt ownership
Labour productivity (log)	1								
TFP residual (log)	0.1795	1							
Wooldridge MFP (log)	0.1611	-0.1058	1						
BMB	-0.1179	-0.1327	0.0824	1					
Govt grants	-0.0264	0.0096	0.2282	0.2336	1				
Revenue	0.1965	0.1299	0.4698	0.0672	0.2477	1			
Zombie	-0.2004	-0.0818	-0.0757	-0.0127	-0.0331	-0.0532	1		
R&D spending	0.2047	0.1723	0.4396	-0.0311	0.2409	0.8254	-0.0468	1	
Govt ownership	-0.1221	-0.058	-0.0295	0.232	0.2659	-0.0794	0.0237	-0.0974	1

Annex B. Econometric results

Table A B.1. Equation 1: Net investment in fixed tangible assets and government support (continuous variables)

	Net investment (log)	Net investment (log)	Net investment (log)	Net investment (log)		Net inv./assets	Net inv./assets	Net inv./assets	Net inv./assets
Total assets (log)	0.795***	0.752***	0.784***	0.783***					
	(0.049)	(0.045)	(0.049)	(0.049)					
Revenue growth	0.839***	0.867***	0.837***	0.848***	Revenue growth	0.090***	0.090***	0.088***	0.089***
	(0.149)	(0.138)	(0.148)	(0.151)		(0.013)	(0.012)	(0.013)	(0.013)
EBITDA (log)	0.089**	0.144***	0.105**	0.103**	EBITDA/assets	0.065*	0.081***	0.083**	0.080**
	(0.041)	(0.038)	(0.041)	(0.041)		(0.034)	(0.031)	(0.033)	(0.034)
Govt. grants (log)	0.029*		0.015	0.018	Govt grants/assets	0.4		0.161	0.204
	(0.015)		(0.016)	(0.016)		(0.316)		(0.252)	(0.248)
BMB (log)		0.046***	0.046***	0.043***	BMB/assets		1.286***	1.218***	1.156***
		(0.013)	(0.015)	(0.015)			(0.393)	(0.414)	(0.418)
Average int. rate				-1.453	Average int. rate				-0.148**
				(1.187)					(0.075)
Constant	-2.796***	-2.653***	-2.347***	-2.247***	Constant	-0.023***	0.035***	-0.022**	-0.014
	(0.338)	(0.309)	(0.288)	(0.301)		(0.008)	(0.006)	(0.009)	(0.012)
R-squared, adj.	0.702	0.713	0.709	0.709	R-squared, adj.	0.207	0.22	0.221	0.222
Observations	2099	2604	2095	2095	Observations	2396	3007	2392	2392

Note: * p<0.1, ** p<0.05, *** p<0.01. All regressions include sector and year dummies. Standard errors are clustered by firm and shown below each coefficient. BMB = below-market borrowings. These specifications include government grants and BMB as level, continuous variables.

Table A B.2. Equation 1: Net investment in fixed tangible assets and government support (dummy variables)

	Net investment (log)	Net investment (log)	Net investment (log)	Net investment (log)		Net inv./assets	Net inv./assets	Net inv./assets	Net inv./assets
Total assets (log)	0.757***	0.752***	0.744***	0.741***					
	(0.045)	(0.045)	(0.046)	(0.046)					
Revenue growth	0.878***	0.829***	0.835***	0.841***	Revenue growth	0.091***	0.089***	0.089***	0.089***
	(0.137)	(0.133)	(0.132)	(0.133)		(0.011)	(0.011)	(0.011)	(0.011)
EBITDA (log)	0.139***	0.165***	0.171***	0.172***	EBITDA/assets	0.073**	0.086***	0.090***	0.091***
	(0.038)	(0.039)	(0.039)	(0.039)		(0.031)	(0.030)	(0.030)	(0.030)
Grants_0	0.036		-0.003	0.002	Grants_0	0.006		0.004	0.004
	(0.089)		(0.087)	(0.087)		(0.005)		(0.005)	(0.005)
Grants_1	0.01		-0.055	-0.047	Grants_1	0.010**		0.005	0.005
	(0.081)		(0.081)	(0.081)		(0.005)		(0.005)	(0.005)
Grants_2	0.096		-0.033	-0.025	Grants_2	0.013**		0	0.001
	(0.093)		(0.089)	(0.089)		(0.006)		(0.006)	(0.006)
Grants_3	0.149*		0.097	0.101	Grants_3	0.012**		0.008	0.008
	(0.084)		(0.082)	(0.082)		(0.005)		(0.005)	(0.005)
BMB_0		-0.024	-0.022	-0.03	BMB_0		0	0	0
		(0.066)	(0.068)	(0.068)			(0.004)	(0.004)	(0.004)
BMB_1		0.052	0.062	0.055	BMB_1		0.007	0.007	0.007
		(0.070)	(0.071)	(0.070)			(0.005)	(0.005)	(0.005)
BMB_2		0.498***	0.510***	0.500***	BMB_2		0.044***	0.044***	0.044***
		(0.100)	(0.101)	(0.101)			(0.006)	(0.007)	(0.006)
Average int. rate				-0.913	Average int. rate				-0.062
				(0.964)					(0.068)
Constant	-2.374***	-2.454***	-2.449***	-2.377***	Constant	-0.028***	-0.022**	-0.024***	-0.021**
	(0.265)	(0.261)	(0.266)	(0.280)		(0.007)	(0.010)	(0.009)	(0.010)
R-squared, adj.	0.707	0.713	0.713	0.713	R-squared, adj.	0.209	0.232	0.233	0.233
Observations	2608	2608	2608	2608	Observations	3011	3011	3011	3011

Note: * p<0.1, ** p<0.05, *** p<0.01. All regressions include sector and year dummies. Standard errors are clustered by firm and shown below each coefficient. BMB = below-market borrowings. These specifications include government grants and BMB as dummy variables that vary depending on the proportion of support received as a share of firm revenue. See Annex A for more details.

