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Covid-19 and International Trade: Evidence from New Zealand*

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Abstract
The impact of the Covid-19 pandemic on international trade varies along several dimensions, including the type of product, the size of firm and over time. In this note, I provide evidence of systematic variation in the trade response to the pandemic along another, previously unexplored dimension, the mode of transportation. Analyzing daily data from New Zealand, I find that the value of seaborne exports and imports increases relative to shipments by air during pandemic lockdowns. While this finding is consistent with many explanations, including the sensitivity of trade to external finance, it generally provides support for the importance of frictions on the supply side.

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1. Introduction

Sharp contractions in world trade typically raise considerable interest in the channels and mechanisms underlying the decline. For the collapse in trade during the 2008-2009 global recession, for instance, various explanations have been examined. While changes in expenditure have been identified as the main driver of the decline in trade, other factors, such as export finance constraints, contributed measurably to the trade contraction. Based on the collection of evidence, Bems, Johnson and Yi (2013, p. 396) note that "one benefit of the trade collapse is that it stimulated work on neglected areas at the intersection of international trade and macroeconomics".

The dramatic decline in world trade in early 2020, after the outbreak of the coronavirus (Covid-19) pandemic, provides another such interesting episode. According to the World Trade Organization (2020), global merchandise trade fell in volume by a record 14 percent in the second quarter of 2020 compared to the previous period. Consequently, a growing number of studies aim to analyze this collapse in more detail. Benguria (2021), for instance, examines firm-level data from Colombia and argues that most of the decline in exports is due to adjustments along the intensive margin (that is, export growth among continuing exporters and varieties). Bricongne, Carluccio, Fontagné, Gaulier and Stumpner (2021) analyze firm-level data from France and find that the largest exporters account for a disproportionately large fraction of the decline in trade.

In this note, I offer evidence for another empirical regularity in the response of international trade to the Covid-19 pandemic. Based on high-frequency data from New Zealand, I document that the negative impact of the pandemic on cross-border trade has been stronger on shipments by air than on shipments by sea. This evidence is consistent with a channel that has also been emphasized for the great trade collapse. In line with the argument that the sensitivity of trade to external finance likely differs by mode of transportation, Ahn, Amiti and Weinstein (2011) show that goods exported by sea experience a price increase relative to goods shipped by air or land during the crisis period.[1] Pandemic-related disruptions also vary across transportation infrastructures, with aviation having been hit particularly hard. More generally, the finding of systematic changes in the composition of trade by mode of

[1] Specifically, it is argued that seaborne shipments display features different from other modes of transportation, such as greater shipping times, which likely imply greater needs for trade finance. Based on this reasoning, one can argue, along similar lines, that mode-related specifics affect a mode's susceptibility to pandemic shocks.

transportation, while other features of trade remain unaffected, provides support for the idea that supply side factors contributed measurably to the trade response during the pandemic.

2. Empirics

After the outbreak of the coronavirus pandemic, the national statistical office of New Zealand, Stats NZ, began publishing daily international trade data. The data reach back to January 1, 2015, to allow for useful comparison; the most recent data available before publication was ceased again is for December 15, 2021. In addition to total values of exports, imports and re-imports, the office released information at various levels of disaggregation. In particular, details are provided on trade with selected (main) trading partners, trade in a few product categories, and, most notably for my purposes, aggregate trade by mode of transportation. Since New Zealand is an island economy, there are only cross-border shipments by sea or air.

Although the generalizability of findings from a single country is generally unknown, the case of New Zealand offers at least two advantages. First, New Zealand's trade performance mimics that of other countries during the pandemic. As shown in Figure 1, trade declined sharply during the first four months of 2020, followed by a strong rebound afterwards. In fact, trade values at the end of 2021, at a time at which the global pandemic is in full swing and many containment measures are still in place, are considerably higher than before the pandemic.[2] Second, due to its isolation, New Zealand was much less directly affected by the pandemic than other countries. More specifically, in view of low domestic infection rates, Covid-19 protection measures were actively implemented and lifted in due course, thereby allowing for a timely and consistent identification of episodes during which New Zealand suffered from pandemic-related hardships. Figure 2 graphs a summary index of national 'lockdown style' policies ('stringency index'), compiled by the Oxford Covid-19 Government Response Tracker. This graph illustrates substantial variation for New Zealand and remarkable stability at high levels for its main trading partners. In the empirical implementation, I define periods with a stringency index above the value of 25 as lockdown episodes.[3]

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[2] Goldbach and Nitsch (2022) find that the effects of government measures in response to Covid-19 on capital flows differ considerably across waves of the pandemic.

