Intensive and extensive margins of manufacturing exports: impact of commodity windfalls*

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Abstract

How do commodity windfalls affect the number of exporters (extensive margin) and the average export value per exporter (intensive margin) within the manufacturing sector? A large body of theoretical and empirical literature showed that these windfalls could be detrimental to the manufacturing sector, but none untangled the margins through which the exports from the manufacturing sector adjusts to these windfalls. 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. First, I find 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 exporting firms that enter more exportable industries decline relative to the less exportable industries. Thirdly, for the more exportable industries, the average export value per incumbent exporters industries decline while that of the new exporters increases relative to the less exportable industries.

JEL classification codes: F1, F4, L6, Q3

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1 Introduction

What are the margins through which manufacturing exports from commodity exporting countries adjust to commodity related income gains ? Developing countries rich in natural resources tend to have relatively lower economic and export diversification (Cadot et al., 2011; Ross, 2019; Bahar and Santos, 2018). This makes them vulnerable to external shocks (Van der Ploeg and Poelhekke, 2009; Venables, 2016). Theoretically, commodity windfalls increase domestic demand, induces wage increases (cost push factor) and 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. Recent trade models with heterogeneous firms (Melitz, 2003; Chaney, 2008) showed that only some firms are able to export thereby resulting in the existence of the number of firms that export (extensive margin) and the average export value per exporter (intensive margin).

In this paper, I examine the impact of the windfalls generated by the boom in commodity prices during the early to mid 2000s (from 2003 to 2013) on the extensive and intensive margins of manufacturing exports. This recent boom in commodity prices was driven by China's rapid economic growth (Hamilton, 2009; Costa et al., 2016; Kaplinsky, 2006; Erten and Ocampo, 2013), which took commodity producers unaware . How did the margins of manufacturing exports adjust to these windfalls? Specifically, are manufacturing industries that historically had a higher share of exports to value added ratio (more exportable) affected differently than others (less exportable)?[1] Answering these questions is important in enhancing our understanding of how manufacturing exports adjust to commodity windfalls and the implications for export diversification.

To guide empirical work, I first introduce a DD framework into a simple version of a trade model with heterogeneous firms (Melitz, 2003; Chaney, 2008) to generate predictions about the impact of commodity windfalls on the margins of trade. 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. I then combine

[1]This distinction between manufacturing industries captures the idea that international competitiveness is reflected in a few industries within the manufacturing sector in these countries (Rajan and Subramanian, 2011). Therefore, the more competitive industries should be more vulnerable to DD effect compared to other industries within the manufacturing sector.

country specific commodity terms of trade data with country-industry–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 commodity windfalls with country specific commodity terms of trade index which is a weighted average of the world price of 45 individual commodities with the weights given by net export to GDP ratio. This measure of commodity windfall takes into account the composition of each countries' commodity import and exports. This is important because almost all commodities experienced a boom in prices during the period under consideration. Also, 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 of these commodities.

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 for the identification strategy as the individual countries are price takers and cannot significantly affect the prices on the international market.[2]

I find that a 1% increase in commodity windfalls led to about 1% decrease in the number of exporters and 3% decrease in the value of exports per exporter 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 0.95% relative decline in the number of new exporters that enter the export market for the more exportable manufacturing industries.

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 per new exporter, of the more exportable industries relative to the less exportable industries.

In line with the theoretical prediction, I find that commodity windfalls led to a growth in

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

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, the historical less exportable manufacturing industries benefited more from the windfalls generated by the 2000s commodity booms.

To the best of my knowledge, this paper is the first to study the impact of commodity windfalls 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). The 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.

This paper is also related to the literature on the impact of windfalls on export diversification (Bahar and Santos, 2018; Djimeu and Omgba, 2019; Wiig and Kolstad, 2012). Bahar and Santos (2018) showed that countries with larger shares of natural resources in exports have more concentrated non-resource export baskets while Djimeu and Omgba (2019) found that an oil boom positively affects export concentration in countries with initial low level of export diversification. By studying the impact of windfalls on the margins of manufacturing exports, I contribute to this strand of literature by showing the channels through which non-resource exports tend to be affected.

Finally, the paper is also related to the literature on the drivers of the extensive and intensive 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 additional evidence that commodity windfalls can act as a cost push factor on both margins. I also examine the heterogeneity by the type of exporter.

The rest of the paper is structured as follows. Section 2 provides a brief description of the commodity booms of the 2000s. Section 3 summarizes the theoretical framework and the main theoretical predictions. Section 4 discusses the empirical strategy and data. Section 5 reports the empirical results. Section 6 investigates the potential mechanisms driving the results. Section 7 presents the robustness tests. The paper concludes in section 8.

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). According to Radetzki (2006), 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; Baffes and Haniotis, 2010). 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 due to an unexpected and persistent acceleration in economic growth (Kilian and Hicks, 2013; Erten and Ocampo, 2013; Costa et al., 2016). 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 supply response from the commodity producers to the unexpected price increase was at a slower pace because of little spare capacity and just-in-time inventories (Radetzki, 2006).

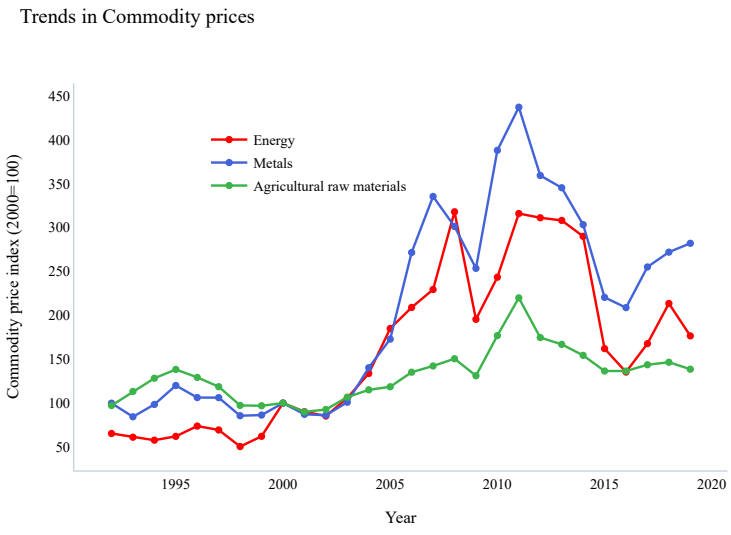

Figure 1: Trend in Commodity prices
Source: IMF, Primary Commodity Price System database

3 Theoretical Framework

To guide the empirical work, I introduce a Dutch disease framework (see Appendix A) into a 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). The purpose is to generate predictions about how an increase in expenditure, due to a commodity windfall affects the extensive and intensive margins of manufacturing exports. The model is similar to Bahar and Santos (2018) who analyzed the impact of windfalls on export concentration. The model I use in this paper differs in two ways. I assume for simplicity there is only one mobile factor of production, labor, which is fixed in supply. 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 only 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.