Table A B.3. Equation 2: Government grants and firm productivity

	Labour productivity	Labour productivity	Labour productivity	TFP residual	TFP residual	TFP residual	Wooldridge MFP	Wooldridge MFP	Wooldridge MFP
Government grants (log)	-0.077***	-0.064***	-0.041**	-0.052***	-0.050***	-0.032**	-0.043	-0.049*	-0.044*
	(0.019)	(0.018)	(0.016)	(0.017)	(0.015)	(0.028)	(0.026)	(0.026)	(0.024)
Revenue (log)	0.194***	0.1	0.075	0.112***	-0.036	-0.057	0.365***	0.102	0.096
	(0.035)	(0.061)	(0.058)	(0.031)	(0.061)	(0.062)	(0.055)	(0.080)	(0.084)
Zombie dummy	-0.913***	-0.864***	-0.848***	-0.758***	-0.739***	-0.726***	-0.465*	-0.380**	-0.375**
	(0.189)	(0.166)	(0.143)	(0.212)	(0.209)	(0.198)	(0.278)	(0.154)	(0.152)
R&D spending (log)		0.104***	0.108***		0.128***	0.131***		0.236***	0.237***
		(0.040)	(0.040)		(0.038)	(0.038)		(0.040)	(0.041)
Govt ownership			-0.141***			-0.112***			-0.031
			(0.053)			(0.037)			(0.060)
Constant	-4.242***	-3.934***	-3.517***	2.218***	2.956***	3.306***	-2.397***	-1.516**	-1.420*
	(0.335)	(0.408)	(0.406)	(0.293)	(0.475)	(0.517)	(0.611)	(0.674)	(0.759)
R-squared	0.345	0.393	0.417	0.398	0.364	0.369	0.932	0.946	0.946
Observations	1761	1469	1469	1693	1417	1417	1449	1282	1282

Note: * p<0.1, ** p<0.05, *** p<0.01. All regressions include sector and year dummies. Standard errors are clustered by firm and shown below each coefficient.

Table A B.4. Equation 2: Below-market borrowings and firm productivity

	Labour productivity	Labour productivity	Labour productivity	TFP residual	TFP residual	TFP residual	Wooldridge MFP	Wooldridge MFP	Wooldridge MFP
Below-market borrowings (log)	-0.098***	-0.073***	-0.059***	-0.074***	-0.061***	-0.050***	-0.126***	-0.105***	-0.102***
	(0.020)	(0.023)	(0.021)	(0.016)	(0.020)	(0.018)	(0.022)	(0.021)	(0.021)
Revenue (log)	0.166***	0.133**	0.123**	0.095***	-0.031	-0.039	0.319***	0.068	0.064
	(0.031)	(0.053)	(0.052)	(0.027)	(0.053)	(0.053)	(0.043)	(0.061)	(0.063)
Zombie dummy	-0.927***	-0.764***	-0.760***	-0.656***	-0.602***	-0.599***	-0.299	-0.193	-0.189
	(0.191)	(0.176)	(0.156)	(0.183)	(0.194)	(0.183)	(0.229)	(0.145)	(0.143)
R&D spending (log)		0.051	0.053		0.104***	0.106***		0.225***	0.226***
		(0.035)	(0.035)		(0.033)	(0.034)		(0.034)	(0.034)
Govt ownership			-0.097**			-0.076**			-0.022
			(0.047)			(0.033)			(0.051)
Constant	-4.138***	-4.094***	-3.833***	2.357***	3.041***	3.239***	-1.290***	-0.128	-0.066
	(0.311)	(0.369)	(0.371)	(0.265)	(0.400)	(0.428)	(0.456)	(0.503)	(0.557)
R-squared	0.348	0.377	0.389	0.423	0.393	0.396	0.913	0.937	0.937
Observations	2215	1814	1814	2117	1736	1736	1763	1518	1518

Note: * p<0.1, ** p<0.05, *** p<0.01. All regressions include sector and year dummies. Standard errors are clustered by firm and shown below each coefficient.

Table A B.5. Equation 2: Grants, below-market borrowings, and firm productivity

	Labour productivity	Labour productivity	Labour productivity	TFP residual	TFP residual	TFP residual	Wooldridge MFP	Wooldridge MFP	Wooldridge MFP
Below-market borrowings (log)	-0.086***	-0.064**	-0.049**	-0.070***	-0.058***	-0.046**	-0.139***	-0.116***	-0.115***
	(0.022)	(0.025)	(0.023)	(0.018)	(0.022)	(0.021)	(0.025)	(0.023)	(0.023)
Government grants (log)	-0.055***	-0.050**	-0.033*	-0.033**	-0.038**	-0.025*	-0.017	-0.026	-0.024
	(0.018)	(0.019)	(0.018)	(0.015)	(0.015)	(0.015)	(0.026)	(0.024)	(0.024)
Revenue (log)	0.185***	0.103*	0.08	0.105***	-0.034	-0.053	0.345***	0.089	0.086
	(0.034)	(0.059)	(0.056)	(0.030)	(0.061)	(0.062)	(0.046)	(0.064)	(0.066)
Zombie dummy	-0.936***	-0.882***	-0.864***	-0.777***	-0.754***	-0.740***	-0.471*	-0.381***	-0.378***
	(0.187)	(0.172)	(0.151)	(0.208)	(0.210)	(0.201)	(0.258)	(0.146)	(0.145)
R&D spending (log)		0.093**	0.099**		0.119***	0.124***		0.222***	0.223***
		(0.039)	(0.039)		(0.039)	(0.039)		(0.037)	(0.037)
Govt ownership			-0.122**			-0.095***			-0.013
			(0.051)			(0.035)			(0.051)
Constant	-4.269***	-3.961***	-3.595***	2.238***	2.971***	3.262***	-1.338***	-0.437	-0.396
	(0.336)	(0.407)	(0.400)	(0.288)	(0.481)	(0.523)	(0.500)	(0.496)	(0.561)
R-squared	0.373	0.408	0.424	0.404	0.367	0.37	0.92	0.941	0.941
Observations	1746	1457	1457	1685	1410	1410	1415	1249	1249

Note: * p<0.1, ** p<0.05, *** p<0.01. All regressions include sector and year dummies. Standard errors are clustered by firm and shown below each coefficient.

Table A B.6. Equation 2: Grants, below-market borrowings, and firm productivity (dummy variables)

	Labour productivity	TFP residual	Wooldridge MFP
Revenue (log)	0.089*	-0.068	0.016
	(0.052)	(0.050)	(0.061)
R&D spending (log)	0.056*	0.105***	0.222***
	(0.033)	(0.032)	(0.032)
Grants_0	0.107	0.066	0.165
	(0.090)	(0.085)	(0.128)
Grants_1	-0.118	-0.072	0.082
	(0.104)	(0.096)	(0.125)
Grants_2	-0.156	-0.127	-0.055
	(0.114)	(0.094)	(0.140)
Grants_3	-0.085	-0.135	-0.162
	(0.094)	(0.087)	(0.135)
BMB_0	-0.061	-0.064	-0.197**
	(0.077)	(0.065)	(0.089)
BMB_1	-0.286***	-0.11	-0.495***
	(0.093)	(0.096)	(0.096)
BMB_2	-0.549***	-0.682***	-0.803***
	(0.140)	(0.203)	(0.117)
Zombie dummy	-0.751***	-0.578***	-0.166
	(0.168)	(0.194)	(0.144)
Constant	-3.641***	3.450***	0.249
	(0.375)	(0.413)	(0.498)
R-squared	0.398	0.403	0.942
Observations	1828	1743	1525

Note: * p<0.1, ** p<0.05, *** p<0.01. All regressions include sector and year dummies. Standard errors are clustered by firm and shown below each coefficient. BMB = below-market borrowings. These specifications include government grants and BMB as dummy variables that vary depending on the proportion of support received as a share of firm revenue. See Annex A for more details.

