The Impact of Political Violence on Export Flows: Evidence From South Africa

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Abstract

This paper examines the impact of the civil unrest episode that struck South Africa's KwaZulu Natal region in July 2021 on export flows. Using monthly transaction-level data and a difference-in-differences identification strategy, the study finds that the unrest period resulted in a significant decline in export values, originating primarily from a reduction in the extensive margin (number of distinct product varieties exported per origin-destination relationship). However, these results are found to mask heterogeneity in terms of the impact of this effect across products of varying levels of differentiation, with the total effect of the unrest episode on export values and the extensive margin found to only be significant for differentiated products during the crisis period. Exports of undifferentiated products, meanwhile, exhibited the largest negative effect on the intensive margin (the average value per product variety exported). These significant effects, however, were only present during the month of the unrest for both differentiated and undifferentiated products – suggesting that exporters in affected regions quickly re-entered those product-destination relationships that had been destroyed during the unrest episode; and that the strength of those relationships was not permanently affected by this period.

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1. Introduction

In July 2021, parts of South Africa's KwaZulu-Natal and Gauteng provinces were hit by a wave of civil unrest never before seen in democratic South Africa (Africa et al., 2021). During a period spanning eight days following the arrest of former president Jacob Zuma, these regions were blighted by displays of public violence resulting in an estimated 354 deaths, thousands of injuries, extensive damage to public and private property and widespread looting of private property (Africa et al., 2021). The economic devastation wrought by this period of unrest was stark: official estimates pegged the damage to the South African economy at between R35 – R50 billion, with an estimated R1.5 billion lost in trading stock. Moreover, roughly 150 000 individuals were left jobless and below the breadline, whilst over 90 000 businesses and informal traders reported being negatively impacted to varying degrees (Hunter et al., 2021).

Less, however, is known about the impact of this civil unrest episode on trade flows within the effected regions. These effects are likely to be substantial due to the significant prohibitive effects of the unrest period on production and export activity. Specifically, the unrest episode is likely to have disrupted production through the destruction of physical capital, worker absences attributed to the fear of facing violence in the workplace, and supply chain disruptions due to the crippling effect of the unrest episode on logistics networks. Similarly, the unrest episode is likely to have had a significant prohibitive effect on export activity, due to the closure of various ports in affected regions as well as the closure of road and rail networks used to transport goods to their port of exit. Moreover, these effects are expected to be relatively persistent, due to the subsequent unavailability of intermediate inputs resulting from shutdowns in production and delays in transportation for local suppliers.

As such, this paper looks to exploit the nature of the widespread unrest that struck regions of South Africa in July 2021 to shed light on some of the economic consequences of civil unrest and political violence, particularly on export activity[1]. Particularly, using a standard difference-in-differences research design, this study looks to examine the impact of the unrest episode on export flows, particularly focusing on the size and permanence of the effect, as well as the margins and product composition of the effect and subsequent recovery. To these ends, the empirical analysis assesses the impact of the civil unrest episode on the export performance of

[1] This is a particularly salient issue in developing countries, given the endemic nature of political violence in many developing countries and the important disruptive effects it can have on export activity. Strauss & Taylor (2009), for example, find that 58% of elections in Sub-Saharan Africa between 1990-2007 involved some form of violence.

exporters in the affected regions, relative to those in unaffected regions. In this case, South Africa represents a particularly useful case study. First, the somewhat sudden and abrupt eruption of violence offer a unique opportunity for an event study on the effect of civil unrest and internal violence on exports. Second, the fact that much of the violence is concentrated in particular regions within South Africa allows for the adoption of a quasi-natural experimental approach, where regions can clearly be classified into the treatment and control groups based on whether or not they were exposed to the violence. Then, the relatively short duration of the civil unrest permits an analysis on the recovery path of trade once it subsided.

This study also contributes to several broad strands of literature. It adds to a large literature on trade fluctuations caused by supply shocks, particularly those emanating from "natural disasters" such as floods and earthquakes (Andrade da Silva & Cernat, 2012; Blyde & Martincus, 2013; Besedes & Murshid, 2017; Fernandes & Tang, 2020; Gassebner et al., 2010; Oh, 2017; Oh & Reuveny, 2009; Osberghaus, 2019). Then, by analysing whether the unrest episode had any differential effects on products of varying levels of differentiation, it also contributes to a literature that examines the relative sensitivity of export values to changes in export costs according to product characteristics (Persson, 2013; Ranjan & Lee, 2003; Sadikov, 2007).

Finally, the most salient piece of literature that it naturally contributes to is one which specifically examines the impact of internal conflict and associated supply shocks on export flows (Ahsan & Iqbal, 2019; Amponsah et al., 2011; Blomberg & Hess, 2006; Glick & Taylor, 2010; Kapri, 2019; Ksoll et al., 2009; Long, 2008; Martin et al., 2008; Nitsch & Schumacher, 2004). Whilst these studies unanimously report a decline in exports subsequent to the onset of the respective unrest episode, they do not consider the impact of these events on the extensive versus intensive margin of exports, and do not consider how these effects may differ across products. This paper therefore expands on this body of research by explicitly considering how domestic unrest and the associated supply shocks impact the extensive and intensive margins of export flows. In addition, this paper contributes to the literature by explicitly considering whether there are any heterogenous effects on exports of differentiated relative to undifferentiated goods.

The rest of this paper is organized as follows. First, Section 2 presents and discusses some of the details around the civil unrest period, particularly around how it impacted infrastructure that would plausibly be influential in the production and exporting of goods. Then, Section 3

discusses various theoretical models that may be applied to inform expectations around how civil unrest and political violence may interact with exports, particularly through the imposition of additional trade costs. Section 4 presents and discusses the methodologies and results from other empirical studies from similar strands of literature. Section 5 outlines the broad empirical framework to be employed in the remainder of the paper, as well as a description of the data and a presentation of some preliminary trends. Section 6 then provides the basis for the difference-in-differences identification strategy by employing a midpoint growth decomposition to understand some of the key trends that exist within the data over the entire sample period and how these trends may differ between regions that were impacted by the unrest and those that were not. Section 7 then outlines the specifics of the empirical identification strategy and specifications to be estimated – as well as the results and discussion around these estimates. Finally, Section 8 concludes and suggests avenues for future research.

2. Background of Civil Unrest in July 2021

On the 28th of July 2021, the Constitutional Court of South Africa found former president Jacob Zuma guilty of contempt of court, handing him a 15-month jail sentence. This after Zuma defied orders from the Constitutional Court to testify before a commission of inquiry that sought to investigate his role in allegations of state corruption during his presidency from 2009 to 2018 and engaged in what senior members of the judiciary called a "politically motivated smear campaign" against key figures within the country's judicial system (Hunter et al., 2021). Zuma was given a week to turn himself in, but in a final act of defiance remained holed up in his villa as the deadline approached. However, on the 8th of July, hundreds of police officers surrounded his home, ready to arrest him if necessary. With just minutes until the deadline, Zuma brought an end to the tense standoff and handed himself over to prison authorities at Estcourt Correctional Centre in South Africa's KwaZulu-Natal province (Hunter et al., 2021).

On the 9th of July, the same day the Pietermaritzburg High Court upheld his conviction, the unrest began. Hundreds of incidents of public violence, burglary and malicious property damage were reported in parts of KwaZulu Natal and to a lesser extent in Gauteng, spanning an eight-day period until the 18th of July. The impact of this period of unrest on businesses and commerce in the affected regions was significant. Roughly 40 000 businesses and 50 000 traders were reported to be adversely affected by the unrest during this period, of which 89% were found to be small to medium enterprises (Arnoldi, 2021; Hunter et al., 2021). A subsequent survey found that only 6% of impacted businesses were open as usual, whilst 7%

closed permanently and 44% closed temporarily in the immediate aftermath of the unrest (Arnoldi, 2021). There was also a substantial increase in worker absences, with hundreds of thousands of workers stranded due to road closures, the fear of facing violence in the workplace as well as the suspension of minibus taxi services[2] (Hunter et al., 2021). In the aftermath of the unrest, businesses also faced a significant increase in insurance costs – as multiple insurers increased their premiums, particularly for heavy and light commercial vehicles such as trucks[3] (Moodley, 2022). Meanwhile, exports fell month-on-month by around 11% in July, representing a decline of roughly R18 billion (Toyana, 2021).

The unrest also had a devastating impact on transport and logistical networks within KwaZulu Natal and between neighbouring provinces. Protestors blocked several key link roads within KwaZulu Natal, frequently erecting barricades or employing a tactic whereby vehicles would be stopped, their keys stolen and used to block the road (Hunter et al., 2021). Moreover, multiple national roads – linking KwaZulu Natal with neighbouring provinces – were closed. The N3 highway, a critical freight route running from the port of Durban (a major city in KwaZulu Natal) to the province of Gauteng, was blockaded by protestors and subsequently closed completely due to fear of further attacks following the torching and stoning of various vehicles on this route (Hunter et al., 2021). Moreover, parts of the N2 highway, linking KwaZulu Natal with regions along South Africa's East Coast and spanning until the Western Cape, were closed. These road closures significantly impacted the movement of goods between KwaZulu Natal and the provinces to the north, as well as landlocked countries such as Botswana and Zimbabwe and other African countries as far north as the Democratic Republic of Congo (Hunter et al., 2021; Kew et al., 2021). Moreover, a "force majeure" was declared on the Natal Corridor (NATCOR) rail line, the key freight transport corridor linking Durban and Gauteng dubbed as "the backbone of South Africa's freight transportation network"; whilst critical fuel shortages gripped the province as multiple refineries were forced to close (de Wet, 2021; Hunter et al., 2021). Infrastructure critical to the storage and transport of goods was also vandalized or destroyed, including many delivery vehicles, trucks, and warehouses (West, 2021). As such, multiple logistics and fuel companies declared temporary closures of their operations in the province, citing fears of continued looting, truck burnings and unrest that

[2] This factor was particularly salient, as minibus taxi's ferry around 70% of the working population to and from their places of work (South African Government, 2019).

[3] These vehicles were particularly subject to premium increases since they were primarily targeted during the unrest episode, since they were viewed to contain more valuable/bulk items and were also used to make blockades on roads (Hunter et al., 2021).

could further impact business operations (Hunter et al., 2021; Nair, 2021). In the aftermath of these episodes of violence and destruction, the Road Freight Association of South Africa estimated riots to be associated with increased operational-asset costs for freight companies to be in excess of R300 million (Kew et al., 2021).

There were also severe disruptions at ports in KwaZulu Natal. Durban port – one of the busiest shipping terminals in Africa and a major hub for exports[4]– was forced to cease operations since roads into and out of the port were closed, preventing launch crews from reaching their places of work as well as the availability of Covid-19 testing that was necessary to continue with operations (Heiberg et al., 2021). Particularly impacted was the agricultural export sector, particularly the export of citrus fruits about which 55% of export volumes typically go via the Durban port (Smith, 2021). Similar disruptions occurred at the Richards Bay port in KwaZulu Natal, a major coal export terminal (Heiberg et al., 2021). These closures – coupled with closures at multiple warehouses and depots - caused many shipments to be delayed and perhaps point toward a potential recovery of export values as the backlog clears (Roelf, 2021). However, multiple reports of shipping containers and warehouses being looted by protestors perhaps point toward a permanent loss of exports rather than merely a delay (Roelf, 2021).

In sum, the civil unrest in parts of KwaZulu Natal and Gauteng in July 2021 imposed significant additional costs on exporters. First, additional temporary fixed costs were incurred in the replacement of damaged infrastructure critical to the production and export of goods, such as warehouses, depots, delivery vehicles and capital; increases in the insurance premiums facing firms associated with the increased perception of risk, additional costs associated with storing goods to be exported for an extended period of time due to severe bottlenecks in the transportation of goods arising from road closures and the closure of seaports. Whilst many of these costs are likely to increase with the scale of exports, it is also likely that many of these costs need to be incurred independent of the scale of subsequent export sales (Lawless, 2011). Then, there was also likely to have been an increase in the variable costs, namely the average costs per unit export. This is likely to have occurred through the additional costs associated with substituting toward more expensive forms of transport that were less affected by the unrest such as air freight as well as the replacement of the damaged and looted goods themselves.