First, 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.[3] The price of the non-traded goods increases and given the assumption of fixed labor supply, leads to an increase in domestic wages.

Second, the model predicts that export productivity cut-off increases in response to the increase in wages. This leads to a decline in the number of exporters (extensive margin). This is because the increase in the export productivity cutoff due to the wage increase implies only a relatively few number of firms will 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 existing exporters, but it can also lead to the exit of marginal exporters.[4]

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

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

4 Data and Empirical Strategy

In this section, I discuss the main sources of data, the empirical model and the identification strategies. The variables and data used in the study are discussed in section 4.1 while the empirical model and the identification issues are discussed in 4.2.

4.1 Data

4.1.1 Extensive and Intensive Margins

The measures of the extensive and intensive margins comes from the World Bank Exporter Dynamics Database (EDD). The EDD contains information on aggregated measures of export-sector characteristics and dynamics presented at five levels of aggregation (Fernandes et al., 2016). These are the country-year, country-year-product (HS 2-digit, HS 4-digit, or HS 6-digit), country-year-destination, country-year-HS 2 digit industry-destination and country-year-ISIC revision 3 industry classification levels.[5] Specifically, the EDD has information 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, industry 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 industry.

These measures are constructed using exporter-level customs data as input, covering the universe of annual exporter transactions for 70 countries. I define the extensive margin as the total number of firms that export and the intensive margin as the average export value per exporter. I use the country–HS2 industry–destination–year level for the manufacturing sector. This is the most granular level at which the aggregated bilateral trade data is available in

off

[5] In International trade, products are classified using various international & trade classification systems. The common classification systems are the Harmonized Commodity Description and Coding Systems (HS), International Standard of Industrial Classification (ISIC) of all economic activities and the Standard International Trade Classification (SITC).

the EDD. This level of aggregation has information on 78 H2 industries in the manufacturing sector.

4.1.2 Industry specific exportability index

As demonstrated by Rajan and Subramanian (2011), international competitiveness in the manufacturing sector is reflected in a few industries in most developing countries. To capture this idea, I identify exportable industries as done in Rajan and Subramanian (2011) using historical (from 1980 to 2000) export and value added data from De Sousa et al. (2012). I define a dummy variable which takes a value of 1 if the historical average export to value added ratio of a manufacturing industry across a sample of developing countries is greater than the median across industries and zero otherwise. These industries are mainly textiles, clothing, leather, and footwear (H2 industry codes 50 to 63).

Figure 2 shows the trend in the extensive and intensive margins for the more exportable industries (those with an exportability index of 1) and the less exportable (those with an exportability index of 0) from 2000 to 2014. The extensive margin is shown in the first row and the intensive margin in the second row. The trend in the margins for all exporters, incumbents and entrants are shown in the first, second and third columns respectively.[6] I normalize the values of the extensive and intensive margins to one in 2000. The normalized values are displayed on the y-axis while the corresponding years are shown on the x-axis.

As can be seen from the graph, both industries exhibit different trends relative to the year 2000. Specifically, both the extensive and intensive margins of the less exportable industries grew at faster rate than the more exportable industries. For all exporters, the extensive (intensive) margin of the less exportable industries increased sharply, peaked in 2010 (2011) and then started to decline. As at the year 2010, the extensive margin for all exporters in the less exportable industries increased by more than twice its value in 2000 while that of the intensive margin increased by about 5 times its value in 2000. A similar pattern is observed for the incumbents and entrants although the growth rates for the incumbents are higher than that of the entrants at both margins.

On the other hand, the extensive margin for all exporters in the more exportable industries experienced a steady increase, peaked in 2012 before experiencing a decline. As of 2010, the

[6] An exporter is any firm that exports in year t. An entrant is a firm that does not export in year $t-1$ but exports in year t. An incumbent is a firm that exports in both years $t-1$ and t.

extensive margin for all exporters in the more exportable industries increased by 45% relative to 2000. Moreover, the intensive margin for all exporters peaked in 2006, declined in 2007 and remained steady thereafter. As at the year 2010, the intensive margin for all exporters increased by 19% relative to 2000. A similar pattern is observed for both the entrants and incumbents at both margins.