Annex C. List of firms in the sample

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Aerospace and Defence -- AERO	3030	AECC	Aero Engine Corporation of China; 中国航空发动机集团; 中国航发; 中國航空發動機集團	CHN
Aerospace and Defence -- AERO	3030	AVIC	Aviation Industry Corporation of China; 中国航空工业集团公司	CHN
Aerospace and Defence -- AERO	3030	Aero Vodochody	AERO Vodochody AEROSPACE a.s.; TULAREO a.s.	CZE
Aerospace and Defence -- AERO	3030	Airbus	Airbus SE; EADS; Airbus N.V.	NLD
Aerospace and Defence -- AERO	3030	BAE Systems	BAE Systems plc	GBR
Aerospace and Defence -- AERO	3030	Boeing	The Boeing Company	USA
Aerospace and Defence -- AERO	3030	Bombardier	Bombardier Aviation; Bombardier Inc.	CAN
Aerospace and Defence -- AERO	3030	COMAC	Commercial Aircraft Corporation of China, Ltd.; 中国商用飞机有限责任公司	CHN
Aerospace and Defence -- AERO	3030	Dassault Aviation	Dassault Aviation SA	FRA
Aerospace and Defence -- AERO	3030	Embraer	Empresa Brasileira de Aeronáutica; Embraer S.A.	BRA
Aerospace and Defence -- AERO	3030	GE	GE Aviation; General Electric Co.	USA
Aerospace and Defence -- AERO	3030	GKN	GKN Holdings plc; Guest, Keen and Nettlefolds	GBR
Aerospace and Defence -- AERO	3030	General Dynamics	General Dynamics Corp.	USA
Aerospace and Defence -- AERO	3030	Hanwha Aerospace	Hanwha Aerospace Co., Ltd.; Hanwha Techwin; 한화에어로스페이스; Samsung Techwin	KOR
Aerospace and Defence -- AERO	3030	Hindustan Aeronautics	Hindustan Aeronautics Limited; HAL; Hindustan Aircraft Limited	IND
Aerospace and Defence -- AERO	3030	Honeywell	Honeywell International Inc.	USA
Aerospace and Defence -- AERO	3030	KAI	Korea Aerospace Industries, Ltd.; 한국항공우주산업	KOR
Aerospace and Defence -- AERO	3030	Kawasaki HI	Kawasaki Heavy Industries, Ltd, 川崎重工業株式会社	JPN
Aerospace and Defence -- AERO	3030	L3 Technologies	L3 Technologies, Inc.; L3	USA
Aerospace and Defence -- AERO	3030	Leonardo	Leonardo S.p.a.; Finmeccanical; Leonardo Group	ITA
Aerospace and Defence -- AERO	3030	Lockheed-Martin	Lockheed-Martin Corportation	USA
Aerospace and Defence -- AERO	3030	Mitsubishi Heavy Ind	Mitsubishi Heavy Industries (MHI), Ltd.; 三菱重工業; Mitsubishi Jūkōgyō	JPN

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Aerospace and Defence -- AERO	3030	Northrop Grumman	Northrop Grumman Corporation	USA
Aerospace and Defence -- AERO	3030	Rolls Royce	Rolls-Royce Holdings plc	GBR
Aerospace and Defence -- AERO	3030	ST Engineering	Singapore Engineering Technologies Ltd.; Chartered Industries of Singapore	SGP
Aerospace and Defence -- AERO	3030	Safran	Safran SA	FRA
Aerospace and Defence -- AERO	3030	Sonaca	Sonaca S.A.; Société Nationale de Construction Aérospatiale	BEL
Aerospace and Defence -- AERO	3030	Textron	Textron Inc.	USA
Aerospace and Defence -- AERO	3030	Thales	Thales SA	FRA
Aerospace and Defence -- AERO	3030	UAC	United Aircraft Corporation; PJSC UAC; Объединённая авиастроительная корпорация ПАО; ОАК	RUS
Aerospace and Defence -- AERO	3030	United Technologies	United Technologies Corporation	USA
Aluminium -- ALUM	2420	AMAG	AMAG Austria Metall AG; AMAG-Gruppe; AMAG Group	AUT
Aluminium -- ALUM	2420	Alba	Aluminium Bahrain B.S.C	BHR
Aluminium -- ALUM	2420	Alcoa	Alcoa, Inc.	USA
Aluminium -- ALUM	2420	Aleris	Aleris Corporation	USA
Aluminium -- ALUM	2420	Aluar	Aluar Aluminio Argentino S.A.I.C.	ARG
Aluminium -- ALUM	2420	Century Aluminum	Century Aluminum Company	USA
Aluminium -- ALUM	2420	Chalco	Aluminum Corporation of China Limited; **中国**铝业股份有限公**司**	CHN
Aluminium -- ALUM	2420	China Hongqiao	China Hongqiao Group Ltd.; Shandong Weiqiao Aluminum & Power; **中国宏**桥集团有限公**司**	CHN
Aluminium -- ALUM	2420	China Zhongwang	China Zhongwang Holdings Ltd.	CHN
Aluminium -- ALUM	2420	Constellium	Constellium N.V.; Constellium SE	NLD
Aluminium -- ALUM	2420	East Hope	East Hope Management; 东方希望企业管理有限公**司**	CHN
Aluminium -- ALUM	2420	Gränges	Gränges AB	SWE
Aluminium -- ALUM	2420	Guangdong Xingfa	Guandong Xingfa Aluminium Co., Ltd.	CHN
Aluminium -- ALUM	2420	Henan Shenhuo	Henan Shen Huo Coal Industry and Electricity Power Co., Ltd.; **河南神火煤**电股份有限公**司**	CHN
Aluminium -- ALUM	2420	Hindalco	Hindalco Industries Ltd.	IND
Aluminium -- ALUM	2420	JISCO	Jiuquan Iron and Steel Co. Ltd.; Jiuquan Iron and Steel (Group) Co., Ltd. ; **酒泉**钢铁（集团）有限责任公司; **酒**钢集团	CHN
Aluminium -- ALUM	2420	Kaiser Aluminium	Kaiser Aluminium Corporation; KALU	USA