[4] Durban port handles roughly 65% of all container traffic in South Africa (Transnet, 2021).

3. Theoretical Framework

3.1 Melitz Model of Heterogenous Firms

A simple conceptual framework used to examine the effect of conflict and political instability on a firm's decision to export comes from Melitz (2003). In response to the empirical challenges faced by the "traditional" models of international trade, the model stresses the importance of firm heterogeneity and country-level fixed export costs in explaining some of the stylized facts found in empirical studies.

The model assumes that the market consists of a large number of firms facing the same inverse demand curve with different levels of productivity. A competitive fringe of potential firms incur a fixed cost when entering a market, which is thereafter sunk. These potential entrants face uncertainty concerning their productivity (and therefore marginal costs) in the industry and draw their productivity from a fixed distribution. Thereafter, once the sunk entry cost is paid, productivity remains fixed, and firms produce horizontally differentiated varieties within the industry under conditions of monopolistic competition and face a constant exogenous probability of death. The existence of fixed production costs means that firms drawing a productivity level below some lower threshold (known as the "zero-profit productivity cut-off") would make negative profits if they chose to produce, and therefore choose to exit the industry. Similarly, the fixed and variable costs of exporting ensure that for the active firms that remain in an industry, only those who draw a productivity above a higher threshold (known as the "export productivity cut-off") find it profitable to export in equilibrium. Moreover, there is assumed to be a steady-state mass of firms active in the industry, meaning that the mass of new firms who enter and draw a productivity level greater than the "export-productivity cut-off" is equal to the mass of existing firms that die (Bernard et al., 2007).

In terms of average sales per firm that remains in the market (the intensive margin), the implications of increased trade costs is more ambiguous. An increase in variable costs will result in a decline in the sales of existing firms but will also result in more marginal low-sale firms exiting the market, thus implying an ambiguous effect on average sales per firms. An increase in fixed costs, on the other hand, will have no impact on the intensive margin.

Based on these theoretical foundations, one can derive several predictions on how the civil unrest episode may have impacted the firm extensive and intensive margins of export flows. The effects of civil unrest and political violence influences these margins in the Melitz model through the imposition of additional production and trade costs on firms in affected regions.

According to the model, the number of firms exporting to a market (the extensive margin) is negatively affected by an increase in both fixed and variable costs. This is because an increase in both fixed and variable trade costs will result in an increase in the threshold level of productivity needed to export. As such, those firms whose productivity was only marginally greater than the costs associated with exporting will exit the foreign market and there will be a change in the composition of low-productivity relative to high-productivity firms in the export market. Meanwhile, for the intensive margin, the model predicts that variables which are expected to be correlated with fixed trade costs, such as GDP, will have a positive effect on the intensive margin (sales per firm); while those variables that impact variable trade costs will have little effect.

3.2 Chaney Model

Chaney (2008) considers a version of the Melitz (2003) model with a Pareto productivity distribution and a fixed measure of potential entrants rather than free entry. The model consists of a static version of the Melitz (2003) model with a single differentiated sector, a global economy consisting of many (potentially asymmetric) countries separated by asymmetric trade barriers, firm productivity which follows the Pareto distribution[5], and that there are two types of costs associated with exporting to a foreign market, fixed and variable costs. Fixed costs are those related to the bureaucracy surrounding exporting, marketing costs as well as the costs of running a wholesale and retail distribution chain. While it is likely that each of these costs increase with the scale of exports; it is also likely that many of these costs need to be incurred independent of the scale of subsequent export sales. Then, variable costs, which are modelled with the iceberg specification, typically refer to transport costs, tariffs, and the variable costs associated with marketing and distribution.

The model produces two equilibrium equations, one governing the extensive margin firm-level export decision and another governing the (conditional) intensive margin export decision. For the extensive margin, a firm *i*'s export decision to market *j* is positively affected by its labour productivity as well as country *j*'s market size. It is negatively affected by country *j*'s remoteness from the rest of the world (making it relatively more difficult for firm *i* to serve country *j*) as well as the fixed costs of exporting. Then, conditional on a positive first-stage

[5] Chaney (2008) argues that the Pareto distribution more accurately represents the observed firm size distribution of US firms. Specifically, the Pareto distribution is thought to be a good approximation of the upper tail of the distribution of firm sizes, since exporters are overwhelmingly large firms.

decision, firm *i*'s second stage export volume decision (intensive margin) is based on the same set of variables, besides the fixed costs of exporting which only affects the extensive margin.

As such, these theoretical foundations can be used to derive several predictions on how the civil unrest episode may have impacted the firm extensive and intensive margins of export flows – particularly by analysing how the model predicts each margin to respond to an increase in both fixed and variable costs. According to the model, an increase in fixed costs will result in a decline in the extensive margin (number of exporters), but this effect will be particularly pronounced for differentiated relative to undifferentiated goods. This is because firms producing differentiated goods (with a relatively low elasticity of substitution) are relatively sheltered from competition, meaning that the new entrants capture a large share of the market such that the impact of these new entrants on trade is large[6]. The intensive margin, on the other hand, will not be affected by the imposition of additional fixed costs, regardless of the level of product differentiation.

Then, an increase in variable costs will result in a decline along both the extensive and intensive margin for all goods. A key finding of the model, however, is that the elasticity of substitution will magnify the intensive margin whilst dampening the extensive margin. As such, following the imposition of additional variable costs, exports of differentiated goods (with a low elasticity of substitution) primarily decline through the extensive margin effect, whilst undifferentiated goods (with a high elasticity of substitution) primarily decline through the intensive margin effect. With a Pareto productivity distribution, these two effects exactly offset each other, resulting in the effect of variable costs on aggregate trade being independent of the elasticity of substitution.

4. Empirical Literature Review

The empirical studies relevant to the analysis conducted in this paper originate from a broad literature that examines the causal impact of various economic shocks on trade flows and consists of several intertwined groups of studies. First, it relates to a group of studies that empirically analyses the role of trade margins on export growth during major crises such as the 2008-2009 global financial crisis and the COVID-19 pandemic. Then, it relates to literature that analyses the impact of supply shocks such as disruptions in transport networks or the destruction of physical capital – typically driven by "natural disasters" such as floods or

[6] On the other hand, when the elasticity of substitution is high, low-productivity entrants can capture only a small market share and as such the impact of these new entrants on trade is low.

earthquakes – on trade performance, and how these effects differ across product and partner-country characteristics. Finally, this paper relates and contributes to a large literature that explicitly examines the relationship between instability (e.g. internal and external conflicts, terrorism, coups) and economic outcomes (e.g. international trade, economic growth). In what follows, this section considers the methodology and extracts various stylized facts from these studies to develop the empirical approach and benchmark the results of this paper. Particularly, this section reviews each of these strands of literature and unpacks the methodologies used, the impact of these shocks according to the role of the intensive and extensive margin in driving the variation of trade during these tumultuous periods, how the determinants of these changes vary by product characteristics as well as what some of the propagation mechanisms between these shocks and trade flows are.

In general, a substantial body of literature has looked to examine the key drivers of the significant contraction in international trade that tends to follow financial crises and subsequent recessions. Much of this research has focused particularly on the adjustment of trade to the 2008-2009 global financial crisis (Behrens et al., 2013; Bems et al. 2013; Bricongne et al., 2012; Eaton et al., 2016; Haddad et al. 2010; Majune & Turkcan, 2022; Matthee et al., 2016). Three prominent empirical approaches within these studies include a difference-in-difference approach using a gravity-style specification in a fixed effects model (Bricongne et al., 2012; Majune & Turkcan, 2022; Munasib et al., 2021), a multi-country general equilibrium model (Eaton et al., 2016) as well as an export growth decomposition along firm, product, or destination margins (Behrens et al., 2013; Bricongne et al., 2012; Haddad et al., 2010; Majune & Turkcan, 2022). Several consistencies and stylized facts emerge across studies. First, much of the adjustment to exports in response to crises is found to occur at the intensive margin, with the decline in the volume of exports in existing firm, product and destination relationships accounting for between 70-95% of the fall in aggregate exports (Behrens et al., 2013; Bricongne et al., 2012; Haddad et al., 2010).

Similarly, a growing literature examines the impact of the COVID-19 pandemic on trade flows, an episode perhaps more applicable to the impact of the civil unrest period analysed in this paper due to the relative importance of supply shocks in explaining the resulting fall in trade (Baldwin & Tomiura, 2020; Benguria, 2021; Bricongne et al., 2021; Minondo, 2021). Despite these differences in the primary propagation mechanisms, there exists several consistencies with the impact of financial crises. First, the firm-intensive margin accounted for the majority (up to 90%) of the overall fall in exports during this period (Benguria, 2021; Bricongne et al.,

2021; Minondo, 2021). Then, the fall in exports was also greatest for intermediate and capital goods relative to final goods; as well as for differentiated goods relative to non-differentiated goods (Benguria, 2021; Bricongne et al., 2021; Majune & Turkcan, 2022). Various propagation channels between the COVID-19 pandemic and the fall in exports have been proposed and analysed, the most important of which include supply shocks such as port closures, border closures, lockdown measures and increased transport costs (Baldwin & Tomiura, 2020; Benguria, 2021).

Whilst supply shocks are hypothesized to have been an important factor driving the decline in trade resulting from the COVID-19 pandemic, the accompanying reduction in demand and expenditure during this period may make it difficult to isolate the role of supply shocks in explaining the fall of trade relative to demand shocks. As such, a further strand of literature worth considering is one consisting of studies that explicitly study the impact of domestic supply shocks on export flows by using "natural disasters" such as floods or earthquakes as exogenous sources of variation and temporary increase in the variable costs of exporting (Andrade da Silva & Cernat, 2012; Besedes & Murshid, 2017; Gassebner et al., 2010; Osberghaus, 2019). Intuitively, such events may mimic the impact of the civil unrest episode in term of the destruction of physical capital, loss of labour capacity, and temporary reduction in available transportation infrastructure. Several relevant insights from these studies emerge. First, the disruptions resulting from these events were associated with a significant contraction of export flows of up to 35% depending on the severity of the disaster and the particular propagation mechanism (Andrade da Silva & Cernat, 2012; Blyde & Martincus, 2013; Besedes & Murshid, 2017; Gassebner et al., 2010; Osberghaus, 2019). For example, in a study using an earthquake in Chile as an exogenous shock to transport infrastructure, Blyde & Martincus (2013) find that exports whose shipments had to be rerouted because their previous routes became impassable had a rate of growth 33.7% lower than their non-affected counterparts. Then, whilst some studies report a modest effect at the extensive margin, the effect on the intensive margin always dominates regardless of the level at which the margins are defined (Besedes & Murshid, 2017; Blyde & Martincus, 2013). Finally, exports of non-differentiated goods decline relatively more than differentiated goods in response to a temporary increase in variable costs – primarily driven by a decline in available transport infrastructure and a subsequent reduction in the number of units shipped (Blyde & Martincus, 2013).

Then, another relevant strand of literature is a group of studies that analyse the impact of internal conflict such as civil wars on export flows. These studies typically employ a bilateral

gravity specification augmented with a variable capturing the presence of conflict in a given region, finding the negative impact of domestic conflict on export values to be large and persistent (Blomberg & Hess, 2006; Glick & Taylor, 2010; Long, 2008; Martin et al., 2008; Nitsch & Schumacher, 2004). For example, Blomberg & Hess (2006) use a panel dataset with annual observations on 177 countries from 1968 to 1999 to find the incidence of internal conflict to have a robust negative – albeit heterogenous - effect on bilateral export flows between roughly 7% and 17%, roughly equivalent to as much as a 30% tariff on trade[7]. Glick & Taylor (2010) and Martin et al. (2008) conduct a similar exercise but extend their analysis to consider contemporaneous as well as lagged effects of domestic conflict on exports, finding that domestic conflict reduces the volume of a country's trade flows by 25 percent a year after the conflict has ended – likely owing to the permanent destruction of production capacity. These studies, however, only analyse the impact of internal conflict on the total value of exports and therefore do not consider the impact of these events on the extensive versus intensive margin of exports, and do not consider how these effects may differ across products.