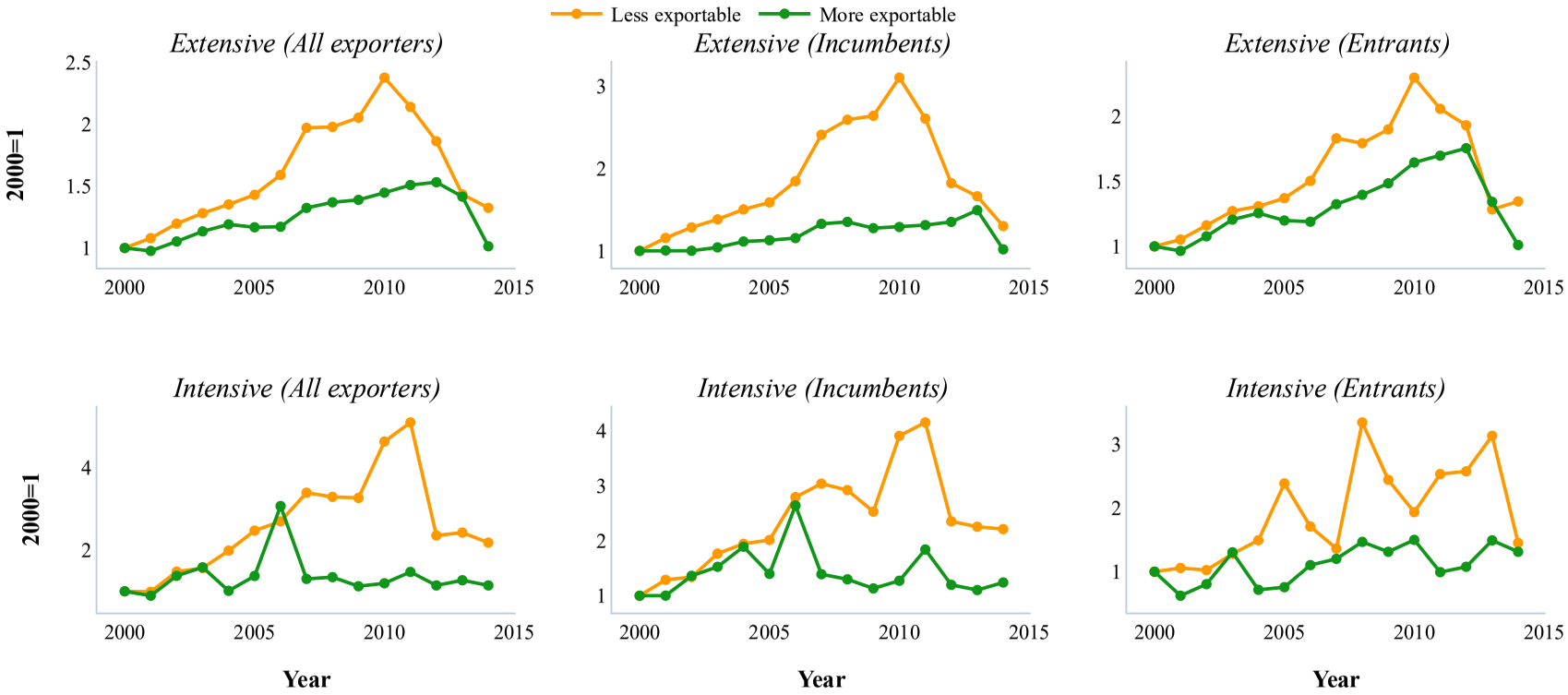

Figure 2: Trend in Extensive and Extensive Margin of Manufacturing export

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

Notes: The values of the extensive and intensive margins are normalized to 1 in 2000.

4.1.3 Commodity windfalls

The measure of commodity windfall comes from the IMF commodity terms of trade (CTOT) database. This is a comprehensive database of country specific commodity price indices covering the period 1962 to 2018 for 182 countries. 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 index is constructed using both time invariant and rolling weights.[7] The time invariant weight has the advantage of making the index invariant to changes in the economy and in the world (Aghion et al., 2010; Gruss and Kebhaj, 2019). That is, the change in the CTOT index based on the time invariant weight is mainly driven by the changes in commodity prices.

Intuitively, the variations in the CTOT index based on the time invariant weight provide an estimate of the gains and losses of income due to variations in the world prices of commodities. A percentage point change in the CTOT index can be interpreted as a change in aggregate disposable income equivalent to one percentage point of GDP (Gruss and Kebhaj, 2019).

4.1.4 Manufacturing industry indicators

I also use industry level data on manufacturing industry wages, value added and employment from the United Nations Industrial Development Organization's (UNIDO) Industrial Statistics Database. Employment is defined as the number of employees.

4.1.5 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 and common colonial ties are sourced from CEPII GeoDist database (Conte et al., 2021). Finally, data on regional trade agreements are taken from Mario Larch's Regional Trade Agreements Database (Egger and Larch, 2008). A detailed definition of all the variables used in the study and their various sources can be found in Table D.3 in Appendix D.

[7] See section 7 for details on the rolling weights.

4.2 Empirical Strategy

Following the existing literature (see for example Lawless (2010) and Bernard et al. (2007)), I decompose the total export value of manufacturing industry p, from the exporting country i, to importing country j, at time t into extensive and intensive components 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 industry p from the exporting country i to importing country j at time t. I use 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:

$$Z_{ijpt} = exp[\beta_1 windfall_{it-1} * expbly_p + \beta_2 RTA_{ijt} + \alpha_{it} + \omega_{jt} + \nu_{ijp}] * \epsilon_{ijt} \tag{4.2}$$

Where Z_{pijt} denotes either the total number of exporters or the average export value per exporter of manufacturing industry p, from exporting country i, to importing country j, at time t. $windfall_{it-1}$ is the lag of the natural log of commodity terms of trade with fixed weights.[8] $expbly_p$ is the exportability index of industry p. 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 and zero otherwise.

The variable ν_{ijp} is exporting and importing country pair-industry fixed effect. The introduction of this variable serves two purposes. First, it eliminates or accounts for the unobservable linkages between the endogenous variable, RTA_{ijt} and the error term (Yotov et al., 2016).[9] Secondly, the country pair-industry fixed effect will absorb all bilateral time invariant covariates that are normally used in gravity regressions.[10] This prevents the situation where the researcher must pick/select which of these variables to include in the model. Also, the country pair-industry 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).

The variables α_{it} and ω_{jt} are exporting and importing countries-time fixed effects respec-

[8] I conduct a robustness test using commodity terms of trade with rolling weights in section 7.

[9] 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.

[10] This includes bilateral distance, common language, common legal origin, common religion, common colonial ties, among others.

tively. First, these two variables provide a flexible way to account for all factors that vary at both the origin and destination country level. This is important because the increase in commodity prices affects economic activities in both the importing and exporting countries. Also, these variables account for the outward multilateral resistances in exporting country i at time t and the inward multilateral resistances in importing country j at time t (Olivero and Yotov, 2012).