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Aluminium -- ALUM	2420	Maaden	Ma'aden; معادن	SAU
Aluminium -- ALUM	2420	Mingtai	Henan Mingtai Aluminium Industrial Co. Ltd, **河南明泰**铝业股份有限公**司**	CHN
Aluminium -- ALUM	2420	Mubadala	Mubadala Development Company PJSC; Mamoura Diversified Global Holding PJSC	ARE
Aluminium -- ALUM	2420	NALCO	National Aluminium Company Limited	IND
Aluminium -- ALUM	2420	Norsk Hydro	Hydro; Norsk Hydro ASA	NOR
Aluminium -- ALUM	2420	Press Metal	Press Metal Aluminium Holdings Berhad	MYS
Aluminium -- ALUM	2420	QPIG	Qinghai Provincial Investment Group, **青海省投**资集团有限公**司**	CHN
Aluminium -- ALUM	2420	Rio Tinto	Rio Tinto plc	GBR
Aluminium -- ALUM	2420	Rusal	UC Rusal; United Co. RUSAL Plc; РУСАЛ	RUS
Aluminium -- ALUM	2420	SPIC	State Power Investment Corporation; **国家**电力投资集团有限公司; **国家**电**投**	CHN
Aluminium -- ALUM	2420	Shandong Nanshan	**山**东南山铝业股份有限公**司**	CHN
Aluminium -- ALUM	2420	South32	South32 Limited	AUS
Aluminium -- ALUM	2420	Vedanta Resources	Vedanta Resources Ltd.	IND
Aluminium -- ALUM	2420	Vimetco	Vimetco N.V.	NLD
Aluminium -- ALUM	2420	Yunnan Aluminium	Yunnan Aluminium Co.	CHN
Automobile -- AUTO	2910	BAIC	BAIC Motor Corporation Limited; **北京汽車股份有限公司**; Beijing Automotive Industry Corp.	CHN
Automobile -- AUTO	2910	BMW	BMW Group; BMW AG; Bayerische Motoren Werke Aktiengesellschaft	DEU
Automobile -- AUTO	2910	Brilliance Auto	Brilliance China Automotive Holdings Limited; Huachen Automotive Group; **華晨汽車集團控股有限公司**	CHN
Automobile -- AUTO	2910	ChangAn B	Chongqing Changan Automobile Company Limited, **重**庆长安汽车股份有限公司, 长安汽车、长安 B	CHN
Automobile -- AUTO	2910	Daimler	Daimler AG	DEU
Automobile -- AUTO	2910	Dongfeng	Dongfeng Motor Group Co., Ltd.; 东风汽车集团股份有限公**司**	CHN
Automobile -- AUTO	2910	FCA	Fiat Chrysler Automobiles N.V.; FCA Group	USA
Automobile -- AUTO	2910	Ferrari	Ferrari N.V.	ITA
Automobile -- AUTO	2910	Ford	Ford Motor Company	USA
Automobile -- AUTO	2910	GAZ	GAZ Group; Группа ГАЗ; GAZ OAO	RUS
Automobile -- AUTO	2910	Geely	Geely Automobile Holdings Limited, **吉利汽**车控股有限公**司**	CHN

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Automobile -- AUTO	2910	General Motors	GM; General Motors Company	USA
Automobile -- AUTO	2910	Great Wall Motor	Great Wall Motor Company Limited; 長城汽車股份有限公司	CHN
Automobile -- AUTO	2910	Honda	Honda Motor Co., Ltd.; 本田技研工業株式会社; Honda Giken Kogyo Kabushiki Kaisha	JPN
Automobile -- AUTO	2910	Hyundai	Hyundai-Kia Motors; Hyundai Motor Company	KOR
Automobile -- AUTO	2910	Mazda	Mazda Motor Corporation; マツダ株式会社	JPN
Automobile -- AUTO	2910	Nissan	Nissan Motor Co. Ltd.日産自動車株式会社	JPN
Automobile -- AUTO	2910	PSA	Peugeot S.A.; PSA Groupe	FRA
Automobile -- AUTO	2910	Renault	Renault SA	FRA
Automobile -- AUTO	2910	SAIC	SAIC Motor Corporation Limited; 上海汽车集团股份有限公司; Shanghai Automotive Industry Corp.	CHN
Automobile -- AUTO	2910	Tata Motors	Tata Motors Group; Tata Motors Limited	IND
Automobile -- AUTO	2910	Toyota	Toyota Motor Corporation; トヨタ自動車株式会社; Toyota jidōsha kabushiki gaisha	JPN
Automobile -- AUTO	2910	VW	Volkswagen; Volkswagen Aktiengesellschaft	DEU
Automobile -- AUTO	2910	Yulon	Yulon Motor Co., Ltd.; Yulon Group; 裕隆汽車; Yue Loong	TWN
Cement -- CEMT	2394	Anhui	Anhui Conch Cement Company Limited, 安徽海螺水泥股份有限公司, 海螺水泥, ACC	CHN
Cement -- CEMT	2394	Arabian Cement	Arabian Cement Company S.A.E.; للاسمنت العربية الشركة	EGY
Cement -- CEMT	2394	Argos	Cementos Argos S.A.	COL
Cement -- CEMT	2394	Buzzi Unicem	Buzzi Unicem SpA	ITA
Cement -- CEMT	2394	CNBM	China National Building Material Company Limited	CHN
Cement -- CEMT	2394	CR Cement	China Resources Cement Holdings Limited, 華潤水泥控股有限公司	CHN
Cement -- CEMT	2394	CRH	Cement Roadstone Holdings (CRH plc)	IRL
Cement -- CEMT	2394	Cementir Holding	Cementir Holding N.V.; Cementir Holding SpA	ITA
Cement -- CEMT	2394	Cemex	Cemex, S.A.B. de C.V.; Cementos Mexicanos	MEX
Cement -- CEMT	2394	Cimsa	Çimsa; Çimsa Çimento Sanayi ve Ticaret A.Ş.	TUR
Cement -- CEMT	2394	Dangote	Dangote Cement Plc; Obajana Cement Plc	NGA
Cement -- CEMT	2394	Eurocement	АО ЕВРОЦЕМЕНТ ГРУП; Eurocement Group JSC	RUS
Cement -- CEMT	2394	HeidelbergCement	Heidelberg Cement	DEU