Perhaps the most salient to the analysis in this paper is a literature which examines the impact of political violence, civil unrest, and instability on trade flows (Ahsan & Iqbal, 2019; Amponsah et al., 2011; Kapri, 2019; Ksoll et al., 2009). These studies consistently report a decline in exports for firms within affected regions of up to 38% during periods of violence (Ksoll et al., 2009). Interestingly, this effect is also relatively persistent. Amponsah et al. (2011), for example, finds a spell of political violence and civil unrest following the 2008 presidential election in Kenya to result in a structural change in the import growth rate for Kenyan roses to the European Union (EU), driven by the importers substituting toward other, less-risky producers as a response to the short bout of political violence. Then, these civil unrest episodes typically reduce export flows through the extensive as well as intensive margin, although the intensive margin accounts for around 85% of the total effect (Ksoll et al., 2009; Ahsan & Iqbal, 2019). In terms of propagation mechanisms, Ksoll et al. (2009) finds the decline in export flows to be primarily driven by worker absences, whilst Ahsan & Iqbal (2019) stress the importance of the disruption in transport networks.

[7] However, they do note several caveats with such comparisons – including that domestic violent episodes tend to be temporary - lasting only a few years - whilst geographic, policy and other barriers to trade tend to be more persistent. As such, even if the estimated coefficients in a gravity model are similar, in a present-value sense the costs associated with violence should be considered to be lower than most other trade barriers (Blomberg & Hess, 2006).

Finally, it is worth briefly considering how a products level of differentiation responds to trade costs in studies that do not specifically consider shocks such as natural disasters. In general, these studies typically look to evaluate the theoretical predictions of the Chaney (2008) model by empirically estimating how an increase in some proxy for transaction costs impacts bilateral trade values and volumes (Persson, 2013; Ranjan & Lee, 2003; Sadikov, 2007). Typically, these studies find that while both differentiated and undifferentiated goods are affected by increased trade costs, the extensive margin effect accounts for majority of the effect for differentiated goods, and vice versa for undifferentiated goods (Persson, 2008; Persson, 2013; Sadikov, 2007). For example, in studies which examines how export values respond to changes in transaction costs by using the number of days needed to export a good as a proxy, Persson (2008) and Persson (2013) find a significant and negative association between export transactions costs and the extensive margin for differentiated goods. The extensive margin effect for undifferentiated goods, meanwhile, is insiginificant. Similarly, to the extent that there is an overall negative effect on undifferentiated goods from export transaction costs, this negative effect stems entirely from the effect on the intensive margin. These results are robust and consistent across other studies using different proxies for trade costs (Ranjan & Lee, 2003; Sadikov, 2007). As such, these studies broadly support the theoretical predictions of the model by Chaney (2008).

In sum, despite the existence of several heterogeneities across literatures, studies, and methodologies, several stylized facts can be gleaned to form various testable hypotheses of how the civil unrest episode of interest may have impacted export flows from affected regions. These hypotheses are:

H1: The civil unrest episode will result in a decline in exports, primarily at the intensive margin.

Almost all studies reviewed report a significant decline in export flows following the onset of a crisis that is characterized by supply shocks similar to the unrest episode analysed in this study (Ahsan & Iqbal, 2019; Blyde & Martincus, 2013; Glick & Taylor, 2010; Ksoll et al., 2009; Martin et al., 2008). Then, the prohibitive effects of the unrest episode such as ports and road closures are hypothesized to result primarily in an increase in variable costs for firms in affected regions (due to increased expenses associated with redirecting their products to unaffected, costlier transportation channels, etc.). As such, based on the model by Chaney (2008), the unrest episode is expected to result in a decline in export flows that consists of a

particularly large intensive margin effect, corresponding with the results in other studies (Ahsan & Iqbal, 2019; Behrens et al., 2013; Benguria, 2021; Besedes & Murshid, 2017; Blyde & Martincus, 2013; Bricongne et al., 2012; Bricongne et al., 2021; Haddad et al., 2010; Ksoll et al., 2009; Minondo, 2021). A priori, this intensive margin dominance is intuitive, given that the civil unrest episode may have been seen as a temporary issue resulting in a transitory increase in variable transport costs, so that exporters may have preferred to keep exporting despite the unfavourable conditions to avoid paying the fixed costs of re-entry.

H2: Total monthly export values will recover relatively quickly, although the decline in exports that is hypothesized to occur during the unrest episode may represent a permanent loss of exports.

Much of the literature reports a relatively quick recovery subsequent to a crisis (Behrens et al., 2013; Eaton et al., 2016; Ksoll et al., 2009; Majune & Turkcan, 2022; Matthee et al., 2016). Such a result would appear intuitive, as a small extensive margin decline favours a relatively quick recovery (Behrens et al., 2013). Moreover, since exporting activity tends to be concentrated amongst larger firms, exporters may plausibly have the financial capacity to replace damaged physical capital and merchandise relatively quickly (Rankin, 2013). However, the decline in total export values that is hypothesized to occur during the unrest episode is expected to represent a permanent loss of exports, due to widespread reports of destroyed merchandise and the looting of warehouses.

H3: Exports of both differentiated and undifferentiated products will decline due to the unrest episode. Exports of differentiated goods will however exhibit a relatively larger extensive margin effect, whilst exports of undifferentiated products will exhibit a relatively larger intensive margin effect.

The elasticity of substitution is one of the important characteristics that may affect a products response to the civil unrest episode. Since the empirical evidence reviewed above appears to suggest that many supply shocks tend to result primarily in an increase in variable costs, exports of differentiated goods (with a low elasticity of substitution) are expected to decline primarily along the extensive margin, whilst exports of undifferentiated goods (with a high elasticity of substitution) are expected to decline primarily along the intensive margin; on the basis of the Chaney (2008) model and various empirical studies (Persson, 2013; Ranjan & Lee, 2003; Sadikov, 2007).

5. Empirical Approach

5.1 Broad Methodological Approach

To identify the effect of the unrest episode on exports, this study uses a difference-in-differences approach – where export flows in the affected region during the period of unrest are compared to those in periods preceding the unrest as well as an unaffected counterfactual region. To conduct this analysis, this approach is empirically applied in two ways. First, a decomposition approach is used to separate out the extensive and intensive margin contributions to the growth in aggregate exports as well as to provide some descriptive analysis of these dynamics over the entire sample period. This decomposition is applied for both the affected and unaffected counterfactual regions, permitting a comparison of how these dynamics differ between regions and across time. Second, the impact of the unrest episode is estimating by embedding the difference-in-difference approach into a gravity model estimation approach.

5.2 Data

This study uses a merged dataset consisting of data from a variety of sources. The primary data source consists of monthly transaction-level data obtained from the South African Revenue Service (SARS) (SARS, 2022). This data, recorded at a monthly frequency, contains information on exports recorded at the point of exit between January 2017 and December 2021, thereby covering the period before and after the civil unrest in July 2021. A single transaction includes information on the district office and province of exit, the month and year of despatch, the customs value (in South African Rands) of the transaction, the country and region of destination (market), the statistical quantity of goods exported, the product classification according to the Harmonized System (HS) at the two and six-digit level, the sector in which the product belongs, as well as the type of port used to export the good (land, air, sea, etc.).

A number of other indicators from a variety of sources are merged into the dataset. First, several conventional gravity equation variables – including distance, contiguity, the existence of a common language and colonial history between two bilateral trading partners – is obtained from the CEPII database to construct a function for trading costs to be included in the main specifications (Head & Mayer, 2014). Income-related data for destination markets are then obtained by using the monthly value of total imports (in South African Rands) from the ITC Trade Map database as a proxy for domestic income and demand.

Finally, measures of product differentiation are obtained using the classification from Rauch (1999)[8]. This classification categorizes products that are listed on a mercantile exchange or are standardized enough so that their prices are listed in the trade publications or trade websites as undifferentiated, whilst differentiated goods are those that do not fit into the previous two categories. Where goods do not fit into a single category, Rauch (1999) proposes a conservative and liberal classification. The conservative classification categorizes all ambiguous products as differentiated goods whilst, by contrast, the liberal classification minimizes the number of differentiated goods by classifying them as homogenous goods. The number of products in each product category according to each iteration of the Rauch (1999) classification are presented in Table A1 and A2 in the appendix, respectively. Since the number of products classified as homogenous goods is relatively low in the conservative classification, the empirical analysis in this paper primarily relies on the liberal classification. However, the results obtained in Section 8 do not differ in terms of the direction and significance of the effect when the conservative classification is used.

To construct the working sample, several amendments are made to the raw dataset. First, the sample is restricted to manufactured good exports – as the exports of primary goods such as minerals originate from a very select group of district offices and do not yield sufficient cross-sectional variation[9]. In addition, underpinning the assumption of parallel trends between the treatment and control regions is the supposition that the composition of goods being exported from each region is roughly similar. This assumption is significantly more likely to hold when considering only goods originating from a single sector (in this case, manufacturing) than considering total trade. Then, additional observations are excluded due to data quality and other issues. First, observations where either destination, product or province of origin are missing are omitted due to the central importance of these variables to the analysis conducted in this paper. In addition, observations where the destination country and product are classified as "other" are omitted[10], with these values accounting for roughly 0.93% of all transactions in the full sample. Following the approach of Bricongne et al. (2012), products classified as "monetary gold" are also omitted.

[8] Rauch (1999)'s classification is at the 4-digit SITC level. As such, a concordance table was used to map Rauch (1999)'s classification to the 6-digit HS level in the data.
[9] In the full sample, manufactured exports account for 86.67% of all exports in South Africa and 87.89% of all exports in KwaZulu Natal.
[10] These observations are dropped due to the fact that the heterogeneity of products and destinations that may have been classified as "other" is unknown, and as such this classification is devoid of any real meaning.

It is worth discussing the classification of exports into the control and treatment groups. All export transactions originating from KwaZulu Natal are assigned to the treatment group. KwaZulu Natal is solely considered as an affected region since despite the fact that there were also reports of civil unrest and violence in other provinces such as Gauteng, these episodes were far more sporadic and isolated to specific districts within the province (Hunter et al., 2021). The control group, meanwhile, consists of all transactions originating from the Western Cape province. Of all candidate provinces, the Western Cape is the optimal choice for the control region and provides an adequate counterfactual for how exports would have evolved in the affected region had the civil unrest not occurred for a number of reasons. First, it is unlikely that the civil unrest spread to parts of the Western Cape due to the lack of a common border with and large distance from affected provinces. Indeed, there are no reports of the violence spreading to parts of the Western Cape (Hunter et al., 2021). Second, the Western Cape is the province most similar to KwaZulu Natal in terms of district office and export composition, with both provinces having land, air and seaports and the port of exit for the majority of export transactions in each province being a single seaport (68.3% in KwaZulu Natal and 72.3% in the Western Cape). Then, as depicted in Table A3, the Western Cape is the province with the average monthly growth rate of total export value that is most similar to that of KwaZulu Natal in the six-month period preceding the civil unrest (1.32% in KwaZulu Natal and 1.51% in Western Cape). More formal analysis and tests are conducted to establish the suitability of the Western Cape as an optimal control region in Section 5.3.

Finally, the working sample is also restricted to only include exports originating from coastal ports. This is because there is no district office in the control region of the Western Cape which exports to neighbouring countries via land, as well as the fact that the data for exports values that are exported through airports is very noisy.

