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WHO BENEFITS FROM THE EXPORT-IMPORT BANK AID?

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ABSTRACT

We study the effectiveness of government aid to exporters by exploring an exogenous shock that affected the ability of the Export-Import Bank of the United States (EXIM) to provide aid to U.S. exporters through loan guarantees to importers. We focus on Boeing, the largest individual recipient of aid. We find that Boeing sales declined only modestly – despite Boeing's significant reliance on EXIM for export credit. Moreover, we find that this decline is driven by financially constrained airlines or by airlines operating in countries with underdeveloped financial systems. We show that airlines in developed countries were easily able to substitute EXIM guaranteed loans for private credit and thus could still purchase Boeing aircraft despite the EXIM shock. Our results are consistent with the view that government-sponsored export credit is mostly relevant for importers in countries with underdeveloped financial systems, which represent a relatively small share of total EXIM aid.

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1 Introduction

We study the effectiveness of industrial policy in boosting exports. Industrial policy, or government aid directed toward exporters, has long been used as a tool to increase employment or sectoral output. However, it has also been criticized as wasteful and inefficient. In this paper, we explore an exogenous shock that prevented the U.S. government from supporting exporters and use it to evaluate the effectiveness of industrial policy.

We examine a shock to the ability of the Export-Import Bank of the United States (EXIM) to conduct industrial policy by providing aid to U.S. exporters. Between June 2015 and June 2019, the bank lacked the minimum quorum of directors required by its statutory charter and was therefore unable to grant loan guarantees exceeding $10 million. Consequently, EXIM's total aid fell from $19 billion in 2014 to just $4 billion in 2016. The type of aid that was most affected was loan guarantees, which is the largest EXIM program. In this program, EXIM guarantees a loan originated by a financial institution to a foreign importer that wishes to purchase goods or services from a U.S. firm. These loan guarantees lower the cost of obtaining credit for these foreign importers. We focus our analysis on the largest EXIM recipient of aid: Boeing. Before 2014, aid to Boeing represented 35% of total aid and 68% of all loan guarantees. Because the cost of a single Boeing aircraft exceeds $10 million, the drying up of EXIM financing for Boeing provides a sharp case study to evaluate the role that export credit agencies such as EXIM play in facilitating international trade.

Airlines rely on credit to purchase aircraft. The shock to EXIM's ability to offer loan guarantees thus increased importers' cost of purchasing Boeing aircraft. Because other aircraft manufacturers – primarily Airbus – were not affected by the EXIM quorum lapse, this shock increased the relative cost of Boeing aircraft. The increase in the relative cost of its products should have led to declining sales of Boeing aircraft and a falling market share.

We begin our analysis by studying at airline-level demand for Boeing aircraft. We compare airlines that operated at least one Boeing aircraft with airlines that did not operate Boeing aircraft. Because airlines that do not operate Boeing aircraft are unlikely to have been affected by the increase in the price of Boeing aircraft, they are a good control group.[1] We find that, for treated airlines, there is decline in the number of Boeing deliveries.

In the absence of a loan guarantee, airlines in countries with underdeveloped financial systems likely faced a significant increase in the relative cost of Boeing aircraft since access to credit in these countries is limited. In contrast, airlines in countries with developed financial systems should have been relatively unaffected by the end of the loan guarantee program since they could have found other sources of funding. We find that, for airlines in countries with a developed financial system, the number of Boeing aircraft delivered to treated airlines did not decline. In contrast, treated airlines in countries with an underdeveloped financial system experienced a large drop in the number of Boeing aircraft: in 2016, the number of Boeing aircraft delivered to these airlines declined by 47% (which represents a decline of around five aircraft relative to an average fleet size of nine aircraft in 2015). Therefore, as a consequence of the increase in the cost of credit, airlines in countries with an underdeveloped financial system or high sovereign risk purchased fewer Boeing aircraft. Moreover, these effects are immediate and persistent. We also explore heterogeneity in airlines' dependence on credit by comparing airlines based on their liquidity ratio, defined as the share

[1] As shown in Benmelech and Bergman (2008) and Benmelech and Bergman (2011), because of economies of scale in fleet operation, airlines tend to limit the number of aircraft types that they operate in order to reduce costs associated with pilot training, maintenance, and spare parts. Airlines that have chosen not purchase Boeing aircraft before 2015 have likely done so in order to avoid these costs.

of cash in total assets. We find that treated airlines with a high liquidity ratio did not experience a decline in the number of Boeing aircraft they purchased. In contrast, treated airlines with a low liquidity ratio saw a sharp decline in the number of Boeing aircraft they purchased.

We next turn to aircraft-level data to explain the evolution of Boeing's share of deliveries. Between 2015 and 2018, Boeing's share of deliveries declined by 2 percentage points from 44% to 42%. This decline is relatively small, particularly given that EXIM funding accounts for 12% of total Boeing sales. We split airlines into two groups: airlines that had at least one Boeing aircraft in their fleet in 2015 represent the treated airlines, and airlines that did not rely on Boeing aircraft represent the control airlines. We find that the likelihood that a delivered aircraft is produced by Boeing did not decline following 2015 for treated firms. However, treated airlines in countries with underdeveloped financial systems experienced a sharp decline in the likelihood of purchasing Boeing aircraft: the likelihood of purchasing Boeing aircraft declined by 38 percentage points between 2015 and 2016 for treated firms in this group, which represents a two-thirds decline relative to 2015. In contrast, treated airlines in countries with a developed financial system experienced no change in the likelihood of purchasing Boeing aircraft, which is consistent with the hypothesis that these airlines were able to find alternative sources of funding. We also find that treated airlines with a low liquidity ratio experienced a large fall in the likelihood of purchasing Boeing aircraft, whereas treated airlines with a high liquidity ratio did not.

Our regression results imply that the Boeing share in total aircraft deliveries should have declined by 2.9 percentage points between 2015 and 2019 as a result of the EXIM shock. In the data, we find that the unconditional Boeing share of deliveries declined by 2.7 percentage points, indicating that our empirical model accurately predicts the decline in deliveries we observe in the data. This decline is quite small – it is almost half of the standard deviation of changes in Boeing's share of deliveries between 2006 and 2014.

Our results suggest that airlines substituted EXIM funding for other sources of funding to purchase aircraft. To test this conjecture directly, we use a dataset with information on all aircraft transactions and the type of funding involved. We compare the probability that a Boeing aircraft transaction is privately funded (i.e., not funded by EXIM) when compared with transactions involving other aircraft. We find that during the EXIM quorum lapse, the probability that a Boeing aircraft was purchased using private credit increases by 13 percentage points when compared with transactions involving aircraft by other manufacturers. This increased probability is not driven by a decline in transactions involving Boeing aircraft – between 2014 and 2018, the number of transactions involving Boeing aircraft increased by 14%. Instead, the increase in the probability that a Boeing aircraft was purchased using private external credit is driven entirely by airlines that had previously received EXIM aid to purchase Boeing aircraft. The increase in the probability that a Boeing aircraft was purchased using private external credit is also more pronounced for wealthier countries and for countries with a high level of financial development. This suggests that the ease with which airlines were able to substitute the EXIM loan guarantees with external private funds is an important determinant of the impact of the EXIM shock on airline behavior. Airlines that could easily obtain external private funds did not find it necessary to decrease their purchase of Boeing aircraft, whereas airlines with a greater difficulty of obtaining external private funds responded by decreasing their purchase of Boeing aircraft.

Our findings are consistent with a view that EXIM subsidizes airlines in low-income countries with less developed financial systems. In countries where access to private credit is limited, airlines reduced their demand for Boeing aircraft in response to the end of the loan guarantee program. However, in countries with abundance of private credit, airlines did not change their behavior and still purchased Boeing aircraft. Moreover, even with the EXIM shock, Boeing sales did not observe a sharp decline since airlines in devel-

oped countries were able to find alternative sources of funding. Thus, it seems that – at least when it comes to supporting sales of Boeing aircraft – the EXIM bank guarantees program was subsidizing financially constrained airlines in countries where access to credit is limited.

Our paper is silent on whether the level of government aid to Boeing is efficient or optimal. Instead, our results suggest that skewing aid toward importers in developed countries is inefficient because these importers do not require U.S. government aid to purchase U.S. goods. Instead, our findings suggest that EXIM aid, and industrial policy in general, should target importers with tight financial constraints: those with difficulties in accessing credit markets, or high costs of credit.

The rest of the paper is organized as follows. In Section 2 we provide institutional details on export credit agencies as well as on the EXIM shock. We outline the data in Section 3. In Section 4 we explore the impact of the shock on airlines, and in Section 5 we explore the impact of the shock on Boeing deliveries. In Section 6 we study the substitutability of EXIM funds by private funds. Section 7 concludes.

1.1 Related Literature

Our paper contributes to a literature that studies the effectiveness of industrial policy. Harrison and Rodríguez-Clare (2010) argue that the use of industrial policy, and export credit in particular, may have limited effects in such large countries as the United States, while the effects may be larger in smaller countries. Similarly, Bartelme et al. (2019) argue that, for large open economies (such as the United States), the effectiveness of industrial policy may be small. We contribute to this literature in two ways. First, we study the effectiveness of industrial policy directly by exploiting an exogenous shock to EXIM's ability to provide aid to exporters. Second, our analysis allows us to study the efficiency of the allocation of export credit, rather than the level of export credit. Most of the literature assumes that, conditional on a given level of government support to exports, aid is allocated efficiently.[2] Our paper adds to the literature by showing that aid is inefficiently allocated because it is skewed toward developed countries.

We also contribute to the literature on the intersection of international trade and finance. In this literature, Manova (2013) shows that financial frictions represent a substantial drag on trade, acting both through the intensive margin (volume of exports) and the extensive margin (entry and exit decisions). In similar work, Chaney (2016) shows that the presence of these credit frictions may make currency appreciations better from the perspective of exporters, as it increases the value of their assets, thus alleviating credit constraints. Using data on Japanese banks and firms, Amiti and Weinstein (2011) find that bank health has important and economically significant effects on exports. Caggese and Cuñat (2013) find that financial constraints also reduce productivity gains that are induced by trade liberalizations through distortions in the extensive margin. During the Great Recession, which also saw a drop in world trade of around 12 percent, Chor and Manova (2012) argue that the tightening of credit conditions were an important channel through which the financial crisis affect credit volumes (and similar results can be found in Ahn et al. 2011). Comparing domestic activity and exporting activity, Minetti and Zhu (2011) find that exporting activity is far more sensitive to credit rationing, particularly in industries that rely heavily on external finance. Schmidt-Eisenlohr (2013), Antràs and Foley (2015) and Niepmann and Schmidt-Eisenlohr (2017) conduct a thorough analysis of the role of trade finance in the organization of exporting firms. In recent work, Monteiro and Moreira (2023) show that in response to an increase in the cost of credit affecting only some destinations,

[2]To be precise, most of the literature has sidestepped this issue by assuming that importers are not different in their potential dependence on export credit. That assumption implies that export credit is allocated efficiently across importers (for a particular exporter).

exporters reduce their exports to the affected countries and also skew their product mix towards products with a lower dependence on credit.

However, there has been little focus on the effect of credit constraints on importers. One exception is Muûls (2015), who studies the role of credit constraints in both exporting and importing behavior using a sample of Belgian manufacturing firms. She finds that firms with tighter financial constraints import less. Moreover, firms with lower credit ratings also import less. Our results confirm this hypothesis, as we can think of the lack of quorum as a tightening of financial constraints for constrained firms. Our contribution to this literature is twofold. First, we leverage a quasi-experimental source of variation. Second, we focus on a particular sector where the importers do not export. This lack of exporting behavior means that our analysis is not affected by the type of feedback loops between exports and imports, as present in network models of trade (Caliendo and Parro, 2015; Baqaee and Farhi, 2021).

Our paper is also related to a literature focusing on the role of export credit agencies in facilitating international trade. Using firm-level data from Austria, Badinger and Url (2013) document that the use of public export credit is concentrated among firms with higher risk. They also show that firms that are a part of a foreign multinational enterprise are less likely to use public export credit. Using Korean data, Choi and Kim (2021) show that short-term credit insurance helps mitigate the financial constraints of exporting firms and is more effective when the destination country is a developing country. In related work, Egger and Url (2006), Moser et al. (2008), and Felbermayr and Yalcin (2013) argue that public export credit help promote international trade. Using U.S. data, Agarwal and Wang (2018) argue that the effectiveness of EXIM aid is small and most aid is directed at large firms. Similarly, James (2011) argues that EXIM aid can be viewed as a subsidy to large firms, rather than supporting smaller firms that face tighter financial constraints. The paper closest to ours is Kurban (2021), who uses the quorum lapse in the EXIM board to estimate the effectiveness of aid in facilitating U.S. exports using sectoral-level export data. He argues that EXIM aid is valuable in relaxing financial constraints but that the allocation of aid across sectors and firms is not optimal.

Our paper contributes to this literature in three ways. First, we use an exogenous shock to investigate whether public export credit is valuable in facilitating exports. We argue that it is valuable only in facilitating exports to countries where access to credit is poor. Second, by focusing on a single (large) exporter, we can directly study how individual importers react to the increase in the cost of credit. Third, we can evaluate the elasticity of substitution between private credit and public export credit. We find that this elasticity is high for importers in countries where credit is cheaper.

2 The Export-Import Bank and Boeing

2.1 Role of the U.S. Export-Import Bank

The Export-Import Bank of the United States is the official export credit agency of the U.S. government. Its goal is to support the creation and maintenance of jobs in the United States by facilitating the exports of U.S. goods and services. Similar to other export credit agencies (ECAs) around the world, EXIM attempts to fill the void when private lenders are unable or unwilling to provide export financing. Between 2000 and 2019, EXIM provided U.S. exporters with $212 billion in aid.

EXIM offers four main programs: (i) loan guarantees for foreign buyers of U.S. exports; (ii) insurance for U.S. exporters against buyer nonpayment; (iii) working capital loan guarantees for exporters; and (iv) direct

loans to foreign buyers. Loan guarantees are the largest program, representing 47% of total aid between 2007 and 2021. In this program, EXIM guarantees financing to foreign buyers for purchases of U.S. capital goods and services who, in turn, obtain a loan from a commercial bank, typically a U.S. bank. Although the terms of these loans may vary, they typically have a maturity of up to 10 years and a guaranteed amount of up to 85% of the export cost. The insurance program, which represents 25% of all aid, aims to protect U.S. exporters' accounts receivable. Under this program, EXIM provides insurance against the importer's default risk by covering up to 95% of sales invoices. This allows U.S. exporters to offer trade credit to their trade partners while being insured against counterparty risk. Direct loans represent 18% of total aid. In this program, EXIM provides direct fixed-rate financing to importers seeking to purchase U.S. goods or services (up to 12 years in general and up to 18 years for renewable energy projects). The smallest program is the working capital program, which represents 11% of EXIM aid. In this program, EXIM provides a 90% loan-backing guarantee to U.S. exporters.

