Intensive and Extensive Margins of manufacturing exports: impact of commodity windfalls

Abraham Lartey*

This version: 12th December, 2021
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Abstract

How do commodity windfalls affect the number of exporters (extensive) or the average export value per exporter (intensive) within the manufacturing sector? I exploit the exogenous variation in the windfalls generated by the increase in prices of all major commodities during the early 2000s to fill this gap in the literature. I found that manufacturing industries that historically had a relatively higher share of exports to value added ratio (more- exportable) tend to be negatively affected relative to the other manufacturing industries at both margins. Secondly, the extensive margin is largely driven by entrants. i.e., the number of new firms that enter the export market for the more- exportable industries decline relative to the less exportable industries. Thirdly, for the more-exportable industries, the average export value per incumbent exporters of the more- exportable industries decline while that of the new exporters increases relative to the less exportable industries. This implies that commodity windfalls act as a cost push on both margins within the manufacturing sector, but the effect depends on the type of exporter.

JEL classification codes: F1, F4, L6, Q3

*PhD Student, Fundamentos del Análisis Económico (FAE), Universidad de Alicante Spain email:abrahamlartey06@gmail.com. I am grateful to my advisors Fidel Perez Sebastian and Pedro Albarran for their guidance. Special thanks also go to Lola Collado, Javier Andrés Santiago and other participants at the Macroeconomics, Macroeconometrics and Financial Econometrics PhD Students workshop for their valuable comments. Financial support from Generalitat Valencia (GRISOLIA/2018/110) is duly acknowledged.

1 Introduction

What are the margins through which manufacturing exports from commodity exporting countries adjust to income gains (due to an exogenous increase the price of the commodities they export or a new discovery) ? Theoretically, commodity windfalls increases domestic demand, induces wage increases (cost push factor), leads to an appreciation of the real exchange making the non-booming tradable sector less competitive according to the predictions of the core Dutch disease (DD) model (Corden and Neary, 1982; Corden, 1984). This suggests that the windfalls generated by a resource boom should cripple the total value of non-resource exports. The empirical literature on the impact of commodity windfalls on non-resource trade is not only scant but have so far reached mixed conclusions. Some studies found a crippling effect on non-resource exports (Harding and Venables, 2016; Stijns, 2003) while others found a positive effect (Smith, 2019) . The lack of consensus could be because these studies focused on aggregate trade flows and do not explicitly disentangle the margins (extensive and intensive) through which this effect takes place. The relative dominance of each margin might lead to a positive, negative, or neutral effect.

In this paper, I examined the impact of the 2000s commodity windfalls on the extensive (number of exporters) and intensive (the export value per exporter) margins of manufacturing exports. Commodity exporting countries benefited from booms in commodity prices between 2003 and 2014. The boom in prices which is arguably of the longest, was driven by China's rapid economic growth, increased global commodity prices, which was then followed by production responses from commodity producers. It is still unclear how non-resource exports in these countries adjusted to the boom. Recent trade models with heterogeneous firms(Melitz, 2003; Chaney, 2008) showed that only some firms will be able to export thereby resulting in two (2) margins: the number of firms that export (extensive margin) and the average export value per exporter (intensive margin). Do commodity windfalls affect both margins of manufacturing exports? Specifically, are historically more exportable manufacturing industries affected differently than the less exportable ones? If yes, are incumbent ex-

porters affected differently than new exporters? Answering these questions enhances our understanding of the impact on commodity windfalls on non-resource trade.

To guide empirical work, I introduced a DD framework into a simple version of the trade model with heterogeneous firms by Melitz (2003) and later adapted by Chaney (2008) to generate testable hypothesis. I then combined country specific commodity terms of trade (CTOT) data with country-product–destination–year level manufacturing export data for 48 commodity exporters for the period 2003 to 2013 to examine the impact of the windfalls generated by the 2000s commodity booms using a gravity model of trade. I proxy windfalls with country specific CTOT. This is important because almost all commodities experienced a boom in prices during the period under consideration. Secondly no country is a net producer of all commodities in the world. Therefore, the extent to which movements in commodity prices translates into windfalls for each country depends on the composition of both their exports and imports. The implication is that spikes in commodity prices will affect each country differently. The identification assumption of the paper is that the boom of the 2000s is exogenous to the countries in the sample used in the study. This assumption could be problematic if there are strategic responses from the producing countries that affect the prices. This should not be a problem[1] for the identification strategy as the individual countries are price takers and cannot significantly affect the prices on the international market. I also distinguished[2] between manufacturing industries that historically have relatively high proportion of value added going to exports (more-exportable) compared to other manufacturing industries (less-exportable). This distinction allows me to estimate my parameter of interest while controlling for exporting and destination countries time fixed effects. It also allows me to test the main predictions of the core DD model within the manufacturing sector.[3]

[1]The sample is limited to developing countries. Also, I exclude all the major producers as a robustness check and the results remain similar.

[2]To the best of my knowledge, this was first done by Rajan and Subramanian (2011) to study the effect of foreign aid on manufacturing. They found that aid had a negative effect on more-exportable manufacturing exports compared to less-exportable manufacturing exports

[3]The idea is that not only manufacturing products end up in the export market. Some of them mainly serve the domestic market while others mainly serve the export market. The later should be relatively more affected according to the prediction of the DD model.

I found that a 1% increase in commodity windfalls led to about 1% decrease in the number of exporters (extensive margin) and 3 % decrease in the value of exports per exporter (intensive margin) of the more-exportable manufacturing industries relative to less-exportable manufacturing industries. However, the negative impact at the extensive margin is driven by new exporters. That is the number of new exporters that enter the export market for the more-exportable manufacturing industries decline relative to the less exportable industries Specifically, a 1% increase in commodity windfalls led to relatively 0.95% decline in the number of new exporters that enter the export market for the more-exportable manufacturing industries. No statistically significant effect is found at the extensive margin for incumbent exporters. The negative effect at the intensive margin on the other hand is driven by incumbent exporters. A 1% increase in commodity windfalls led to about 2.5% decline in the average export value of the more-exportable industries per incumbent exporters relative to the less -exportable industries. On the other hand, a 1% increase in commodity windfalls led to about 2.46% increase in the average export value of the more-exportable industries per new exporters relative to the less -exportable industries. The main prediction of the theoretical model is that an increase in expenditure due to windfalls puts upward pressure on domestic wages which increases the export productivity cut-off. To test the mechanisms driving the result, I used data on manufacturing sub-sector wages, employment, value added and labor productivity. I found that commodity windfalls led to a growth in manufacturing sector wages. However, wages in the less -exportable manufacturing industries grew more than that of the more-exportable industries. This induced a relatively higher growth in employment, value added and the labor productivity in the former. This suggests that within the manufacturing sector, commodity windfalls benefit the less-exportable manufacturing industries and hurts the more exportable manufacturing industries. I also found that public expenditure increased due to the windfalls in line with the spending channel of the DD model. I therefore proceeded to study the role of Natural resource funds (NRFs) and expenditure rules (ERs) in ameliorating or amplifying the observed effect. NRFs and

ERs if effective should limit the level of expenditure thereby reducing the negative impact of commodity windfalls in the domestic economy. I found that ERs are effective in reversing the observed negative impact at the extensive margin but not the intensive margin. NRFs on the other hand do not have any effect at both the intensive and extensive margins.

To the best of my knowledge, this paper is the first to study the impact of commodity booms on the extensive (number of exporters) and intensive (average export value per exporter) margins of manufacturing exports. Several empirical studies have examined the impact of commodity windfalls in both developed and developing countries on the value added and employment in the non-resource sector (Sala-i Martin and Subramanian, 2013; Ismail, 2010; Cavalcanti et al., 2019; Aragón et al., 2018; Allcott and Keniston, 2018; Pelzl and Poelhekke, 2021; Cust et al., 2019) but only a few studies have examined the impact on non-resource trade. Using a gravity framework Harding and Venables (2016) found that a dollar increase in resource revenues decreases non-resource exports and increase imports by 44 and 23 cents respectively. Using a similar framework, Stijns (2003) also found that a 1% increase in an energy exporting country's net energy exports led to an 8% decrease in real manufacturing exports. Unlike the previous two (2) papers, I focused only on manufacturing exports and makes a distinction between the degree of exportability within the manufacturing sector. More closely related to my paper is that of Smith (2019). The author [4] examined the impact of the 1970s oil price boom and the subsequent bust on non-oil economic activity in oil-dependent countries. The author found that manufacturing exports and output increased significantly relative to non-oil countries by increasing local demand. Bahar and Santos (2018) studied the impact of natural resources exports on the concentration of non-resource exports and found that countries with larger shares of natural resources in exports have more concentrated non-resource export baskets.

The paper is also related to the literature on the drivers of the extensive and inten-

[4] I must add that the author also examined the impact of the boom on total value added and made a distinction between the degree of exportability as in Rajan and Subramanian (2011). This distinction was however not done for exports.

sive margins of trade. Some studies examined the impact of the Uruguay Round multilateral trade agreement (Buono and Lalanne, 2012), financial development (Berman and Héricourt, 2010) innovation (Chen, 2013) and export promotion (Martincus and Carballo, 2008). I provide evidence that commodity booms can act as a cost push factor on both margins. I also examined the heterogeneity by the type of exporter.

Finally, my paper enhances our understanding of the effectiveness of Natural resource funds (NRFs) and fiscal rules particularly expenditure rules in amplifying or ameliorating the negative impact of commodity booms. NRFs in the form of stabilization or savings funds reduce the number of windfalls that is spent in the economy and therefore expected to ameliorate the negative effect if they are effective. Mohaddes and Raissi (2017) found that NRFs dampen the negative effect of commodity price volatility on economic growth. I found that this is not the case for manufacturing exports at both the intensive and extensive margins.

The rest of the paper is structured as follows. A brief description of the commodity booms of the 2000s is presented in section 2. A summary of the theoretical predictions is provided in 3. The empirical strategy and data are described in section 4 while the empirical results are presented in section 5. The potential mechanisms driving the results are investigated in 6 while the role of NRFs are investigated in section 7. Robustness tests are presented in section 8 and conclusions in section 9.