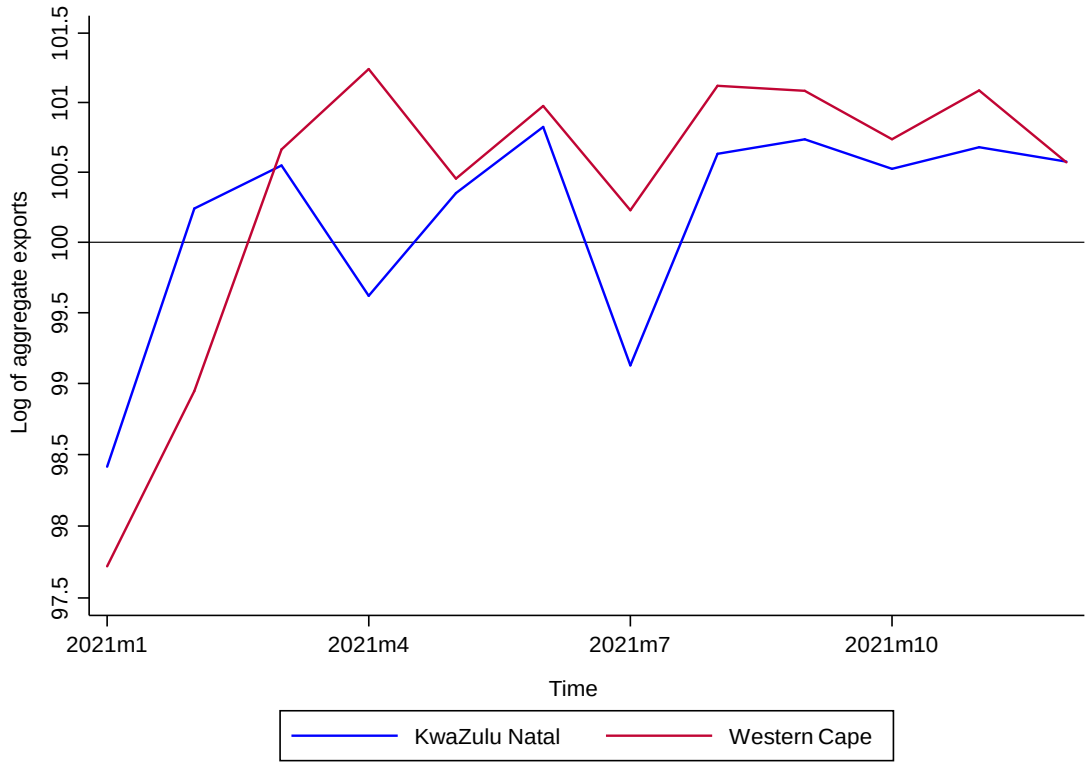
5.3 Preliminary Data Analysis

In this section, preliminary analysis is conducted to analyse and understand the overall dynamics of exports in the treatment and control region – before and after the period of interest. In doing so, this section aims to consider how these dynamics differ across various characteristics including the region of origin as well as across products of varying levels of differentiation. Particularly, the evolution of exports across groups is analysed at the aggregate level, as well as along the extensive and intensive margins. In this study, the extensive margin is defined as the number of distinct HS6 product varieties exported, while the intensive margin

is the average value per HS6 product exported. In all of these figures, the dependent variable is indexed such that the average in the six-months preceding the unrest period (January – June 2021) is equal to 100. Then, as a final step, this section also tests for the existence of parallel trends between the treatment and control region prior to the unrest period – a crucial assumption permitting the causal interpretation of the effects estimated in later sections of this paper.

Figure 1 illustrates the evolution of the log of export values across the treatment and control regions in 2021 relative to the average in the pre-unrest period, before and after the unrest period. The substantial drop in the indexed value of log exports below the reference line for KwaZulu Natal indicates that export values in KwaZulu Natal declined significantly in the month of unrest relative to the average in the pre-unrest period. The difference between log export values in the month of unrest relative to the pre-unrest period for the Western Cape, meanwhile, was relatively small. Subsequent to the unrest period, however, log of exports rapidly recovered above the average of the pre-unrest period. Since this appears to suggest "above-normal" growth in the post-unrest period, this would a priori be consistent with the hypothesis that exporters were able to clear their inventories once the unrest subsided, resulting in a significant increase in export values that exceeded the average value of exports in the pre-unrest period.

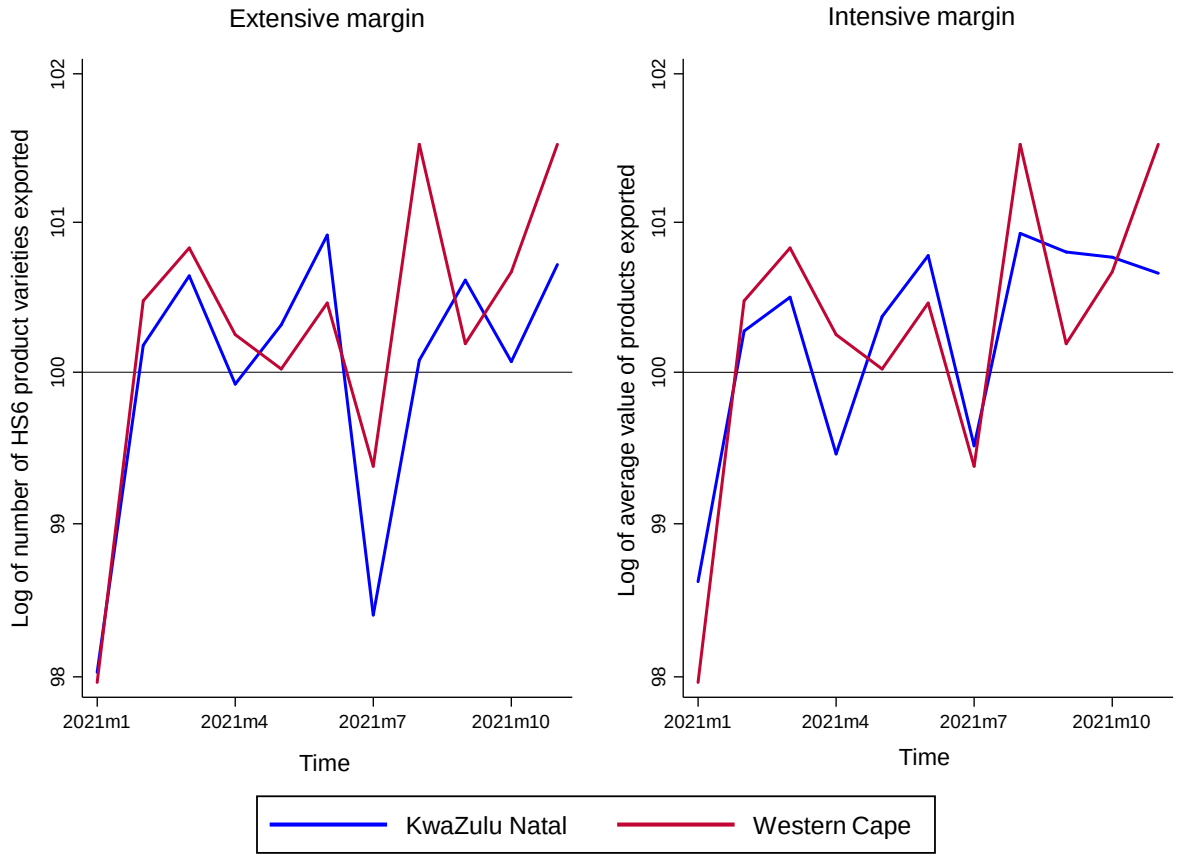
Figure 1: Log of Average Export Value for KwaZulu Natal and Western Cape in 2021, Indexed: Average Between 2021m1 – 2021m6 = 100



Source: Own calculations using SARS (2022) data.
Note: data in figure is normalized such that the average value of exports from 2021m1 – 2021m6 is set equal to 100.

To gain a deeper understanding of some of the margin contributions driving the drop in total export values during the month of unrest in KwaZulu Natal that was evident in Figure 1, Figure 2 illustrates the evolution of the extensive and intensive margin of export flows in KwaZulu Natal and the Western Cape throughout the period of analysis. Evidently, the log of the number of HS6 products exported from KwaZulu Natal was significantly lower than the average in the pre-unrest period as well as the value in the Western Cape during the unrest episode. Subsequently, the extensive margin appears to have recovered to pre-crisis trends, albeit still below the indexed value for the Western Cape. For the intensive margin, meanwhile, the log of the average value per product exported was only slightly lower in the unrest period for both KwaZulu Natal and the Western Cape relative to their averages in the pre-crisis period. Subsequent to the unrest period, however, the extensive and intensive margin appear to have recovered back to pre-crisis levels relatively quickly.

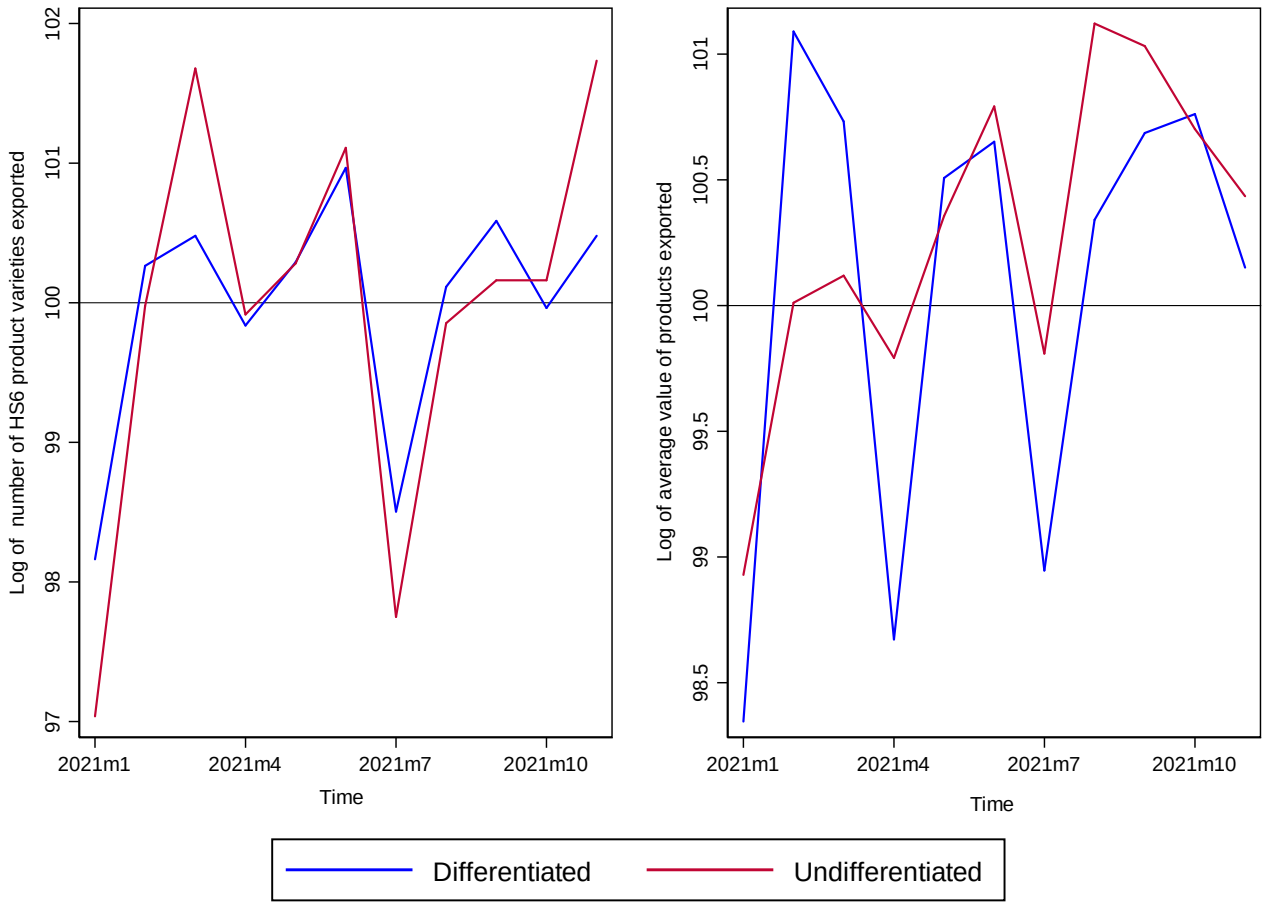
Figure 2: Log of Number HS6 Product Varieties and Average Value Per Product Exported for KwaZulu Natal and Western Cape in 2021, Indexed: Average Between 2021m1 – 2021m6 = 100



Source: Own calculations using SARS (2022) data.
Note: data in figure is normalized such that the average value of exports from 2021m1 – 2021m6 is set equal to 100.

Then, to examine the heterogeneity of the unrest episode on exports of different levels of variation, Figure 3 plots the trends in the extensive margin and intensive margin variables for differentiated and undifferentiated products in KwaZulu Natal. Evidently, the number of distinct product varieties was significantly lower during the crisis relative to the pre-unrest period for both differentiated and undifferentiated products. This was followed by what appears to be a relatively quick recovery back to normal pre-crisis levels. The unrest episode also appears to have coincided with a significant decline in the intensive margin of differentiated product exports, followed by a recovery. The intensive margin of undifferentiated products, meanwhile, remained relatively stable throughout the period of analysis.