The Export-Import Bank of the United States is one of many ECAs around the world. According to the OECD, every member country has at least one ECA, with the goal of supporting that country's exporting sector and increasing its competitiveness. For example, in 2014, Germany provided over $14 billion in export credit.[3]

Proponents of ECAs argue that by providing loans or loan guarantees to foreign importers they effectively lower the cost of exports for their country's firms – by lowering the cost of export credit. According to this view, ECAs increase the comparative advantage of exporting firms, which results in higher exports. Moreover, one of the main challenges exporters face is the long time lag between production and the receipt of payment from an importer. By offering working capital loans at lower rates, ECAs are able to lower the marginal costs of exporting firms. Finally, the insurance program protects exporters against buyer default – enabling exporters to hedge counterparty risk.

The main argument in favor of ECAs is that they help fill a void caused by either market failures or market inefficiencies. For example, some macro-prudential regulations, such as Basel II and III, impose reserves requirements that result in a higher cost of funding exports in non-OECD countries. ECAs are particularly important in facilitating exports to emerging countries. Direct loans or loan guarantees from an ECA in a developed country are likely to lower the cost of trade for an importer in an emerging country with limited access to credit markets. Moreover, counterparty risk is likely to be higher for exports to emerging countries due to weaker contractual enforcement. An ECA can mitigate such risks, limiting the exposure of local exporters to the risk of nonpayment and facilitating export.

ECAs have also been widely criticized. The main critique is that ECAs take excessive, and unnecessary, risks and require large budgets to fund their operations. There is also a public debate concerning the gains from the provision of trade credit. In the United States, 11% of EXIM aid involves loan guarantees to JPMorgan Chase. And critics of ECAs argue that commercial banks such as JPMorgan Chase should be able to finance exports and hedge risk without government support. Similarly, critics of EXIM argue that it has become the "Boeing Bank" since Boeing has been a beneficiary of more than a third of EXIM aid. It has also been argued that ECAs, and foreign aid in general, have political goals rather than economic ones. For example, EXIM is expressively forbidden from providing aid to "Marxist-Leninist" countries.[4] In fact, EXIM has a special program, the China and Transformational Exports Program, whose only goal is to aid U.S. exporters facing competition from Chinese exporters. China has also been widely criticized for using

[3] We present the amount of aid for each ECA in Figure A1.

[4] This prohibition is laid out in EXIM's charter, in Section 2(b)(2).

its foreign aid and export credit agency as a mechanism to establish political links with other emerging countries, particularly in Africa.

ECAs, particularly in the OECD, have also been criticized for providing aid mostly to exporters who are selling to either developed or high-income emerging countries. For example, in 2014, 51% of total aid was given to exporters selling to either OECD or non-OECD high-income countries. In this same year, only 12% of aid went to low- and middle-to-low-income countries.[5][6]Moreover, most of the aid given by ECAs is given to large firms. For example, in 2014, only 22% of EXIM aid was directed at small or medium enterprises. Large firms have, in general, greater ease at obtaining working capital loans at favorable rates and should be able to hedge against counterparty risk themselves – but they receive almost 80% of total aid.[7]

Critics of ECAs have argued that they effectively subsidize large firms at the cost of smaller firms, even within the same country. There are then two main criticisms of ECAs. The first is related to the allocation of support across domestic firms or sectors (large vs. small firms, productive vs. unproductive sectors). The second is related to the allocation of aid across importers, conditional on a particular sector or product. In this paper, we focus on the second problem.

At its heart, this type of aid to exports is an example of protectionism. In this case, however, rather than imposing tariffs on imports, countries are subsidizing exports, and from a current account perspective, these policies have similar outcomes.[8] Export aid is also an example of industrial policy as countries use aid to lower the relative price of their exports in the world market. However, the effectiveness of this policy in fostering growth is limited, as argued in Harrison and Rodríguez-Clare (2010), and exists only for relatively small countries.[9] In related work, Bartelme et al. (2019) argue that industrial policy in general (which includes export aid) may have minimal gains even for fully open economies such as the United States. Export aid is also often used as a means of controlling employment in certain sectors, as highlighted by Mueller (2022) for China. However, it can also lead to misallocation in factors of production (e.g. excess employment in certain sectors to the detriment of others), thus distorting relative domestic prices as well.

2.2 Shock of 2015 to 2019

Established in 1934, EXIM, the official U.S. export credit agency, provides financing and insurance to facilitate U.S. goods and services exports to support U.S. jobs, per a renewable general statutory charter (Export-Import Bank Act of 1945, as amended; 12 U.S.C. § 635). The bank is chartered as a government corporation by the U.S. Congress for a specified period of time. For example, the current charter of EXIM, which was passed by Congress in December 2019, specifies that the authorization expires on December 31, 2026. EXIM was chartered for a three-year term in 2012, which was extended in September 2014 through June 30, 2015. However, due to political differences between the Republican-controlled Congress and President Barack Obama, congressional authorization for EXIM lapsed on July 1, 2015. As a result, EXIM was unable to provide any new aid between July and December 2015.

[5]We present a decomposition of aid by all OECD ECAs by the income of the destination in Figure A2.

[6]In the period between 2007 and 2015, 8% of total EXIM aid supporting the purchasing of Boeing aircraft went to Ireland and another 8% went to China. Over 9% of this aid was given to the United Arab Emirates. In contrast, 3% of aid went to Ethiopia.

[7]One exception is the working capital program of EXIM aid, where 73% of aid in 2014 is given to small and medium enterprises. However, this program represents only 11% of total aid.

[8]One possible advantage of export aid versus import tariffs has to do with targeting. With tariffs on imports, governments effectively subsidize all domestic firms. With export credit, governments provide aid only to the most productive domestic firms, which are the ones that participate in the export market.

[9]In fact, Harrison and Rodríguez-Clare (2010) argue that export credit is only an important tool if domestic markets are small enough.

According to its charter, EXIM can authorize long-term financing support for transactions above $10 million only if it has approval from a quorum of three members of its board. EXIM's board consists of five members: the President of the Bank, the First Vice-President, and three additional directors. These members are presidentially appointed and Senate-confirmed. In 2014, the board had four members – but in July 2015, the terms of two members expired – leaving EXIM without the required quorum to authorize transactions over $10 million. President Obama nominated a new director in January 2016, but the Senate did not move to confirm the nomination. The quorum lapse lasted until July 2019, when three new board members were confirmed by the Senate and EXIM regained its full capacity to provide aid to U.S. exporters.

This quorum lapse led to a sharp decline in both the number of aid projects and the value of aid EXIM was able to provide. In Figure 1, we plot the evolution of the value of aid granted by EXIM by program type.[10] As the figure illustrates, starting in 2016, there was a sharp decline in total aid given by EXIM that continued until 2019. EXIM activity did not return to its pre-2015 levels after its 2019 reauthorization mostly due to the Covid-19 pandemic. Before 2015, the loan guarantees program was EXIM's largest in dollar value. For example, in 2014, loan guarantees represented 56% of all aid given (and only 4% of the number of projects undertaken) by EXIM in that year. The EXIM quorum lapse from 2015 until 2019 affected in particular EXIM's loan guarantees. In 2016, loan guarantees accounted for less than 3% of total aid, which increased to 4% in 2017 and 7% in 2018. In 2019, the share of loan guarantees decreased again and represented only 3% of total aid. The reason for the collapse in EXIM loan guarantees is that the program typically guarantees relatively large loans. During the years 2007 to 2014, the average loan guarantee was $53 million, whereas the average insurance project was only $2 million. In contrast, the average loan size in the direct loan program was $107 million in the same time period.

2.3 Boeing and EXIM

Up until 2014, Boeing was the largest recipient of aid from EXIM. In particular, between 2007 and 2014, Boeing received around $64 billion in aid, representing 35% of all aid granted by EXIM in that period. Most of this aid to Boeing was given under the loan guarantee program, where Boeing accounted for 68% of all aid under this program. Naturally, the EXIM quorum lapse posed a significant financial shock to Boeing, which resulted in a substantial cut in the aid it received from EXIM. Figure 2 plots the total amount of aid given to Boeing and to other exporters by EXIM.

In 2016 and 2018, Boeing received no aid from EXIM. In 2017, it received aid for four projects, with a total value of $19 million, which represented 0.7% of total aid given by EXIM in that year. According to EXIM, its aid helps to fill gaps in private-sector financing for exports and helps U.S. firms compete against foreign ECA-backed firms. In particular, ECAs step in when an importer is either credit constrained or facing a high cost of obtaining credit. By providing a loan guarantee, EXIM reduces the risk of the loan and allows importers to pay lower interest rates. Since the purchase of new aircraft is often financed with debt, EXIM financing effectively lowers the cost of a Boeing aircraft. In that sense, EXIM's quorum lapse represented a shock to the cost of credit for some airlines, which, in turn, could have been translated into an increase in the relative price of Boeing aircraft.

[10] In Figure A3, we present the same evolution for the number of EXIM transactions.

3 Data

In our empirical analysis we use four main datasets, which we describe below.

3.1 EXIM Transaction-Level Data

EXIM provides detailed data on all authorizations approved between October 1, 2006, and June 30, 2022. The data include information on type of aid, the U.S. recipient of aid (the exporter), the foreign recipient of aid (the importer), and the financial institution involved. The dataset also includes the industry of the exporter, as well as the state and city where the firm is headquartered. In addition, EXIM provides information on the identity of the importer and its country, the value of the aid, and the decision date.[11] For example, as we show in Table I, in June 2015, EXIM provided a loan guarantee to the South African airline Comair in the total value of $80 million, and the loan was provided by the South African bank Needbank. In March 2011, EXIM provided KLM with a loan guarantee relative to a loan obtained from two different banks in the total value of $376 million.

The EXIM dataset contains information on 45,310 transactions between 2007 and 2021. In our analysis, we focus on the period between 2012 and 2018, for which there are 22,902 transactions in the dataset, of which 938 are loan guarantees.[12]

3.2 Aircraft Deliveries and Orders

The main dataset we use in the analysis is the Ascend CASE database, which contains ownership and operating information on the stock of all commercial aircraft worldwide. For every aircraft in operation in August 2020, we can identify the aircraft model (and therefore its manufacturer), the airline that currently operates the aircraft (as well as its country), and the original operator of the aircraft. We can also identify the delivery date of the aircraft. Using the Ascend CASE dataset, we focus on the original operator and delivery date as the relevant information. We restrict the data to commercial passenger aircraft and to observations where we can identify the country of the original operator. To match the the Ascend CASE dataset to the EXIM data we focus on aircraft deliveries from 2006 to 2020. This process results in 18,678 aircraft deliveries.

3.3 Airline and Country Data

We supplement our fleet dataset with country-level data, which we obtain from the Centre for Research and Expertise on the World Economy (CEPII), which is an institution that provides data on a variety on economic variables at the country level.[13] We also use firm-level information on airlines from Compustat and Compustat Global. We match each airline in the Ascend CASE dataset to Compustat and Compustat Global. Out of the 781 airlines in the Ascend CASE dataset we are able to match 103 airlines. These airlines tend to be larger and represent 53% of all aircraft deliveries during our period of study.

[11] The EXIM data is available at https://data.exim.gov/dataset/Authorizations-From-10-01-2006-Thru-9-30-2021/vbhv-d8am.

[12] In the appendix we present more statistics on these transactions. In Figure A3 we decompose the number of transactions by program.

[13] There are some aircraft for which we cannot identify the country of the operator. We exclude these observations, which account for around 5% of the total number of observations.

3.4 Aircraft Financing data

We also use the Deal Tracker dataset from *Airfinance Journal*. This dataset contains information on all aircraft deals, including the identity of the buyer and the seller, as well as information on the aircraft and its financing. In particular, we observe whether the aircraft was financed by a bank, a bond, equity, or received aid from an ECA such as EXIM. The dataset covers about 15,000 transactions starting in 1997. We focus on transactions of aircraft involving commercial airlines.

There are several options to finance the purchase of an aircraft, as illustrated in Figure 3. The most common financing form is an operating lease, which represents 69% of total transactions. Commercial loans from financial institutions are also common and represent around 17% of all transactions. Export credit, which includes EXIM aid, is also an important source of financing for airlines and represents 9% of all transactions. Tax leases represent 2%, as does debt issuance.

As Figure 3 shows, there is a significant increase in the number of transactions following 2012, with operating leases accounting for the majority of transactions. Export credit is also an important source of financing, and it declines after 2014 due to the EXIM quorum lapse.

4 Effect of the EXIM Quorum Lapse on Boeing

In this section, we estimate the impact of the lack of a quorum on the EXIM board on Boeing by focusing on the impact on aircraft deliveries. Before 2015, EXIM provided loan guarantees to airlines buying Boeing aircraft. These loan guarantees arguably led to lower loan rates for airlines, which in turn led to a decline in the relative price of Boeing aircraft. Once EXIM was unable to provide airlines with these loan guarantees, the relative price of Boeing aircraft increased, which in turn should have led to a decline in Boeing's aircraft sales. Indeed, our estimates suggest that whereas in 2015, the probability that a newly delivered aircraft was produced by Boeing was 0.44, by 2018, this probability declined to 0.42.[14] This decline in Boeing's market share seems small given that Boeing's revenues from commercial aircraft in 2014 were $60 billion – out of which $7 billion, or 12%, of commercial aircraft revenue was financed with EXIM loan guarantees. A potential explanation for this discrepancy may be that EXIM's guarantees are not indispensable – at least not for airlines that have access to private credit markets. An EXIM loan guarantee is likely to have a larger effect on the cost of credit of airlines with limited access to credit markets. In contrast, obtaining a loan guarantee may have a smaller effect on the cost of credit of airlines with access to credit – and therefore is less likely to have a significant effect on the relative price of Boeing aircraft.

To explore this heterogeneity across airlines, we begin by comparing airlines based on the country in which they operate. We consider two country-level measures of financial development. First, we follow Rajan and Zingales (1998) and compute the capitalization-to-GDP ratio in 2014 as a measure of financial development. Capitalization is the sum of total domestic credit to the private sector and the total market capitalization of publicly traded firms. A high capitalization ratio suggests that the country's financial system is sufficiently developed and therefore credit is available and priced competitively, and as a result, the effect of the EXIM quorum lapse should be smaller. Our second measure of credit availability is Moody's sovereign risk rating in 2014. We split countries into two groups: low-risk countries (with ratings above or equal to Baa3) and high-risk countries (with ratings below Baa3). The intuition is that airlines operating in high-risk countries likely face higher costs of credit overall and hence have a higher dependency on EXIM

[14] To compute this probability, we divide the number of delivered Boeing aircraft by the total number of delivered aircraft. We also present the time series of the unconditional Boeing share in Figure A4.

financing. Moreover, there is some evidence that firms are unlikely to have a higher credit rating than the sovereign rating of the country in which they operate (Chen et al. 2016, Almeida et al. 2017, and Drago and Gallo 2017).