I focus on the effect of commodity windfalls on manufacturing industries that historically had a higher share of exports to value added ratio, relative to other manufacturing industries i.e β_1. This is because I cannot identify the average effect when all factors are properly accounted for. The interaction between the windfall variable and the industry specific exportability index, $windfall_{it-1} * expbly_p$, captures the idea that Dutch disease effect should affect manufacturing industries that are more competitive relative to others (Rajan and Subramanian, 2011).

Furthermore, equation 4.2 is specified in multiplicative form (the dependent variable is in levels) instead of logarithmic form to take into account zero trade flows. A clear drawback of estimating the equation with dependent variables in logs is that zero trade flows cannot be taken into account. 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 and intensive margins. I estimate equation 4.2 with the dependent variable in levels using the Poisson Pseudo Maximum Likelihood (PPML) estimator 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) estimates 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.

One of the features of model (4.2) is that the main coefficient of interest β_1 can still be interpreted as an elasticity. The identification assumption is that the boom of the 2000s is exogenous to the countries in the sample and therefore the windfall gains are driven by factors exogenous to these countries. The boom, driven by China's rapid economic growth (Hamilton, 2009; Costa et al., 2016; Kaplinsky, 2006; Erten and Ocampo, 2013), increased global commodity prices, which was then followed by production responses from commodity producers albeit at a slower rate. 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. I estimate equation (4.2) for all exporters and separately for entrants and incumbents to study the heterogeneity of the impact of commodity windfalls by the type of exporter.

5 Empirical Results

I present and discuss the empirical results in this section. The measure of windfalls is based on the time invariant weight. The results for all exporters are presented in Table 1. The first three columns (columns 1 to 3) report the results for the extensive margin while that of the intensive margins are reported in the last three columns (columns 4 to 6). Columns 1 and 4 include controls for a number of exporting country level time varying characteristics, the traditional gravity time invariant bilateral trade costs and importing country time fixed effects. The traditional gravity time invariant bilateral trade costs variables are replaced with the pair-industry fixed effects in columns 2 and 5. The preferred specifications are columns 3 and 6 which account for all exporting and destination country time varying characteristics. The results as shown in Table 1 indicate a negative effect of commodity windfalls on manufacturing industries that have historical higher value added to export ratio (more exportable) at both the extensive and intensive margins relative to those that are less exportable in all of the specifications. The magnitude of the relative impact of commodity windfalls is larger when all time-invariant bilateral variables are controlled for and more precisely estimated when both multilateral resistance terms have been accounted for. This points to the importance of controlling for outward and inward multilateral resistance.

Using the preferred specification, the results indicate that within the manufacturing sector, the number of exporters in the historical more exportable industries are relatively negatively affected compared to the historical less exportable industries by the windfalls generated by the commodity booms of the early 2000s. Specifically, a 1% increase in commodity windfalls led to about 1% relative decline in the number of exporters in the historical more exportable industries. A relatively higher magnitude is observed at the intensive margin on the other hand. The average export value per exporter in the historically more exportable industries decline by 3% relative to the historically less exportable industries due to a 1% increase in commodity windfalls. That is at aggregate level, both the extensive and intensive margins of the historically more exportable manufacturing industries tend to be negatively affected relative to the other manufacturing industries by commodity windfalls.

Next, I estimate model (4.2) separately for entrants and incumbents. This is important because the main specification does not account for exporting firm level time varying char-

[10]The exporting country level time varying characteristics are the lags of GDP per capita, foreign direct investment, foreign aid and remittances.

acteristics. I therefore separately estimate the model for the two types of exporters to take into account the heterogeneity of the results by the type of exporter. The results for entrants are shown in Table 2 while that of incumbents are shown in Table 3. For the sake of brevity, only the preferred specifications (columns 3 and 6) are discussed here. As can be seen from Table 2, the number of new exporters that enter the export market for the historical more exportable industries decline relative to the less exportable industries in response to commodity windfalls. However, conditional on entering the export market, the export value per new exporters of the more exportable industries tends to increase relative to others. Specifically, for the new exporters (entrants), the extensive margin of manufacturing industries that are historically more exportable decreases by 0.95% and the intensive margin increases by about 2.5% relative to those that are historically less exportable (see Table 2) in response to a 1% increase in commodity windfalls. On the other hand, I find that the effect of the commodity windfalls on the extensive margin of incumbents is negative although not statistically different from zero. Also, a 1% increase in commodity windfalls led to a 2.4% relative decline in the intensive margin of manufacturing industries that were historically more exportable compared to the other industries (see Table 3) i.e. incumbent exporters adjust to commodity windfalls by reallocating their export volumes away from the historical more exportable industries in response to commodity windfalls.

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
windfall_$t-1$ x expbly	-0.0214	-1.027*	-1.011**	-0.232***	-2.305	-3.033**
	(0.0686)	(0.619)	(0.415)	(0.0385)	(1.558)	(1.375)
windfall_$t-1$	3.745**	0.205		-2.762	-1.021**	
	(1.768)	(0.471)		(2.052)	(0.518)	
Observation	363161	363161	363161	363161	363161	363161
Year FE	✓	✓		✓	✓	
Origin country controls	✓	✓		✓	✓	
Time invariant gravity controls	✓			✓		
Origin country x Importing country x Industry FE		✓	✓		✓	✓
Origin country x Year FE			✓			✓
Importing country 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 value per exporters (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. All regressions control for regional trade agreements. Origin country controls include the lags of GDP per capita, foreign direct investment, aid and remittances. Time invariant gravity controls include Contiguity, bilateral distance, common language, colony, religion, and legal origin. Robust standard errors clustered at the 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 margins of manufacturing export (entrants)

	Extensive			Intensive		
	1	2	3	4	5	6
windfall_$t-1$ x expbly	-0.0218	-0.895	-0.950**	-0.179***	3.298*	2.464*
	(0.0620)	(0.727)	(0.397)	(0.0420)	(1.765)	(1.358)
windfall_$t-1$	3.670**	0.673		-2.615	-0.948	
	(1.718)	(0.545)		(1.763)	(1.109)	
Observation	329319	329319	329319	329319	329319	329319
Year FE	✓	✓		✓	✓	
Origin country controls	✓	✓		✓	✓	
Time invariant gravity controls	✓			✓		
Origin country x Importing country x Industry FE		✓	✓		✓	✓
Origin country x Year FE			✓			✓
Importing country 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 average export value per exporter (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. All regressions control for regional trade agreements. Origin country controls include the lags of GDP per capita, foreign direct investment, aid and remittances. Time invariant gravity controls include Contiguity, bilateral distance, common language, colony, religion, and legal origin. Robust standard errors clustered at the 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 margins of manufacturing export (incumbents)