2 The 2000 Commodity booms

The literature has identified 3 main episodes of commodity booms (see Radetzki (2006) for a detailed discussion of the 3 booms). The booms of early 1950s and the 2000 were driven by demand factors while that of 1973-74 was caused by a combination of supply and demand factors. The 2000s commodity boom is arguably the longest and involved three main commodities, energy, metals, and agriculture (World Bank, 2009). As shown in Figure 1, the prices of all commodities especially that of metals and energy began to increase sharply in 2003. As of 2008, the price of metals and energy commodities were more than three times their levels in 2000. The surge in prices were driven mainly by demand for raw material in emerging and developing countries led by China and India to meet an unexpected and persistent acceleration in economic growth. The prices declined (still above 2000 levels) during the initial stages of the 2008 financial crisis but rebounded again reaching a peak in 2011. The producing countries responded to the unexpected price increase albeit at a slower pace.

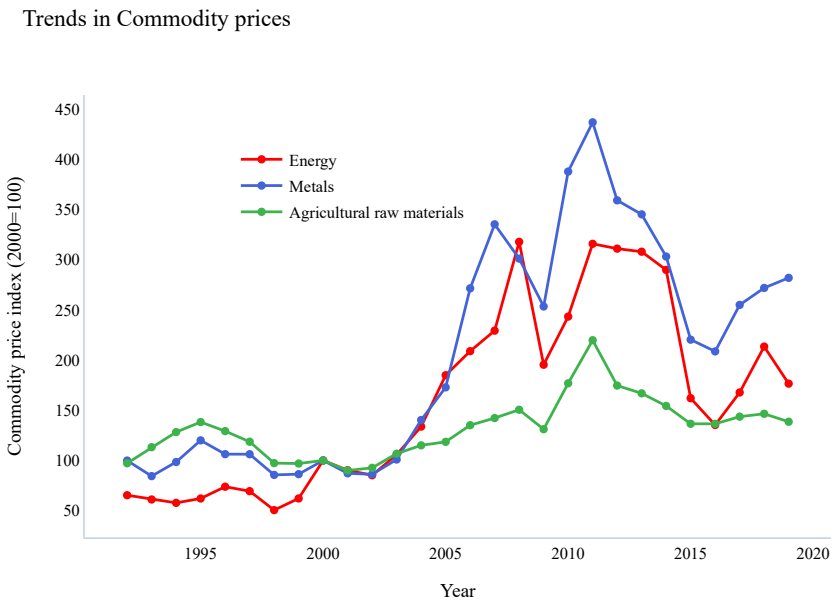

Figure 1: Trend in Commodity prices
Source: IMF, Primary Commodity Price System database

3 Theoretical Framework

To guide the empirical work, I introduce a Dutch disease framework (see Appendix C) into a trade model with heterogeneous firms by Melitz (2003) and later adapted by Chaney (2008). The model is similar to Bahar and Santos (2018) who analyzed the impact of windfalls on export concentration. The model I used in this paper differs in two (2) ways. I assume for simplicity there is only mobile factor of production, labor. Also, I include both the manufacturing (traded) and non-traded goods sector. Both the manufacturing and non-traded sector produce differentiated varieties. Some of the manufacturing varieties can be exported while some can be sold in the domestic market. The varieties produced from non-traded sector can only be sold in the domestic market. Commodity windfall is modeled as an exogenous increase in income which leads to an increase in domestic expenditure. I then use this to study the impact of windfalls on the intensive and extensive margins of manufacturing exports. The model predicts that an increase in expenditure due to windfalls puts upward pressure on domestic wages. This is because the increase in expenditure leads to an increase in aggregate demand therefore firms must increase their stock of labor to meet the increase in domestic demand[5]. The price of the non-traded goods increases and given the assumption of fixed labor supply, leads to an increase in domestic wages. Secondly, the model predicts that the export productivity increases in response to the increase in wages. This leads to a decline in the number of exporters (intensive margin). This is because the increase in the export productivity cutoff due to the wage increase implies that only relatively few firms have productivities above the cutoff therefore the number of exporters decline. Without any assumptions about the form of the productivity distribution function, the effect on the intensive margin is ambiguous as predicted by Melitz (2003). Intuitively, the increase in wage drives up variable trade cost and therefore can lead to a reduction in the export value of ex-

[5]The increase in demand for some of the traded varieties can be met with imports but the that of the non-traded good sector can only be met with domestic production

isting exporters, but it can also lead to the exit of marginal exporters[6]. Finally, given that the manufacturing firm can sell some varieties domestically and export some, the effect of windfall on manufacturing products at both margins would depend on their export share in total manufacturing output.

4 Methodology and Data

4.1 Empirical Strategy

Following the existing literature (see for example Lawless (2010) and Bernard et al. (2007)), I decompose the the total export value of manufacturing product p from the exporting country i to importing country j at time t in extensive(number of exporters) and intensive form (average export value per exporter) in log form as:

$$lnX_{pijt} = lnN_{pijt} + ln\bar{V}_{pijt} \tag{4.1}$$

Where N_{pijt} ($\bar{V}_{pijt}$) is the total number of exporters (average export value per exporter) of manufacturing product p from the exporting country i to importing country j at time t. I used the gravity model which is widely used in the empirical trade literature to model the bilateral trade flows as a function of income(for both exporting and importing country) and bilateral trade costs. The empirical model is specified as;

$$lnZ_{ijpt} = \beta_1 windfall_{it-1} + \beta_2 y_{it} + \beta_3 y_{jt} + \beta_4 RTA_{ijt} + \eta H_{ij} + \alpha_{it} + \omega_{jt} + \nu_{ijp} + \epsilon_{ijt} \tag{4.2}$$

Z denotes either the total number of exporters and the average export value per exporter, $windfall_{it-1}$ is the natural log of commodity terms of trade, y_{it} and y_{jt} are GDP per capita of the exporting country i and importing country j respectively, RTA_{ijt} is a dummy variable that takes the value of 1 if there exists a regional trade agreement between trading partners i and j at time t by and zero otherwise. H_{ij} is a vector of

[6]It can also make more productive firms to enter the market due to the increase in the export productivity cut off

traditional gravity bilateral trade costs variables such as bilateral distance, common language, common colony, etc. ν_{ijp} is country pair-product fixed effect[7]. The introduction of ν_{ijp} serves two (2) purposes, it first eliminates or accounts for the unobservable linkages between the endogenous covariate trade policy (RTA_{ijt} in this case) and the error term in gravity regressions and thus accounting for the endogeniety[8] of this variable. Secondly, the set of pair-product fixed effects will absorb all bilateral time-invariant covariates that are used in standard gravity regressions i.e H_{ij}. This prevents the situation where the researcher must pick/select which of these variables to include in the model. Also, the pair-product fixed effects are a better measure of bilateral trade costs than the standard set of gravity variables (Agnosteva et al., 2019; Egger and Nigai, 2015). α_{it} is exporting country-time fixed effect which controls for the outward multilateral resistances in exporting country i at time t, ω_{jt} is importing country-time fixed effect which controls for the inward multilateral resistances in importing country j at time t. However, the inclusion of these fixed effects does not allow one to estimate our main parameter of interest, β_1 and other observable and unobservable country-specific characteristics, which vary at the importing and exporting country levels. To deal with this issue, I define a dummy variable called exportability (expbly) which takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS) data (Rajan and Subramanian, 2011). These are mainly textiles, clothing, leather, and footwear (H2 product codes 50 to 63). This variable is then interacted with the main variable of interest. This interaction ($boom_{it-1} * expbly_p$) captures the idea that not all manufacturing products are the same: Some of them tend to be more exportable than others in developing countries. Therefore, according to the predictions of the core Dutch model, manufacturing products that are more exportable should be affected more by commodity booms compared to those that are less exportable. Furthermore, two (2) other econometric issues need to be dealt with:

[7]The paper omits the vector H_{ij} in specifications where ν_{ijp} is included

[8]For instance, trade policy variables may suffer from "reverse causality", because all else equal, a given country is more likely to liberalize its trade with another country that is already a significant trade partner. (Yotov et al., 2016)

zero trade flows and heteroskedasticity. A clear drawback of estimating (4.2) with the OLS is that it cannot take into account the information contained in the zero trade flows, because these observations are simply dropped from the estimation sample when the value of trade is transformed into a logarithmic form. This problem become more pronounced as I disaggregate manufacturing exports into extensive (number of exporters) and intensive margins (average export per exporter). I therefore specify the gravity model in multiplicative form (the dependent variable is in levels instead of logs) instead of logarithmic form in order to take into account zero trade flows. Taken together the final econometric specification is thus given as;

$$Z_{ijpt} = exp[\beta_1 windfall_{it-1} * expbly_p + \beta_2 RTA_{ijt} + \alpha_{it} + \omega_{jt} + \nu_{ijp}] * \epsilon_{ijt} \tag{4.3}$$

Equation (4.3) is estimated using Poisson Pseudo Maximum Likelihood (PPML) as proposed by Silva and Tenreyro (2006, 2011). The authors note that the PPML estimator leads to more robust and consistent coefficient estimates than the standard log-linear ordinary least squares (OLS) method in the presence of heteroskedasticity. The authors further note that the performance of the PPML estimator is consistent irrespective of whether the ratio of zero trade flows is low or high in the dataset. Finally, the additive property of the PPML estimator ensures that the gravity fixed effects are identical to their corresponding structural terms (Arvis and Shepherd, 2013; Fally, 2015). One of the nice features of model (4.3) is that the main coefficient of interest β_1 can still be interpreted as an elasticity. The identification assumption used is that, the boom of the 2000s is exogenous to the countries in the sample used in the study and therefore the windfall gains are driven by factors exogenous to these countries. The boom, driven by China's rapid economic growth, increased global commodity prices, which was then followed by production responses from commodity producers. The specification also controls for any time invariant firm level and country level factors that may affect the decision to enter or exit the export market. However the specification does not account for time variant firm level characteristics. Equation (4.3) is estimated for all exporters and separately for entrants and incumbents to study the

heterogeneity of the impact of commodity booms by the type of exporter.