Figure 4 graphs the distribution of airlines that operate Boeing aircraft across two country characteristics: market capitalization and sovereign risk. We define countries as having high market capitalization if their capitalization-to-GDP ratio is above the median, and low if their capitalization-to-GDP ratio is below the median. Similarly, countries are defined as low and high sovereign risk based on their Moody's sovereign credit risk rating. Each circle in the figure is an airline, and the size of the circle reflects the number of Boeing aircraft delivered to the airline in that year. We report a two-way frequency of aircraft deliveries for 2014 (Panel A) and 2018 (Panel B).

As Panel A demonstrates, 26% of Boeing deliveries are directed to airlines in countries with low market capitalization or high sovereign risk.[15] In particular, 8% of Boeing aircraft were delivered to countries with high sovereign risk in 2014. By 2018, deliveries to countries with high sovereign risk declined to 4% of total deliveries. In 2014, 20% of all deliveries were to countries with low market capitalization; by 2018, that number had declined to 14%. As Figure 4 shows, the decline in Boeing deliveries seems to be concentrated in countries with either low market capitalization or high sovereign risk rating. Moreover, by comparing the size of the circles (which represent the size of the airline fleet), Figure 4 shows that airlines in countries with either low market capitalization or high sovereign risk reduce the size of their Boeing aircraft deliveries.

In Figure 5 we plot the distribution of the quantity of Boeing aircraft in all transactions financed by EXIM across market capitalization and sovereign risk, using all transactions until 2014. Each circle in Figure 5 represents a country, and the size of the circle represents the number of aircraft financed by EXIM. As with Figure 4, we find that EXIM aid is directed largely toward airlines in countries with high market capitalization and low sovereign risk. In fact, out of all aircraft financed by EXIM between 2012 and 2014, only 11% are purchased by airlines in countries with a high sovereign risk, and only 18% are purchased by airlines in countries with low market capitalization. The distribution of EXIM aid is very similar to the distribution of all Boeing aircraft sold. This fact is in line with one of the most common criticisms of ECAs – namely, that they do not focus their aid on countries where access to credit is poorer.

4.1 Effect on airlines

We begin by focusing on the impact on the number of Boeing deliveries. To do so, we aggregate our aircraft data at the airline-year level to obtain a balanced panel of 529 airlines between 2013 and 2018.[16] As a starting point, we compare airlines that had at least one Boeing aircraft in their fleet in 2015 (which we term the treated airlines) with those airlines that did not have Boeing aircraft in their fleet in 2015 (the control airlines). Since airlines tend to operate aircraft produced by a single manufacturer, as shown in Benmelech and Bergman (2008) and Benmelech and Bergman (2011), airlines that do not operate Boeing aircraft in 2015 should be unaffected by the EXIM quorum lapse. For these airlines, the shock should not affect the likelihood of purchasing Boeing aircraft. In contrast, for treated airlines, the shock reduces the airlines'

[15] We add the shares for countries with low market capitalization and low sovereign risk (18%), of countries with low market capitalization and high sovereign risk (2%), and of countries with high sovereign risk and high market capitalization (6%).

[16] We stop in the year 2018 in order to avoid the impact of the 737-Max shock – which represents a decline in the demand for Boeing aircraft. This decline naturally impacts airlines that rely more on Boeing aircraft, and so it represents a confounder in our empirical strategy.

demand for Boeing aircraft. We estimate the following event study regression

$$\log\left(1+\text{Boeing deliveries}_{it}\right) = \lambda_t + \alpha_i + \sum_{m=-3, m\neq -1}^{2} \delta_m \times \mathbf{1}\left\{m = t - 2016\right\} \times \mathbf{1}\left\{i \in \text{Treated}\right\} + \beta X_{it} + \theta W_{\text{country},t} + \varepsilon_{it}, \quad (1)$$

where the outcome variable is logarithm of one plus the number of Boeing deliveries to airline i in year t.[17] We include time fixed effects, airline fixed effects, and a vector of country controls, including the logarithm of GDP, the logarithm of population, and the level of GDP per capita. The inclusion of airline fixed effects is crucial because it allows us to capture the permanent airline characteristics that led airlines to focus on Boeing versus other manufacturers (e.g., European airlines are more likely to want to purchase Airbus aircraft). In our main specification, the only airline control we include is the logarithm of the fleet size. In additional specifications, we also include the logarithm of total assets, the ratio of cash flows to sales, leverage, liquidity (defined as the share of cash in total assets), and the share of collateral (defined as the share of PPE in total assets).[18] The coefficients of interest are δ_m which capture the effect of the lack of quorum m periods after 2016. We cluster standard errors at the airline level and present the results of estimating equation (1) in Figure 6.

In all specifications, we observe a decline in the number of Boeing aircraft deliveries following the end of the loan guarantee program. In fact, the coefficients after 2015 are effectively identical and do not seem to depend on the inclusion of airline controls. Therefore, we focus on the specification that includes only the logarithm of fleet size as our preferred specification in order to maintain a sufficiently large sample and to ensure that there are no pre-trends. We find that, in 2016, there is a decline of 20% in the number of Boeing deliveries to treated airlines (which corresponds to a decline of two aircraft relative to the 2015 average of 11 Boeing aircraft deliveries). The effect seems to be smaller in absolute value in the latter part of the sample, as the coefficient in 2018 represents a decline of only 19% relative to 2015. This finding suggests that, over time, airlines were able to find alternatives to EXIM funding and therefore the demand for Boeing aircraft slightly recovered.

In Figure A5, we also show that there is no decline in the number of Airbus deliveries in this period. We also show that Airbus deliveries increased for airlines in both low capitalization high capitalization countries – suggesting that the effect was not driven by a secular decline in the demand for aircraft.

4.1.1 The role of access to credit markets

We have found that airlines that rely on Boeing aircraft experience a decline in their demand for Boeing aircraft in response to the EXIM quorum lapse. However, this decline should not be homogeneous across airlines. Airlines with access to credit should be able to find alternatives to EXIM aid and should therefore experience a smaller decline in their demand for Boeing aircraft when compared with airlines with limited access to credit markets.[19] We define access to credit at the country level using the capitalization-to-GDP

[17] In this specification, we include observations of airlines that do not purchase Boeing aircraft or any aircraft at all.

[18] We focus on the logarithm of fleet size as the main airline control to maximize the sample size. Out of the 529 airlines, we observe the remaining airline controls for 75 airlines. However, the coefficients we estimate are largely robust to the inclusion of these additional airline controls.

[19] There are two possible drivers for this heterogeneity. The end of the loan guarantees leads to an increase in interest rates for airlines that wish to purchase Boeing aircraft. The cost of credit should increase by more for airlines that have lower access to credit markets. In fact, we would expect that the change in the cost of credit induced by the removal of loan guarantees should be larger for airlines in emerging economies than it is for airlines in developed economies. A second driver is rationing. If the end of loan

ratio used in Rajan and Zingales (1998), where capitalization is the sum of total domestic credit directed to the private sector and market capitalization of all publicly traded firms. We split countries into two groups based on their capitalization-to-GDP ratio in 2015: countries where the measure is below the median are classified as low capitalization countries, and countries where the measure is equal to and higher than the median are classified as high capitalization countries. Therefore, we assume that airlines in high capitalization countries have greater access to capital markets. To test this hypothesis, we estimate equation (1) on three samples: (i) using all observations; (ii) using observations only for airlines in low capitalization countries; and (iii) using observations only for airlines in high capitalization countries. We present the results of this analysis in Figure 7.

We find that all of the decline in demand for Boeing aircraft is driven by a decline in demand on the part of airlines in low capitalization countries. In fact, in 2016, the average treatment effect for airlines in low capitalization countries is 47%, which represents a decline of around five aircraft relative to the unconditional average of nine Boeing aircraft deliveries in 2015. This effect is very close to the one we documented in Figure 6, which is consistent with airlines in high capitalization countries observing no variation in the demand for Boeing aircraft. In fact, the treatment effects for high capitalization airlines are never statistically different from zero, and the magnitudes are also very small.[20] Therefore, we observe a decline in the demand for Boeing only for airlines that have difficulty in substituting EXIM aid with private credit.[21]

4.1.2 The role of firm liquidity

We can also explore the importance of airlines' cash holdings in determining their response to the EXIM shock. Cash holdings are important in two key dimensions. First, airlines with more cash should observe a lower cost of credit once the loan guarantees program ends. Second, airlines with more cash also have an alternative to credit markets since they have a higher likelihood of purchasing an aircraft using cash instead of borrowing in credit markets. Therefore, we should expect the decline in the demand for Boeing aircraft to be concentrated in airlines with lower cash holdings. We split airlines into two groups using their liquidity ratio (which is defined as the ratio of cash and cash equivalents to total assets) in 2015: airlines with a liquidity ratio below the median are classified as low liquidity airlines, and airlines with a liquidity ratio above or equal to the median are classified as high liquidity. To test this hypothesis, we estimate equation (1) on three samples: (i) using all observations for which we observe the airline liquidity ratio; (ii) using only low liquidity airlines; and (iii) using only high liquidity airlines. Note that using the liquidity ratio greatly reduces our sample, since we observe this variable for only 79 airlines. We present the results of this analysis in Figure 8.

We find that all of the decline in Boeing demand is driven by low liquidity airlines. In fact, in 2016, the treatment effect for low liquidity airlines is 45%, which represents a decline of around three Boeing aircraft, which is comparable to the values we document for airlines in low capitalization countries.[22] This decline

guarantees forces some airlines to exit credit markets, then we would observe a decline in demand for Boeing for these airlines, which are likely based in emerging countries. In our analysis, we will not be able to distinguish between a cost-of-credit effect or a rationing effect.

[20] We have conducted an F-test under the null hypothesis that all treatment effects after 2015 for airlines in low capitalization countries are equal to zero, we reject the null with a p-value of 0.05. When we conduct the same test for airlines in high capitalization countries we obtain a p-value of 0.81 and cannot reject the null hypothesis.

[21] In Figures A6 and A7, we also show that these effects are not driven by U.S. or Chinese airlines. Removing airlines for either of these countries does not change the coefficients we estimate.

[22] In the sample for which we observe liquidity ratios, 81% of the airlines are located in countries with a high capitalization ratio. Moreover, if we replicate Figure 8 using only observations for airlines in high capitalization countries, we still find that the drop in

also seems to be permanent, since the coefficients do not vary greatly between 2016 and 2018. In contrast, the coefficients associated with airlines with a high liquidity ratio are not statistically different from zero and are relatively small.

5 Effect on Aircraft Deliveries

We have so far focused on the effects of the lack of quorum at the airline level. In this section, our goal is to understand how the Boeing market share of deliveries changes in response to the EXIM shock. We use aircraft-level data to investigate the impact of the EXIM shock on the probability of a Boeing aircraft delivery.

As in our previous analysis, we split airlines into two groups: airlines that had at least one Boeing aircraft in their fleet in 2015 are the treated group, while airlines that did not operate Boeing aircraft are the control group. We estimate the following event study regression

$$\begin{aligned}\text{Boeing}_{jit} = \lambda_t + \alpha_i + \sum_{m=-3, m\neq -1}^{2} \delta_m \times \mathbf{1}\{m = t - 2016\} \times \mathbf{1}\{i \in \text{Treated}\} \\ + \beta X_{it} + \theta W_{\text{country},t} + \varepsilon_{it},\end{aligned} \tag{2}$$

where the dependent variable takes the value of one if aircraft j delivered to airline i in year t was produced by Boeing, and zero if otherwise. We include airline and time fixed effects, as well as country controls. In our main specification, the only airline control we include is the logarithm of one plus the size of the fleet.[23] The coefficients of interest are δ_m which represent the effect of the lack of quorum m periods after 2015. In this regression, we can interpret the δ_m coefficient as the change in the Boeing share of deliveries between 2016 and 2016 + m. We cluster errors at the airline level and present the results of this analysis in Figure 9. As with our previous analysis, we find that the inclusion or exclusion of firm controls does not change the coefficients and seems to change only the confidence intervals. Therefore, we use the specification that includes only the logarithm of the fleet size as a control in order to maximize sample size. We find that, following the EXIM shock in 2015, there is a slight decline in the likelihood of an airline purchasing Boeing aircraft. For example, in 2018, we estimate that treated airlines experience a decline of 9 percentage points in the probability of purchasing Boeing aircraft (which represents a 14% decline relative to the 2015 unconditional average). However, note that the confidence interval includes zero and so we cannot reject the null hypothesis that the effect on the likelihood of purchasing Boeing aircraft is zero.[24]

Boeing demand is more pronounced for airlines with a lower liquidity ratio, although the reduced number of observations greatly widens the confidence intervals. Therefore, it is unlikely that the results using the liquidity ratio are not driven by a correlation between the liquidity ratio and the capitalization-to-GDP ratio. In fact, using the liquidity ratio skews our sample toward larger airlines for which we can observe this variable – leading to a modest negative correlation between the liquidity ratio and the capitalization-to-GDP ratio of -0.05.

[23]Note that, by including airline fixed effects, we are estimating the equation only for airlines that buy aircraft from at least two different manufacturers in our sample period. This may skew our sample toward larger airlines. However, we show that the results are qualitatively similar to those we observe in Section 4.

[24]In fact, if we conduct a Wald test under the null hypothesis that $\delta_1 = \delta_2 = \delta_3 = 0$, we obtain a p-value of 0.39 and so we do not reject the null that all of the effects on the likelihood of purchasing a Boeing aircraft are equal to zero.

5.1 The role of access to financial markets

We have found some evidence of a decline in the likelihood of purchasing a Boeing aircraft. In the previous section, we have also shown that the effects are heterogeneous across airlines depending on their ease of accessing credit. To test this hypothesis using aircraft deliveries we estimate equation (2) for three samples: (i) using all aircraft deliveries, (ii) using deliveries to airlines in countries with a high capitalization-to-GDP ratio; and (iii) using deliveries to airlines in countries with a low capitalization-to-GDP ratio. We present the results of this analysis in Figure 10.