[3] Since New Zealand effectively closed its borders to all but New Zealand citizens and permanent residents on March 19, 2020 and only plans to gradually re-open borders in 2022

To analyze the impact of the pandemic on international trade, I estimate equations of the form:

$$(1) \quad \text{ShareTradebySea}_d = \alpha_{year} + \alpha_{dayofyear} + \beta \times \text{Lockdown}_d + \varepsilon_d \,,$$

where ShareTradebySea_d is the fraction of New Zealand's international trade shipped by sea at day d, Lockdown is a binary variable that is one for periods of strict Covid-19 lockdown policies in New Zealand as defined above (and zero otherwise), and α_{year} and $\alpha_{dayofyear}$ are sets of year and day-of-year fixed effects. Since trade shares are bounded between 0 and 1, I transform the dependent variable using the logit transformation (log[Share/(100-Share)]); similar results are obtained when ordinary least squares or fractional response regression are used.

Table 1 reports the results. Columns (1)-(4) tabulate estimates for exports; the remaining four columns show the corresponding estimates for imports. I begin with the baseline specification of equation (1). As shown in the column on the extreme left of Table 1, the estimate of β is positive and statistically significant, indicating that during pandemic lockdowns, the value of New Zealand's seaborne exports increases relative to shipments by air. This finding is not driven by the global pandemic itself; the estimate of β remains basically unchanged when year fixed effects are replaced with a binary variable that is one for the years of the pandemic, 2020 and 2021, and zero otherwise. The finding is also robust for a shorter sample period (only analyzing data from 2018 onwards) and for using the share of shipments by air as dependent variable (the shares do not always sum to 100 due to rounding).[4] In terms of magnitude, an (unconditional) analysis of the raw data indicates that seaborne trade as a fraction of total trade increases, on average, by one to two percentage points during lockdowns. Analogous estimation results for imports are presented in columns

(see https://covid19.govt.nz/international-travel/travel-to-new-zealand/when-new-zealand-borders-open/), fluctuations in the stringency index mainly reflect changes in domestic containment measures.

[4] It should be noted that pre-existing trends are not a relevant issue in this empirical setting, for at least two reasons. First, the results are not derived from a simple comparison of the share of trade between a single pre- and post-period (e.g., before and after the outbreak of the pandemic), but I analyze multiple episodes of lockdowns during the pandemic. Since there are several switches between 'no lockdown' and 'lockdown' periods, there is no reason to believe that changes in the share of trade during lockdowns (in daily data) are the result of pre-existing trends. Second, systematic changes in the share of trade over time are captured by year-fixed effects. For instance, to the extent that there is a secular (i.e., long-term) decline in the share of trade by air which simply has continued during the pandemic, this effect will be absorbed by the year fixed effects. Additional material is provided in an online appendix.

(5)-(8) of Table 1; the estimates are qualitatively similar, though slightly smaller in magnitude.

A plausible explanation for the observed shifts in the mode of transportation is the sharp decline in international air travel.[5] With borders closed, passenger travel collapsed, thereby also reducing capacities for air cargo traffic. In fact, inefficient transportation seems to have been a serious supply-side constraint during the pandemic. According to the International Air Transport Association (2021, p. 15), "capacity is the problem, as international travel restrictions limit belly space."

To explore the relevance of this channel, I analyze daily air passenger arrivals and departures, available from New Zealand Customs Service. In particular, I construct a new binary variable, LowAirTraffic, that identifies (91) days of exceptionally low air traffic to and from New Zealand, with fewer than either 150 incoming or outgoing international passengers, and re-estimate equation (1) for this alternative measure of pandemic-related hardships and restrictions.

The results are presented in Table 2. Columns (1) and (3) indicate that LowAirTraffic has a positive and reasonably large point estimate when added by itself, such that days of low travel activity are associated with a higher share of seaborne trade. As shown in columns (2) and (4), however, the effect shrinks and loses significance when included simultaneously with Lockdown. Therefore, although relevant, passenger travel explains only part of the observed shift towards shipments by sea during lockdown episodes. Figure 3 shows that the number of passengers was low throughout the pandemic, with large day-to-day fluctuations. Moreover, for airlines, air cargo business was of the utmost importance.