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Cement -- CEMT	2394	Holcim	Holcim Ltd.	CHE
Cement -- CEMT	2394	InterCement	InterCement Participações S.A.; ICP Group; Cimpor	BRA
Cement -- CEMT	2394	Jidong Cement	Tangshan Jidong Cement Co., Ltd.; 唐山冀东水泥股份有限公司	CHN
Cement -- CEMT	2394	Lafarge	Lafarge S.A.	FRA
Cement -- CEMT	2394	LafargeHolcim	LafargeHolcim Ltd.	CHE
Cement -- CEMT	2394	PT Semen	PT Semen Indonesia (Persero) Tbk	IDN
Cement -- CEMT	2394	Qatar National Cement	Qatar National Cement Company Q.P.S.C.; للأسمنت قطر	QAT
Cement -- CEMT	2394	SCG	Siam Cement Public Company Limited; Siam Cement Group	THA
Cement -- CEMT	2394	Saudi Cement	Saudi Cement Company SJSC (SCC); السعودية الإسمنت	SAU
Cement -- CEMT	2394	Shanshui	China Shanshui Cement Group Limited, SUNNSY, 中國山水水泥集團有限公司	CHN
Cement -- CEMT	2394	Taiheiyo	Taiheiyo Cement Corporation	JPN
Cement -- CEMT	2394	Taiwan Cement	Taiwan Cement Corporation; TCC	TWN
Cement -- CEMT	2394	Tianrui	China Tianrui Group Cement Co. Ltd, 中国天瑞集团水泥有限公司	CHN
Cement -- CEMT	2394	Titan Cement	Titan Cement Group; Τσιμέντα TITAN	GRC
Cement -- CEMT	2394	UltraTech Cement	UltraTech Cement Ltd	IND
Cement -- CEMT	2394	VICAT	Groupe Vicat; Vicat S.A.	FRA
Cement -- CEMT	2394	Votorantim	Votorantim Cimentos S.A.; VCSA	BRA
Cement -- CEMT	2394	Xinjiang QSCC	Xinjiang Qingsong Building Materials and Chemicals(group) Co, Ltd., QSCC, 新疆青松建材化工(集团)股份有限公司, 青松建化	CHN
Cement -- CEMT	2394	Xinjiang TSC	Xinjiang Tianshan Cement Company, TSC, 新疆天山水泥股份有限公司, 天山股份	CHN
Chemicals -- CHEM	20	3M	3M Company	USA
Chemicals -- CHEM	20	Acron	Akron PAO; Акрон	RUS
Chemicals -- CHEM	20	Air Liquide	Air Liquide SA	FRA
Chemicals -- CHEM	20	Air Products	Air Products & Chemicals, Inc.	USA
Chemicals -- CHEM	20	Arkema	Arkema SA	FRA
Chemicals -- CHEM	20	BASF	BASF SE; Badische Anilin- & Soda-Fabrik	DEU
Chemicals -- CHEM	20	Bayer	Bayer AG; Bayer Group	DEU

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Chemicals -- CHEM	20	Borealis	Borealis AG	AUT
Chemicals -- CHEM	20	Braskem	Braskem S.A.	BRA
Chemicals -- CHEM	20	Celanese	Celanese Corporation	USA
Chemicals -- CHEM	20	Chandra Asri	PT Chandra Asri Petrochemical Tbk	IDN
Chemicals -- CHEM	20	ChemChina	China National Chemical Corporation Limited; 中国化工集团公司; 中國化工集團公司	CHN
Chemicals -- CHEM	20	Chemours	The Chemours Company	USA
Chemicals -- CHEM	20	Clariant	Clariant AG	CHE
Chemicals -- CHEM	20	Dalian Rubber&Plastics	Dalian Rubber & Plastics Machinery Co., Ltd.; 大连橡胶塑料机械股份有限公司	CHN
Chemicals -- CHEM	20	Dow	The Dow Chemical Company	USA
Chemicals -- CHEM	20	DowDuPont	DowDuPont Inc.	USA
Chemicals -- CHEM	20	DuPont	E.I. Du Pont de Nemours and Company	USA
Chemicals -- CHEM	20	Eastman	Eastman Chemical Company	USA
Chemicals -- CHEM	20	Evonik	Evonik Industries	DEU
Chemicals -- CHEM	20	Formosa Plastics	Formosa Plastics Corporations, 台灣塑膠工業股份有限公司	TWN
Chemicals -- CHEM	20	Huntsman	Huntsman Corporation	USA
Chemicals -- CHEM	20	ICL	Israel Chemicals Ltd.; ICL Group Ltd.; מ"בע לישראל כימיקלים	ISR
Chemicals -- CHEM	20	Indorama	Indorama Ventures; IVL; อินโดรามา เวนเจอร์ส	THA
Chemicals -- CHEM	20	Ineos	Ineos Group Holdings S.A.	GBR
Chemicals -- CHEM	20	Kemira	Kemira Oyj	FIN
Chemicals -- CHEM	20	LG Chem	LG Chem, Ltd.; LG화학	KOR
Chemicals -- CHEM	20	Lotte Chemical	LOTTE Chemical Corporation; 롯데케미칼; Honam Petrochemical Corp.	KOR
Chemicals -- CHEM	20	LyondellBasell	LyondellBasell Industries N.V.	NLD
Chemicals -- CHEM	20	Mitsubishi Chem	Mitsubishi Chemical Holdings, MCHC, 三菱ケミカル	JPN
Chemicals -- CHEM	20	Mitsui Chem	Mitsui Chemicals, Inc., 三井化学株式会社	JPN
Chemicals -- CHEM	20	Orbia	Mexichem; Koura; Mexichem, S.A.B. de C.V.	MEX
Chemicals -- CHEM	20	PIC KSC	Petrochemical Industries Company K.S.C.; البترولية الكيماويات صناعة شركة (ك م ش)	KWT