We find that, for treated airlines in high capitalization countries, there is no decline in the likelihood of purchasing Boeing aircraft. This result in line with what we document in Figure 7 and suggests that, for airlines that face a low cost of credit, the end of the EXIM quorum is not a substantial shock to their willingness of purchasing Boeing aircraft. Note that neither the Boeing share of deliveries nor the total number of Boeing aircraft they purchase declines, which suggests that their total aircraft purchases also do not decline. In contrast, the likelihood that treated airlines in low capitalization countries purchase Boeing aircraft declines quite substantially.[25] In 2016, the likelihood that a treated airline in a low capitalization country purchases Boeing aircraft falls by 38 percentage points (or by two-thirds relative to the unconditional average in 2015). This effect is larger in magnitude to the one we document in Figure 7, where the decline in the number of Boeing aircraft approaches 50%. Moreover, the decline in the likelihood of purchasing Boeing aircraft is persistent, since it is still negative and statistically significant in 2018. However, airlines in low capitalization countries represent a relatively small share of total Boeing deliveries (around 20% of total deliveries in 2014), and so the overall effect on deliveries is much smaller. For the bulk of Boeing deliveries (which go to airlines in countries with a high capitalization ratio), there seems to be no change in the likelihood of purchasing Boeing aircraft.[26]

5.2 The role of firm liquidity

As in the previous section, we also compare the evolution of the likelihood of purchasing Boeing aircraft across two groups of airlines: airlines with a high liquidity ratio and airlines with a low liquidity ratio. We present the results of this analysis in Figure 11.

We find that there is no evidence of a decline in the likelihood of purchasing a Boeing aircraft for airlines with a high liquidity ratio. In fact, there is some evidence that the likelihood increases after 2015. This finding is in line with our hypothesis – airlines that have easy access to alternative funding sources (private credit or cash) experience no decline in their demand for Boeing aircraft. In contrast, there is a sharp decline in the likelihood that an airline with a low liquidity ratio purchases Boeing aircraft. For instance, in 2017, the likelihood that a low liquidity airline purchases a Boeing aircraft decreases by 20 percentage points (which represents a decline of around one-third relative to the unconditional average in 2015). Therefore, we observe a very sizable decline in demand for Boeing aircraft for airlines that represent a small share of overall Boeing deliveries, which leads to an effect on overall Boeing performance that is not statistically

[25] We conduct the same exercise using sovereign risk ratings: we compare airlines in countries with a sovereign risk that is investment grade with airlines in countries with a higher sovereign risk. We present the results in Figure A8 and find that, for airlines in low-risk countries, there is no decline in the likelihood of purchasing Boeing aircraft. In contrast, airlines in high-risk countries experience a sharp decline in the likelihood of purchasing Boeing aircraft.

[26] In Figure A9 we conduct the same analysis for three different samples. First, we exclude U.S. airlines, which do not receive EXIM support. We find that there is still a sharp decline in the likelihood of purchasing Boeing aircraft for airlines in low capitalization countries. Second, we exclude Chinese airlines. All the results are qualitatively identical, and by excluding Chinese airlines, we no longer observe a pre-trend in the specification using all observations. Third, we exclude deliveries of the 737-Max Boeing aircraft, which represents a significant share of the deliveries in this period. This does not seem to affect our results.

different from zero.[27]

5.3 Overall effect on Boeing's share of aircraft deliveries

We have so far shown that, in response to the EXIM quorum lapse, Boeing's deliveries experienced only a small decline. However, we have found that this fact masks substantial heterogeneity: airlines in countries where access to credit markets is more difficult experience a large decline in demand for Boeing aircraft. Given these findings, we can now predict the effects of the quorum lapse on the overall Boeing share of deliveries. We express the change in the Boeing share of deliveries as $\Delta s = \Delta s^{\text{exim}} + \Delta s^{\text{non-exim}}$ where s is the Boeing share of deliveries , s^{exim} is the Boeing share of deliveries attributable to transactions financed by EXIM, and $s^{\text{non-exim}} = s - s^{\text{exim}}$ is the Boeing share of deliveries attributable to transactions which are not financed by EXIM. As a result of the shock, it follows that $\Delta s^{\text{exim}} = -s^{\text{exim}}$, as all transactions that were financed by EXIM can no longer take place. Therefore, we now ask the question: how many of these deliveries are still taking place?

We can decompose the share of all Boeing deliveries that are not financed by EXIM as

$$\Delta s^{\text{non-exim}} = \Delta s^{\text{non-exim, high}} + \Delta s^{\text{non-exim, low}},$$

where $\Delta s^{\text{non-exim, high}}$ represents the change in the share of all Boeing deliveries which are not financed by EXIM to airlines in countries with a high capitalization-to-GDP ratio and $\Delta s^{\text{non-exim, low}}$ represents the change in the share of all Boeing deliveries which are not financed by EXIM to airlines in countries with a low capitalization-to-GDP ratio. So far, we have made no assumptions on the behavior of $\Delta s^{\text{non-exim}}$. We now assume that all of the variation is driven by deliveries that were previously financed by EXIM and are now financed by other means. If $\Delta s^{\text{non-exim}} = s^{\text{exim}}$, the share of Boeing deliveries does not change. For each of the country groups, we assume that

$$\Delta \widetilde{s}^{\text{non-exim, c}} = \mathbb{P}\left(\text{Buys Boeing} \mid c\right) \times s^{\text{exim, c}}, \quad c \in \{\text{high, low}\}.$$

This assumption implies that only some of the transactions that were being financed by EXIM still take place once EXIM aid is no longer available. In particular, some aircraft deliveries might no longer take place because the cost of private funding is too high for some airlines. In order to discipline this transaction, we need to compute the probability that an airline in country group c still purchases Boeing aircraft after the EXIM shock. Therefore, we can write the estimated change in Boeing's share of deliveries for a given year $t \geq 2016$ as

$$\Delta \widetilde{s}_t = -s^{\text{exim}}_{2015} + \sum_{c \in \{\text{high, low}\}} \mathbb{P}\left(\text{Buys Boeing} \mid c\right)_t \times s^{\text{exim, c}}_{2015}. \tag{3}$$

To compute the model-implied change in the Boeing share of deliveries we need to know s^{exim}_{2015},$s^{\text{exim, low}}_{2015}$ and $s^{\text{exim, high}}_{2015}$ which we can compute using our data on aircraft deliveries and EXIM transactions.[28] To compute the probabilities, we can use the coefficients we estimate in Figure 10. In those regressions, the δ_m

[27] We find similar effects if we compare airlines based on their external financing ratio, which is defined as the share of capital expenditures that is not financed with cash flows, as we do in Figure A10. We find that, for airlines with a low dependence on external capital (a low external financing ratio), the likelihood of purchasing Boeing aircraft does not decline. In contrast, if we look at airlines with a high dependence on external capital, we observe a decline in the likelihood of purchasing Boeing aircraft.

[28] We present more details on these calculations in Appendix A.2. In the base case, we set $s^{\text{exim}}_{2015} = 0.24$, $s^{\text{exim, low}}_{2015} = 0.04$ and $s^{\text{exim, high}}_{2015} = 0.2$.

coefficients capture the change in the likelihood of purchasing a Boeing aircraft, conditional on purchasing a Boeing aircraft. Therefore, $\mathbb{P}\left(\text{Buys Boeing} \mid c\right)_t = 1 + \delta_m^c$ where $\delta_m^c < 0$ and $c \in \{\text{high}, \text{low}\}$. Using these estimates, we can then compute the model-implied change in the Boeing share of deliveries, which we present in Figure 12.

Between 2015 and 2018, the Boeing share of total aircraft deliveries declined from 44% to 42%, which is a very small decline. Therefore, the EXIM shock represents a very small decline in Boeing's share of deliveries, as we have shown in Figure 9 - it represents less than half of the standard deviation of the changes in the Boeing share of deliveries between 2006 and 2014. Our model predicts a decline of the same magnitude: from 44% to 41.5%, and so the fit of the model is very good, even though the model targets conditional moments. This finding suggests that EXIM aid was not an essential driver of Boeing's performance and that airlines did not react to the shock by reducing their Boeing purchases.

6 The EXIM Shock and the Financing of New Aircraft

We have shown that following EXIM's quorum lapse, Boeing's deliveries declined in countries with less developed financial markets – most likely since the lapse in EXIM's loan guarantees increased the relative price of Boeing aircraft. However, deliveries of aircraft to countries with more developed financial markets increased, and as we have demonstrated in Figure 5, more than 80% of EXIM financing was directed at countries with more developed financial markets. In this section we examine whether airlines were able to substitute EXIM financing with other sources of financing.

In Figure 13, we decompose the number of transactions involving Boeing aircraft by the type of financing. As the figure illustrates, until 2014, export credit played a significant role in the financing of Boeing aircraft – accounting for 20% of all transactions. During the years 2006 to 2014, the most important source of financing is operating leases, which account for 55% of all transactions. After 2015, there is a substantial decline in the share of export credit to 2.6% of all transactions. During the EXIM quorum lapse the total number of transactions does not decline, and the share of operating leases increases to 79%. That is, airlines adjust to the lack of EXIM financing by using private financing instead of loans guaranteed by EXIM.

We now turn to analyze the substitution between EXIM and private financing using the Deal Tracker dataset from the AirFinance journal database. We define private funding as any funding that is not provided by a government export credit agency – in particular EXIM.

6.1 The Case of Ethiopian Airlines

To motivate our analysis, we focus on the case of Ethiopian Airlines, the flag carrier of Ethiopia, a country with an underdeveloped financial system. In Table II, we decompose both the number of transactions and the amount involved for Ethiopian Airlines in the years 2012 to 2018 between transactions involving EXIM funding and transactions that do not involve EXIM funding. Within transactions with EXIM funding, we split transactions into those involving U.S. banks and those that do not. Within transactions that do not use EXIM funding, we split transactions into three groups: (i) transactions that involve U.S. banks; (ii) transactions that do not involve U.S. banks; and (iii) transactions that do not involve U.S. banks and involve funding from the Aircraft Finance Insurance Consortium (AFIC), which was developed in 2017 as a private alternative to EXIM.[29]

[29] AFIC offers an insurance-based aircraft finance product and has mostly focused on transactions involving Boeing aircraft.

In the period before the shock, there are 10 Boeing transactions involving Ethiopian Airlines totaling $1,768 million. Of these, six used EXIM financing. All the transactions that do not use EXIM financing are financed by non-U.S. banks. In contrast, almost all transactions that use EXIM financing involve U.S. banks, which also represent 97% of the value for transactions involving EXIM financing. Following 2015, the overall number of transactions declines to five, and the volume in millions of U.S. dollars declines by almost two-thirds. However, there is also a change in the composition of these transactions. All of the transactions between 2016 and 2018 involve non-U.S. banks and funding from AFIC. Therefore, Ethiopian Airlines reacted to the lack of quorum in the EXIM board in two ways. First, it reduced the number of Boeing aircraft it purchased, as evidenced by the lower number of transactions. Second, and more important, it substituted away from EXIM funding to a private provider of credit, AFIC. Since AFIC provides an insurance product, it reduces the risk lenders take when providing loans to Ethiopian Airlines and therefore mitigates the lack of loan guarantees. This case also illustrate the endogenous creation of financial institutions when government funding dries up.

6.2 Effect of EXIM Quorum Lapse on Private Financing

We now turn to a formal test of the hypothesis that airlines were able to substitute away from EXIM funding and toward private providers of funding. To do this, we compare the likelihood that a particular transaction involving a Boeing aircraft is financed with external private funds, using transactions without Boeing aircraft as the control group. We estimate the following equation using all transactions between 2012 and 2018:

$$\text{Private}_{ijt} = \lambda_{jt} + \alpha_{c(j)} + \delta W_{c(j)t} + \mu_{\text{Boeing}} + \gamma \cdot \mathbf{1}\{i \in \text{Boeing}\} \cdot \mathbf{1}\{t \geq 2016\} + \varepsilon_{ijt}, \tag{4}$$

where the outcome variable takes the value of one if transaction i by airline j in year t is not funded by EXIM, and zero otherwise. Our regression specification includes airline-year and country fixed effects, as well as country macro and demographic controls, including the logarithm of GDP, the logarithm of population, and GDP per capita.[30] The country fixed effects and controls aim at capturing possible changes in demand for air travel in the different countries, as well as changes and differences in overall economic conditions. Our parameter of interest is the average treatment effect γ, which captures the likelihood that a Boeing aircraft is financed with non-EXIM funding after 2015 compared to aircraft produced by other manufacturers. We cluster standard errors by country. Table III presents the results.

The coefficient associated with the Boeing dummy is negative and statistically significant across all specifications. In particular, in our preferred specification in column (4), we show that the probability that a particular transaction is financed by external private funds before 2016 is 14 percentage points lower for Boeing when compared with other manufacturers. This finding reflects the crucial role that EXIM played in financing the purchase of Boeing aircraft until the middle of 2015. The average treatment effect on Boeing aircraft after 2015, by contrast, is positive and statistically significant across all specifications. In column (4), we find that after 2015, Boeing transactions are more likely to be financed by private external funds when compared with transactions involving aircraft from other manufacturers. This increase in likelihood is 13 percentage points, which effectively undoes most of the gap between Boeing and other manufacturers, reflecting the fact that airlines chose to substitute EXIM funds with other sources of private funding such

[30] In this specification, we can include firm-year fixed effects because we have more firms per country when compared with our sample of aircraft deliveries.

as operating leases.

6.2.1 Heterogeneity across countries

We have found that the likelihood of purchasing Boeing aircraft during the EXIM quorum lapse is lower for airlines operating in countries with low financial development. We have argued that this decline is driven by two mechanisms: (i) an increase in the cost of credit, which makes Boeing aircraft more expensive, leading airlines to reduce Boeing purchases; and (ii) a difficulty in switching from publicly provided loan guarantees to private external funding. To test the second mechanism, we estimate equation (4) on two subsamples: one with countries with high financial development and one with countries with low financial development. We present the results in Table IV.

We start by focusing on our preferred measure of financial development, which is the capitalization-to-GDP ratio. We find that before 2015, airlines in countries with high financial development were less likely to use private funds to purchase Boeing aircraft. In fact, the probability that an airline purchased is financed with private funds before 2015 is 15 percentage points lower for Boeing aircraft if we focus on airlines in countries with high financial development. This result is in line with the common criticism of EXIM aid that it seems to be directed mainly at developed countries. We also find that airlines in countries with high financial development find it easier to shift from EXIM funds toward external private funds. For airlines in countries with high financial development, the likelihood that a transaction is financed with external private funds increases by 13 percentage points for Boeing aircraft when compared with other aircraft. This effect is 18% stronger in countries with high financial development than it is in countries with low financial development. We can also compare the effects by splitting countries according to GDP per capita. We find that all of the shift from EXIM funds is driven by airlines in countries with a high GDP per capita. Therefore, airlines in countries with low financial development buy fewer Boeing aircraft because they also find it harder to substitute the EXIM loan guarantees with private external funds.