	Extensive			Intensive		
	1	2	3	4	5	6
windfall_$t-1$ x expbly	-0.00597	-1.008	-0.761	-0.244***	-2.045	-2.499*
	(0.0732)	(0.668)	(0.567)	(0.0374)	(1.378)	(1.331)
windfall_$t-1$	2.885*	-0.452		-1.520	-0.436	
	(1.739)	(0.522)		(2.585)	(0.637)	
Observation	293689	293689	293689	293689	293689	293689
Year FE	✓	✓		✓	✓	
Origin country controls	✓	✓		✓	✓	
Time invariant gravity controls	✓			✓		
Origin country x Importing country x Industry FE		✓	✓		✓	✓
Origin country x Year FE			✓			✓
Importing country 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 value per exporter (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. All regressions control for regional trade agreements. Origin country controls include the lags of GDP per capita, foreign direct investment, aid and remittances. Time invariant gravity controls include Contiguity, bilateral distance, common language, colony, religion, and legal origin. Robust standard errors clustered at the exporting country level are in parentheses. ***, **, * denotes 1%, 5% and 10% level of significance respectively.*

6 Mechanisms

I empirically investigate the potential mechanisms driving the results in section 5. The main theoretical predictions are that an exogenous windfall lead to an increase in expenditure and induces wage increases. I first test for the effect of commodity windfalls on consumption and investment in section 6.1. In section 6.2, I examine the average and heterogeneous effect of commodity windfalls on manufacturing wages (and other manufacturing industry indicators) to provide insights into how the more exportable manufacturing industries, are affected differently than the other manufacturing industries.

6.1 Consumption and Investment

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

$$\Delta y_{i,t+k} = \beta_k windfall_{it-1} + \alpha X_{it-1} + \nu_i + \omega_t + \epsilon_{it+k} \tag{6.1}$$

Where Δy_{it} denotes the change in the dependent variables of interest (in logs) from year t to t+k. These are the real private consumption, real government consumption, real government investment and real private investment. X_{it} comprises log of real GDP and the log of population. ν_i and ω_t are country and year fixed effects respectively. The impulse responses for each horizon k are given by $[\beta_k]_{k=1}^{10}$. This captures the effect of the commodity windfalls at each horizon k. Following Jordà et al. (2015), I correct for the potential heteroscedasticy and serial correlation using the country specific cluster-robust standard errors.

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. Private investment also remained relatively the same and not different from zero.The results therefore indicates both government consumption and investment increased during the period under consideration while household consumption and private investment remained relatively stable. This is in line with the spending effect prediction i.e the commodity windfalls tend to increase public expenditure.

One can argue that not all the windfalls are spent in the economy. Some may be saved abroad and hence can limit the impact of commodity windfalls on the margins of manufacturing exports. In Appendix C, I explore further the role of savings fund in reducing the negative effects of commodity windfalls.

6.2 Manufacturing sector indicators

In order to provide insight into how the relative impact of commodity windfalls operates, I use industry level data on manufacturing sector wages, employment, real value added and labor productivity (real value added per worker) from United Nations Industrial Development Organization's (UNIDO) Industrial Statistics Database to estimate the following model:

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

Where y_{ipt} is the log of the manufacturing sector indicator of interest. Ψ_{it} comprises log of GDP per capita, the square of the log of GDP per capita and the log of population. They enter with a lag to limit endogeneity issues. ϕ_t is time fixed effect while λ_{ip} is exporting country-industry fixed effect. The results are shown in Table 4.

The results indicate a positive and statistically significant effect of the windfalls on the growth rates of all the manufacturing indicators. In addition, all the interaction terms are negative and statistically significant although small in magnitude. Specifically, 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 in 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. Also, both the growth rates in employment (see column 2) and value-added growth (column 3) of the more exportable industries decline relative to 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 less exportable manufacturing industries benefits more from increase in wages due to commodity windfalls while largely the more exportable

manufacturing industries benefits less from the wage increase. The response however differs by the type of exporter. There is a relative decline in the average export value per incumbent exporter 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 a relative smaller number of new exporters will export the products from these industries 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 export value per new exporter of the more exportable industries increases relative to the less exportable industries.