4.2 Data

The World Bank Exporter Dynamics Database (EDD) contains aggregated measures on export-sector characteristics and dynamics presented at various levels (Fernandes et al., 2016). The EDD includes measures on

1. export sector characteristics in each country: e.g., number of exporters, export value per exporter and exporter growth rates. These characteristics are disaggregated by the type of exporter (incumbents and entrants);

2. concentration/diversification: e.g., Herfindahl index, share of top exporters, number of products and destinations per exporter);

3. firm, product and market dynamics: e.g., entry, exit, first-year and second-year survival rates of entrants);

4. unit prices: e.g., per exporter of a given product

The measures are constructed using exporter-level customs data as input, covering the universe of annual exporter transactions for 70 countries. The study used the country–HS2-digit product–destination–year level for the manufacturing sector.

4.2.1 IMF commodity terms of trade database

A comprehensive database of country specific commodity price indices for 182 economies covering the period 1962 to 2018. For each country, the change in the international price of up to 45 individual commodities is weighted using commodity-level trade data. The weight of each commodity is given by the share of net exports of that commodity in aggregate output. The commodity terms-of-trade index (ctot) proxies the windfall gains and losses of income associated with changes in world prices. Variations in the commodity terms-of-trade index provide an estimate of the windfall gains and losses of in- come associated with changes in international prices. That is, a one

percentage point change in the commodity terms-of-trade index can be interpreted as a change in aggregate disposable income equivalent to one percentage point of GDP (Gruss and Kebhaj, 2019).

4.2.2 Manufacturing sector product level data

I also use product level data on manufacturing wages, value added and employment from the United Nations Industrial Development Organization's (UNIDO) Industrial Statistics Database.

4.2.3 Other data

Data on GDP per capita in both the exporting and destination countries are sourced from World Bank (2020). Data on conventional gravity bilateral variables that do not vary over time such as bilateral distance,common language,common legal origin, common religion, common colonial ties were taken from CEPII GeoDist database Finally, data on regional trade agreements were taken from Mario Larch's Regional Trade Agreements Database Egger and Larch (2008).

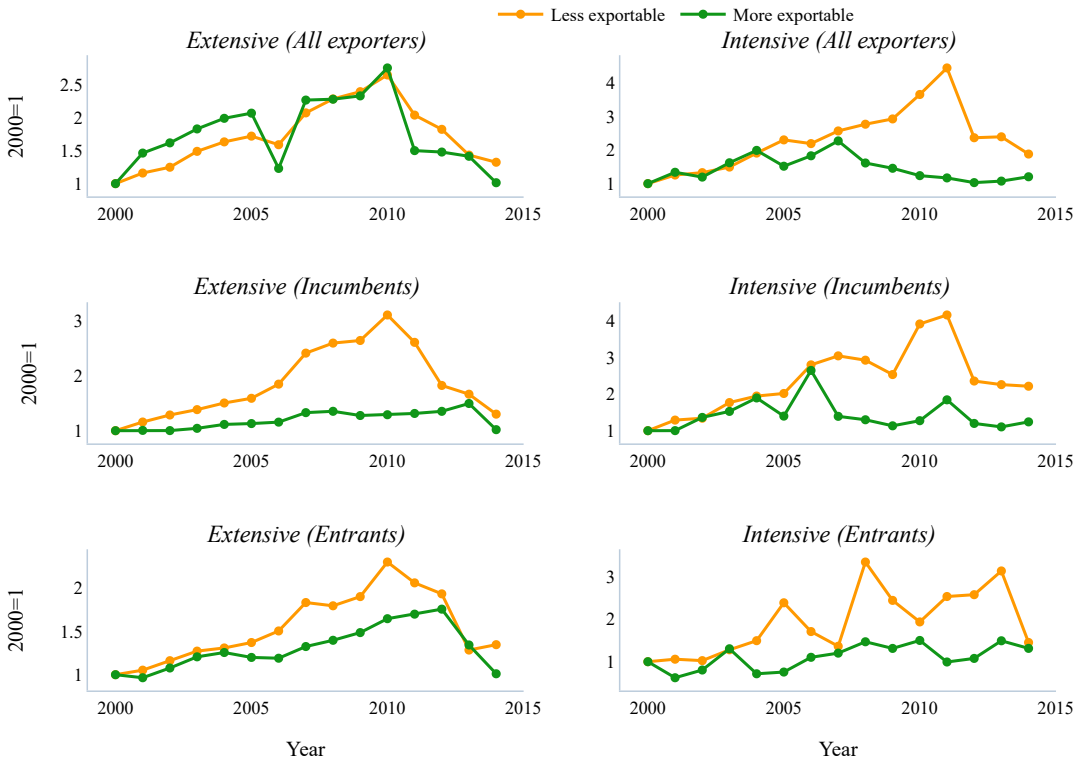

Figure 2: Trend in Extensive and Extensive Margin of Manufacturing export

Source: Own Construct based on Fernandes et al. (2016)

Notes: The figure was constructed by normalizing the extensive and extensive margins to 1 in 2000 for each country and then taking averages across countries for each year.

5 Empirical Results

I present and discuss the empirical results in this section. The results for all exporters are presented in Table 1. The first four columns report the results for the extensive margin while that of the intensive margins are reported in the last four columns (columns 5 to 8). Columns 1, 2, 5 and 6 controls for the traditional gravity time invariant bilateral trade costs, columns 3, 4, 7 and 8 replaces them with the pair-product fixed effects. Columns 1, 3, 5 and 7 also controls for GDP per capita for both the importing and the exporting country while they are replaced with importer-year and exporter-year fixed effects in columns 2, 4, 6 and 8. The results indicate a negative effect of commodity windfalls on manufacturing products that are more exportable at both the extensive and intensive margins relative to those that are less exportable. The impact of commodity windfalls becomes statistically significant when multilateral resistance terms have been accounted for and is larger when all time-invariant bilateral variables are controlled for. Specifically, the effect of commodity booms on the extensive margin is negative but statistically insignificant with the inclusion of traditional gravity control variables and year fixed effect (column 1). The estimate however becomes statistically significant when the year fixed fixed effects are replaced with importer-year and exporter-year fixed effects (column 3) which points to the importance of controlling for outward and inward multilateral resistance. The windfall coefficient becomes larger when the traditional gravity variables are replaced with pair-product fixed effects (column 3) but remains statistically insignificant. The magnitude of the effect remains largely the same albeit statistically significant in the preferred specification (column 4). Using the preferred specification (column 4), the results indicates that commodity windfalls decrease the number of exporters of manufacturing products that more exportable by decreases by 0.5% relative to less exportable manufacturing products.

On the other hand, the intensive margin is less sensitive to the inclusion and exclusion of control variables. The magnitude of the effect is larger when all time-invariant bilateral variables are controlled for. Specifically, controlling for traditional gravity

variables indicates that the average export value per firm decreases by 0.2% (columns 5 and 6) for manufacturing products that are more exportable relative to those that are less exportable while it decreases by 3% when all time-invariant bilateral variables are accounted for (column 8). That is at aggregate level, the number of exporters and average export per exporters of the more exportable manufacturing products tend to decrease more. These results are generally in line with the prediction of the Dutch disease model and some empirical findings.

Next, I estimate model (4.3) separately for entrants (see Table 2) and incumbents (see Table 2). This allows me to consider the heterogeneity of the type of exporter. For the sake of brevity only the preferred specifications (columns 4 and 8) are discussed here. For entrants, the extensive margin of manufacturing products that are more exportable decreases by 0.93% and the intensive margin increases by 2.5% relative to those that are less exportable. On the other hand, I find that the effect of the commodity windfalls on the extensive margin of incumbents is positive although not statistically different from zero. Also, the intensive margin of manufacturing products that are more exportable decreases by 2.4% for the incumbents. This suggests that the negative impact observed on aggregate at the extensive margin is largely driven by new exporters while that of the intensive margin is driven by incumbent exporters.

Table 1: Effect of commodity windfalls on the extensive and intensive margin of manufacturing export (all exporters)

	Extensive				Intensive			
	1	2	3	4	5	6	7	8
windfall_t-1 x expbly	-0.00781	-0.0399	-0.362	-1.011**	-0.232***	-0.212***	-1.373	-3.033**
	(0.0631)	(0.0642)	(0.938)	(0.415)	(0.0361)	(0.0414)	(1.494)	(1.375)
windfall_t-1	1.447		-0.219		-1.875		-1.158	
	(1.740)		(0.573)		(2.420)		(0.738)	
Observation	363161	363161	363161	363161	363161	363161	363161	363161
Year FE	✓		✓		✓		✓	
Time invariant gravity controls	✓	✓			✓	✓		
GDP controls	✓				✓			
Importer x Exporter x Industry FE			✓	✓			✓	✓
Exporter x Year FE		✓		✓		✓		✓
Importer x Year FE		✓		✓		✓		✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports along the extensive and intensive margins for all exporters. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). All regions control for regional trade agreements. GDP controls are origin and destination GDP per capita. Time invariant gravity controls include Contiguity, bilateral distance, common language, colony, religion, and legal origin. Robust standard errors clustered at exporting country level are in parentheses. ***, **, * denotes 1%, 5% and 10% level of significance respectively.*

Table 2: Effect of commodity windfalls on the extensive and intensive margin of manufacturing export (entrants)