6.2.2 The role of dependence on EXIM funds

We have shown that, after 2015, airlines substituted EXIM funding with external private funding. This suggests that the loan guarantees directed at Boeing were not necessary for all airlines. However, this analysis mixes two different groups of airlines: (i) airlines that relied on EXIM funds; and (ii) airlines that did not rely on these funds. For airlines that did not previously rely on EXIM funds, there should be no difference in the share of privately funded transactions because these airlines were financing their transactions with external private funds even before 2015. All of the average treatment effect in Table III should be explained by airlines that previously relied on EXIM funds. To test this, we include a third difference in equation (4) as we compare airlines that received EXIM support for Boeing purchases before 2015 with airlines that did not receive EXIM support for Boeing purchases in the same period. We present the results of this analysis in Table V.

The first column in Table V is exactly the same as column (4) in Table III and reflects our previous results: following 2015 and the end of the quorum at the EXIM board, airlines substitute EXIM funds with private funds. In the second column, we estimate the same equation but use only transactions involving airlines that previously relied on EXIM funds to finance the purchase of Boeing aircraft. We find that the coefficient associated with the Boeing dummy is still negative and statistically significant but is now larger in absolute value. The average treatment effect is also larger, since the likelihood that airlines now use

private external funds is 16 percentage points higher. In the last column, we estimate the triple difference specification.[31] We find that for airlines that did not previously rely on EXIM funds, there is no difference in the likelihood of using external private funds to fund the purchase of Boeing aircraft when compared with all other commercial aircraft. Instead, all of the effects are driven by airlines that had previously relied on EXIM funds since the coefficient associated with the triple difference is positive and statistically significant.

We have shown that, in response to the cessation of the loan guarantees program that helped airlines finance the purchase of Boeing aircraft, airlines shifted toward private external funds (e.g., operating leases or commercial loans). We also show that this shift is driven entirely by airlines that had previously received EXIM funds to purchase Boeing aircraft – suggesting that this shift is driven by the drying up of EXIM funds rather than an unrelated move of airlines toward private funds.

7 Conclusion

We study the effectiveness of industrial policy in boosting exports by exploring an exogenous shock that prevented the U.S. government from supporting exporters and use it to evaluate the effectiveness of industrial policy. We explore a shock to the ability of the Export-Import Bank of the United States (EXIM) to provide aid to U.S. exporters, focusing on loan guarantees. These loan guarantees reduce the cost of obtaining credit for these foreign importers. We focus our analysis on the largest recipient of aid from EXIM: Boeing. The shock to EXIM's ability to offer loan guarantees increased importers' cost of purchasing Boeing aircraft. Since other aircraft manufacturers – mostly Airbus – were not affected by the EXIM bank quorum lapse, this shock led to an increase in the relative cost of Boeing aircraft for importers.

We begin by analyzing airline-level demand for Boeing aircraft. We find that airlines operating in countries with a developed financial system are unaffected by the quorum lapse In contrast, airlines operating in countries with an underdeveloped financial system experienced a large drop in their Boeing aircraft deliveries. Similarly, airlines with a high liquidity ratio did not experience any decline in the number of Boeing aircraft they purchased. In contrast, low liquidity airlines purchase fewer Being aircraft. We then turn to aircraft level data to explain the evolution of the Boeing share of deliveries. Between 2015 and 2018, the Boeing share of deliveries declined by 2.7 percentage points from 44.4% to 41.7%. This decline is small, particularly given that EXIM funding accounts for 12% of total Boeing sales. Our results suggest that airlines substituted EXIM funding with other sources of funding to purchase aircraft. EXIM quorum lapse did not lead to a sharp decline in Boeing sales since airlines in developed countries, which accounted for the majority of EXIM-funded transactions, were able to find alternative sources of private funding.

[31] In this specification, we do not report the coefficient associated with the Used EXIM dummy variable because it is collinear with the airline fixed effects.

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Table and Figures

Figures

FIGURE 1. Evolution of Total Aid Given by EXIM

This figure plots the evolution of total aid given by the Export-Import Bank to U.S. exporters between 2007 and 2019. We decompose the aid into four categories: (1) loan guarantees to foreign firms importing U.S. goods and services, (2) insurance for U.S. exporters against accounts receivable risk, (3) direct loans to foreign firms, and (4) working capital loans to U.S. firms.

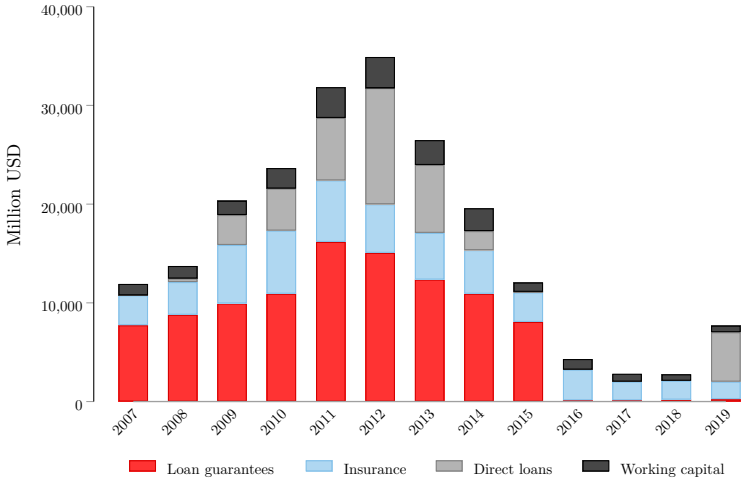


FIGURE 2. Evolution of Aid Given by EXIM to Boeing

This figure plots the evolution of total aid given by the Export-Import Bank to U.S. exporters between 2007 and 2019. We decompose aid into two categories: (1) aid given to Boeing, and (2) aid given to all other firms.

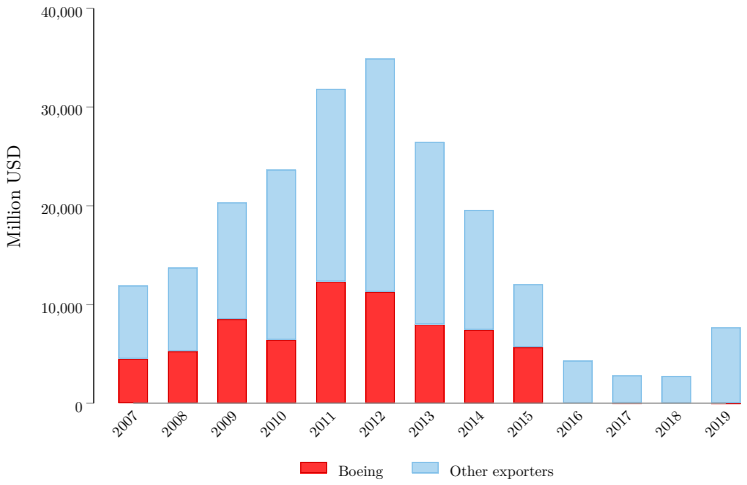


FIGURE 3. Decomposition of the number of transactions by financing type

This figure presents a decomposition of the number of transactions involving commercial airlines by source of financing every year between 2006 and 2019. We consider eight types of financing: (1) commercial loans (mostly from financial institutions), (2) bond issuance, (3) equity issuance, (4) export credit (aid from export credit agencies like EXIM), (5) operating leases, (6) other sources of financing (mostly internal funds), (7) structured operating leases (operating leases with additional characteristics, like a call option), and (8) tax leases.

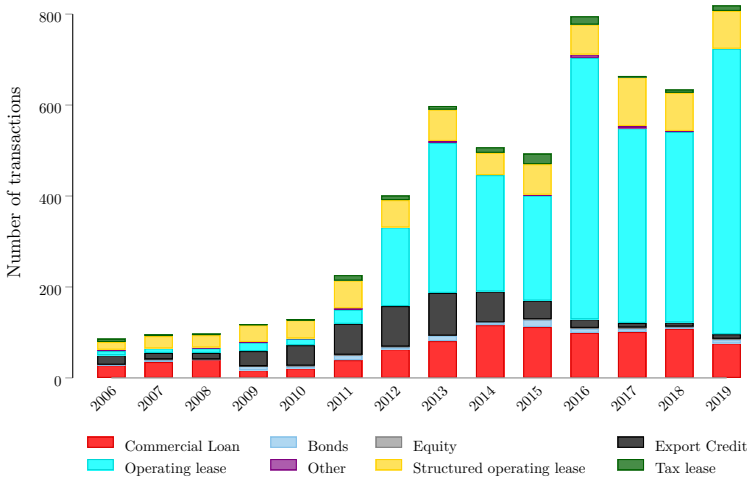
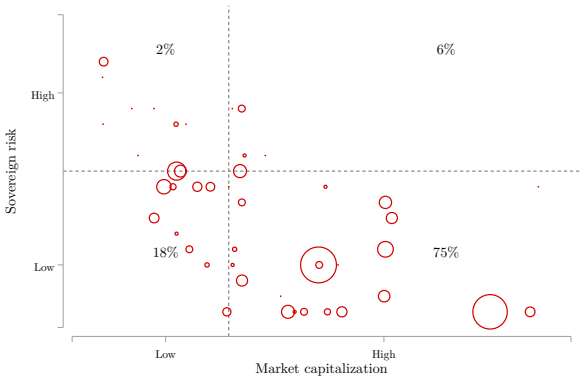


FIGURE 4. Distribution of airlines over country characteristics: All Boeing aircraft

This figure presents the distribution of airlines that operate Boeing aircraft over two country characteristics measured in 2014: market capitalization and sovereign risk. Each circle represents an airline, and the size of the circle represents the number of Boeing aircraft delivered to that airline in that year. For market capitalization, we split countries into two groups: above the median (high) and below the median (low) according to their market capitalization in 2014. For sovereign risk, we classify countries as low risk if their sovereign rating in 2014 is above or equal to Baa3 and as high risk if otherwise. For each of the four groups, we also compute the share of Boeing aircraft delivered to airlines in that group. In Panel A, we present the distribution of aircraft deliveries for 2014, and in Panel B, we present the distribution of aircraft deliveries for 2018.

(a) 2014



(b) 2018

FIGURE 5. Distribution of aircraft over country characteristics: EXIM financed aircraft

This figure presents the distribution of the number of aircraft in all transactions financed by EXIM over two country characteristics measured in 2014: market capitalization and sovereign risk. Each circle represents a country, and the size of the circle represents the number of Boeing aircraft financed by EXIM bought by airlines in that country between 2012 and 2014. For market capitalization, we split countries into two groups: above the median (high) and below the median (low) according to their market capitalization in 2014. For sovereign risk, we classify countries as low risk if their sovereign rating in 2014 is above or equal to Baa3 and as high risk if otherwise. For each of the four groups, we also compute the share of Boeing aircraft delivered to airlines in countries in that group.

FIGURE 6. Effects on Boeing aircraft deliveries

This figure presents the results of estimating equation (1) on a balanced sample of 529 airlines between 2013 and 2018. The outcome variable is the logarithm of one plus the number of Boeing aircraft delivered to an airline in a given year. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We use the year 2015 as the base year and we present average treatment effects for treated airlines relative to 2015. We consider three specifications: (1) no airline controls, (2) including only the logarithm of fleet size as a time-varying airline control and (3) including also the logarithm of total assets, the ratio of cash flows to sales, leverage, liquidity (ratio of cash to total assets), and collateral (ratio of PPE to total assets). We cluster errors at the firm level and display 90% confidence intervals.

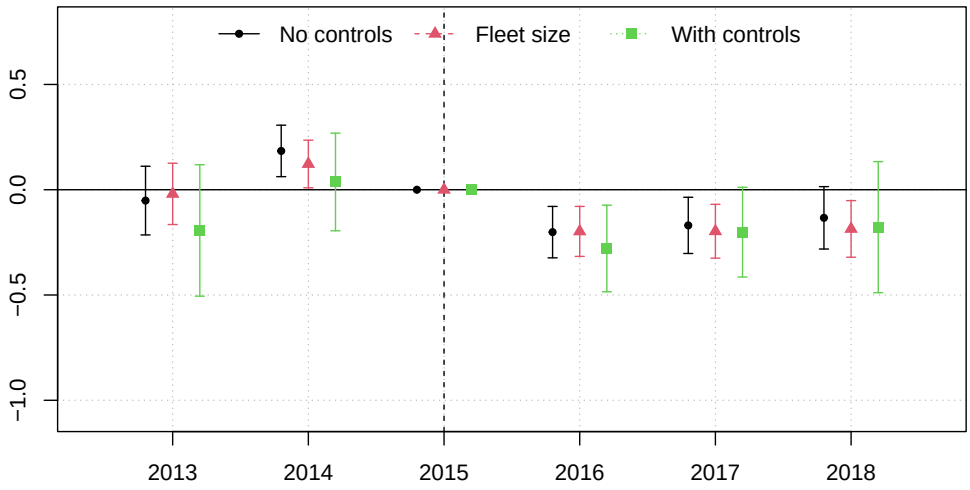


FIGURE 7. Effects on the number of Boeing aircraft: role of access to credit markets

This figure presents the results of estimating equation (1) on a balanced sample of 529 airlines between 2013 and 2018. The outcome variable is the logarithm of one plus the number of Boeing aircraft delivered to an airline in a given year. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We also include the logarithm of the fleet size as an airline control. We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide countries into two groups based on their capitalization-to-GDP ratio in 2015 (which is defined as the sum of market capitalization to total domestic credit to the private sector, divided by GPP): countries above or equal to the median are classified as having a high capitalization, and countries below the median are classified as having a low capitalization. We present three specifications: (1) an estimation that uses all observations, (2) an estimation that uses only observations for airlines in low capitalization countries, and (3) an estimation that uses only observations for airlines in high capitalization countries. We cluster errors at the airline level and display 90% confidence intervals.