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Chemicals -- CHEM	20	PTT Global Chemical	PTT Global Chemical Public Company Limited; GC; บริษัท พีทีที โกลบอล เคมิคอล จำกัด	THA
Chemicals -- CHEM	20	Petronas Chem	Petronas Chemicals Group Berhad, PCG	MYS
Chemicals -- CHEM	20	PotashCorp	Potash Corporation of Saskatchewan	CAN
Chemicals -- CHEM	20	QAPCO	Qatar Petrochemical Company (QAPCO) Q.P.J.S.C.; قطر شركة للبتروكيماويات (قابكو) ش.خ.م.ق.	QAT
Chemicals -- CHEM	20	Reliance	Reliance Industries Limited	IND
Chemicals -- CHEM	20	SABIC	Saudi Basic Industries Corporation; سابك	SAU
Chemicals -- CHEM	20	SASOL	Sasol Limited	ZAF
Chemicals -- CHEM	20	SH Huayi	Shanghai Huayi (Group) company, **上海**华谊(**集**团)**公司**	CHN
Chemicals -- CHEM	20	SIBUR	PJSC SIBUR Holding; СИБУР	RUS
Chemicals -- CHEM	20	Shin Etsu	Shin-Etsu Chemical Co., Ltd. **信越化学工業株式会社**	JPN
Chemicals -- CHEM	20	Sinochem	Sinochem International Corporation **中化国**际（控股）股份有限公司 (see notes)	CHN
Chemicals -- CHEM	20	Solvay	Solvay SA	BEL
Chemicals -- CHEM	20	Sumitomo Chem	Sumitomo Chemical Company, Limited, **住友化学株式会社**	JPN
Chemicals -- CHEM	20	Synthos	Synthos S.A.	POL
Chemicals -- CHEM	20	Tongkun Group	Tongkun Group Co Ltd; **桐昆集**团股份有限公**司**	CHN
Chemicals -- CHEM	20	Toray	Toray Industries	JPN
Chemicals -- CHEM	20	Wanhua	Wanhua Chemicals; **万**华化学集团股份有限公**司**	CHN
Chemicals -- CHEM	20	Xinjiang Zhongtai	Xinjiang Zhongtai Chemical co.,LTD, **新疆中泰化学股份有限公司, 中泰化学**	CHN
Chemicals -- CHEM	20	Yara	Yara International ASA	NOR
Chemicals -- CHEM	20	Yunnan Yuntianhua	**云南云天化股份有限公司**	CHN
Glass and Ceramics -- GLAS	2310	AGC	Asahi Glass Co., Ltd.; AGC**株式会社**	JPN
Glass and Ceramics -- GLAS	2310	Apogee	Apogee Enterprises, Inc.; Viracon	USA
Glass and Ceramics -- GLAS	2310	Arnold Glas	Arnold Zentralverwaltungsgesellschaft mbH; Glaswerke Arnold; Arnold Glas Unternehmensgruppe	DEU
Glass and Ceramics -- GLAS	2310	CSG	CSG Holding Co., Ltd., **中国南玻集**团股份有限公司, **南玻集**团 (formerly China Southern Glass Holding Limited)	CHN
Glass and Ceramics -- GLAS	2310	CeramTec	CeramTec TopCo GmbH; Faenza Germany GmbH	DEU
Glass and Ceramics -- GLAS	2310	China Glass	China Glass Holdings Limited, CNG,	CHN

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Glass and Ceramics -- GLAS	2310	Corning	Corning Incorporated; Corning Glass Works	USA
Glass and Ceramics -- GLAS	2310	Fuyao	Fuyao Glass Industry Group Co. Ltd., 福耀玻璃工業集團股份有限公司, FYG,	CHN
Glass and Ceramics -- GLAS	2310	Kyocera	Kyocera Corporation; 京セラ株式会社; Kyōsera Kabushiki-gaisha; Kyoto Ceramic Co., Ltd.	JPN
Glass and Ceramics -- GLAS	2310	Luoyang	Luoyang Glass Company Limited, 洛陽玻璃股份有限公司, LYG	CHN
Glass and Ceramics -- GLAS	2310	Morgan	Morgan Advanced Materials plc; The Morgan Crucible Company plc	GBR
Glass and Ceramics -- GLAS	2310	NSG	NSG Group; Nippon Sheet Glass Co., Ltd.; 日本板硝子株式会社; Nihon Ita-Garasu Kabushiki-gaisha	JPN
Glass and Ceramics -- GLAS	2310	RHI	RHI AG	AUT
Glass and Ceramics -- GLAS	2310	RHI Magnesita	RHI Magnesita N.V.	AUT
Glass and Ceramics -- GLAS	2310	Saint Gobain	Compagnie de Saint-Gobain SA	FRA
Glass and Ceramics -- GLAS	2310	Sisecam	Şişecam Group; Türkiye Şişe ve Cam Fabrikaları A.Ş.	TUR
Glass and Ceramics -- GLAS	2310	Vitro	Vitro, S.A.B. de C.V.	MEX
Rolling stock -- TRAN	3020	Alstom	Alstom SA	FRA
Rolling stock -- TRAN	3020	Bombardier	Bombardier Transportation; Bombardier Inc.	CAN
Rolling stock -- TRAN	3020	CAF	Construcciones y Auxiliar de Ferrocarriles, S.A.	ESP
Rolling stock -- TRAN	3020	CRRC	CRRC Corporation Limited; 中国中车股份有限公司; 中国中车	CHN
Rolling stock -- TRAN	3020	CRSC	China Railway Signal & Communication Corporation Limited, 中國鐵路通信信號股份有限公司, 中國通號	CHN
Rolling stock -- TRAN	3020	CSR	CSR Corporation Limited; 中國南車股份有限公司	CHN
Rolling stock -- TRAN	3020	GE	GE Transportation; General Electric Co.	USA
Rolling stock -- TRAN	3020	Greenbrier	The Greenbrier Companies, Inc.; GBX	USA
Rolling stock -- TRAN	3020	HD Rotem	Hyundai Rotem Co.	KOR
Rolling stock -- TRAN	3020	Kawasaki HI	Kawasaki Heavy Industries, Ltd, 川崎重工業株式会社	JPN
Rolling stock -- TRAN	3020	NEWAG	NEWAG S.A.; Grupa Kapitałowa NEWAG	POL
Rolling stock -- TRAN	3020	Nippon Sharyo	Nippon Sharyo, Ltd, 日本車輛製造株式会社	JPN
Rolling stock -- TRAN	3020	Siemens	Siemens AG	DEU
Rolling stock -- TRAN	3020	Stadler	Stadler Rail	CHE
Rolling stock -- TRAN	3020	Talgo	Talgo SA	ESP