	Extensive				Intensive			
	1	2	3	4	5	6	7	8
windfall_t-1 x expbly	-0.00850	-0.0390	-0.272	-0.950**	-0.179***	-0.157***	5.553**	2.464*
	(0.0559)	(0.0582)	(1.160)	(0.397)	(0.0411)	(0.0433)	(2.735)	(1.358)
windfall_t-1	1.342		0.235		-3.172**		-1.675	
	(1.681)		(0.602)		(1.402)		(1.488)	
Observation	329319	329319	329319	329319	329319	329319	329319	329319
Year FE	✓		✓		✓		✓	
Time invariant gravity controls	✓	✓			✓	✓		
GDP controls	✓				✓			
Importer x Exporter x Industry FE			✓	✓			✓	✓
Exporter x Year FE		✓		✓		✓		✓
Importer x Year FE		✓		✓		✓		✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports along the extensive and intensive margins for entrants. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). All regions control for regional trade agreements. GDP controls are origin and destination GDP per capita. Time invariant gravity controls include Contiguity, bilateral distance, common language, colony, religion, and legal origin. Robust standard errors clustered at exporting country level are in parentheses. ***, **, * denotes 1%, 5% and 10% level of significance respectively.*

Table 3: Effect of commodity windfalls on the extensive and intensive margin of manufacturing export (incumbents)

	Extensive				Intensive			
	1	2	3	4	5	6	7	8
windfall_t-1 x expbly	0.00826	-0.0269	-0.470	-0.761	-0.243***	-0.226***	-1.656	-2.499*
	(0.0675)	(0.0685)	(0.801)	(0.567)	(0.0338)	(0.0419)	(1.563)	(1.331)
windfall_t-1	0.958		-0.0933		-0.553		0.272	
	(1.676)		(0.557)		(3.161)		(1.652)	
Observation	293689	293689	293689	293689	293689	293689	293689	293689
Year FE	✓		✓		✓		✓	
Time invariant gravity controls	✓	✓			✓	✓		
GDP controls	✓				✓			
Importer x Exporter x Industry FE			✓	✓			✓	✓
Exporter x Year FE		✓		✓		✓		✓
Importer x Year FE		✓		✓		✓		✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports along the extensive and intensive margins for incumbents. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). All regions control for regional trade agreements. GDP controls are origin and destination GDP per capita. Time invariant gravity controls include Contiguity, bilateral distance, common language, colony, religion, and legal origin. Robust standard errors clustered at exporting country level are in parentheses. ***, **, * denotes 1%, 5% and 10% level of significance respectively.*

6 Mechanisms

The theoretical predictions in line with the core DD model is that an exogenous windfalls leads to an increase in expenditure and induces wage increases. In this section, I test this mechanisms by examining the effect of the 2000s commodity windfalls on consumption, investment and manufacturing sector indicators.

6.1 Consumption and Investment

Did the 2000 commodity boom lead to an increase in government spending? In order to answer this question I studied the impact of the windfall on consumption and investment using a local projection a la Jordà (2005);

$$y_{it+k-1} - y_{it-1} = \beta_1^k windfall_{it-1} + \beta_2 X_{it-1} + \omega_t + \nu_i + \epsilon_{it} \tag{6.1}$$

Where y_{it} comprises the natural logarithm of real private consumption, real government consumption, real government investment and real private investment. Consumption is defined as consumption expenditures and come from IMF World Economic outlook database. Public and Private Investment data comes from IMF Investment and Capital Stock database. The impulse responses at horizon k are given by the vector $\{\beta_1^k\}$ and captures the effect of the commodity booms at horizon k. The impulse responses are shown in Figure 3. Government consumption experienced a positive boost for the first three years before declining while private consumption remained relatively the same and not different from zero. Public investment also followed a similar pattern as the public consumption i.e., public investment increased for the first three years and then stabilized before experiencing a decline. Unlike private consumption, private investment experienced a slight positive boost. The results therefore indicates both government consumption and investment increased during the period under consideration while house consumption and private investment remained relatively stable. This is in line with the spending effect of the core Dutch disease model where a boom in commodity prices tend to increase public expendi-

ture thereby increasing aggregate demand.

6.2 Manufacturing sector indicators

I empirically investigate the potential mechanisms driving the main result in this section. The core Dutch disease model predicts that increase in spending due to windfall induces an increase in wages (cost push) and thus reduces employment in the non-booming sector. In order to test if this mechanism is at work, the paper used product level data on manufacturing sector wages, employment, and labor productivity (real value added per worker) from United Nations Industrial Development Organization's (UNIDO) Industrial Statistics Database using the model below;

$$\Delta y_{ipt} = \alpha_1 ln(windfall_{it-1}) * expbly_p + \alpha_2 ln(windfall_{it-1}) + \gamma \Psi_{it-1} + \phi_t + \lambda_{ip} + \mu_{it} \tag{6.2}$$

Where y_{ipt} is the log of the manufacturing sector variable as mentioned above; Ψ_{it} comprises log of GDP per capita and its square, log of population. They enter with a lag to limit endogeneity issues. ϕ_t is time fixed effect while λ_{ip} is exporting country-product fixed effect. In addition, I compute productivity as value added per number of employees. The results are shown in Table 4. The results indicate that a 1% increase in commodity windfalls led to about 0.7% increase in the growth rate of wages for all manufacturing industries. This is line with the theoretical predictions. However, the change in growth rate in wages is relatively lesser for the more-exportable manufacturing industries. Unlike the more-exportable manufacturing industry, the less exportable manufacturing industries can afford to increase wages because this can be passed on to the consumers. The boost in wages induces a relatively higher growth in employment (see column 2) and decline in the value-added growth rate (column 3) in the less-exportable manufacturing industries. Since the decline in value added is higher than the decline in employment, the labor productivity growth (column 4) experiences a decline in the more-exportable industries.

Taken together, the result shows the increase in wages due to commodity largely

benefits the less-exportable manufacturing industries and hurts the more exportable manufacturing industries. The response however differs by the type of exporter. There is a relative decline in the average export per incumbent exporters decrease in line with theoretical predictions but no significant impact is observed at the extensive margin. On the other hand, the number of new firms that enter the export market for the more exportable declines relatively. This implies that only relatively a smaller number of new firms will export these products i.e., only the new firms that are productive enough to generate enough profits to cover their fixed cost will export these products. However, conditional on entering the market, the average exports per new exporters of the more exportable products relative to the less exportable products increases.

Table 4: Effect of commodity windfalls on the growth rate of manufacturing sector indicators

	Wages	Employment	Value Added	Labor Productivity
windfall_t-1	0.687***	0.295**	1.228***	0.933***
	(0.156)	(0.140)	(0.175)	(0.104)
windfall_t-1 x expbly	-0.00789***	-0.00543**	-0.00904***	-0.00361*
	(0.00288)	(0.00259)	(0.00324)	(0.00192)
Observation	20401	20571	20571	20571
Year FE	✓	✓	✓	✓
Country x Product FE	✓	✓	✓	✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing sector indicators.The dependent variables are in log differences. Except for employment the other variables are in real terms. Employment is defined as the number of employees and productivity real value added per employee. windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an export to value-added ratio above the median according to World Integrated Trade Solution (WITS). Robust standard errors clustered are the country level are in parentheses. ***, **, * denotes 1%, 5% and 10% level of significance respectively.*

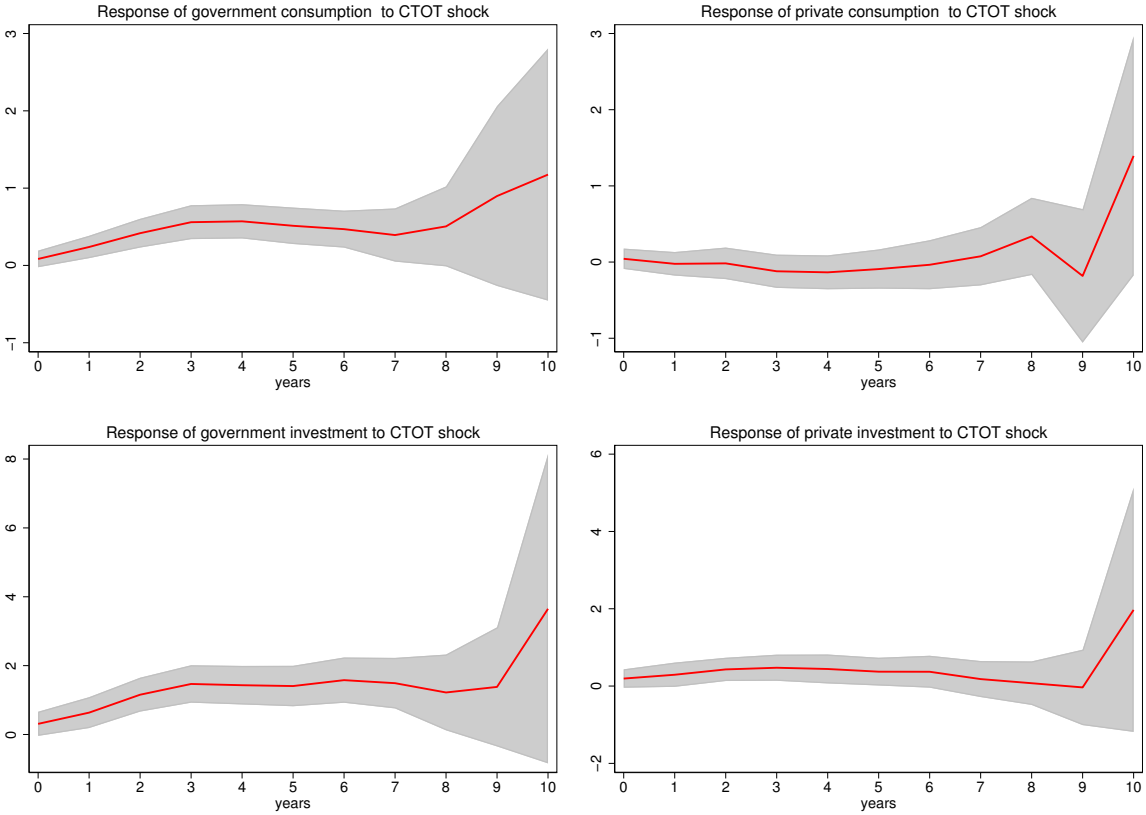

Figure 3: Response of consumption and investment to Commodity Terms of Trade Shock

Note: : The figure presents the impulse response of commodity windfalls on consumption and investment.The shaded area are 90 percent confidence bands.