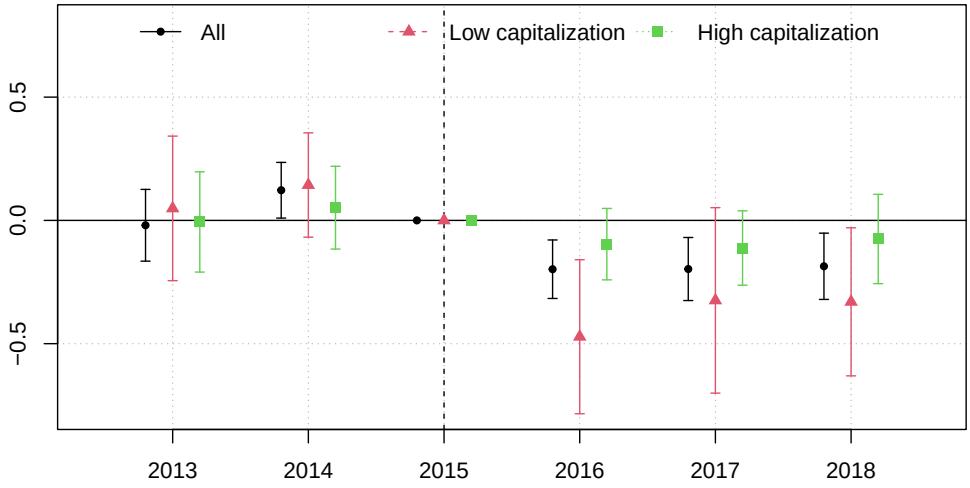


FIGURE 8. Effects on the number of Boeing aircraft: role of firm liquidity

This figure presents the results of estimating equation (1) on a balanced sample of 79 airlines between 2013 and 2018. The outcome variable is the logarithm of one plus the number of Boeing aircraft delivered to an airline in a given year. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We also include the logarithm of the fleet size as an airline control. We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide airlines into two groups based on their liquidity ratio in 2015 (which is defined as the ratio of cash and equivalents to total assets): airlines with a liquidity ratio above or equal to the median are classified as having a high liquidity, and airlines with a liquidity ratio below the median are classified as having a low liquidity. We present three specifications: (1) an estimation that uses all observations for which we observe the airline's liquidity ratio, (2) an estimation that uses only observations for airlines with a low liquidity ratio, and (3) an estimation that uses only observations for airlines with a high liquidity ratio. We cluster errors at the airline level and display 90% confidence intervals.

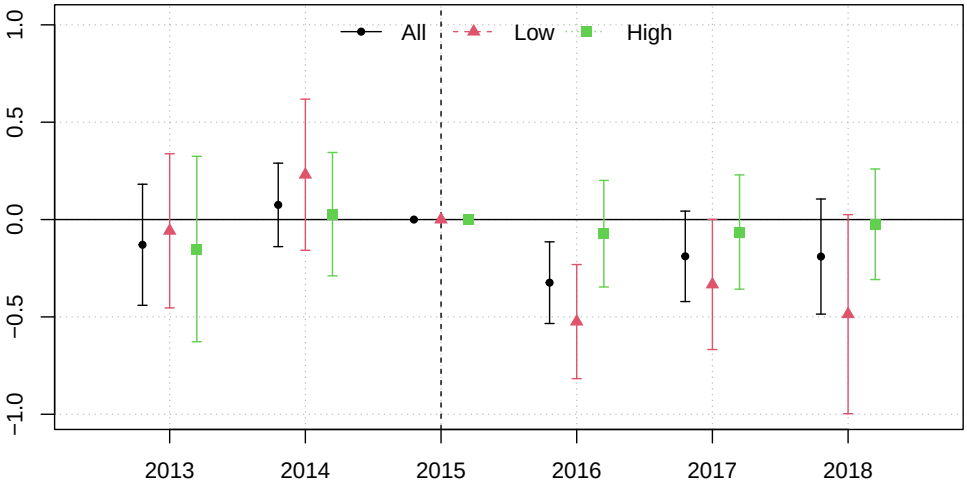


FIGURE 9. Effects on the likelihood of purchasing a Boeing aircraft

This figure presents the results of estimating equation (2)on a sample of 4,563 aircraft deliveries between 2013 and 2018. The outcome variable takes the value of one if the aircraft being delivered was produced by Boeing, and zero if otherwise. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We consider three specifications: (1) no airline controls, (2) including only the logarithm of fleet size as a time-varying airline control, and (3) including also the logarithm of total assets, the ratio of cash flows to sales, leverage, liquidity (ratio of cash to total assets), and collateral (ratio of PPE to total assets). We cluster errors at the airline level and display 90% confidence intervals.

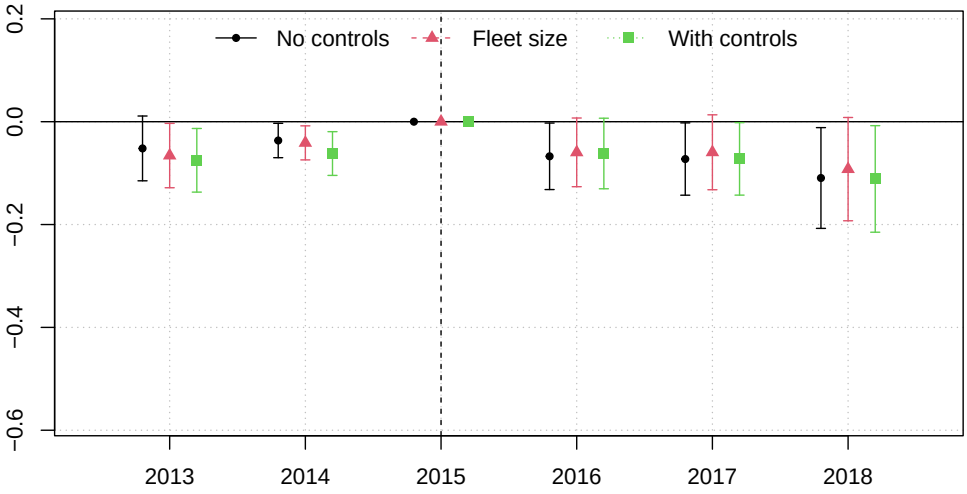


FIGURE 10. Effects on the likelihood of purchasing a Boeing aircraft: role of access to credit markets

This figure presents the results of estimating equation (2) on a sample of 4,563 aircraft deliveries between 2013 and 2018. The outcome variable takes the value of one if the aircraft being delivered was produced by Boeing, and zero if otherwise. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We also include the logarithm of the fleet size as an airline control. We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide countries into two groups based on their capitalization-to-GDP ratio in 2015 (which is defined as the sum of market capitalization to total domestic credit to the private sector, divided by GPP): countries above or equal to the median are classified as having a high capitalization, and countries below the median are classified as having a low capitalization. We present three specifications: (1) an estimation that uses all observations, (2) an estimation that uses only observations for airlines in low capitalization countries, and (3) an estimation that uses only observations for airlines in high capitalization countries. We cluster errors at the airline level and display 90% confidence intervals.

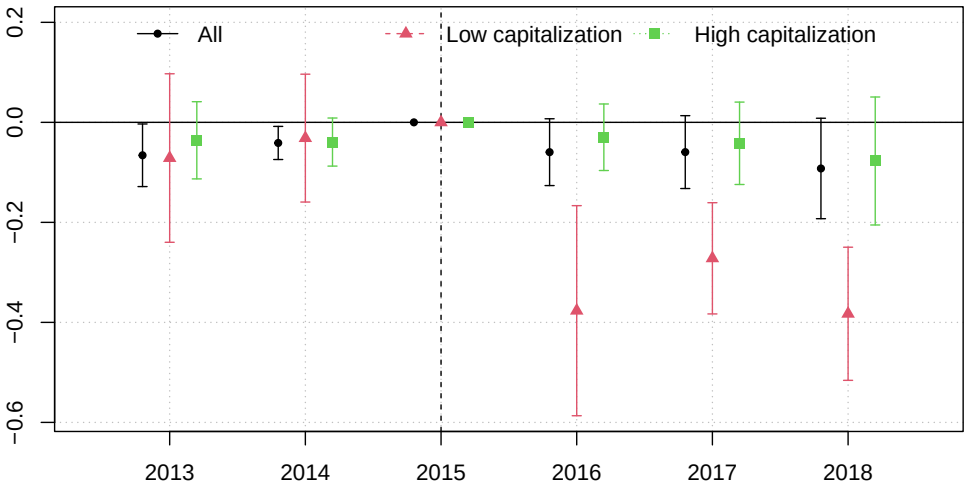


FIGURE 11. Effect on the likelihood of purchasing a Boeing aircraft: role of firm liquidity

This figure presents the results of estimating equation (2) on a sample of 4,563 aircraft deliveries between 2013 and 2018. The outcome variable takes the value of one if the aircraft being delivered was produced by Boeing, and zero if otherwise. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We also include the logarithm of the fleet size as an airline control. We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide airlines into two groups based on their liquidity ratio in 2015 (which is defined as the ratio of cash and equivalents to total assets): airlines with a liquidity ratio above or equal to the median are classified as having a high liquidity and airlines with a liquidity ratio below the median are classified as having a low liquidity. We present three specifications: (1) an estimation that uses all observations for which we observe the airline's liquidity ratio, (2) an estimation that uses only observations for airlines with a low liquidity ratio, and (3) an estimation that uses only observations for airlines with a high liquidity ratio. We cluster errors at the airline level and display 90% confidence intervals.

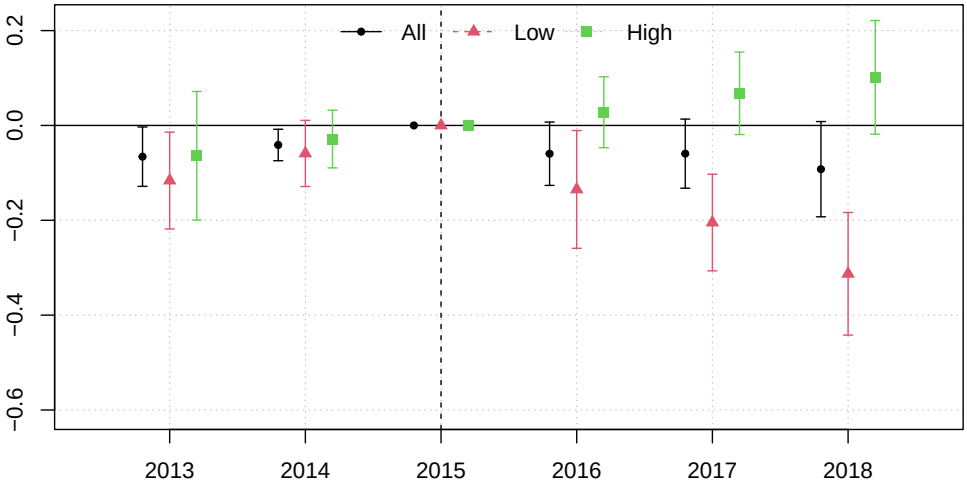


FIGURE 12. Model-implied change in Boeing share of deliveries

This figure presents the model-implied change in the Boeing share of deliveries, as in equation (3). The black line represents the actual Boeing share of deliveries, which is defined as the share of all aircraft deliveries to commercial airlines of Boeing aircraft. The orange line is the model-implied Boeing share of deliveries

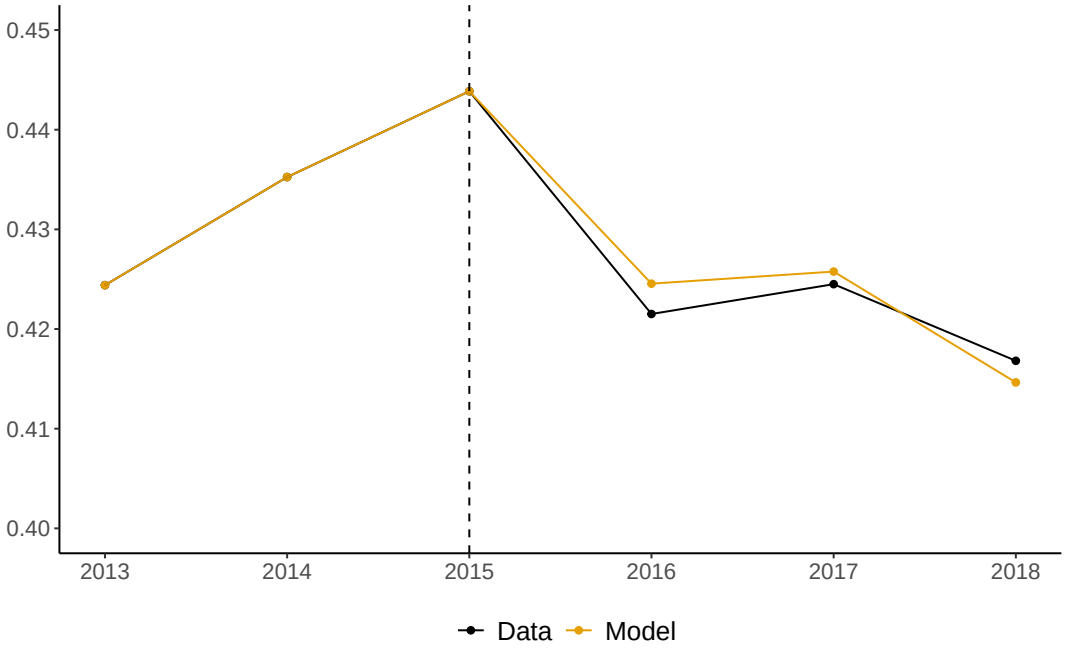
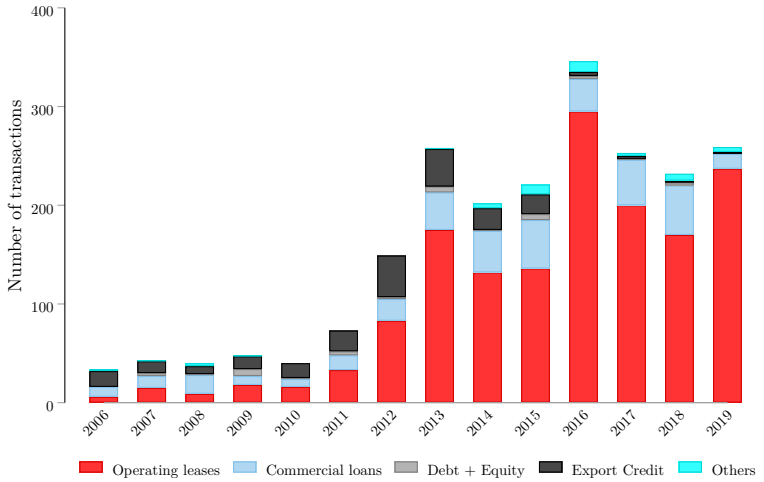


FIGURE 13. Decomposition of the number of transactions by financing type for Boeing

This figure presents a decomposition of the number of transactions involving Boeing aircraft by source of financing every year between 2006 and 2019. We consider five types of financing: (1) operating leases, (2) commercial loans, (3) debt and equity issuance, (4) export credit, and (5) other means of financing.



Tables

TABLE I. Example of EXIM Transaction

This table contains two examples of EXIM transactions involving Boeing as the exporting firm.