3. Conclusions

A prominent approach to highlighting the role of factors affecting export supply in international trade, such as reduced credit availability, is to analyze variations in trade by mode of transportation, emphasizing, for instance, differences in shipping times. The trade response to the global Covid-19 pandemic is broadly in line with this reasoning. According to

[5] Another possible explanation are pandemic-related changes in the geographic and product composition of New Zealand's trade. However, while New Zealand's patterns of trade vary considerably between exports and imports anyway, I find in unreported results no evidence of adjustments in trade during lockdowns which systematically benefit seaborne shipments.

evidence from New Zealand, the value of seaborne exports and imports increases relative to shipments by air during pandemic lockdowns. While this finding is consistent with many explanations, from trade finance constraints to infrastructure deficiencies, it generally provides support for the importance of trade frictions on the supply side. Moreover, in view of imperfect substitutability of modes of transport in trade, shocks whose effect varies by mode of shipment may justify targeted policy responses.

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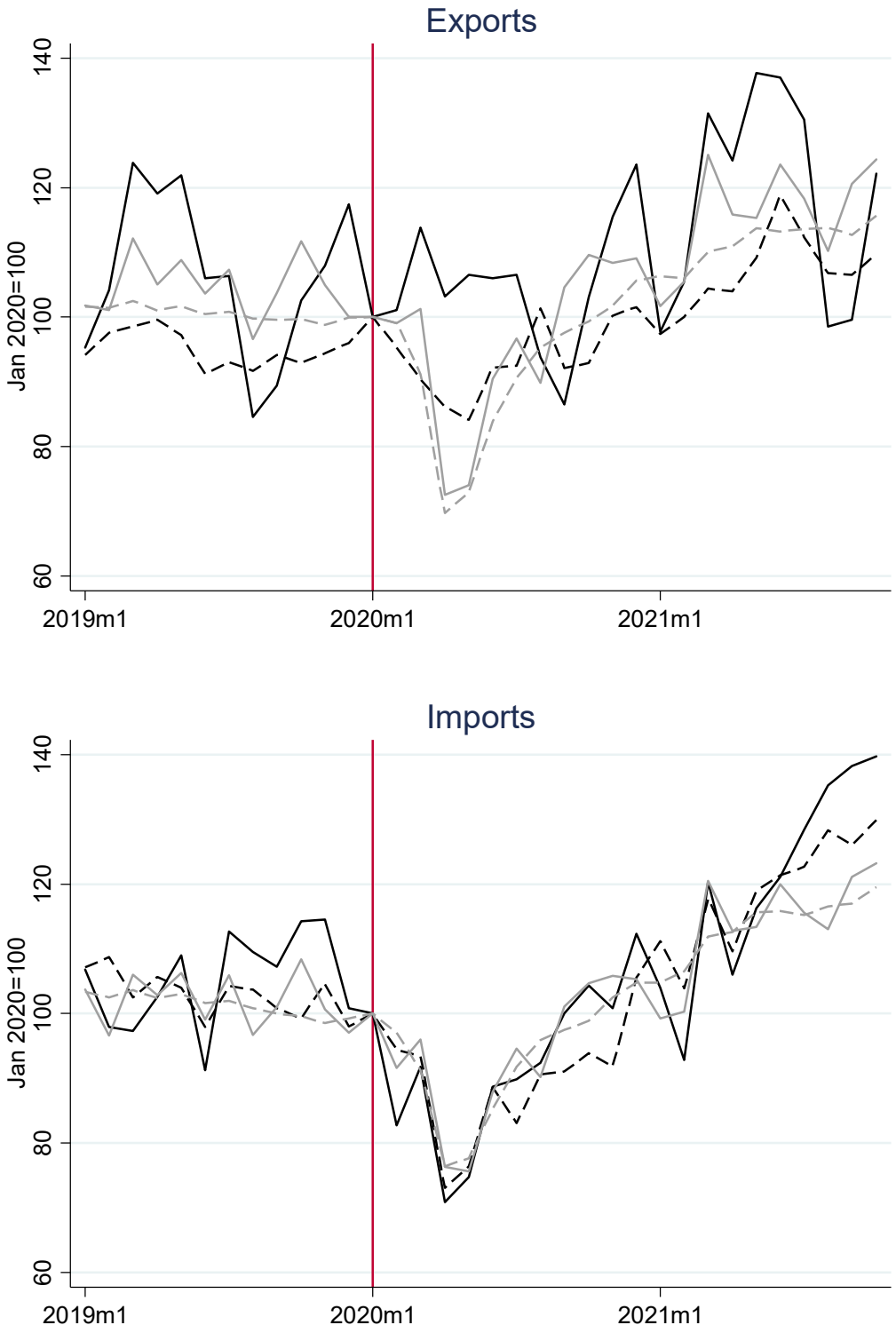
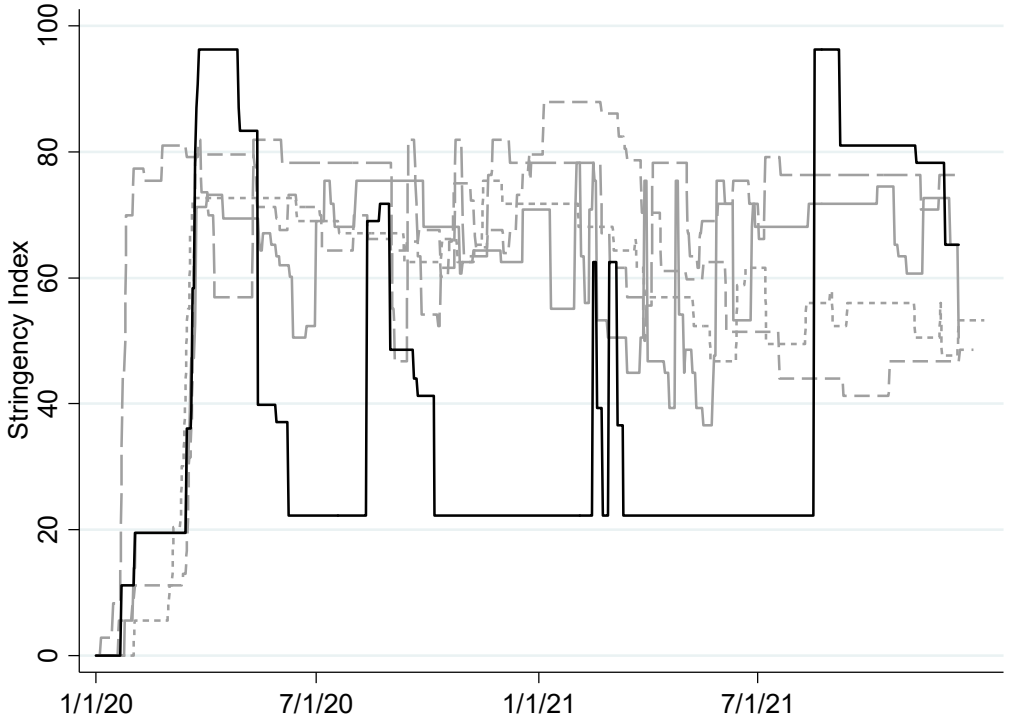
Figure 1: Monthly Foreign Trade of New Zealand, 2019-21