Figure 3: Log of Number HS6 Product Varieties and Average Value Per Product Exported of Differentiated and Undifferentiated Goods from KwaZulu Natal in 2021, Indexed: Average Between 2021m1 – 2021m6 = 100



Source: Own calculations using SARS (2022) data.
Note: data in figure is normalized such that the average value of exports from 2021m1 – 2021m6 is set equal to 100.

As a final check, the existence of parallel trends - an important assumption underlying the difference-in-differences identification strategy used in the empirical analysis of this paper – is tested for. First, the three primary dependent variables of interest in this study (aggregate exports, number of HS6 product varieties and average value per HS6 product variety) are plotted against time in Figure A1, A2, and A3 in the appendix respectively. Based on these figures, these variables appear to have evolved over the pre-unrest period in a similar manner until the beginning of the unrest episode, where they diverged slightly. To formally test for the existence of parallel trends, these variables are regressed on the time variable, a dummy variable indicating whether the observation was recorded in KwaZulu Natal and an interaction term between the two. The results of this exercise are reported in Table A4 with the insignificance of the interaction term in each of the specifications confirming that the assumption of parallel trends in the period preceding the unrest holds. As such, it appears that without the unrest episode, the exports of treated regions would have evolved in the same way as that of untreated regions – providing support for the interpretation of the results estimated in later sections of this paper as reflecting a causal impact of the crisis.

6. Decomposition Analysis

6.1 Methodology

This section builds on the difference-in-differences approach used in this study and provide further descriptive analysis by employing a decomposition approach to separate out the extensive and intensive margin contributions to trade growth across products of different levels of differentiation as well as across the treatment and control region. This is done using a mid-point growth rate decomposition, a common approach in the trade literature used to examine the impact of firm, product, and destination entry/exit in response to a crisis (Bricongne et al., 2012; Bricongne et al., 2021; Buono et al., 2013; Matthee et al., 2016; Majune & Turkcan, 2022).

The mid-point growth rate establishes exports over a high frequency, such as two years, instead of a low frequency like a month. Such an approach avoids the necessity of controlling for seasonality and the over-estimation of product/destination entries and exits that are associated with low frequency data. Moreover, the use of mid-point growth rates permits growth rates associated with newly created or destroyed flows to be estimated. The use of ordinary growth rates, on the other hand, would not permit an analysis of the extensive margin adjustment as they would be undefined for created/destroyed relationships and would therefore rely on

probabilistic methodologies to quantify the impact of determinants of exports at the extensive margin (Majune & Turkcan, 2022; Matthee et al., 2016).

Here, mid-point growth rates are calculated on elementary flows, defined as monthly export flows to a given destination for each HS6-product. To examine to what extent the adjustments in export are due to the extensive margin and to the intensive margin, all elementary monthly trade flows can be classified into four broad types: created relationships (positive extensive margin), destroyed relationships (negative extensive margin), increase in existing flows (positive intensive margin), and decrease in existing flows (negative intensive margin). As such, the net extensive margin is defined as the difference between created and destroyed flows, whilst the net intensive margin as the difference between increased and decreased flows.

Note that mid-point growth rates are calculated as changes in the value of exports of product *k* to destination *d* at time *t* relative to 24 months prior. While other studies such as Bricongne et al. (2012), Bricongne et al. (2021) and Buono et al. (2013) use the 12-month mid-point growth rate, such an approach would result in the use of 2020 as the base year when calculating mid-point growth rates for 2021, the primary period of interest. Since export values in 2020 were far lower than normal due to the onset of trade restrictions resulting from the COVID-19 pandemic, this would result in abnormally large growth rates for the first six months of 2021 (the pre-treatment period), thereby confounding the estimates in this section. As such, 24-month mid-point growth rates are used.

For every destination *d* and HS6-product *k,* exports (in rands) are denoted at time *t* (e.g. July 2021) by $x_{dk,t}$. The 24-month mid-point growth rate of export value of destination *d* for product *k* is then defined as:

$$g_{dk,t} = \frac{x_{dk,t} - x_{dk,(t-24)}}{\frac{1}{2}(x_{dk,t} + x_{dk,(t-24)})} \quad (1)$$

This growth rate is symmetric around zero and lies in the interval [-2, 2], taking the maximum value of 2 when export flows are considered to be positive extensive margin and minimum value of -2 when they are considered to be negative extensive margin. Note also that $g_{dk,t}$ ranges from 0 to 2 when export flows are classified as positive intensive margin and from -2 to 0 when export flows are classified as negative intensive margin. The weight, $w_{dk,t}$ given to each flow $g_{dk,t}$ is given by the relative share of the flow in total exports, where total refers to the total value of exports in the region examined:

$$w_{dk,t} = \frac{x_{dk,t} + x_{dk,(t-24)}}{X_t + X_{t-24}} \quad (2)$$

A convenient feature of the mid-point growth rate is that it aggregates exactly (unlike the log change). As such, the aggregate growth rate of the total value of exports can be expressed as a weighted average of the transaction-level growth rates:

$$G_t = \left(\sum_k \sum_d w_{dk,t} * g_{dk,t} \right) \quad (3)$$

Provided that the elementary flows can each be classified into four subsets, G_t can be calculated by aggregating separate flows corresponding to the four contributions listed above: positive extensive (entry), negative extensive (exit), positive intensive (increase in existing flows) and negative intensive (decrease in existing flows). In this approach, a new flow may be from a new destination being served or a new product being exported to an already established destination. *G* is also a very good approximation of the log change in total exports and is monotonically related to the conventional growth rate measure by the following identity:

$$G_t \approx \frac{2gr_t}{(2 - gr_t)} \quad (4)$$

Based on these mid-point growth rates, this section seeks to identify the impact of the civil unrest episode on the growth rate of exports as follows. First, the contributions of the extensive and intensive margins to export growth *within* KwaZulu Natal (the treatment group) before, during and after the unrest episode are considered – with a particular focus on the change in these margins contributions in the period of unrest as well as the subsequent recovery. The potential for any heterogeneity in the growth rate of exports according to product and destination characteristics are then considered. Then, to isolate the impact of the civil unrest episode on these growth rates, the dynamics of the mid-point growth rate and its constituent margins contributions are compared with those within a comparator region where there was no civil unrest episode (in this case, the Western Cape). Note that for the extensive margin, the *net* contributions are focused upon rather than the *gross* contributions since the use of monthly data is likely to result in the gross contributions being inflated, as shown by Bricongne et al. (2012).

6.2 Decomposition Results

Table 1 presents the contributions of net margins to the mid-point growth rates of export values in KwaZulu Natal for 2021, including a breakdown of these values before (January – June 2021), during (July 2021) and after (August – December 2021) the unrest period[11]. Column 1 shows that the net intensive margin accounts for roughly 90% of the total export growth rate during 2021. The dominance of the intensive margin corresponds to expectations for developing countries, where continuing products and markets typically drive the variations in exports (Besedes & Prusa, 2011; Matthee et al., 2016). Product entry and exit contributes the most at the extensive margin, whilst destination entry and exit contribute very minimally to export growth rates.

The month of unrest coincided with a significant decline in exports in the affected region – declining by 15.44% as shown in Column 3. This decline was primarily driven by the net extensive margin, which contracted by 22.01% in the unrest period and therefore accounted for more than the total decline. This extensive margin contraction was primarily driven by the net product-extensive margin which declined by 21.96% relative to that of 24-months prior. The net destination-extensive margin, meanwhile, remained relatively unchanged. As such, it appears that exporters retained an export relationship with their destination markets but cut the number of products sold to these markets during the unrest episode.

Table 1: Margins Contributions to 24-Month Mid-Point Growth Rates in KwaZulu Natal,2021

	Overall	**Pre-unrest**	**During unrest**	**Post-unrest**
Destination entry	0.25	0.26	0.17	0.25
Destination exit	-0.23	-0.19	-0.22	-0.29
Net distance extensive	0.02	0.07	-0.05	-0.04
Product entry	23.88	23.09	18.16	25.96
Product exit	-23.62	-23.11	-40.12	-20.95
Net product extensive	0.25	-0.01	-21.96	5.01
Total entry	23.89	22.72	19.78	26.12
Total exit	-25.47	-24.3	-41.46	-23.68
Net extensive	0.27	0.06	-22.01	4.98
Intensive positive	35.3	32.34	29.34	41.47
Intensive negative	-19.96	-22.66	-22.77	-16.17
Net intensive	15.34	8.5	6.57	25.31
Total	15.61	8.56	-15.44	30.28

Source: Own calculations using SARS (2022) data. Sample includes exports originating from seaports for the manufacturing sector in KwaZulu Natal. Sample period is 2021, with the pre-unrest period corresponding to January – June 2021, the unrest period corresponding to July 2021, and the post-unrest period corresponding to August – December 2021. The base year of the midpoint growth rate is 2019.

[11] The evolution of these net margin contributions are also presented graphically in Figure A4.

Then, a comparison between the average growth rates in Column (4) and those in the pre-unrest period in Column (2) permits an understanding of the recovery dynamics of the unrest episode. Specifically, a growth rate that is similar to the pre-unrest period would signal a "normal" growth trajectory, whilst post-unrest growth rate that is relatively higher in the would signal "above-normal" growth. Evidently, average export values appear to have recovered relatively rapidly following the unrest episode, with a positive average midpoint growth rate in the post-unrest period of 30.28% driven primarily driven by a growth rate of the intensive margin of 25.31%. As such, compared to growth rates in the pre-unrest period, the relatively large growth rates in the post-unrest period suggest that there was "above-normal" growth in the aftermath of the unrest episode, suggesting that there was a relatively quick recovery in both the extensive and intensive margin. The destruction of destination-product trading relationships which occurred during the unrest episode therefore appears to have been temporary rather than permanent, contrary to *hypothesis H2*. These results suggest that the closure of the main seaport and road networks resulted in a temporary decline in the portfolio of products being offered to destination countries, but that once the unrest subsided exporters were able to clear their inventories – resulting in a significant increase in the intensive margin in the months after the unrest episode as exporters rid themselves of the backlog from the crisis.

Then, Table 2 considers the dynamics of the 24-month mid-point growth rate for both differentiated and undifferentiated goods in the affected region during the pre-unrest, unrest, and post-unrest periods. Whilst the unrest period coincided with an overall decline in the value of exports, this decline was more pronounced for undifferentiated goods which contracted by 17.19%. Exports of differentiated goods, meanwhile, declined by 11.1%. Across both levels of product differentiation, these declines were driven primarily by a reduction in the net product extensive margin – implying that there was a smaller portfolio of both differentiated and undifferentiated manufacturing products being exported to destination markets during the period of unrest relative to 24-months prior.

Table 2: Margins Contributions to 24-Month Mid-Point Growth Rates in KwaZulu Natal for Aggregate Manufacturing Sector by Level of Product Differentiation, 2021

	Pre-unrest		**Unrest**		**Post-unrest**	
	Differentiated	Undifferentiated	Differentiated	Undifferentiated	Differentiated	Undifferentiated
Destination entry	0.72	0.38	0.3	0.14	1.13	0.29
Destination exit	-0.78	-0.33	-0.4	-1.31	-1.04	-0.13
Net destination extensive	-0.06	0.05	-0.1	-1.17	0.09	0.16
Product entry	32.96	19.04	20.68	17.12	29.72	24.06
Product exit	-24.75	-22.06	-32.94	-41.85	-23.26	-19.97
Net product extensive	8.2	-3.02	-12.26	-24.73	6.46	4.09
Total entry	33.68	19.42	20.98	17.26	30.85	24.35
Total exit	-25.53	-22.39	-33.34	-43.16	-24.3	-20.1
Net extensive	8.25	-5.23	-12.36	-25.9	6.55	4.24
Intensive positive	36.46	29.15	25.16	31.02	43.67	40.63
Intensive negative	-16.65	-24.93	-23.9	-22.31	-15.15	-16.5
Net intensive	19.82	4.22	1.26	8.71	28.52	24.13
Total	27.96	1.25	-11.1	-17.19	35.06	28.37

Source: Own calculations using SARS (2022) data. Sample includes transaction-level exports originating from seaports for the manufacturing sector in KwaZulu Natal. Figures represent the average monthly 24-month mid-point growth rate in the respective period. Sample period is 2021, with the pre-unrest period corresponding to January – June 2021, the unrest period corresponding to July 2021, and the post-unrest period corresponding to August – December 2021. Products are classified as differentiated or undifferentiated based on the liberal classification by Rauch (1999). The base year of the midpoint growth rate is 2019.