Decision date	Exporter	Importer	Country	Program	Lender	Amount (million USD
Example 1: Comair						
June 25, 2015	Boeing	Comair	South Africa	Loan guarantee	Needbank	40
June 25, 2015	Boeing	Comair	South Africa	Loan guarantee	Needbank	40
Example 2: KLM						
March 2, 2011	Boeing	KLM	Netherlands	Loan guarantee	ABN Amro Bank	120
March 2, 2011	Boeing	KLM	Netherlands	Loan guarantee	Apple Bank for Savings	256

TABLE II. Number of transactions for Ethiopian Airlines

This table presents the decomposition of the number of transactions and the total amount in million USD conducted by Ethiopian Airlines to purchase Boeing aircraft between 2012 and 2018. We include only transactions for which we can identify the lender or lenders. We split the transactions into two groups: (1) transactions involving financing by EXIM via loan guarantees, and (2) transactions that only rely on external private funds. Within transactions financed by EXIM, we split transactions depending on whether they involve at least one U.S. bank or no U.S. bank at all. For transactions involving external private funds, we consider three classifications: (1) involving at least one U.S. bank, (2) involving no U.S. bank and no aid from AFIC, and (3) involving no U.S. banks and with aid from AFIC.

	Number of transactions		Amount (million USD)	
	2012–2015	2016–2018	2012–2015	2016–2018
EXIM financing				
U.S. Banks	5	0	1,357	0
Non-U.S. Banks	1	0	41	0
External private financing				
U.S. Banks	0	0	0	0
Non-U.S. Banks	4	0	370	0
Non-U.S. Banks and AFIC	0	5	0	669

TABLE III. Effects on likelihood of external private financing

This table presents the results of estimating equation (4) on all aircraft transactions between 2012 and 2018 and where the outcome variable takes the value of one if the transaction is not funded by EXIM, and zero if otherwise. We compare transactions involving Boeing aircraft (the treated group) with transactions involving aircraft produced by other manufacturers (the control group) and present the average treatment effect. We include country controls, which include the logarithm of GDP, the logarithm of population, and GDP per capita. We also include airline-year and country fixed effects. Errors are clustered by country. *** ,** ,* denote significance at the 10%, 5% and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Boeing	-0.138***	-0.137***	-0.137***	-0.138***
	(0.026)	(0.026)	(0.038)	(0.038)
Boeing × Post 2015	0.132***	0.132***	0.128***	0.129***
	(0.025)	(0.025)	(0.035)	(0.035)
Year FE	✓	✓		
Firm FE	✓	✓		
Country FE	✓	✓	✓	✓
Firm × Year FE			✓	✓
Country controls		✓		✓
Number of countries	104	100	92	90
Number of airlines	423	418	280	278
Observations	3,776	3,757	3,165	3,155

TABLE IV. Effects on likelihood of external private financing: the role of financial development

This table presents the results of estimating equation (4) on all aircraft transactions between 2012 and 2018 and where the outcome variable takes the value of one if the transaction is not funded by EXIM, and zero if otherwise. We compare transactions involving Boeing aircraft (the treated group) with transactions involving aircraft produced by other manufacturers (the control group). We also include a third difference and compare airlines in countries that received EXIM support for Boeing purchases before 2015 with airlines in countries that did not receive EXIM support for Boeing purchases in the same period. We present the average treatment effects. We include country controls, which include the logarithm of GDP, the logarithm of population, and GDP per capita. We also include airline-year and country fixed effects. We consider three specifications: (1) estimating equation (4) on all aircraft transactions between 2012 and 2018, (2) estimating equation (4) on all aircraft transactions between 2012 and 2018 for airlines in countries with a capitalization-to-GDP ratio in 2014 which is below the median, (3) estimating equation (4) on all aircraft transactions between 2012 and 2018 for airlines in countries with a capitalization-to-GDP ratio in 2014 which is above the median, (4) estimating equation (4) on all aircraft transactions between 2012 and 2018 for airlines in countries with a GDP per capita in 2014 which is below the median, and (5) estimating equation (4) on all aircraft transactions between 2012 and 2018 for airlines in countries with a GDP per capita in 2014 which is above the median. Errors are clustered by country. *** ,** ,* denote significance at the 10%, 5% and 1% levels, respectively.

	Base	Capitalization		GDP	
	All	Low	High	Low	High
Boeing	-0.138***	-0.109*	-0.149***	-0.163***	-0.125**
	(0.038)	(0.059)	(0.052)	(0.041)	(0.054)
Boeing × Post 2015	0.129***	0.109*	0.129***	0.145***	0.126**
	(0.035)	(0.059)	(0.047)	(0.033)	(0.054)
Country FE	✓	✓	✓	✓	✓
Firm × Year FE	✓	✓	✓	✓	✓
Country controls	✓	✓	✓	✓	✓
Number of countries	90	28	31	37	53
Number of airlines	271	74	143	105	160
Observations	3,155	840	1,767	1,311	1,813

TABLE V. Effects on likelihood of external private financing: the role of EXIM dependence

This table presents the results of estimating equation (4) on all aircraft transactions between 2012 and 2018, and where the outcome variable takes the value of one if the transaction is not funded by EXIM, and zero if otherwise. We compare transactions involving Boeing aircraft (the treated group) with transactions involving aircraft produced by other manufacturers (the control group). We also include a third difference and compare airlines that received EXIM support for Boeing purchases before 2015 with airlines that did not receive EXIM support for Boeing purchases in the same period. We present the average treatment effects. We include country controls, which include the logarithm of GDP, the logarithm of population, and GDP per capita. We also include airline-year and country fixed effects. We consider three specifications: (1) estimating equation (4) on all aircraft transactions between 2012 and 2018, (2) estimating equation (4) on all aircraft transactions between 2012 and 2018 for airlines in countries that relied on EXIM funds, and (3) estimating equation (4) with the third difference on all aircraft transactions between 2012 and 2018. Errors are clustered by country. *** ,** ,* denote significance at the 10%, 5% and 1% levels, respectively.

	All	Used Exim funds	All
Boeing	-0.138***	-0.171***	-0.034*
	(0.038)	(0.038)	(0.018)
Boeing × Post 2015	0.129***	0.160***	0.033*
	(0.035)	(0.037)	(0.019)
Boeing × Post 2015 × Used Exim			0.163***
			(0.049)
Country FE	✓	✓	✓
Firm × Year FE	✓	✓	✓
Country controls	✓	✓	✓
Number of countries	90	43	90
Number of airlines	278	188	278
Observations	3,155	2,364	3,155

A Appendix: Tables and Figures

A.1 Figures

FIGURE A1. Total Aid to Exports by ECAs in 2014

This figure plots total medium- and long-term aid to exports by ECAs for the largest ECAs in the world for 2014.

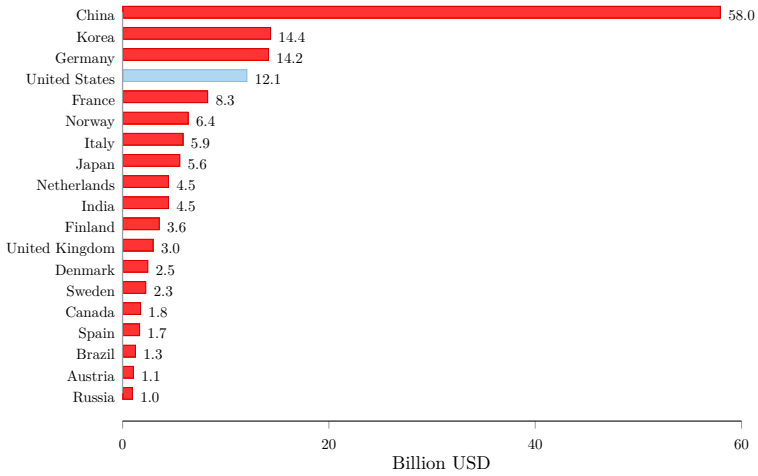


FIGURE A2. Decomposition of Total Aid by OECD ECAs by Destination of Exports

This figure decomposes total aid given by all reporting ECAs in the OECD by the country of destination of the exports. Destinations are split into five groups: OECD countries, high-income countries that are not OECD members, upper-middle-income countries, lower-middle-income countries, low-income countries, and other countries for which there are no data for the level of income.

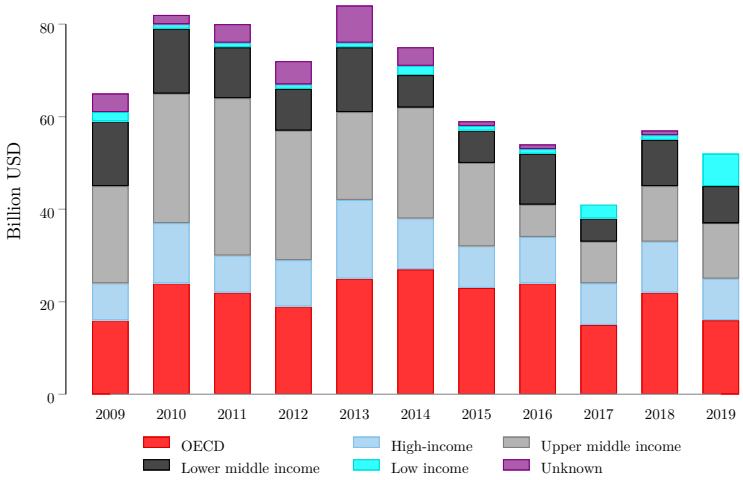


FIGURE A3. Evolution of Number of Transactions

This figure plots the evolution of the total number of transactions of aid by EXIM between 2007 and 2021. We decompose aid into four categories: (1) loan guarantees, (2) insurance against risk in accounts receivable, (3) direct loans, and (4) working capital loans.

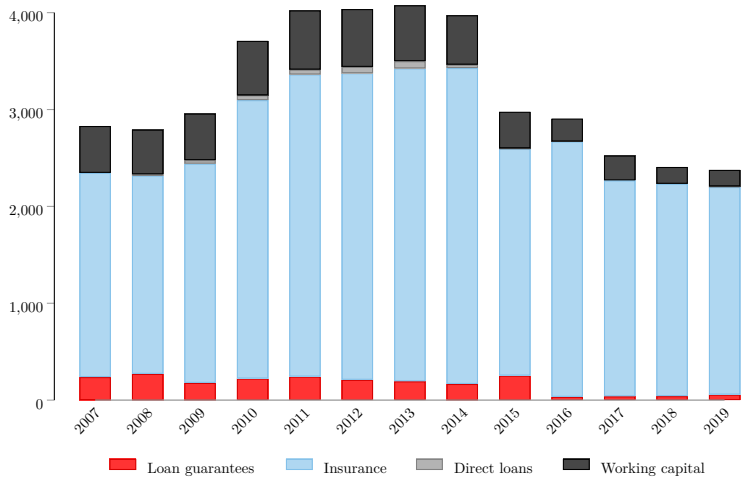


FIGURE A4. Boeing market share

This figure shows the Boeing market share in all new aircraft deliveries to commercial airlines between 2006 and 2018. To compute the market share in each year, we divide the number of delivered Boeing aircraft by the number of total aircraft deliveries.

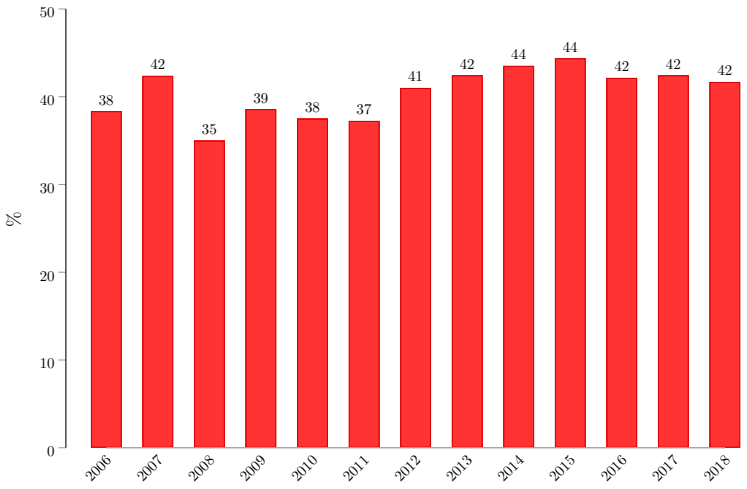
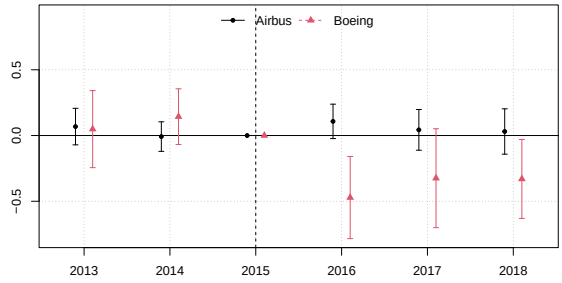


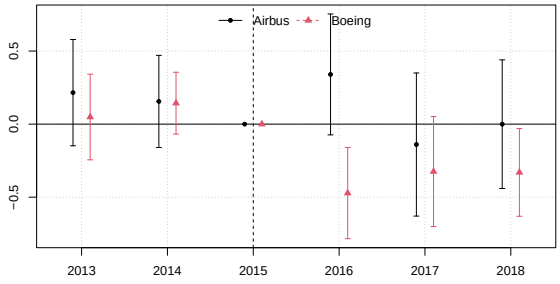
FIGURE A5. Effects on the number of aircraft deliveries: Boeing vs. Airbus

This figure presents the results of estimating equation (1) on a balanced sample of 529 airlines between 2013 and 2018. We consider two outcome variables: (1) the logarithm of one plus the number of Boeing aircraft delivered to an airline in a given year; and (2) the logarithm of one plus the number of Airbus aircraft delivered to an airline in a given year. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide countries into two groups based on their capitalization-to-GDP ratio in 2015 (which is defined as the sum of market capitalization to total domestic credit to the private sector, divided by GPP): countries above or equal to the median are classified as having a high capitalization, and countries below the median are classified as having a low capitalization. In Panel A, we present estimates for all observations. In Panel B, we present estimates using only observations for airlines in low capitalization countries. In Panel C, we present estimates using only observations for airlines in high capitalization countries. We cluster errors at the firm level and display 90% confidence intervals.