7 Role of Natural Resource Funds (NRFs) and Expenditure Rules (ERs)

Given the complications associated with the management of commodity revenues and the volatility that they transmit into the economy, various policies have been proposed to help mitigate the negative effects of commodity booms. One of such is the establishment of NRFs (see for example Davis et al. (2003)). This is based on the Norwegian model where the revenues can be saved in an offshore account;

Stabilization Funds(STF): aims to insulate the budget and the country's economy from commodity price volatility and play the role of savings fund in the short term.

Saving Funds(SF): are intended to transfer non-renewable assets into a diversified portfolio of international financial assets to provide for future generations or other long-term objectives.

While SFs mainly play the role of savings in both the short and long run, STFs play the role of savings in only the short run. Therefore, both funds can be considered to play the role of savings in the short run. One of the main intuitions behind this is that saving revenues abroad has the advantage of reducing the amount of windfalls that is spent in the domestic economy which limits inflation, real exchange rate appreciation and contraction of other traded sectors (Wills et al., 2016). As shown in the previous section, the windfalls led to an increase in public expenditure. Therefore, if NRFs are effective they should reduce the negative effect of commodity booms. Another policy response is to put a numerical constraint on the level of expenditure known as expenditure rules (ER) either in percent of GDP, growth rates or absolute terms. If this is effective, the rule should limit the level of public expenditure. To ascertain empirically the effectiveness of NRFs and ER, I define a dummy variable (NRF and ER) equal to 1 if a country has either of these 2 funds or an expenditure rule in place before the start of the boom (as at the year 2001) and zero otherwise. This dummy is then interacted with the main variable of interest. The results for all exporters are shown in Table 5. As be seen, the average effects remain similar. At the extensive

margin, expenditure rules overturn the negative impact (see columns 1 to 3) while no statistically significant effect is observed for NRFs. On the other hand, no statistically significant effect is found for both NRFs and ER at the intensive margin. Furthermore, the dampening effect of ER at the extensive margin is largely driven by entrants while no effect is found in general for incumbents (see Tables 6 and 7). The results that NRFs are not effective at first sight seems counterintuitive. However, research [9] has shown the deposits and withdrawals rules governing these funds are sometimes not followed which could explain the observed result.

[9] see for example https://resourcegovernance.org/sites/default/files/documents/fiscal-rules-commodity-crash.pdf

Table 5: Role of resource funds and Expenditure Rules(All exporters)

	Extensive			Intensive		
	1	2	3	4	5	6
windfall_t-1 x expbly	-0.671*	-1.272***	-1.176***	-3.380**	-3.090***	-3.498**
	(0.382)	(0.266)	(0.444)	(1.355)	(1.132)	(1.466)
windfall_t-1 x expbly x NRF	-0.678		-0.173	1.247		1.367
	(0.499)		(0.548)	(1.942)		(2.021)
windfall_t-1 x expbly x ER		2.776***	2.681***		0.872	1.287
		(0.607)	(0.703)		(2.169)	(2.358)
Observation	363161	363161	363161	363161	363161	363161
Importer x Exporter x Product FE	✓	✓	✓	✓	✓	✓
Exporter x Year FE	✓	✓	✓	✓	✓	✓
Importer x Year FE	✓	✓	✓	✓	✓	✓

*Notes: The table presents the estimates of the heterogeneous effect of 2000s commodity boom on manufacturing exports along the extensive margins for entrants and incumbents. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). NRF and ER takes the value if a country has either Stabilization or Savings Funds and Expenditure Rules respectively in place as at the year 2001 and zero otherwise. Robust standard errors clustered at the exporting country level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table 6: Role of resource funds and Expenditure Rules (Extensive Margin)

	Entrants			Incumbents		
	1	2	3	4	5	6
windfall_t-1 x expbly	-0.512	-1.108***	-1.108***	-0.309	-1.075***	-0.892
	(0.352)	(0.255)	(0.255)	(0.480)	(0.323)	(0.575)
windfall_t-1 x expbly x NRF	-0.848*			-0.913		-0.331
	(0.474)			(0.598)		(0.677)
windfall_t-1 x expbly x ER		1.861***	1.861***		2.949***	2.766***
		(0.597)	(0.597)		(0.715)	(0.858)
Observation	329319	329319	329319	293689	293689	293689
Importer x Exporter x Product FE	✓	✓	✓	✓	✓	✓
Exporter x Year FE	✓	✓	✓	✓	✓	✓
Importer x Year FE	✓	✓	✓	✓	✓	✓

*Notes: The table presents the estimates of the heterogeneous effect of 2000s commodity boom on manufacturing exports along the extensive margins for entrants and incumbents. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). NRF and ER takes the value if a country has either Stabilization or Savings Funds and Expenditure Rules respectively in place as at the year 2001 and zero otherwise. Robust standard errors clustered at the exporting country level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table 7: Role of resource funds and Expenditure Rules(Intensive Margin)

	Entrants			Incumbents		
	1	2	3	4	5	6
windfall_t-1 x expbly	0.972	2.743**	1.249	-1.629	-2.554**	-1.616
	(1.378)	(1.218)	(1.487)	(1.520)	(1.177)	(1.662)
windfall_t-1 x expbly x NRF	4.749*		4.470*	-3.114*		-3.127
	(2.526)		(2.585)	(1.779)		(1.904)
windfall_t-1 x expbly x ER		-4.514	-3.014		0.813	-0.144
		(3.371)	(3.463)		(2.264)	(2.547)
Observation	329319	329319	329319	293689	293689	293689
Importer x Exporter x Product FE	✓	✓	✓	✓	✓	✓
Exporter x Year FE	✓	✓	✓	✓	✓	✓
Importer x Year FE	✓	✓	✓	✓	✓	✓

*Notes: The table presents the estimates of the heterogeneous effect of 2000s commodity boom on manufacturing exports along the intensive margins for entrants and incumbents. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). NRF and ER takes the value if a country has either Stabilization or Savings Funds and Expenditure Rules respectively in place as at the year 2001 and zero otherwise. Robust standard errors clustered at the exporting country level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

8 Robustness Tests

In this section I perform several tests to check the robustness of the main results.

8.1 Rolling weights

The commodity term of trade I used in the main section was computed with fixed weight. I replace this fixed weight with a rolling weight. A limitation of using the fixed weights is that they are likely to misrepresent the relevance of individual commodities at some point along the sample. The mix of traded commodities and the overall importance of net commodity exports in output can change significantly over time. Indices based fixed weights can thus provide a poor approximation of the role of commodity prices during periods in which the relevance of individual commodities is very different from that in the reference period Gruss and Kebhaj (2019). Thankfully the database I used computes the terms of trade using time-varying weights. The time-varying weights are based on three-year rolling averages of trade values and output to smooth fluctuations. These weights are also lagged and thus predetermined to price fluctuations, so that changes in index reflect variation in international prices rather than endogenous changes in export or import volumes. The results are presented in Table A.1. One can observe that the results are similar to those obtained in the previous sections which is not surprising. This is because the time considered in this study is relatively short therefore using a fixed or a rolling weight does not make any significant difference.

8.2 Exclusion of main producers

The commodity booms of the 2000s was largely a demand shock and the producers responded to the price increase. One may argue that there may be strategic responses from the producing countries such as restricting production to maintain the higher prices. This argument should not matter as the individual countries considered in this study are price takers and cannot significantly affect the prices on the interna-

tional market. Also, one could argue that the results are largely driven by big producers as they capture a larger part of the windfall. Using UN COMTRADE data, (Gruss and Kebhaj, 2019) computes the average market share of individual country commodity exports in world commodity exports from 2000 to 2015 for each commodity group. For agriculture raw materials, the top 10 market shares are: Australia (wool), USA (Cotton), Canada (Soft sawn wood), Thailand (Rubber), Canada (Soft Logs), USA (Hard sawn wood), Italy (Hides), USA (Hard logs) and Indonesia (Rubber). For food & beverages the top 10 market shares are Malaysia (Palm oil), USA (Soybeans), USA(Corn), Spain (Olive oil), Argentina (Soybeans Oil), Indonesia (Palm oil), Spain (Orange), Brazil (Soybeans), Peru (Fish meal), Brazil (Sugar). For metals, the top 10 shares are Australia (Uranium), Niger (Uranium), Namibia (Uranium), Australia (Iron Ore), Indonesia (Tin), Chile (Copper), Canada (Nickel), Russia (Nickel), Australia (Lead) and Brazil (Iron Ore). Finally for Energy, the top 10 shares are Australia (Coal), Russia (Natural Gas), Saudi Arabia(Crude oil), Indonesia(Coal),Canada(Natural gas),Qatar(Natural gas),Norway(Natural gas),Russia(Crude Oil), Russia(Coal) and China (Coal). Out of all these large producers, only 2 can be found in the sample for this study: Chile and Peru. I exclude these 2 countries from the sample. The results remain similar (see Table A.2)

8.3 Inclusion of tariffs

In the main section, the only trade policy variable included in the analysis is the RTA. There are other trade policy variables especially bilateral tariffs that are important for trade. I excluded the tariff in the main analysis because data on the effective applied tariff is missing for some products and for some countries which makes me lose some observations. The effective applied tariff takes into accounts the tariff rate that is effectively applied by the importing country. I nonetheless include the ad valorem tariffs as a robustness check. In Table A.3 report the estimates using the simple average and that of the weighted average are reported in Table A.4. As can be seen from both tables, the main predictions remain the same.