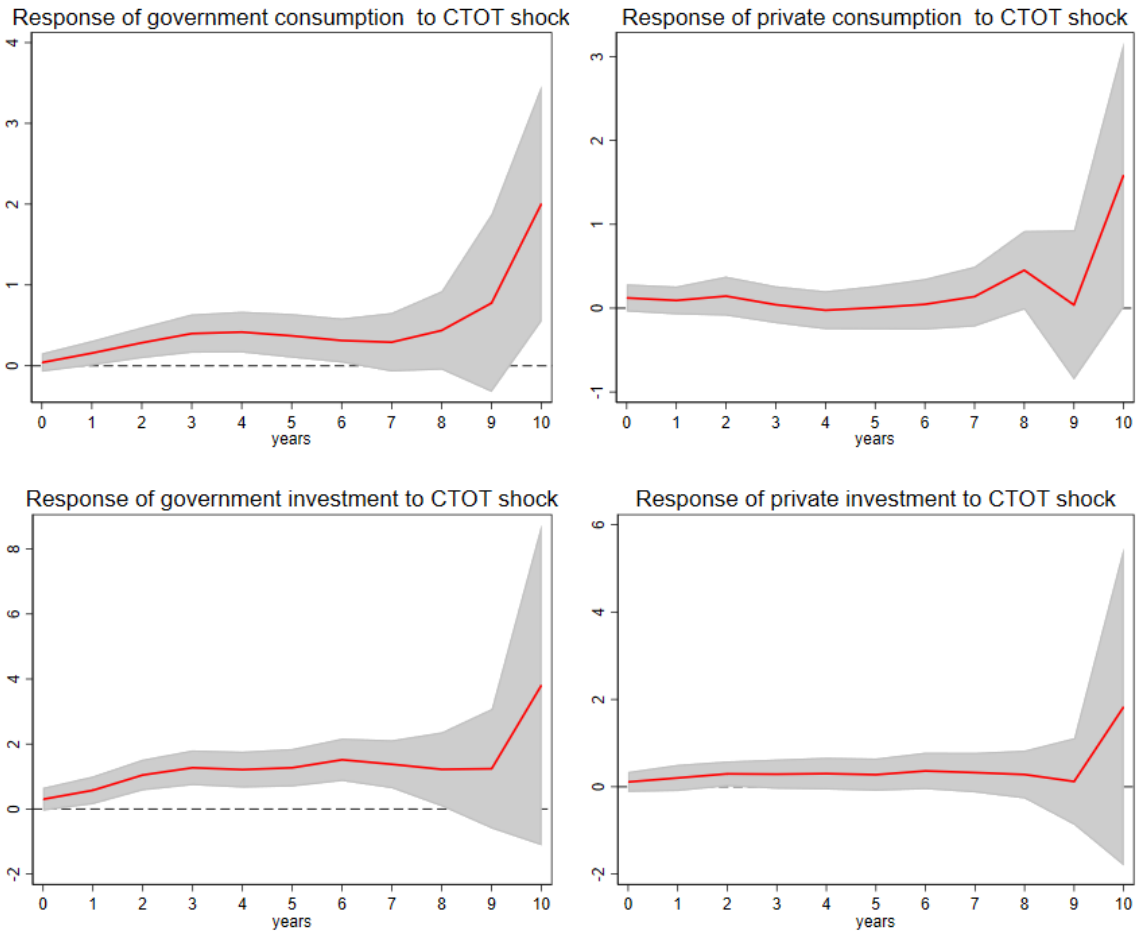

Figure 3: Response of consumption and investment to Commodity Terms of Trade Shock
Note: : The figure presents the impulse response of commodity windfalls on consumption and investment.The shaded areas are 90 percent confidence bands.

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 industry and takes a value of 1 of if a manufacturing industry historically had an export to value-added ratio above the median across industries. Robust standard errors clustered at the country level are in parentheses. ***, **, * denotes 1%, 5% and 10% level of significance respectively.*

7 Robustness Tests

In this section I perform several tests to check the robustness of the main results. The tables are shown in Appendix B.

7.1 Commodity terms of trade based on rolling weights

Although using commodity terms of trade based on time invariant weight has the advantage of been less sensitive to developments in the economy and the world, one may argue that the time invariant weight is likely to misrepresent the importance of individual commodities. This is because the composition of export and import of commodities may change significantly over time (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 the index reflect variation in international prices rather than endogenous changes in export or import volumes. The results are presented in Table B.1. One can observe that the results are similar to those obtained in the previous sections.

7.2 Exclusion of main producers

The commodity booms of the 2000s was largely a demand shock and the producers responded to the price increase. However, there may be strategic responses from the producing countries such as restricting production to maintain the higher prices. This should not matter as the individual countries considered in this study are price takers and cannot significantly affect the prices on the international market. One could also argue that the results are largely driven by big producers as they capture a larger part of the windfall. I therefore test the robustness of the results to the exclusion of large producers found in the sample.

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.[11] Out of all these large producers, only 2 can be found in the sample

[11]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)

for this study, Chile and Peru. I exclude these 2 countries from the sample. The results remain similar (see Table B.2).

7.3 Inclusion of tariffs

The only time varying trade policy variable included in model 4.2 is the regional trade agreement. 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 ad valorem tariff is missing for some industries and for some countries. The effective applied ad valorem tariff takes into account, the tariff rate that is applied by the importing country. I include the effective applied ad valorem tariff in the regression to ascertain the robustness of the results. The results are shown in Table B.3. As can be seen from both tables, the results remain similar despite the reduction in the number of observations.

8 Conclusion

There is a renewed interest in export diversification in commodity exporting countries because export diversification is key to economic diversification and long-term growth in these countries. However, our understanding of how commodity windfalls affect the manufacturing (non-commodity) exports is limited. This study is the first to examine the impact of the commodity windfalls on the intensive and extensive margins in line with recent literature on the trade models with heterogeneous firms.

I exploit the exogenous variation in windfalls generated by the 2000s commodity price boom using a panel of 48 commodity exporting countries. I find that commodity windfalls exert a more negative impact on both the intensive and extensive margins of manufacturing industries with historically high export to value added ratio relative to other industries. 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 policy implication for commodity exporting countries that want to pursue export diversification based on the manufacturing sector is that the impact of commodity windfalls on the margins of manufacturing exports depend on the type of exporter. For new firms that

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).

want to export, export promotion policies to reduce the barriers to enter the more competitive industries will be key. The main limitation of the paper is that I am unable to explore the exporter level adjustment mechanisms to understand the differential response by incumbent and new exporters at the intensive margin.

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9 Appendix A: 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 goods, C_M, and non-traded goods, C_N, takes the Cobb-Douglas form:

$$U = C_M^{\alpha} C_N^{1-\alpha} \tag{9.1}$$

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

$$C_i = \left[\int_{\omega \in \Omega_i} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} \qquad i \in (M, N) \qquad \sigma > 1 \tag{9.2}$$

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 $P_N C_N + P_T C_T \leq Y$. Where P is the price of each good. It is assumed that labor, L is the only factor of production which is fixed in supply. 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. Using the CES aggregator, the quantity demanded of each good is given as:

$$q_i(\omega) = p_i(\omega)^{-\sigma} E_i P_i^{\sigma-1} \tag{9.3}$$

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 the following optimal price :

$$p^j(\phi) = \frac{\sigma}{\sigma - 1}\frac{w}{\phi}\tau, \qquad j \in (d, f) \tag{9.4}$$

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

$$TR_i^d = \sigma\psi\left(\frac{P_i\phi}{w}\right)^{\sigma-1} E_i \tag{9.5}$$

$$TR_M^f = \sigma\psi\left(\frac{\bar{P}\phi}{\tau w}\right)^{\sigma-1} \bar{E} \tag{9.6}$$