Whilst Table 1 and 2 are helpful to illuminate some of the trends in export values during the period of analysis, it is difficult to make any strong statements regarding a causal impact of the unrest episode as these results may be driven by aggregate effects common to all regions in South Africa (e.g. a recovery from COVID-19). As such, the impact of the unrest episode on the growth path of export values in the affected region is further examined by comparing the relative contributions of net margins to that of the control region - a counterfactual for how export growth in the affected region may have evolved had the unrest not occurred. More specifically, Table 3 seeks to analyse the impact of how the civil unrest may have impacted export growth in the affected region by presenting the relative export growth rate and constituent margins contributions between KwaZulu Natal and the Western Cape for 2021. Briefly considering the pre-unrest period, Column 2 indicates that the average growth rate in the affected region was 2.54 percentage points higher than in the unaffected region in the six months preceding the unrest. Since an ideal control region would have an average mid-point growth rate that is as close to that of the affected region in the period preceding the unrest as possible, the Western Cape appears to be a relatively good counterfactual for how export growth in KwaZulu Natal would have evolved had the unrest not occurred.

Then, Column 3 depicts the relative export growth rate, and its constituent net margins contributions between the affected and unaffected region during the month of unrest. Evidently, the unrest period coincided with an export growth rate in the affected region that was 14.9 percentage points lower than in the unaffected region. This difference was particularly accounted for by the net product extensive margin, which was 18 percentage points lower in the affected region. The net intensive margin, meanwhile, was 2.49 percentage points lower in KwaZulu Natal than in the Western Cape during the period of unrest – suggesting that the civil unrest may have also been associated with a weakening of surviving trade relationships.

Then, in the post-unrest period, Column 4 indicates that export growth in the affected region was marginally greater than that of the unaffected region, similar to the relative value of growth rates in the pre-unrest period (2.54 percentage points in the pre-unrest period versus 2.77 percentage points in the post-unrest period). As such, there appears to be a persistence in the effect of the crisis: while aggregate export growth recovered, it was still not much greater than the comparator region in the recovery period relative to in the pre-unrest period. This is primarily driven by weaker extensive margin growth, particularly in the product extensive margin. There is however some recovery in the net intensive margin relative to the counterfactual region, suggesting that for those products that continued to be exported through the crisis, there was a strong recovery above the benchmark – perhaps reflecting exports of backlogged products.

Table 3: Relative Margins Contributions to 24-Month Mid-Point Growth Rates Across Pre-Unrest, Unrest and Post-Unrest Periods for Affected and Unaffected Regions, 2021

	Overall	**Pre-unrest**	**Unrest**	**Post-unrest**
Net destination extensive	0.98	-0.01	5.84	1.22
Net product extensive	1.4	8.12	-18	-2.77
Net extensive	2.38	8.11	-12.41	-1.54
Net intensive	0.16	-2.86	-2.49	4.33
Total	2.54	5.26	-14.9	2.77

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from seaports only. Figures reflect the difference in the average mid-point growth rate in each period between KwaZulu Natal and the Western Cape. The pre-unrest period corresponds to January – June 2021, the unrest period to July 2021, and the post-unrest period to August – December 2021. The base year of the 2021 mid-point growth rate is 2019.

In sum, the period of civil unrest coincided with a significant reduction in the mid-point growth rate of exports in the affected region. Specifically, in the affected region of KwaZulu Natal, the mid-point growth rate indicates that the period of unrest was associated with a 15.44% decline in the value of exports relative to the same month two years prior. This decline was primarily driven by the net product extensive margin, with the reduction in the portfolio of products

exported to existing destinations contributing toward a 21.96% reduction in aggregate exports. Moreover, whilst export values of all product categories declined during the period of unrest, this decline was most pronounced for undifferentiated goods. Then, considering the impact on the growth trajectory of export values relative to the counterfactual values of an unaffected region, the civil unrest period coincided with a mid-point growth rate that was 14.9 percentage points lower than the control region. In all cases, the extensive margin, particularly the product-extensive margin, accounts for roughly 65% of the reduction in the mid-point growth rate. The destination-extensive margin, on the other hand, shows little variation.

7. Difference-in-Differences Estimation

7.1 Identification

Whilst the decomposition technique applied in Section 6 is useful to analyse the dynamics of the growth rate of export values and how they vary across affected and unaffected regions, such an approach is limited in terms of drawing any causal inference between the impact of the civil unrest episode as well as product and destination characteristics on export values. For example, since the midpoint growth rate during the unrest period is a measure of exports values in July 2021 relative to July 2019, the significant, negative midpoint growth rate may reflect the lingering impact of the COVID-19 shock to exports in origin and destination markets. Similarly, the unrest period may have coincided with shocks to product categories which, owing to differences in the composition of products exported by KwaZulu Natal and the Western Cape, would have confounded the impact of the riots on the relative midpoint growth rate between the two regions. As such, this section seeks to reliably identify the impact of the civil unrest on the extensive and intensive margins of exports by estimating various regression models whilst controlling for any unobserved heterogeneity.

Particularly, the impact of the unrest episode on export flows is examined using an augmented gravity framework. General gravity comprises the set of models where the unidirectional trade flow between two countries can be explained by supply conditions at the origin, demand conditions at the destination, and economic forces either promoting or hindering the movement of bilateral trade. More specifically, the basic gravity model can be expressed as:

$$X_{in} = GS_i M_n \emptyset_{ni} \tag{5}$$

where the S_i factor represents the "capabilities" of exporter i as a supplier to all destinations, M_n captures all characteristics of destination market n that promote imports from all sources

(such as income), and $\emptyset_{ni}$ captures bilateral accessibility of exporter *i* to destination market *n*. Finally, *G* is the "gravitational constant", although it is only held constant in the cross-section (Head & Mayer, 2014). The multiplicative form means that, after taking logs, equation (5) can be estimated by regressing the log of bilateral exports on exporter and importer fixed effects as well as a vector of bilateral trade cost variables.

To render it appropriate to the analysis of the civil unrest episode, several alterations to the gravity framework denoted in Equation (5) are made. First, whilst typical gravity models define exporter *i* as the country or firm of origin, this study uses the district office of origin as the unit of analysis. Then whilst the exposition in Equation (5) is based on cross-sections, this study (and most other modern gravity estimations) employs data that spans many years, with such an approach permitting the mitigation of bias arising from the failure to fully control for exporter and importer heterogeneity through the use of fixed effects (Hallahan & Vollrath, 2009; Head & Mayer, 2014). Finally, to permit the analysis of the impact of the civil unrest period, the general gravity model expressed in Equation (5) is augmented with a difference-in-differences variable that exploits the spatial and time variation of the episode to construct the civil unrest indicator constructed as the interaction term:

$$Unrest_{ot} = Treatment_o * Post_t \quad (6)$$

where $Treatment_o \in \{0,1\}$ is an indicator of the region where the district office of exit is located, where $Treatment_o = 1$ if the district office is located within KwaZulu Natal and $Treatment_o = 0$ if the district office is located within the Western Cape. $Post_t \in \{0, 1\}$ takes the value $Post_t = 1$ in the period of unrest (in the month of July 2021) and 0 otherwise. Based on the $Unrest_{ot}$ indicator, the identification strategy is straightforward: export flows from affected districts during the unrest period are compared to export flows from districts in unaffected regions as well as districts in affected regions before the unrest episode.

Based on this augmented gravity framework, multiple regressions are used to meet several objectives. First, as outlined in Section 7.1.1, a regression of total export values on the unrest indicator at the origin-product-destination level is employed to estimate the *average* effect of the unrest episode across products. This approach is then extended to include a triple differences variable to examine whether the average effect of the unrest episode across products differed for differentiated relative to undifferentiated products. Whilst the average effect of the unrest episode across products is informative, it may not necessarily reflect the total impact of the unrest episode since the unrest may have had a differential impact on products that

constitute a relatively larger share of a regions aggregate trade relative to products that constitute a relatively smaller share of trade. To this end, as outlined in Section 7.1.2, the *aggregate* or *total* impact of the unrest episode is estimated using a regression of total export values on the unrest episode at the origin-destination level. Total export values in these estimations are then decomposed to consider the total impact on the extensive margin (the number of distinct HS6 products exported) and the intensive margin (the average value per product exported). Finally, to consider whether the total impact of the unrest episode differs across products of different levels of differentiation, total export values (and its constituent margins) are regressed on the unrest as well as triple differences indicator at the origin-group-destination[12] level.

7.1.1 Average Effect Across Products

Log-linear Specification

To begin, the study employs the traditional log-linear gravity model of trade to examine the average impact of the unrest episode across products, defined according to the HS6 product classification. For total aggregate exports, the baseline specification of the following form:

$$\ln X_{okdt} = \beta_0 + B_1 Unrest_{ot} + \theta_{dt} + \mu_{okdt} \quad (7)$$

is first estimated, where the subscript *o* denotes the district office of origin, *k* denotes the product category defined according to the HS6 product classification, *d* denotes the destination country and *t* denotes time. The dependent variable in Equation (7) is the value of exports from origin district *o* of product *k* to destination country *d* in month *t*, with the unit of analysis therefore being at the origin-product-destination level. The primary independent variable of interest across both specifications, $Unrest_{ot}$, is an interaction between a dummy variable equal to 1 if an observation is recorded in the unrest period and a dummy variable equal to 1 if an observation is recorded in the affected region, as defined in Equation (6). As such, this variable represents the regional and time component of the difference-in-differences effect – capturing whether the observation was recorded in a district that was exposed to the civil unrest episode (i.e. located in the KwaZulu Natal province in July 2021). The coefficient β_1 therefore identifies the impact of the civil unrest episode on the total value of exports for affected regions,

[12] In this analysis, products belong to one of two "groups", either differentiated or undifferentiated.

relative to periods with no unrest and to unaffected regions[13]. θ_{dt} - a vector of gravity variables – is included to account for observed destination heterogeneity, such that:

$$\theta_{dt} = INC_{dt} + POP_{dt} + DIST_d + CCOL_d + COL_d + CLANG_d + CONT_d + \mu_{dt} \quad (8)$$

where INC_{dt}, POP_{dt} and $DIST_d$ are indicators for destination country *d*'s income[14], population size and distance from South Africa, respectively. As is standard in the gravity literature, these variables are expressed in logs, permitting the interpretation of coefficients as elasticities. Then, $CCOL_d$, COL_d,$CLANG_d$ and $CONT_d$ are set to 1 if destination country d shares a common colonizer, colonial relationship, common language, or common border with South Africa, respectively.

The basic gravity-style specification in (7) is then extended to include several fixed effects to control for potential omitted variable bias and unobserved heterogeneity:

$$\ln X_{okdt} = \beta_0 + B_1 Unrest_{ot} + \varphi_{ok} + \theta_{kt} + \lambda_{dt} + \tau_{odk} + \mu_{okdt} \quad (9)$$

Where origin-product fixed effects, denoted by φ_{ok}, are included to control for time-invariant differences across origin districts, including a district offices overall level of exports[15]; as well as to eliminate observations where a product is not exported from a given origin district office over the entire sample period. Destination-time and product-time fixed effects, denoted by θ_{dt} and λ_{kt} respectively, are then introduced to control for unobserved destination country and product attributes, as well as for the presence of time varying multilateral trade resistance terms such as multilateral prices. Their inclusion implies that the vector of gravity variables θ_{dt} in Equation (7) is eliminated due to multicollinearity. Finally, origin-product-destination fixed effects, denoted by τ_{okd}, substitute for time-invariant dyadic effects (such as distance) that are commonly used in gravity specifications, as well as eliminate all observations where there are no exports from a given origin-destination pair of a particular product over the entire sample period. μ_{okdt} is the residual term. As is common in gravity specifications, standard errors are

[13] Since the unrest episode may have impacted the value of exports in the months after the initial unrest period, these observations are initially excluded from the analysis. As such, this section looks at the impact of the unrest episode during the period of unrest. Later, these observations are reintroduced to study the potential long-term impact of the unrest period.