9 Conclusion

The study contributes to an old age debate about the impact of commodity booms on manufacturing export. Unlike existing studies, the present study investigated this in the context of intensive and extensive margins in line with recent literature on the trade models with heterogeneous firms. To accomplish this objective, the study exploits the exogenous variation in windfalls generated by the 2000s commodity price boom in a structural gravity framework. The paper found that commodity booms exert a more negative impact on both the intensive and extensive margins of highly exportable manufacturing sub-sectors relative to low-exportable manufacturing sub-sectors. However, the negative impact observed on aggregate at the extensive margin is largely driven by entrants while that of the intensive margin is driven by incumbent exporters. The result underscores the fact all exporters are not alike, and the impact of commodity booms depend on the type of exporter. The study also found that the mechanisms through which the boom operate is to increase the relative wage and decrease the labor productivity of the more exportable manufacturing sub-sectors. This is due to an increase in public expenditure in line with the core Dutch disease model. Furthermore, expenditure rules reverses the negative impact at the extensive margin but not at the intensive margin while no statistically significant effect is found for Natural resource funds. The main limitation of the paper is that the data I used makes it unable to exploit the firm level mechanisms driving the result.

References

Agnosteva, D. E., Anderson, J. E., and Yotov, Y. V. (2019). Intra-national trade costs: Assaying regional frictions. *European Economic Review*, 112:32–50.

Allcott, H. and Keniston, D. (2018). Dutch disease or agglomeration? the local economic effects of natural resource booms in modern america. *The Review of Economic Studies*, 85(2):695–731.

Aragón, F. M., Rud, J. P., and Toews, G. (2018). Resource shocks, employment, and gender: evidence from the collapse of the uk coal industry. *Labour Economics*, 52:54–67.

Arvis, J.-F. and Shepherd, B. (2013). The poisson quasi-maximum likelihood estimator: a solution to the 'adding up'problem in gravity models. *Applied Economics Letters*, 20(6):515–519.

Bahar, D. and Santos, M. A. (2018). One more resource curse: Dutch disease and export concentration. *Journal of Development Economics*, 132:102–114.

Berman, N. and Héricourt, J. (2010). Financial factors and the margins of trade: Evidence from cross-country firm-level data. *Journal of Development Economics*, 93(2):206–217.

Bernard, A. B., Jensen, J. B., Redding, S. J., and Schott, P. K. (2007). Firms in international trade. *Journal of Economic perspectives*, 21(3):105–130.

Buono, I. and Lalanne, G. (2012). The effect of the uruguay round on the intensive and extensive margins of trade. *Journal of International Economics*, 86(2):269–283.

Cavalcanti, T., Da Mata, D., and Toscani, F. (2019). Winning the oil lottery: The impact of natural resource extraction on growth. *Journal of Economic Growth*, 24(1):79–115.

Chaney, T. (2008). Distorted gravity: the intensive and extensive margins of international trade. *American Economic Review*, 98(4):1707–21.

Chen, W.-C. (2013). The extensive and intensive margins of exports: The role of innovation. *The World Economy*, 36(5):607–635.

Corden, W. M. (1984). Booming sector and dutch disease economics: survey and consolidation. *oxford economic Papers*, 36(3):359–380.

Corden, W. M. and Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *The economic journal*, 92(368):825–848.

Cust, J., Harding, T., and Vezina, P.-L. (2019). Dutch disease resistance: Evidence from indonesian firms. *Journal of the Association of Environmental and Resource Economists*, 6(6):1205–1237.

Davis, J., Fedelino, A., and Ossowski, R. (2003). 11 stabilization and savings funds for nonrenewable resources: Experience and fiscal policy implications. In *Fiscal policy formulation and implementation in oil-producing countries*. International Monetary Fund.

Egger, P. and Larch, M. (2008). Interdependent preferential trade agreement memberships: An empirical analysis. *Journal of International Economics*, 76(2):384–399.

Egger, P. H. and Nigai, S. (2015). Structural gravity with dummies only: Constrained anova-type estimation of gravity models. *Journal of International Economics*, 97(1):86–99.

Fally, T. (2015). Structural gravity and fixed effects. *Journal of International Economics*, 97(1):76–85.

Fernandes, A. M., Freund, C., and Pierola, M. D. (2016). Exporter behavior, country size and stage of development: Evidence from the exporter dynamics database. *Journal of Development Economics*, 100(119):121–137.

Gruss, B. and Kebhaj, S. (2019). Commodity terms of trade: A new database.

Harding, T. and Venables, A. J. (2016). The implications of natural resource exports for nonresource trade. *IMF Economic Review*, 64(2):268–302.

Ismail, K. (2010). The structural manifestation of the'dutch disease': The case of oil exporting countries. *IMF Working papers*, pages 1–36.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American economic review*, 95(1):161–182.

Lawless, M. (2010). Deconstructing gravity: trade costs and extensive and intensive margins. *Canadian Journal of Economics/Revue canadienne d'économique*, 43(4):1149–1172.

Martincus, C. V. and Carballo, J. (2008). Is export promotion effective in developing countries? firm-level evidence on the intensive and the extensive margins of exports. *Journal of International Economics*, 76(1):89–106.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *econometrica*, 71(6):1695–1725.

Mohaddes, K. and Raissi, M. (2017). Do sovereign wealth funds dampen the negative effects of commodity price volatility? *Journal of Commodity Markets*, 8:18–27.

Pelzl, P. and Poelhekke, S. (2021). Good mine, bad mine: Natural resource heterogeneity and dutch disease in indonesia. *Journal of International Economics*, 131:103457.

Radetzki, M. (2006). The anatomy of three commodity booms. *Resources Policy*, 31(1):56–64.

Rajan, R. G. and Subramanian, A. (2011). Aid, dutch disease, and manufacturing growth. *Journal of development Economics*, 94(1):106–118.

Sala-i Martin, X. and Subramanian, A. (2013). Addressing the natural resource curse: An illustration from nigeria. *Journal of African Economies*, 22(4):570–615.

Silva, J. S. and Tenreyro, S. (2006). The log of gravity. *The Review of Economics and statistics*, 88(4):641–658.

Silva, J. S. and Tenreyro, S. (2011). Further simulation evidence on the performance of the poisson pseudo-maximum likelihood estimator. *Economics Letters*, 112(2):220–222.

Smith, B. (2019). Dutch disease and the oil boom and bust. *Canadian Journal of Economics/Revue canadienne d'économique*, 52(2):584–623.

Stijns, J.-P. (2003). An empirical test of the dutch disease hypothesis using a gravity model of trade. *Available at SSRN 403041*.

Wills, S. E., Senbet, L. W., and Simbanegavi, W. (2016). Sovereign wealth funds and natural resource management in africa. *Journal of African Economies*, 25(suppl_2):ii3–ii19.

World Bank (2009). *Global economic prospects 2009: commodities at the crossroads*. The World Bank.

World Bank (2020). World development indicators.

Yotov, Y. V., Piermartini, R., Monteiro, J.-A., and Larch, M. (2016). *An advanced guide to trade policy analysis: The structural gravity model*. World Trade Organization Geneva.

A Appendix A: Robustness Results

Table A.1: Robustness Test Effect of commodity windfalls on the extensive and intensive margin of manufacturing export(rolling weights)

	Extensive Margin			Intensive Margin		
	All	Entrants	Incumbents	All	Entrants	Incumbents
windfall_t-1 x expbly	-0.871***	-0.831***	-0.653	-1.502	3.532***	-1.861*
	(0.281)	(0.294)	(0.472)	(1.281)	(1.159)	(1.064)
RTA	0.0365	0.0691	-0.0113	0.0142	-0.00739	-0.00859
	(0.0352)	(0.0473)	(0.0126)	(0.0752)	(0.0937)	(0.0831)
Observation	363161	329319	293689	363161	329319	293689
Year FE						
Importer x Exporter x Product FE	✓	✓	✓	✓	✓	✓
Exporter x Year FE	✓	✓	✓	✓	✓	✓
Importer x Year FE	✓	✓	✓	✓	✓	✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports along the extensive and intensive margins using rolling weights for the windfall variable. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). Robust standard errors clustered by importer-exporter-product level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table A.2: Effect of commodity booms on the extensive and intensive margin of manufacturing export(Exclusion of major producers)

	Extensive Margin			Intensive Margin		
	All	Entrants	Incumbents	All	Entrants	Incumbents
windfall_t-1 x expbly	-1.313***	-1.136***	-1.105	-2.891*	3.360**	-2.230**
	(0.398)	(0.421)	(0.784)	(1.728)	(1.504)	(1.081)
RTA	0.0663*	0.114**	-0.00734	-0.145*	0.0912	-0.134*
	(0.0380)	(0.0481)	(0.0139)	(0.0810)	(0.122)	(0.0716)
Observation	320076	289284	256572	320076	289284	256572
Year FE						
Importer x Exporter x Product FE	✓	✓	✓	✓	✓	✓
Exporter x Year FE	✓	✓	✓	✓	✓	✓
Importer x Year FE	✓	✓	✓	✓	✓	✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports along the extensive and intensive margins using a sample of non-major producers. The dependent variables are the log of number of manufacturing exporting firms (Extensive Margin) and log of manufacturing export per exporting firm (Intensive Margin). Commodity boom is the log of commodity terms of trade to GDP , population is the log of population, real GDP per capita is the log of Gross domestic product, PPP (constant 2017) . All specifications control for year fixed effects. Columns 1 and 5 includes product(H6) FE, columns 2 and 6 include Country-Product fixed effect. Columns 3,4,7 and 8 include Country-Product-Exporter type fixed effect. In addition, columns 4 and 8 controls for log of population and the log of real GDP per capita. Robust standard errors clustered by country-product level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table A.3: Robustness Test Effect of commodity windfalls on the extensive and intensive margin of manufacturing export(inclusion of simple average tariff)