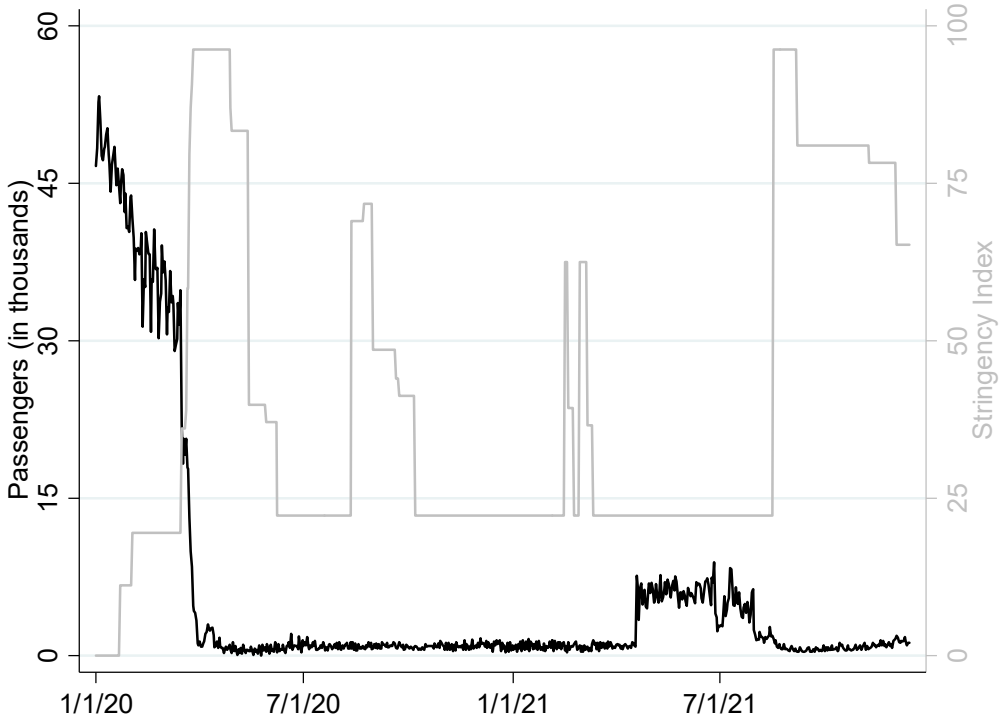
Source: OECD.
Notes: This graph plots original (solid) and seasonally adjusted (dashed) monthly trade values for New Zealand (black) and OECD countries (grey). All data are indexed, with January 2020 = 100.