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Rolling stock -- TRAN	3020	Tatravagonka	Tatravagónka Poprad; TATRAVAGÓNKA a.s.	SVK
Rolling stock -- TRAN	3020	Thales	Thales SA	FRA
Rolling stock -- TRAN	3020	Transmashholding	CJSC Transmashholding; TMH; АО Трансмашхолдинг (TMX)	RUS
Rolling stock -- TRAN	3020	Trinity	Trinity Industries, Inc.	USA
Rolling stock -- TRAN	3020	Vossloh	Vossloh AG	DEU
Rolling stock -- TRAN	3020	Wabtec	Wabtec Corporation; Westinghouse Air Brake Technologies Corp.	USA
Semiconductors -- SEMI	2610	AMD	Advanced Micro Devices, Inc.	USA
Semiconductors -- SEMI	2610	ARM	ARM Holdings plc.	GBR
Semiconductors -- SEMI	2610	ASE	ASE Technology Holding	TWN
Semiconductors -- SEMI	2610	Amkor	Amkor Technology, Inc.	USA
Semiconductors -- SEMI	2610	Analog Devices	Analog Devices, Inc., ADI	USA
Semiconductors -- SEMI	2610	Broadcom	Broadcom Inc.	USA
Semiconductors -- SEMI	2610	Hua Hong	Hua Hong Semiconductor Ltd.; 華虹半導體有限公司	CHN
Semiconductors -- SEMI	2610	Infineon	Infineon Technologies AG	DEU
Semiconductors -- SEMI	2610	Intel	Intel Corp.	USA
Semiconductors -- SEMI	2610	JCET	Jiangsu Changjiang Electronics Technology Co., Ltd., 江苏长电科技股份有限公司, 长电科技	CHN
Semiconductors -- SEMI	2610	MediaTek	MediaTek Inc, 联发科技股份有限公司	TWN
Semiconductors -- SEMI	2610	Micron	Micron Technology, Inc.	USA
Semiconductors -- SEMI	2610	NXP	NXP Semiconductors N.V.	NLD
Semiconductors -- SEMI	2610	Nvidia	NVIDIA Corporation	USA
Semiconductors -- SEMI	2610	Powerchip	Powerchip Technology Corporation, PTC, 力晶科技股份有限公司	TWN
Semiconductors -- SEMI	2610	Qorvo	Qorvo, Inc.	USA
Semiconductors -- SEMI	2610	Qualcomm	Qualcomm Incorporated	USA
Semiconductors -- SEMI	2610	Renesas	Renesas Electronics Corporation	JPN
Semiconductors -- SEMI	2610	SK Hynix	SK Hynix Inc.; SK하이닉스	KOR
Semiconductors -- SEMI	2610	SMIC	Semiconductor Manufacturing International Corporation	CHN

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Semiconductors -- SEMI	2610	STMicro	STMicroelectronics N.V.	CHE
Semiconductors -- SEMI	2610	Samsung Electronics	Samsung Electronics Co., Ltd.	KOR
Semiconductors -- SEMI	2610	Sony	Sony Kabushiki Kaisha, Sony Corporation	JPN
Semiconductors -- SEMI	2610	TSMC	Taiwan Semiconductor Manufacturing Company Limited; 台灣積體電路製造股份有限公司	TWN
Semiconductors -- SEMI	2610	Texas Instruments	Texas Instruments Incorporated	USA
Semiconductors -- SEMI	2610	TowerJazz	Tower Semiconductor Ltd.	ISR
Semiconductors -- SEMI	2610	Tsinghua Unigroup	Tsinghua Unigroup Co. Ltd; 紫光集团有限公司	CHN
Semiconductors -- SEMI	2610	VIS	Vanguard International Semiconductor Corporation; 世界先進積體電路股份有限公司	TWN
Semiconductors -- SEMI	2610	Western Digital	Western Digital Corporation	USA
Shipbuilding -- SHIP	3011	CSIC	China Shipbuilding Industry Corporation; 中国船舶重工集团有限公司	CHN
Shipbuilding -- SHIP	3011	CSSC	China State Shipbuilding Corporation; 中国船舶工业集团有限公司	CHN
Shipbuilding -- SHIP	3011	DSME	Daewoo Shipbuilding & Marine Engineering Co., Ltd.; 대우조선해양, 大宇造船海洋	KOR
Shipbuilding -- SHIP	3011	Fincantieri	Fincantieri SpA; Società Finanziaria Cantieri Navali	ITA
Shipbuilding -- SHIP	3011	Fujian SB	Fujian Shipbuilding Industry Group Company Limited, 福建省船舶工业集团有限公司	CHN
Shipbuilding -- SHIP	3011	Hyundai Heavy Industries	Hyundai Heavy industries Co., Ltd.; 현대중공업; Korea Shipbuilding & Offshore Engineering Co., Ltd.; KSOE	KOR
Shipbuilding -- SHIP	3011	JFE Holdings	JFE Holdings, Inc.; JFE Group; JFEホールディングス; Universal Shipbuilding Corporation	JPN
Shipbuilding -- SHIP	3011	Kawasaki HI	Kawasaki Heavy Industries, Ltd, 川崎重工業株式会社	JPN
Shipbuilding -- SHIP	3011	Meyer Werft	MEYER WERFT GmbH & Co. KG	DEU
Shipbuilding -- SHIP	3011	Mitsubishi Heavy Ind	Mitsubishi Heavy Industries (MHI), Ltd.; 三菱重工業; Mitsubishi Jūkōgyō	JPN
Shipbuilding -- SHIP	3011	Mitsui E&S	Mitsui E&S Holdings Co., Ltd., 株式会社三井E&Sホールディングス (formerly Mitsui Engineering & Shipbuilding Co., Ltd., 三井造船株式会社)	JPN
Shipbuilding -- SHIP	3011	Namura	Namura Shipbuilding Co. Ltd, 株式会社名村造船所	JPN
Shipbuilding -- SHIP	3011	STX	STX Offshore & Shipbuilding	KOR
Shipbuilding -- SHIP	3011	Samsung Heavy Industries	Samsung Heavy Industries Co., Ltd.; SHI; 삼성중공업	KOR
Shipbuilding -- SHIP	3011	Yangzijiang	Yangzijiang Shipbuilding (Holdings) Ltd.; 揚子江船業（控股）有限公司	CHN
Solar photovoltaic panels -- SOLA	2710	Canadian Solar	Canadian Solar Inc.	CAN
Solar photovoltaic panels -- SOLA	2710	First Solar	First Solar, Inc.	USA