	Extensive			Intensive		
	All	Entrants	Incumbents	All	Entrants	Incumbents
windfall_t-1 x expbly	-0.912***	-0.951*	-0.0106	-2.630***	2.248*	-0.230***
	(0.271)	(0.518)	(0.0668)	(0.950)	(1.204)	(0.0439)
RTA	0.0384***	0.0662	0.703***	0.0201	-0.0860*	0.0590
	(0.0139)	(0.0529)	(0.210)	(0.0784)	(0.0496)	(0.122)
ln(tariffs)	-0.00814**	-0.00772	-0.163***	-0.0358	-0.0453**	-0.271***
	(0.00383)	(0.00570)	(0.0583)	(0.0288)	(0.0191)	(0.0848)
Observation	267868	242673	228010	267868	242673	228010
Year FE						
Importer x Exporter x Product FE	✓	✓	✓	✓	✓	✓
Exporter x Year FE	✓	✓	✓	✓	✓	✓
Importer x Year FE	✓	✓	✓	✓	✓	✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports along the extensive and intensive margins with the inclusion of the simple average of bilateral tariff. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). Robust standard errors clustered by importer-exporter-product level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table A.4: Robustness Test Effect of commodity windfalls on the extensive and intensive margin of manufacturing export(inclusion of weighted average tariff)

	Extensive			Intensive		
	All	Entrants	Incumbents	All	Entrants	Incumbents
windfall_t-1 x expbly	-0.917***	-0.957*	-0.0120	-2.594***	2.227*	-0.226***
	(0.271)	(0.515)	(0.0666)	(0.945)	(1.205)	(0.0433)
RTA	0.0380***	0.0659	0.728***	0.0228	-0.0834*	0.0462
	(0.0139)	(0.0529)	(0.218)	(0.0795)	(0.0497)	(0.128)
ln(tariffs)	-0.00943***	-0.00922*	-0.128**	-0.0542*	-0.0696	-0.330***
	(0.00356)	(0.00472)	(0.0545)	(0.0307)	(0.0435)	(0.0907)
Observation	267868	242673	228010	267868	242673	228010
Year FE						
Importer x Exporter x Product FE	✓	✓	✓	✓	✓	✓
Exporter x Year FE	✓	✓	✓	✓	✓	✓
Importer x Year FE	✓	✓	✓	✓	✓	✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports along the extensive and intensive margins with inclusion of the weighted average of bilateral tariff. The dependent variables are the number of manufacturing exporting firms (Extensive Margin) and the export per exporting firm (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). Robust standard errors clustered by importer-exporter-product level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

B Appendix B: Additional results

Table B.1: Effect of commodity windfalls on destination dynamics

	Destination entry rate of incumbents	Destination exit rate of incumbents	Share of New Destinations in TEV of Incumbents	Share of New Destinations in TEV of Surv Entrants
windfall_t-1	-0.0416	-0.0423	-0.0223	-0.0996
	(0.103)	(0.108)	(0.0973)	(0.113)
windfall_t-1 x expbly	-0.169	-0.189	-0.154	-0.179
	(0.144)	(0.160)	(0.184)	(0.156)
Observation	22548	22548	22548	17524
Year FE	✓	✓	✓	✓
Country x Product FE	✓	✓	✓	✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports on the destination dynamics. Robust standard errors clustered at the exporting country level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

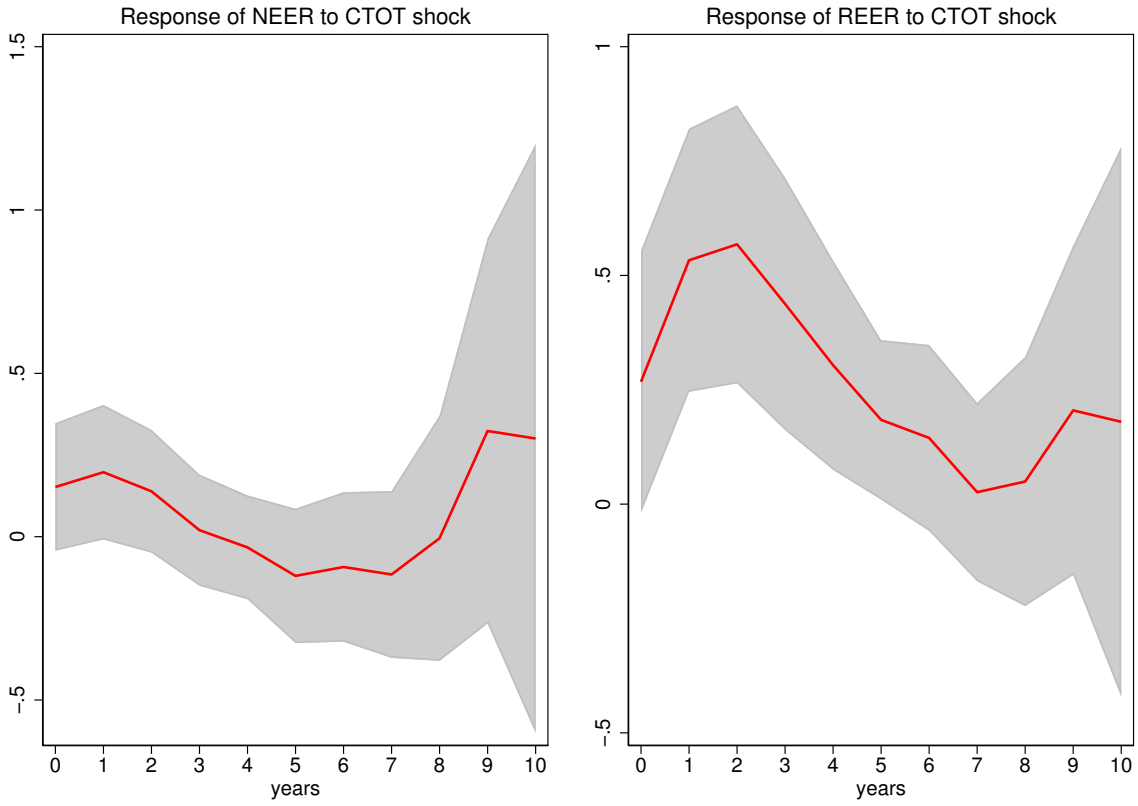

Figure B.1: Response of effective exchange rates to Commodity Terms of Trade Shock
Note: : The figure presents the impulse response of commodity windfalls on nominal (NEER) and real(REER)effective exchange rates.The shaded area are 90 percent confidence bands.

Table B.2: Effect of commodity windfalls on the extensive and intensive margin of total manufacturing export value

	All		Entrants		Incumbents	
	1	2	3	4	5	6
windfall_t-1 x expbly	-2.649	-3.782	5.846	1.534	-5.741	-3.596
	(3.351)	(4.354)	(3.707)	(1.750)	(3.762)	(4.098)
windfall_t-1	-0.372		-0.467		1.090	
	(0.654)		(1.005)		(0.884)	
GDP per capita(destination)	1.442***		0.575**		1.036***	
	(0.160)		(0.239)		(0.400)	
GDP per capita(origin)	1.248***		1.788***		1.146***	
	(0.378)		(0.452)		(0.383)	
RTA	0.0110	0.0426	0.230**	0.176*	1.196**	0.0213
	(0.0731)	(0.0428)	(0.109)	(0.0947)	(0.538)	(0.0445)
Observation	363161	363161	329319	329319	293689	293689
Year FE	✓		✓		✓	
Importer x Exporter x Product FE	✓	✓	✓	✓	✓	✓
Exporter x Year FE		✓		✓		✓
Importer x Year FE		✓		✓		✓

*Notes: The table presents the estimates of the effect of 2000s commodity boom on manufacturing exports on the total export value. windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing product and takes a value of 1 of if a manufacturing product historically had an exports to value-added ratio above the median according to World Integrated Trade Solution (WITS). Robust standard errors clustered by importer-exporter-product level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table B.3: Summary Statistics

	N	Mean	Min	Max
Number of Exporters	363161	21.44	2.00	7624.00
Number of Entrants	351691	11.42	0.00	3586.00
Number of Incumbents	351691	9.65	0.00	4336.00
Export Value per Exporter	363161	422328.76	0.05	1.72e+09
Export Value per Entrants	331080	93703.80	0.00	1.82e+09
Export Value per Incumbents	299400	792139.61	0.00	3.17e+09
Commodity terms of trade	363161	99.80	67.15	112.11

Table B.4: Countries included in the study

Country	STF	SF	ER
Burkina Faso			
Bangladesh			
Bolivia			
Botswana	Y	Y	
Chile	Y	Y	
Côte d'Ivoire			
Cameroon			
Colombia	Y		Y
Costa Rica			
Dominican R			
Ecuador	Y		
Ethiopia			
Gabon		Y	
Guinea			
Guatemala			
Iran	Y		
Jordan			
Kenya			
Kyrgyzstan			
Cambodia			
Kuwait	Y	Y	
Lebanon			
Sri Lanka			
Morocco			
Madagascar			
Mexico	Y		
Mali			
Myanmar			
Mauritius			
Malawi			
Niger			
Nicaragua			
Nepal			
Pakistan			
Peru	Y		Y
Paraguay			
Rwanda			
Senegal			
El Salvador			
Sao Tome and Principe			
Thailand			
Timor-Leste			
Tanzania			
Uganda			
Uruguay			
Yemen			
South Africa			
Zambia			

C Appendix C: Theoretical Framework

I set up a simple two sector model to illustrate how exogenous commodity windfalls affect the intensive and extensive margins of manufacturing exports using a simple version of the trade model with heterogeneous firms by Melitz (2003) and later adapted by Chaney (2008). The model is designed to replicate the spending channel of the core DD model (Corden and Neary, 1982; Corden, 1984).

Preferences

Preferences over the consumption of differentiated traded (manufacturing), C_M and non-traded goods, C_N takes the Cobb-Douglas form:

$$U = C_M^{\alpha} C_N^{1-\alpha} \tag{C.1}$$

C_M and C_N are the aggregation of differentiated varieties which takes a CES form:

$$C_i = \left[\int_{\omega \in \Omega_i} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} \quad i \in (M, N) \qquad \sigma > 1 \tag{C.2}$$

Where σ is the elasticity of substitution, Ω is a set of varieties, $q(\omega)$ is quantity consumed of variety ω The budget constraint is denoted as $P_N C_N + P_T C_T \leq Y$. It is assumed that labor, L is the only factor of production which fixed in supply. Therefore national income, Y is the sum of the labor income and exogenous commodity windfall, Z i.e $Y = wL + Z$, where w is the wage. The aggregator leads to the quantity demanded of each good;

$$q_i(\omega) = p_i(\omega)^{-\sigma} E_i P_i^{\sigma-1} \tag{C.3}$$

where E_i is expenditure on each good which is a constant share of income. $P_i \equiv \left(\int_{\Omega} p_i(\omega)^{1-\sigma} d\omega \right)^{\frac{1}{1-\sigma}}$ is the Dixit-Stiglitz price index.