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 market, d and export market, f as follows:

$$TR^d = F^d w \tag{9.7}$$

$$TR^f = F^f w \tag{9.8}$$

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;

$$F^e w = \int_{\phi_d}\left(TR_i^d - F^d w\right)dG(\phi) + \int_{\phi_f}\left(TR_M^f - F^f w\right)dG(\phi) \tag{9.9}$$

In order to derive the equilibrium wage, I first write the indirect demand function using equation (9.3);

$$p_i(\omega) = q_i(\omega)^{\frac{-1}{\sigma}} E_i^{\frac{1}{\sigma}} P_i^{\frac{\sigma-1}{\sigma}} \tag{9.10}$$

Total revenue is thus given as;

$$p_i(\omega)q_i(\omega) = q_i(\omega)^{\frac{\sigma-1}{\sigma}} E_i^{\frac{1}{\sigma}} P_i^{\frac{\sigma-1}{\sigma}} \tag{9.11}$$

Next, I rewrite equation (9.11) 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;

$$TR = \phi^{\frac{\sigma-1}{\sigma}} \left(E_i P_i^{\sigma-1} + \Theta_j \tau^{1-\sigma} \bar{E} \bar{P}^{\sigma-1} \right)^{\frac{1}{\sigma}} L^{\frac{\sigma-1}{\sigma}}, \qquad \forall \phi \tag{9.12}$$

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 industry. Free labor mobility across firms and the 2 sectors gives;

$$w = \frac{\sigma-1}{\sigma} \phi^{\frac{\sigma-1}{\sigma}} \left(E_i P_i^{\sigma-1} + \Theta_j \tau^{1-\sigma} \bar{E} \bar{P}^{\sigma-1} \right)^{\frac{1}{\sigma}} L^{\frac{-1}{\sigma}}, \qquad \forall \phi \tag{9.13}$$

Manufacturing exports

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

$$\pi_M^f(\phi) = \psi \left(\frac{\bar{P}\phi}{\tau_f w} \right)^{\sigma-1} \bar{Y} - F_f, \tag{9.14}$$

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;

$$\tilde{\phi}_f = \left(\frac{F_f}{\psi \bar{Y}} \right)^{\frac{1}{\sigma-1}} \frac{\tau_f w}{\bar{P}} \tag{9.15}$$

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

$$N_M^f = \int_{\tilde{\phi}_f}^{\infty} G(\phi) d\phi \tag{9.16}$$

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

$$V_M^f = \int_{\tilde{\phi}_f}^{\infty} v_M^f(\phi) G(\phi) d\phi \tag{9.17}$$

Where $v_M^f(\phi)$ is the export value of a single firm to destination f. Making use of (9.4), this can be written as;

$$v_M^f(\phi) = p_M^f q_M^f = \left(\frac{\bar{P}}{p_M^f}\right)^{\sigma-1} \bar{Y} = \left(\frac{\sigma-1}{\sigma}\frac{\bar{P}\phi_f}{\tau_f w}\right)^{\sigma-1} \bar{Y} \tag{9.18}$$

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

$$\bar{V_M^f} = \frac{V_M^f}{N_M^f} = \frac{\int_{\tilde{\phi}_f}^{\infty} v_f^M(\phi) G(\phi) d\phi}{\int_{\tilde{\phi}_f}^{\infty} G(\phi) d\phi} \tag{9.19}$$

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 (9.13). To see this log-linearize and total differentiate (9.13) ;

$$\hat{w} = \frac{1}{\sigma}\left(\hat{E} + (\sigma-1)\hat{P} - \hat{L}\right) \tag{9.20}$$

  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 (9.15)). To see this more formally, take the total differential of (9.8) to get $\hat{\phi_f} = \frac{\sigma}{\sigma-1}\hat{w}$.

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

$$\frac{\partial N_M^f}{\partial w} = -G(\tilde{\phi})\frac{\partial \tilde{\phi}_f}{\partial w} \tag{9.21}$$

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 (9.19), this can be written as;

$$\frac{\partial \bar{V}_M^f}{\partial w} = \frac{\frac{\partial V_M^f}{\partial x} N_M^f - \frac{\partial N_M^f}{\partial w} V_M^f}{(N_M^f)^2} \tag{9.22}$$

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

$$\frac{\partial V_M^f}{\partial w} = \int_{\tilde{\phi}_f}^{\infty} \frac{\partial v_M^f(\phi)}{\partial w} G(\phi) d\phi - v_M^f(\tilde{\phi}) G(\tilde{\phi}) \frac{\partial \tilde{\phi}_f}{\partial w} \tag{9.23}$$

Substituting (9.21) and (9.23) into (9.22) gives

$$\frac{1}{(N_M^f)^2}\left[\left(\int_{\tilde{\phi}_f}^{\infty} \frac{\partial v_M^f(\phi)}{\partial w} G(\phi) d\phi\right) N_j + (V_M^f - v_M^f(\tilde{\phi}) N_M^f) G(\tilde{\phi}) \frac{\partial \tilde{\phi}_f}{\partial w}\right] \tag{9.24}$$

From (9.18), 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 (9.24) 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.

10 Appendix B: Robustness Results

Table B.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 value per exporter (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. Robust standard errors clustered at the exporting country level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table B.2: Effect of commodity windfalls 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 number of manufacturing exporting firms (Extensive Margin) and the export value per exporter (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. Robust standard errors clustered at the exporting country level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table B.3: Effect of commodity windfalls on the extensive and intensive margin of manufacturing export (inclusion of tariffs)

	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 value per exporter (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. Robust standard errors clustered at the exporting country level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

11 Appendix C: Role of Natural Resource Funds (NRFs)

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.

To ascertain empirically the effectiveness of NRFs, I define a dummy variable (NRF) equal to 1 if a country has either of these 2 funds 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 C.1. As be seen, the average effects remain similar. No statistically significant effect is found for both the intensive and extensive margins on aggregate. The results that NRFs are not effective at first sight seems counterintuitive. However, research has shown the deposits and withdrawals rules governing these funds are sometimes not followed which could explain the observed result.