[14] Typically, destination country GDP measured annually is used as an indicator of domestic income and demand. However, since the dependent variable in (7) varies by month, a monthly income indicator is required. The monthly value of destination country imports is chosen as a suitable proxy, however, the value of imports from South Africa is subtracted from this amount to avoid any issues surrounding endogeneity resulting from simultaneity.

[15] Ideally, origin-time fixed effects would also be included. However, such an approach would result in an inability to identify the coefficient on the difference-in-differences indicator due to multicollinearity.

clustered at the origin-destination dyad level to account for serial correlation in origin-destination trade pairs over time.

Poisson Specification

Whilst the log-linear approach defined in Equations (7) and (9) is commonly used in gravity estimations of bilateral trade flows, it is problematic for two reasons. First, since the natural log of zero is indeterminate, the logarithmic transformation of the dependent variable results in the estimation sample being restricted to those bilateral export relationships for which strictly positive trade flows are observed. This, however, is highly problematic, since ignoring all zero values likely involves dropping a substantial number of observations[16], thereby disposing of a large amount of potentially useful information. For example, as shown in the decomposition analysis, the discontinuation of exporting of products to destinations (net product destination margin) was the dominant driver of changes in in the aggregate value of exports over the crisis period.

Moreover, the deletion of these zeroes results in sample selection bias if these do not occur randomly. For example, if we take a basic log-linear gravity model, by dropping zeros from the sample the dependent variable is no longer really bilateral trade but, rather, bilateral trade contingent on the existence of a trade relationship. In this case, a key variable excluded from the model is the probability of being included in the sample (i.e. of having a non-zero trade flow). As such, to the extent that the probability of having a non-zero trade relationship is correlated with the civil unrest indicator, the application of Ordinary Least Squares (OLS) will lead to a biased estimate of the effect of civil unrest on export flows (Kareem & Kareem, 2019). Indeed, a preliminary test suggests that these selection effects do exist within the data, as Table A5 shows that the unrest indicator had a significant, negative effect on the probability of a bilateral trade relationship existing in a given month. The second key issue with the use of the log-linear specification is that, when the errors are heteroscedastic, the transformed errors will generally be correlated with the covariates, leading to biased estimates of the coefficients when using OLS.

To account for these issues, the impact of the civil unrest episode is further analysed using the Poisson Pseudo-Maximum Likelihood (PPML) estimator proposed by Santos Silva & Tenreyro

[16] Haveman & Hummels (2004), for example, find that nearly a third of the bilateral trade matrix consists of zeroes. The problem becomes even more pronounced as the level of disaggregation increases, with as much of 50% of observations being zero at high levels of disaggregation (Kareem & Kareem, 2019).

(2006). Such an approach is optimal for dealing with these issues for several reasons. First, its multiplicative form provides consistency since it does not force higher-order moments into the residuals, allowing for heteroscedasticity. Then, the multiplicative form also provides a natural way to deal with zero-value export flows since these values are determinate when using the PPML estimator. Finally, the estimator is consistent under weak assumptions and in the presence of multiple fixed effects – and its interpretative methods remain the same as that of OLS despite its multiplicative property. As such, the coefficients can be interpreted as elasticities in the case of continuous variables or as percentage changes associated with changes in indicator variables.

Using the same level of disaggregation as above, the Poisson specification for aggregate exports is given by:

$$X_{okdt} = \exp(\alpha_0 + \alpha_1 Unrest_{ot} + \varphi_{ok} + \theta_{kt} + \lambda_{dt} + \tau_{odk} + \mu_{okdt}) * \mu_{okdt} \quad (10)$$

where the variables and subscripts are as defined in Equation (9). Finally, to test where there is a differential impact in the average effect of the unrest episode across differentiated and undifferentiated products at the origin-product-destination level, the following triple differences specifications are estimated:

$$X_{okdt} = \exp(\alpha_1 Unrest_{ot} + \alpha_2 (Unrest_{ot} * Diff_k) + \varphi_{ok} + \theta_{kt} + \lambda_{dt} + \tau_{okd}) * \mu_{okdt} \quad (11)$$

where X_{okdt} is the value of exports from origin district *o* of HS6 product *k* to destination country *d* in month *t* as in Equation (10). $Diff_k$ is a binary variable equal to one for products classified as differentiated and zero if classified as undifferentiated, according to the liberal classification by Rauch (1999). As such, the coefficient α_1 identifies the average impact of the unrest episode across undifferentiated products, whilst the coefficient α_2 identifies the difference in the average impact of the unrest episode on differentiated relative to undifferentiated products. As in Equation (10), φ_{ok}, θ_{dt}, λ_{kt} and τ_{okd} - representing origin-product, destination-time, product-time, and origin-destination fixed effects – are included to control for unobserved origin, destination, product, and dyad heterogeneity, respectively. Standard errors are clustered by origin-destination dyad.

Finally, since the primary independent variable of interest varies by origin-product-time, the specification in (11) can further be extended to include origin-time fixed effects to account for time-variant origin characteristics[17]:

$$X_{okdt} = \exp(\alpha_1 Unrest_{ot} + \alpha_2 (Unrest_{ot} * Diff_k) + \varphi_{ok} + \psi_{ot} + \theta_{kt} + \lambda_{dt} + \tau_{okd}) * \mu_{okdt} \quad (12)$$

7.1.2 Aggregate Impact and Margins Decomposition

The specifications defined in Section 7.1.1 estimate the *simple average* of the impact of the unrest episode across products. However, such an approach may not necessarily reflect the *total* or *aggregate* impact of the unrest episode on exports, particularly because exports are likely to be concentrated with few products accounting for high shares of the aggregate value of trade[18]. Moreover, such an approach may introduce a lot of noise, particularly since many products are not exported on a regular basis – resulting in high standard errors and potentially biasing the estimated t-statistics.

The next step of the analysis therefore considers the aggregate impact of the unrest episode as well as its impact on the extensive and intensive margins by further aggregating the data. As such, the following specification is estimated at the origin-destination level:

$$X_{odt} = \exp(\alpha_0 + \alpha_1 Unrest_{ot} + \varphi_o + \lambda_{dt} + \tau_{od}) * \mu_{odt} \quad (13)$$

using the PPML estimator. Then, total exports X_{odt} is further decomposed into the extensive and intensive margin as follows:

$$X_{odt} = N_{odt} * \frac{X_{odt}}{N_{odt}} \quad (14)$$

where X_{odt} is decomposed into N_{odt} (the extensive margin) and $\frac{X_{odt}}{N_{odt}}$ (the intensive margin) respectively. In this case, the extensive margin is the number of distinct HS6 product varieties for a given origin-destination pair, whilst the intensive margin represents the average export value across HS6 product varieties. The estimation equations for the extensive and intensive margin can therefore be expressed as:

[17] Whilst the inclusion of origin-time fixed effects will eliminate the coefficient on the difference-in-differences variable, the coefficient on the triple differences variable will still be able to be identified.

[18] If, for example, the unrest episode has a disproportionately larger negative impact on exports of products that form a higher share of aggregate trade, the specifications measuring the *simple average* impact across products defined in Section 7.1.1 are likely to underestimate the effect of the unrest episode on *total* or *aggregate* exports.

$$N_{odt} = \exp(\alpha_0 + \alpha_1 Unrest_{ot} + \varphi_o + \theta_{dt} + \tau_{od}) * \mu_{odt} \quad (15)$$

$$\frac{X_{odt}}{N_{odt}} = \exp(\alpha_0 + \alpha_1 Unrest_{ot} + \varphi_o + \theta_{dt} + \tau_{od}) * \mu_{odt} \quad (16)$$

where φ_o, θ_{dt} and τ_{od} represent origin, destination-time, and origin-destination fixed effects respectively. Standard errors are not clustered in these specifications[19].

Then, to analyse whether there was any significant difference in the aggregate impact of the unrest episode on the export value and margins of differentiated relative to undifferentiated products, the data is further aggregated to the origin-group-destination level. As such, the following specification:

$$X_{ogdt} = \exp\left(\alpha_1 Unrest_{ot} + \alpha_2\left(Unrest_{ot} * Diff_g\right) + \alpha_3 Diff_g + \varphi_{og} + \theta_{dt} + \lambda_{gt} + \tau_{od}\right) * \mu_{ogdt} \quad (17)$$

is estimated. The dependent variable X_{ogdt} is the value of exports from origin district *o* of products of differentiation level group *g* to destination country *d* in month *t*. $Diff_g$ is a binary variable equal to one for products classified as differentiated and zero if classified as undifferentiated, according to the liberal classification by Rauch (1999). The coefficient α_2 therefore identifies the differential change in aggregate export value induced by the unrest episode for differentiated relative to undifferentiated goods. φ_{og}, θ_{dt}, λ_{gt} and τ_{od} refer to origin-group, destination-time, group-time, and origin-destination fixed effects respectively. This triple differences specification is also extended to estimate the differential impact of differentiated relative to undifferentiated goods along both the extensive and intensive margin – similar to Equations (15) and (16).

To study the recovery period of aggregate exports in the aftermath of the unrest episode, specifications similar to Equation (13), (15) and (16) are estimated but with the $Post_t$ dummy variable augmented to take a value of 1 in each of the months following the unrest episode, and 0 otherwise. Observations from July 2021, as well as each month in the post-unrest period that precede the particular month being analysed, are excluded from the sample[20]. In these specifications, the coefficient on the $Unrest_{ot}$ interaction estimates whether aggregate export

[19] When using data aggregated to this level, a concern is that there may be some correlation in errors within each origin-destination pair. However, since there is only a single shock period, this is unlikely to be an issue. Moreover, a lot of the potential correlation in errors within groups is eliminated through the extensive inclusion of fixed effects.

[20] For example, for the specification where the $Post_t$ dummy takes a value of 1 for observations recorded in October 2021, observations recorded in July, August and September 2021 will be excluded from the sample. This allows for a direct comparison between exports in October 2021 and exports in the pre-unrest period.

values in the affected region in a given month after the unrest episode are significantly different from export values in the pre-unrest period and in the unaffected region. This approach is also adopted to analyse whether the recovery dynamics of aggregate exports differs between differentiated relative to undifferentiated products differ by estimating triple differences specifications similar to Equation (17) with the augmented $Unrest_{ot}$ variable. The estimated coefficients will provide insight on the potential medium-term effects of the unrest episode on export values, and whether there is any heterogeneity according to product characteristics.

7.2 Difference-in-Differences Results

7.2.1 Export Performance During the Unrest Episode

Before proceeding with the primary analysis, several preliminary regressions are performed to determine how estimates differ across various specifications and using different estimators. First, the manner in which the inclusion of various fixed effects and the use of different estimators influence coefficient estimates is analysed using Table 4 and Table A6. In Columns (1), (2) and (3) - where destination-time fixed effects are not included to permit the identification of the included gravity variables - all of the coefficients carry the expected signs when using both the PPML and OLS estimator, although some are insignificant[21].

In both Table 4 and Table A6, the specifications in Column (4) and (5) extends the estimates to control for unobserved destination and dyadic characteristics by including destination-time, product-time, and finally origin-product-destination fixed effects. The coefficient on the difference-in-differences variable in these specification when using both PPML and OLS estimators is negative and significant, indicating that the unrest episode had a significant, negative impact on total export values relative to the pre-unrest period and the unaffected region. Specifically, according to the results in Table 4 using the preferred specification in Column (5), the unrest episode coincided with an average decline in export values in the affected region across products of roughly $(e^{-0.15} - 1)$ 14% *ceteris paribus*. Whilst the magnitude of the estimated effect is larger in the OLS relative to the PPML regression (20.55%

[21] The variables expressed in logs should be interpreted as elasticities. For example, the coefficient $\beta = -0.5$ for destination country income in Column (3) implies that a 1% increase in destination country income is accompanied by a 0.5% increase in average export values, *ceteris paribus.*

relative to 14%), the PPML estimate is preferred due to the relatively large number of zeroes[22] in the working sample as well as the reasons outlined in Section 7.1.1[23].