Figure 2: Daily Covid-19 Stringency Index, 2020-21



Source: Oxford Covid-19 Government Response Tracker.
Notes: This graph plots the daily Covid-19 stringency index, a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest), for New Zealand (black), Australia (grey, line), China (longdash), the United Kingdom (dash) and the United States (shortdash). The following periods are defined as Covid-19 crisis episodes for New Zealand: March 16, 2020-June 7, 2020; August 12, 2020-October 6, 2020; February 15, 2021-March 11, 2021; August 17, 2021-. This classification is consistent with the assessment of the pandemic situation by the government of New Zealand; see https://covid19.govt.nz/about-our-covid-19-response/history-of-the-covid-19-alert-system/.

Figure 3: Daily Number of Air Passengers in New Zealand, 2020-21



Source: New Zealand Customs Service.
Notes: This graph plots the number of arriving and departing air passengers in New Zealand (black) and the country's Covid-19 stringency index (grey, right scale) by day.

Table 1: Lockdown Policies and Mode of Transportation

Direction of trade	**Exports**				**Imports**			
Dependent variable	Share Sea	Share Sea	Share Sea	Share Air	Share Sea	Share Sea	Share Sea	Share Air
Period	2015-2021	2015-2021	2018-2021	2015-2021	2015-2021	2015-2021	2018-2021	2015-2021
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lockdown	0.120**	0.123**	0.128**	-0.117**	0.096**	0.101**	0.085*	-0.089**
	(0.044)	(0.044)	(0.043)	(0.044)	(0.033)	(0.033)	(0.035)	(0.033)
Pandemic		0.044				-0.090**		
		(0.030)				(0.023)		
Day-of-Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Observations	2,534	2,534	1,445	2,534	2,538	2,528	1,443	2,528
Adj. R2	0.366	0.360	0.331	0.367	0.631	0.624	0.627	0.632

Notes: The dependent variable is logit(share) = log(share/(1-share)). Data are in daily frequency. The day-of-year fixed effects are based on a match of dates provided by StatsNZ. Robust standard errors are reported in parentheses. ** and * denote significant at the 1% and 5% level, respectively.

Table 2: Air Traffic and Variation in Trade

Direction of trade	**Exports**		**Imports**	
	(1)	(2)	(3)	(4)
LowAirTraffic	0.162*	0.133	0.056	0.030
	(0.082)	(0.082)	(0.051)	(0.053)
Lockdown		0.103*		0.092**
		(0.045)		(0.034)
Day-of-Year FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	2,534	2,534	2,534	2,534
Adj. R2	0.366	0.367	0.630	0.631

Notes: The dependent variable is logit(share) = log(share/(1-share)) of the share of trade shipped by sea. Data are in daily frequency for the period 2015-2021. The day-of-year fixed effects are based on a match of dates provided by StatsNZ. Robust standard errors are reported in parentheses. ** and * denote significant at the 1% and 5% level, respectively.

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