Table C.1: Role of resource funds (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)
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 value per exporter (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. NRF takes the value if a country has either Stabilization or Savings Funds 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 C.2: Role of resource funds (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)
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 value per exporter (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. NRF takes the value if a country has either Stabilization or Savings Funds 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 C.3: 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)
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 value per exporter (Intensive Margin). windfall is the log of commodity terms of trade. expbly is the exportability of manufacturing industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. NRF takes the value if a country has either Stabilization or Savings Funds 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.*

12 Appendix D: Additional results

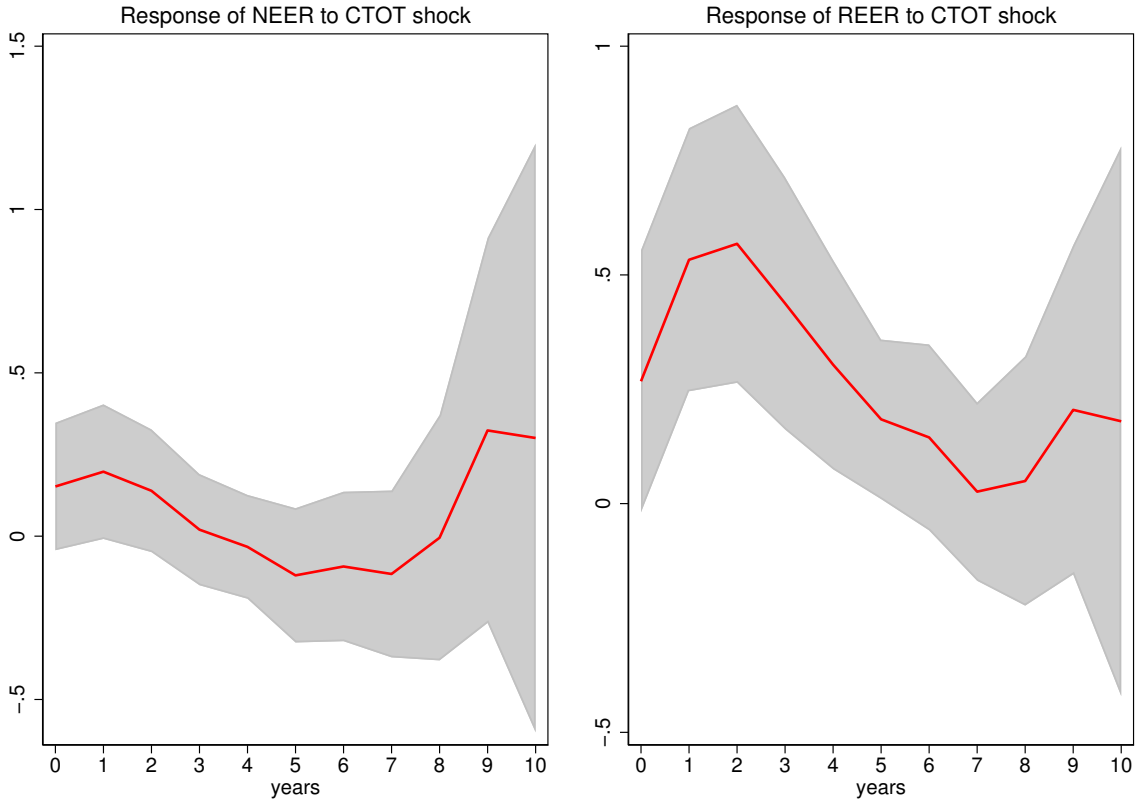

Figure D.1: Response of effective exchange rates to Commodity Terms of Trade Shock
Note: : The figure presents the impulse response of commodity windfalls on nominal (NEER) and real(REER)effective exchange rates.The shaded area are 90 percent confidence bands.

Table D.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	✓	✓	✓	✓
Origin country x Industry 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.*

Table D.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 industry and takes a value of 1 of if a manufacturing industry historically had an exports to value-added ratio above the median across industries. Robust standard errors clustered at the exporting country level are in parentheses. ***, **,* denotes 1%, 5% and 10% level of significance respectively.*

Table D.3: Variables definition and source

Variable	Definition	Source
Extensive Margin	Number of exporters	World Bank's EDD
Intensive Margin	Average export value per exporter	World Bank's EDD
Commodity windfal	Country specific commodity terms of trade	IMF commodity terms of trade database
Exportability index (expbly)	Average ratio of exports to value added greater than median across industries	CEPII TradeProd database
Manufacturing industry wages		UNIDO Industrial Statistics Database
Manufacturing industry employment	Number of employees	UNIDO Industrial Statistics Database
Manufacturing industry productivity	Real value added per employee	UNIDO Industrial Statistics Database
Applied advaloreum tariffs		UNCTAD-TRAINS
Time invariant bilateral trade variables		CEPII GeoDist database
RTA	Regional Trade Agreement	Mario Larch's Regional Trade Agreements Database
GDP per capita (origin)		World Development Indicators
GDP per capita (destination)		World Development Indicators
Remittances	Personal remittances, received (% of GDP)	World Development Indicators
Foreign aid	Net official development assistance (% of GNI)	World Development Indicators
Foreign direct investment	Net inflows of investment to acquire a lasting management interest (% of GDP)	World Development Indicators
Public Investment	General government investment (% of GDP)	IMF Investment and Capital Stock database
Private Investment	Private Investment(% of GDP)	IMF Investment and Capital Stock database
Private Consumption	Private consumption expenditures	IMF World Economic Outlook
Government Consumption	Government consumption expenditures	IMF World Economic Outlook
NEER	Real effective exchange rates	IMF International Financial Statistics
REER	Nominal effective exchange rates	IMF International Financial Statistics
Stabilization Fund (STF)	takes the value if a country has an STF as at 2001 and zero otherwise	IMF Fiscal Rules Database
Savings Fund (SF)	takes the value if a country has an SF as at 2001 and zero otherwise	IMF Fiscal Rules Database

Table D.4: Countries included in the study

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