(a) All observations



(b) Low capitalization



(c) High capitalization

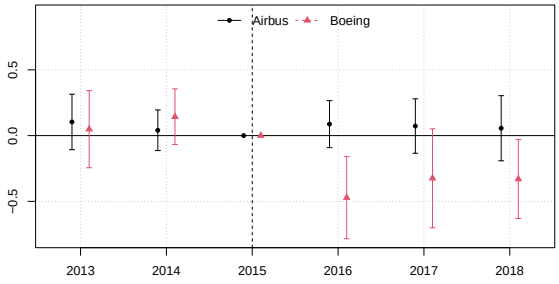


FIGURE A6. Effects on the number of Boeing aircraft: excluding U.S. airlines

This figure presents the results of estimating equation (1)on a balanced sample of 529 airlines between 2013 and 2018, excluding airlines located in the United States. The outcome variable is the logarithm of one plus the number of Boeing aircraft delivered to an airline in a given year. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide countries into two groups based on their capitalization-to-GDP ratio in 2015 (which is defined as the sum of market capitalization to total domestic credit to the private sector, divided by GPP): countries above or equal to the median are classified as having a high capitalization, and countries below the median are classified as having a low capitalization. We present three specifications: (1) an estimation that uses all observations, (2) an estimation that uses only observations for airlines in low capitalization countries, and (3) an estimation that uses only observations for airlines in high capitalization countries. We cluster errors at the airline level and display 90% confidence intervals.

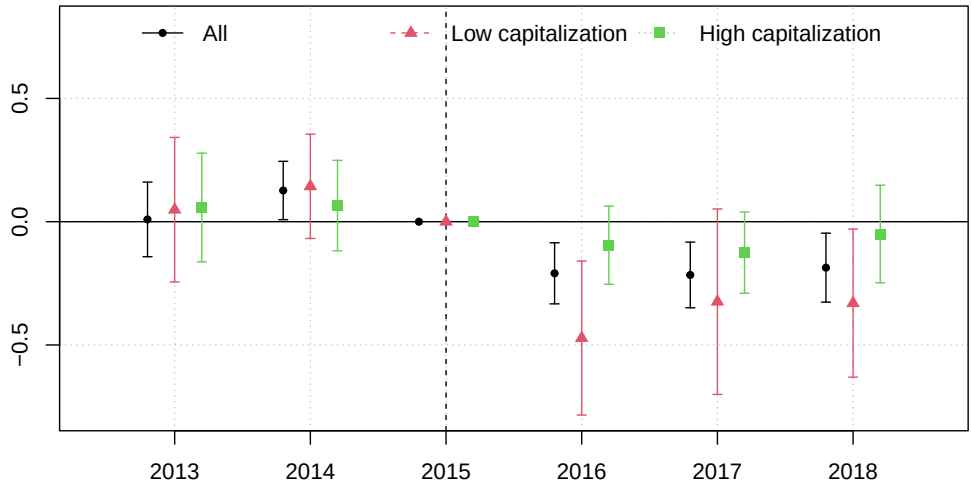


FIGURE A7. Effects on the number of Boeing aircraft: excluding Chinese airlines

This figure presents the results of estimating equation (1) on a balanced sample of 529 airlines between 2013 and 2018, excluding airlines located in China. The outcome variable is the logarithm of one plus the number of Boeing aircraft delivered to an airline in a given year. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide countries into two groups based on their capitalization-to-GDP ratio in 2015 (which is defined as the sum of market capitalization to total domestic credit to the private sector, divided by GPP): countries above or equal to the median are classified as having a high capitalization, and countries below the median are classified as having a low capitalization. We present three specifications: (1) an estimation that uses all observations, (2) an estimation that uses only observations for airlines in low capitalization countries, and (3) an estimation that uses only observations for airlines in high capitalization countries. We cluster errors at the airline level and display 90% confidence intervals.

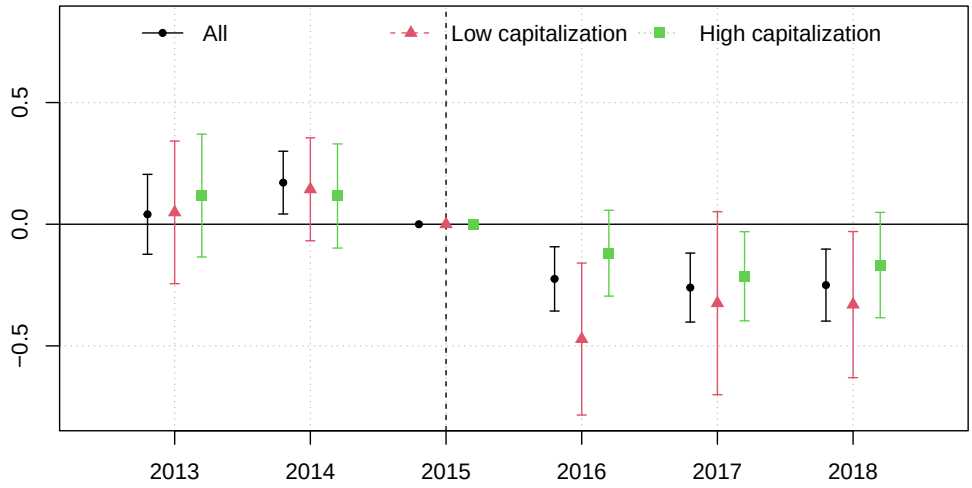


FIGURE A8. Effects on the likelihood of purchasing a Boeing aircraft: role of sovereign risk

This figure presents the results of estimating equation (2) on a sample of 4,563 aircraft deliveries between 2013 and 2018. The outcome variable takes the value of one if the aircraft being delivered was produced by Boeing, and zero if otherwise. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We also include the logarithm of the fleet size as an airline control. We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide countries into two groups based on their sovereign risk rating in 2015: countries with a rating equal or above Baa3 are classified as low risk, and countries with a rating lower than Baa3 are classified as high risk. We present three specifications: (1) an estimation that uses all observations, (2) an estimation that uses only observations for airlines in low-risk countries, and (3) an estimation that uses only observations for airlines in high-risk countries. We cluster errors at the airline level and display 90% confidence intervals.

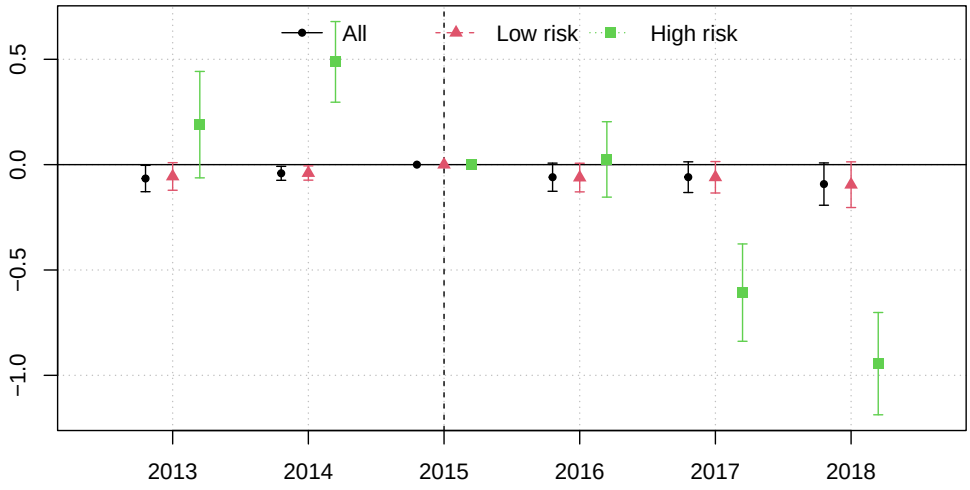
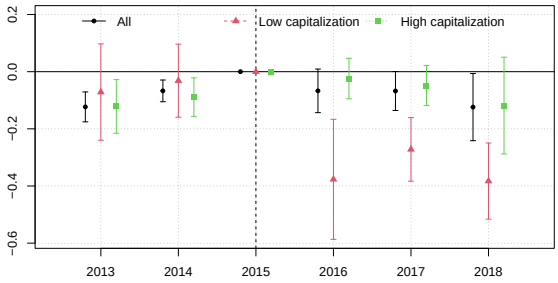


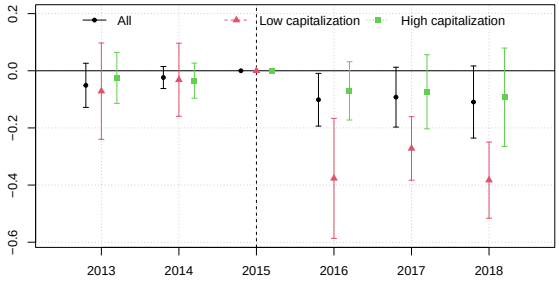
FIGURE A9. Effects on the likelihood of purchasing a Boeing aircraft: role of access to credit markets

This figure presents the results of estimating equation (2) on a sample of 4,563 aircraft deliveries between 2013 and 2018. The outcome variable takes the value of one if the aircraft being delivered was produced by Boeing, and zero if otherwise. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We also include the logarithm of the fleet size as an airline control. We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide countries into two groups based on their capitalization-to-GDP ratio in 2015 (which is defined as the sum of market capitalization to total domestic credit to the private sector, divided by GPP): countries above or equal to the median are classified as having a high capitalization, and countries below the median are classified as having a low capitalization. We present three specifications: (1) an estimation that uses all observations, (2) an estimation that uses only observations for airlines in low capitalization countries, and (3) an estimation that uses only observations for airlines in high capitalization countries. In Panel A, we exclude U.S. airlines. In Panel B, we exclude Chinese airlines. In Panel C, we exclude observations for deliveries of the 737-Max. We cluster errors at the airline level and display 90% confidence intervals.

(a) Excluding U.S. airlines



(b) Excluding Chinese airlines



(c) Excluding 737-Max

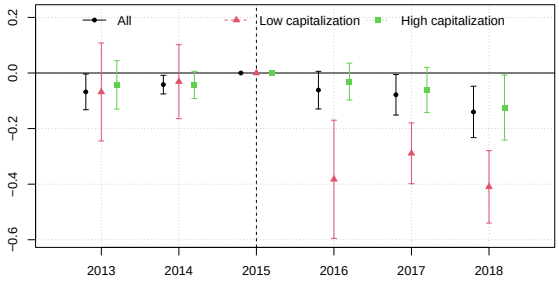
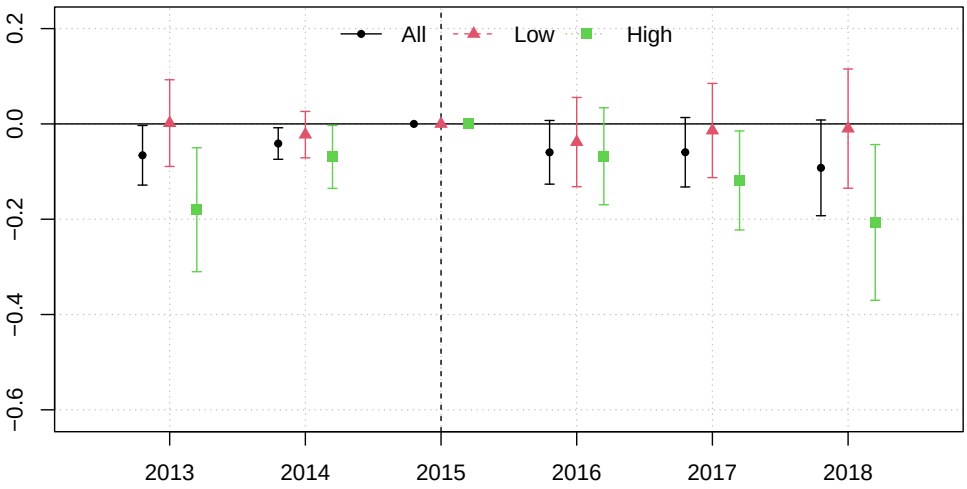


FIGURE A10. Effects on the likelihood of purchasing a Boeing aircraft: role of firm external financing ratio

This figure presents the results of estimating equation (2) on a balanced sample of 4,563 airlines between 2013 and 2018. The outcome variable is the logarithm of one plus the number of Boeing aircraft delivered to an airline in a given year. We compare two groups of airlines: treated airlines (airlines that had at least one Boeing aircraft in their fleet in 2015) and control airlines (airlines that had no Boeing aircraft in their fleet in 2015). We include airline and year fixed effects, as well as time-varying country controls (logarithm of GDP, logarithm of population, and GDP per capita). We also include the logarithm of the fleet size as an airline control. We use the year 2015 as the base year, and we present average treatment effects for treated airlines relative to 2015. We divide airlines into two groups based on their external financing ratio in 2015 as in Rajan and Zingales (1998) (which is defined as the share of capital expenditures that is not financed with cash flows): airlines with an external financing ratio above or equal to the median are classified as having a high external financing ratio, and airlines with an external financing ratio below the median are classified as having a low external financing ratio. We present three specifications: (1) an estimation that uses all observations for which we observe the airline's liquidity ratio, (2) an estimation that uses only observations for airlines with a low external financing ratio, and (3) an estimation that uses only observations for airlines with a high external financing ratio. We cluster errors at the airline level and display 90% confidence intervals.



A.2 Back-of-the-envelope calculation

We can write the change in Boeing's share of deliveries as

$$\Delta \widetilde{s}_t = -s_{2015}^{\text{exim}} + \sum_{c \in \{\text{high, low}\}} \mathbb{P}\left(\text{Buys Boeing} \mid c\right)_t \times s_{2015}^{\text{exim, c}}.$$

We use our results in Figure 10 to compute the probabilities as $\mathbb{P}\left(\text{Buys Boeing} \mid c\right)_t = 1 + \delta_m^c$ where $\delta_m^c < 0$ and $c \in \{\text{high, low}\}$. We now need to compute $-s_{2015}^{\text{exim}}, s_{2015}^{\text{exim, low}}$ and $s_{2015}^{\text{exim, high}}$. To estimate these objects, we need to classify each aircraft delivery as one that receives EXIM funds or not. To do so, we assume that if airline j receives EXIM aid to purchase Boeing aircraft in year t, all Boeing aircraft deliveries from year t until year $t + h$ are financed with EXIM funds. We present the estimates for different values of h in Table A1. We find that the estimates do not vary much with the choice of h.

TABLE A1. Effects on likelihood of purchasing a Boeing aircraft

This table presents the model-implied predictions for the evolution of the Boeing share of deliveries. To estimate s_{2015}^{exim}, $s_{2015}^{\text{exim, low}}$ and $s_{2015}^{\text{exim, high}}$, we need to classify each aircraft delivery as one that receives EXIM funds or not. To do so, we assume that if airline j receives EXIM aid to purchase Boeing aircraft in year t, all Boeing aircraft deliveries from year t until year $t + h$ are financed with EXIM funds. We present the estimated model-implied effect on Boeing's share of deliveries for different values of h.

	$h = 1$	$h = 2$	$h = 3$
s_{Exim}	0.239	0.271	0.271
$s_{\text{Exim, High}}$	0.204	0.233	0.233
$s_{\text{Exim, Low}}$	0.035	0.038	0.038