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Solar photovoltaic panels -- SOLA	2710	Hanwha Group	Hanwha Corp.; 한화그룹	KOR
Solar photovoltaic panels -- SOLA	2710	Hanwha Q Cells	Hanwha Q CELLS Co., Ltd.; Q-Cells SE	KOR
Solar photovoltaic panels -- SOLA	2710	Hanwha SolarOne	Hanwha SolarOne Co., Ltd.; Solarfun Power Holdings Co., Ltd.; SolarOne Qidong	CHN
Solar photovoltaic panels -- SOLA	2710	JA Solar	JA Solar, 晶澳太阳能; JA Solar Technology Co. Ltd., 晶澳太阳能科技股份有限公司, 晶澳科技 (2019); JingAo Solar Co. Ltd., 晶澳太阳能有限公司, 晶澳太阳能 (2017-2018); JA Solar Holdings Co. Ltd. 晶澳太阳能控股有限公司 JASO (2017-)	CHN
Solar photovoltaic panels -- SOLA	2710	JinkoSolar	JinkoSolar Holding Co., Ltd.	CHN
Solar photovoltaic panels -- SOLA	2710	LONGi	LONGi Green Energy Technology Co., Ltd., LONGi, 隆基绿能科技股份有限公司, 隆基股份, Formerly Xi'an LONGi Silicon Materials Corp	CHN
Solar photovoltaic panels -- SOLA	2710	Risen	RISEN ENERGY CO.,LTD., 东方日升新能源股份有限公司, 东方日升	CHN
Solar photovoltaic panels -- SOLA	2710	SunPower	SunPower Corporation	USA
Solar photovoltaic panels -- SOLA	2710	Trina	Trina Solar Co., Ltd., 天合光能股份有限公司	CHN
Steel -- STEE	2410	Ansteel Group	Anshan Iron and Steel Group Corporation; Angang Group; 鞍山钢铁集团公司	CHN
Steel -- STEE	2410	ArcelorMittal	ArcelorMittal S.A.	LUX
Steel -- STEE	2410	China Baowu Steel	中国宝武钢铁集团有限公司; 中國寶武鋼鉄集團有限公司	CHN
Steel -- STEE	2410	EVRAZ	EVRAZ plc; Евраз	GBR
Steel -- STEE	2410	Gerdau	Gerdau S.A.	BRA
Steel -- STEE	2410	HBIS	Hesteel Group Company Limited; Hegang; Hebei Iron and Steel Group Co., Ltd.; 河钢集团有限公司; 河鋼集團有限公司 (formerly: 河北钢铁集团有限公司)	CHN
Steel -- STEE	2410	Hyundai Steel	Hyundai Steel Co., Ltd.; 현대제철	KOR
Steel -- STEE	2410	JFE Steel	JFE Holdings, Inc.; JFE Group; JFEホールディングス	JPN
Steel -- STEE	2410	JSW Steel	JSW Steel Limited	IND
Steel -- STEE	2410	MMK	PJSC Magnitogorsk Iron and Steel Works; ПАО Магнитогорский металлургический комбинат	RUS
Steel -- STEE	2410	NLMK	OJSC Novolipetsk Steel; NLMK Group; ОАО Новолипецкий металлургический комбинат	RUS
Steel -- STEE	2410	Nippon Steel	Nippon Steel Corporation; 日本製鉄株式会社; NSSMC; Nippon Steel & Sumitomo Metal Corporation	JPN
Steel -- STEE	2410	Nucor	Nucor Corporation	USA
Steel -- STEE	2410	POSCO	Pohang Iron and Steel Co., Ltd.; 주식회사 포스코	KOR

Industrial activity	ISIC Rev. 4	Firm name	Other firm names	Home economy
Steel -- STEE	2410	SAIL	Steel Authority of India Limited; Hindustan Steel Limited; भारतीय इस्पात प्राधिकरण	IND
Steel -- STEE	2410	Shagang Group	江苏沙钢集团有限公司; 江蘇沙鋼集團有限公司; Jiangsu Shagang Group Co., Ltd.	CHN
Steel -- STEE	2410	Shandong Steel Group	Shandong Iron and Steel Group Co Ltd; 山东钢铁集团	CHN
Steel -- STEE	2410	Shougang Group	首钢集团有限公司	CHN
Steel -- STEE	2410	Tata Steel	Tata Steel Limited	IND
Steel -- STEE	2410	Ternium	Ternium S.A.	ARG
Steel -- STEE	2410	US Steel	United States Steel Corporation	USA
Telecommunications network equipment -- TELC	2630	Ciena	Ciena Corporation	USA
Telecommunications network equipment -- TELC	2630	Cisco	Cisco Systems, Inc.	USA
Telecommunications network equipment -- TELC	2630	Ericsson	Telefonaktiebolaget LM Ericsson	SWE
Telecommunications network equipment -- TELC	2630	Fujitsu	Fujitsu Limited, 富士通株式会社	JPN
Telecommunications network equipment -- TELC	2630	Huawei	Huawei Investment & Holding Co. Ltd. (2019-2011), Huawei Technologies Co., Ltd (2010-2006)	CHN
Telecommunications network equipment -- TELC	2630	Juniper	Juniper Networks, Inc.	USA
Telecommunications network equipment -- TELC	2630	NEC	NEC corporation, 日本電気株式会社	JPN
Telecommunications network equipment -- TELC	2630	Nokia	Nokia Corporation; Nokia Oyj	FIN
Telecommunications network equipment -- TELC	2630	ZTE	Zhongxing Telecommunication Equipment Company Limited; 中兴通讯股份有限公司	CHN
Wind turbines -- WIND	2811	Envision	Envision Energy International Ltd.; 远见能源国际有限公司	CHN
Wind turbines -- WIND	2811	GE	GE Renewable Energy; General Electric Co.	USA
Wind turbines -- WIND	2811	Goldwind	Xinjiang Goldwind Science & Technology Co. Ltd., 金风科技, 新疆金风科技股份有限公司	CHN
Wind turbines -- WIND	2811	Mingyang	Mingyang Smart Energy Group Co., Ltd., 明阳智慧能源集团股份公司	CHN
Wind turbines -- WIND	2811	Nordex Acciona	Nordex SE	DEU
Wind turbines -- WIND	2811	Senvion	Senvion S.A.; Senvion S.à r.l.; REpower Systems	DEU
Wind turbines -- WIND	2811	Siemens Gamesa	Siemens Gamesa Renewable Energy S.A.; Gamesa Corporación Tecnológica S.A.	ESP
Wind turbines -- WIND	2811	Suzlon	Suzlon Energy Ltd.	IND
Wind turbines -- WIND	2811	UEE Holding	Enercon GmbH, Enercon	DEU
Wind turbines -- WIND	2811	Vestas	Vestas Wind Systems AS	DNK
Wind turbines -- WIND	2811	XEMC	Xiangtan Electric Manufacturing Co.Ltd., 湘潭电机股份有限公司, 湘电股份	CHN

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