Production

Made up of heterogeneous firms that produce differentiated varieties. Each firm has productivity ϕ, drawn from a cumulative distribution function $G(\phi)$ with support $\phi \in (1, \infty)$. The firm incurs both fixed and variable costs to produce each variety. A firm with productivity ϕ incurs a cost of $\frac{1}{\phi}$ units of labor to produce a single unit of differentiated variety. The firms can produce traded goods (manufacturing) to sell in both the domestic market (d) and export market (f) while the non-traded goods can only be sold in the domestic market. However only a selection of firms can sell in the export market. Each exporting firm incurs an iceberg cost of exporting to foreign market, $\tau > 1$. $\tau = 1$ for firms that do not export. Profit maximization leads to an optimal price ;

$$p^j(\phi) = \frac{\sigma}{\sigma - 1}\frac{w}{\phi}\tau, \qquad j \in (d, f) \tag{C.4}$$

i.e. the firm sets the price as a markup over marginal costs. Total revenue is given as

$$TR_i^d = \sigma\psi \left(\frac{P_i\phi}{w}\right)^{\sigma-1} E_i \tag{C.5}$$

$$TR_M^f = \sigma\psi \left(\frac{\bar{P}\phi}{\tau w}\right)^{\sigma-1} \bar{E} \tag{C.6}$$

Where $\psi = (\sigma - 1)^{\sigma-1}\sigma^{-\sigma}$; $\bar{P}$ and $\bar{E}$ are the foreign country price index for the traded good and expenditure levels respectively. This implies that profit (without the fixed cost) is $\frac{1}{\sigma}TR^i$.

Equilibrium

In equilibrium firms will only produce if they can generate enough revenue to cover their fixed costs. This generates cut-off condition for both domestic, d and export market, f;

$$TR^d = F^d w \tag{C.7}$$

$$TR^f = F^f w \tag{C.8}$$

As in Melitz-Chaney model, firms incur a fixed cost, wF^e to produce a variety and then draw their productivity from the distribution, $G(\phi)$. Potential entrants weigh their expected profits against the fixed cost. In equilibrium, free entry implies expected profits should be equal to zero;

$$F^e w = \int_{\phi_d} \left(TR_i^d - F^d w \right) dG(\phi) + \int_{\phi_f} \left(TR_M^f - F^f w \right) dG(\phi) \tag{C.9}$$

In order to derive the equilibrium wage, I first write the indirect demand function using equation (C.3);

$$p_i(\omega) = q_i(\omega)^{\frac{-1}{\sigma}} E_i^{\frac{1}{\sigma}} P_i^{\frac{\sigma-1}{\sigma}} \tag{C.10}$$

Total revenue is thus given as;

$$p_i(\omega) q_i(\omega) = q_i(\omega)^{\frac{\sigma-1}{\sigma}} E_i^{\frac{1}{\sigma}} P_i^{\frac{\sigma-1}{\sigma}} \tag{C.11}$$

Next, I rewrite equation (C.11) separately for the export and domestic sectors as a function of labor demand in each sector. I then solve the optimal allocation of labor for the domestic and export production as a function of labor making use of the fact firms will allocate labor such that the marginal revenue from production for exports equals marginal revenue from domestic production. This gives the total revenue from exporting and domestic production as;

$$TR = \phi^{\frac{\sigma-1}{\sigma}} \left(E_i P_i^{\sigma-1} + \Theta_j \tau^{1-\sigma} \bar{E} \bar{P}^{\sigma-1} \right)^{\frac{1}{\sigma}} L^{\frac{\sigma-1}{\sigma}}, \qquad \forall \phi \tag{C.12}$$

where Θ_j takes the value of 1 if a firm exports and zero otherwise. In equilibrium, the firm will set wages equal to the marginal revenue product. Free labor mobility across

firms and the 2 sectors gives;

$$w = \frac{\sigma - 1}{\sigma} \phi^{\frac{\sigma-1}{\sigma}} \left(E_i P_i^{\sigma-1} + \Theta_j \tau^{1-\sigma} \bar{E} \bar{P}^{\sigma-1} \right)^{\frac{1}{\sigma}} L^{\frac{-1}{\sigma}}, \qquad \forall \phi \tag{C.13}$$

Manufacturing exports

Total profits from exporting manufacturing products, M to destination f is given as;

$$\pi_M^f(\phi) = \psi \left(\frac{\bar{P}\phi}{\tau_f w} \right)^{\sigma-1} \bar{Y} - F_f, \tag{C.14}$$

i.e., only firms with productivity greater or equal to the cut-off productivity will export to destination f. Therefore, profits derived from exporting to destination f are positive if $\pi_M^f(\phi) > 0$. This leads to a cutoff productivity $\tilde{\phi}$ required to export to destination f;

$$\tilde{\phi}_f = \left(\frac{F_f}{\psi \bar{Y}} \right)^{\frac{1}{\sigma-1}} \frac{\tau_f w}{\bar{P}} \tag{C.15}$$

The number of firms exporting manufacturing products to destination f is given as;

$$N_M^f = \int_{\tilde{\phi}_f}^{\infty} G(\phi) d\phi \tag{C.16}$$

The total value of exports of manufacturing to destination f is also given as;

$$V_M^f = \int_{\tilde{\phi}_f}^{\infty} v_M^f(\phi) G(\phi) d\phi \tag{C.17}$$

Where $v_M^f(\phi)$ is the export value of a single firm to destination f. Making use of (C.4), this can be written as;

$$v_M^f(\phi) = p_M^f q_M^f = \left(\frac{\bar{P}}{p_M^f} \right)^{\sigma-1} \bar{Y} = \left(\frac{\sigma - 1}{\sigma} \frac{\bar{P}\phi_f}{\tau_f w} \right)^{\sigma-1} \bar{Y} \tag{C.18}$$

Average exports per exporter to destination f is $\bar{V_M^f}$ is thus given as;

$$\bar{V_M^f} = \frac{V_M^f}{N_M^f} = \frac{\int_{\tilde{\phi}_f}^{\infty} v_f^M(\phi) G(\phi) d\phi}{\int_{\tilde{\phi}_f}^{\infty} G(\phi) d\phi} \tag{C.19}$$

Impact of commodity windfall

Let hat over a variable represent the percentage change. Suppose that the commodity exporting economy receives an exogenous resource windfall which increases Z_0 to Z_1.

- This leads an increase in expenditure E which increases the wage rate. The proof directly follows from equation (C.13). To see this log-linearize and total differentiate (C.13) ;

$$\hat{w} = \frac{1}{\sigma}\left(\hat{E} + (\sigma - 1)\hat{P} - \hat{L}\right) \tag{C.20}$$

  It directly follows that an increase in expenditure due to a windfall leads to an increase in wage.

- The export productivity cutoff increases due to the increase in the wage rate (this follows from (C.15)). To see this more formally, take the total differential of (C.8) to get $\hat{\phi_f} = \frac{\sigma}{\sigma - 1}\hat{w}$.

- The number of exporters of manufacturing products to destination f decreases.

$$\frac{\partial N_M^f}{\partial w} = -G(\tilde{\phi})\frac{\partial \tilde{\phi}_f}{\partial w} \tag{C.21}$$

  This follows from the previous point. The increase in the export productivity cutoff due to the wage increase implies that only relatively few firms have productivities above the cutoff therefore the number of exporters decline.

- The effect on the intensive margin is ambiguous (without assumptions of the productivity distribution). Using (C.19), this can be written as;

$$\frac{\partial \bar{V}_M^f}{\partial w} = \frac{\frac{\partial V_M^f}{\partial x} N_M^f - \frac{\partial N_M^f}{\partial w} V_M^f}{(N_M^f)^2} \tag{C.22}$$

The change in total exports due to a change in w can also be written as;

$$\frac{\partial V_M^f}{\partial w} = \int_{\tilde{\phi}_f}^{\infty} \frac{\partial v_M^f(\phi)}{\partial w} G(\phi) d\phi - v_M^f(\tilde{\phi}) G(\tilde{\phi}) \frac{\partial \tilde{\phi}_f}{\partial w} \tag{C.23}$$

Substituting (C.21) and (C.23) into (C.22) gives

$$\frac{1}{(N_M^f)^2} \left[\left(\int_{\tilde{\phi}_f}^{\infty} \frac{\partial v_M^f(\phi)}{\partial w} G(\phi) d\phi \right) N_j + (V_M^f - v_M^f(\tilde{\phi}) N_M^f) G(\tilde{\phi}) \frac{\partial \tilde{\phi}_f}{\partial w} \right] \tag{C.24}$$

From (C.18), its straightforward to see that the first term in square bracket is negative i.e the export sales of existing exporters decline due to an increase in w. The total value of exports to destination f, V_M^f is greater than the total value of exports to destination f if all exporters sold the same amount to destination f as the exporting firm at exactly the threshold, $v_M^f(\tilde{\phi}) N_M^f$. Combining this with the second point implies that the second term in the square bracket of (C.24) is positive. Therefore, without any assumptions about the form of the productivity distribution function, the overall effect is ambiguous. A likely explanation is that an increase in variable costs can lead to a reduction in the value of sales of incumbent exporters, but it can also lead to the exit of marginal exporters thereby making the effect on the intensive margin ambiguous.

Finally, given that the manufacturing firm can sell some varieties domestically and export some, the effect of windfall on manufacturing products at both margins would depend on their export share in total manufacturing output.