Table 4: PPML Regression of the Total Export Value on the Unrest Indicator and Various Covariates at the Origin-Product-Destination-Time Level

	Export value				
	PPML	PPML	PPML	PPML	PPML
Independent variable	(1)	(2)	(3)	(4)	(5)
Unrest	-0.23	-0.23	-0.23*	-0.21**	-0.15*
	(0.14)	(0.15)	(0.14)*	(0.09)	(0.08)
Log of destination country income	0.38***	0.5***	0.5***		
	(0.15)	(0.09)	(0.09)		
Log of destination country population	0.13	0.13*	0.13**		
	(0.13)	(0.07)	(0.07)		
Log of distance	0.38	-0.4	-0.38		
	(0.54)	(0.33)	(0.33)		
Common border	0.94	0.26	0.28		
	(1.16)	(0.9)	(0.9)		
Common colonizer	0.32	0.17	0.18		
	(0.42)	(0.31)	(0.31)		
Colonial relationship	0.48	0.37	0.38		
	(0.4)	(0.28)	(0.28)		
Common language	-0.79**	-0.04	-0.04		
	(0.34)	(0.25)	(0.25)		
t = July 2021	0.02	0.03			
	(0.09)	(0.09)			
Treatment Region	1.14***				
	(0.18)				
Origin x Product F.E.	No	Yes	Yes	Yes	Yes
Product x Time F.E.	No	No	Yes	Yes	Yes
Destination x Time F.E.	No	No	No	Yes	Yes
Origin x Product x Destination F.E.	No	No	No	No	Yes
Observations	185 235	174 895	174 895	292 620	175 884
R-squared	0.22	0.71	0.71	0.72	0.91

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from seaports in KwaZulu Natal and the Western Cape only, for the period between January – July 2021. Data is aggregated to origin-product-destination-time level, with balanced panel. Heteroskedasticity-robust standard errors reported in parentheses. Standard errors are clustered at the origin-destination level. The dependent variable is the total value of exports of products of a given HS6 product category. per origin-destination pair in a given month. Level of differentiation is categorized according to liberal classification by Rauch (1999). Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1.

[22] The difference between the number of observations in the PPML and OLS specifications indicates that around 74% of the working sample are zeroes.

[23] Note that while the PPML estimates are preferred for the average and aggregate impact on total export values, the OLS estimates are still considered for the extensive and intensive margin estimates given that these effects sum to the effect on total export values and therefore provide insight into which margin dominates.

Then, Table 5 analyses whether there is a differential impact in the average effect of the unrest episode across differentiated and undifferentiated products at the origin-product-destination level by presenting the results of estimation Equation (11) and (12) in Columns (1) and (2), respectively. The coefficients on the triple differences indicator in Columns (1) and (2) indicates that there was no significant difference in the average effect of the unrest episode between differentiated and undifferentiated products – even when accounting for time-variant origin district characteristics. A priori, this result is broadly consistent with the theoretical predictions of the model by Chaney (2008) following an increase in variable costs – where the effect on total export values is independent of a products elasticity of substitution (level of product differentiation). However, further analysis is required to determine whether this lack of an aggregate effect is the result of the elasticity of substitution amplifying the intensive margin whilst dampening the extensive margin as hypothesized by the model.

Table 5: PPML Regression of the Total Export Value on the Unrest and Triple Differences Indicator at the Origin-Product-Destination-Time Level

	Export value	
	(1)	(2)
Independent variable	PPML	PPML
Unrest x Differentiated	-0.27	-0.32
	(0.29)	(0.29)
Unrest	-0.02	
	(0.18)	
Product x Time F.E.	Yes	Yes
Origin x Product F.E.	Yes	Yes
Destination x Time F.E.	Yes	Yes
Origin x Product x Destination F.E.	Yes	Yes
Origin x Time F.E.	No	Yes
Observations	175 884	175 872
R-squared	0.91	0.91

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from KwaZulu Natal and the Western Cape only; sample period is from January – July 2021. Data is aggregated to origin-product-destination-time level, with balanced panel. Heteroskedasticity-robust standard errors reported in parentheses. For all specifications, standard errors are clustered at the origin-destination level. The dependent variable is the total value of exports of a given product per origin-destination pair in a given month. The dependent variables are expressed in levels. Products are classified according to level of differentiation based on Rauch (1999). Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1.

Whilst the results in Table 4 and 5 are useful in illuminating the *average* impact of the unrest episode across products, such estimates may not necessarily provide insight into the *total* impact of the unrest episode given that it may have a differential impact on products that form

a larger share of total exports relative to products that form a lower share of total exports. Moreover, further aggregation is required to estimate the impact of the unrest episode on the extensive and intensive margins. Table 6 therefore presents the results of estimating Equations (13), (15) and (16) at the origin-destination-time level using the PPML estimator. The coefficient in Column (1) indicates that the unrest episode resulted in a reduction of total export values in affected regions of around $(e^{-0.14} - 1)$ 13%, *ceteris paribus*. Since the magnitude of this estimated effect of the unrest episode on total export values (13%) is very similar to the average impact of the unrest episode across products estimated in Table 4 (14%), the unrest episode does not appear to have had a differential impact on products forming a larger share of total exports relative to products forming a lower share of total exports.

In Columns (2) and (3), the total impact is decomposed into the effect on the extensive and intensive margins respectively. The coefficient in Column (2), representing the extensive margin effect of the unrest episode, suggests that the number of HS6 product varieties exported from districts exposed to the unrest episode was $(e^{-0.36} - 1)$ 30.23% lower across origin-destination pairs than in the pre-unrest period and in districts not exposed to the unrest episode, *ceteris paribus*. This result suggests that the prohibitive effects of the unrest episode resulted in exporters from affected regions exiting product-destination markets entirely during the period of unrest. The coefficient representing the intensive margin effect in Column (3), meanwhile, is insignificant. As such, the unrest episode does not appear to have resulted in any meaningful reduction in the average value of each product exported that persisted throughout the unrest episode. Both the relatively large extensive margin and lack of a significant intensive margin effect correspond with Figure A2 and the results in Table 3, where there appeared to be a relatively large decline in the extensive margin in the affected relative to the unaffected region in the period of unrest, whilst the difference in the intensive margin effect was less significant.

Whilst estimates produced by the log-linear specification are problematic for the reasons outlined above, the results can shed some insight into the dominance of each margin given that the extensive and intensive margin effects sum to the total effect[24]. To this end, Table A7 reports the results of estimating the same specifications as in Table 6 using the OLS estimator. In these specifications, only the extensive margin effect is significant (albeit marginally). As such, any significant effect of the unrest episode on exports seems to operate through the extensive margin. Whilst the significant effect on aggregate export values concords with

[24] Moreover, zeroes at this higher level of aggregation are less pervasive.

hypothesis H1, the channel by which it occurs does not. Specifically, the extensive margin exhibits the only significant effect, contrary to other studies which find the intensive margin to account for most of the effect (Ahsan & Iqbal, 2019; Blyde & Martincus, 2013; Glick & Taylor, 2010; Ksoll et al., 2009; Martin et al., 2008). The significant extensive margin effect accompanied by the lack of an intensive margin effect, according to the Chaney (2008) model, would suggest that the unrest episode primarily consisted of a fixed cost increase.

Table 6: PPML Regression of the Total Export Value and the Extensive and Intensive Margin on the Unrest Indicator and Various Fixed Effects at the Origin -Destination-Time Level

	Aggregate export value	Extensive margin (no. products)	Intensive margin (avg. value per product)
	(1)	(2)	(3)
Independent variable	PPML	PPML	PPML
Unrest	-0.14*	-0.36***	-0.22
	(0.08)	(0.11)	(0.16)
Origin F.E.	Yes	Yes	Yes
Destination x Time F.E.	Yes	Yes	Yes
Origin x Destination F.E.	Yes	Yes	Yes
Observations	2 374	2 374	2 374
R-squared	0.97	0.89	0.95

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions from KwaZulu Natal and Western Cape only; sample period is from January 2021 – July 2021. Data is aggregated to origin--destination-time level, with balanced panel. Heteroskedasticity-robust standard errors reported in parentheses. The dependent variable is the total value of exports per origin-destination pair in a given month in Column (1), the number of distinct HS6 product varieties per origin-destination pair exported in a given month in Column (2) and the average value of each HS6 product variety exported per origin-destination pair in a given month in Column (3). The dependent variables are expressed in levels. Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1.

Then, to analyse whether there was any significant difference in the aggregate impact of the unrest episode on the export value and margins of differentiated relative to undifferentiated products, Table 7 presents the results of the estimating Equation (17) and the constituent margins estimations at the origin-group-destination level. For total exports, denoted in Columns (1) and (2), the coefficient on the unrest indicator in Column (1) indicates that the unrest episode had no significant impact on total exports of undifferentiated goods. However, the coefficient on the triple differences variable in Columns (1) and (2) indicate that the unrest episode had a differential impact on differentiated relative to undifferentiated goods. More specifically, in the preferred specification where time-variant origin characteristics are controlled for, the coefficient in Column (2) indicates the unrest episode had a larger impact on total export values of differentiated relative to undifferentiated products, *ceteris paribus*. As

such, much of the negative effect found in the disaggregated regressions reported in Tables 4 and 6 may have been driven primarily by the impact on differentiated products.

Columns (3) and (4) reports the results of estimating the triple differences specification on the extensive margin. The coefficients indicate that the unrest episode only had a significant impact on the extensive margin of undifferentiated products. Specifically, the number of distinct undifferentiated product varieties exported was ($e^{-0.14}$- 1) 13.6% lower in affected regions during the unrest period relative to the pre-unrest period and to the unaffected region, all else equal. There was, however, no differential impact on the extensive margin for differentiated relative to undifferentiated goods. Then, for the intensive margin effect reported in Columns (5) and (6), the results reveal heterogeneity. In Column (5), the coefficient on the unrest indicator indicates that the average value of exports of undifferentiated goods in the affected region during the unrest episode was ($e^{-0.35} - 1$) 29.5% lower than the average value of exports of undifferentiated goods in the pre-unrest period and unaffected region, *ceteris paribus*. Then, in Column (6), the coefficient reveals that the marginal impact of the unrest episode on differentiated relative to undifferentiated goods was positive. Since these coefficients both have different signs, it is unclear whether the intensive margin effect for differentiated goods is positive or merely zero.

To explore some of this heterogeneity further and clearly identify the intensive margin effect for differentiated products, Table A8 reports the results of estimating regressions on total export values and margins at the origin-group-destination level for separate subsamples of differentiated and undifferentiated products. Evidently, and in accordance with the results in Table 7, the total effect of the unrest episode on aggregate export values was only significant for differentiated products. Specifically, the coefficient in Column (1) suggests that the unrest episode resulted in a ($e^{-0.27} - 1$) 23.67% decline in total export values of differentiated products, *ceteris paribus*. Undifferentiated goods, meanwhile, were unaffected. Then, Columns (3) and (4) indicate that the unrest episode had a significant effect on the extensive margin of both differentiated and undifferentiated goods, although the magnitude of the effect for differentiated goods is relatively larger (15.6% for differentiated goods and 5.82% for undifferentiated goods). Finally, Columns (5) and (6) suggest that the unrest episode had a differential effect on the intensive margin of differentiated and undifferentiated products. Specifically, the average value per exported product was higher for differentiated products in affected regions during the period of unrest relative to differentiated products in the pre-unrest period and the unaffected region. The effect on the intensive margin for undifferentiated

products, meanwhile, was negative – in concordance with the results in Table 7. Based on these results, the insignificant effect on the intensive margin when all products are pooled together in Table 6 appears to mask some heterogeneity on the intensive margin effect of the unrest period on differentiated relative to undifferentiated goods.

Table 7: PPML Regression of the Total Export Value and the Extensive and Intensive Margin on the Unrest and Triple Differences Indicator and Various Covariates at the Origin-Group-Destination-Time Level

	Aggregate export value		Extensive margin (no. products)		Intensive margin (avg. value per product)	
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	PPML	PPML	PPML	PPML	PPML	PPML
Unrest	0.02		-0.14**		-0.35***	
	(0.16)		(0.06)		(0.12)	
Unrest x Differentiated	-0.35*	-0.37*	-0.02	-0.01	0.51**	0.45*
	(0.21)	(0.21)	(0.08)	(0.08)	(0.26)	(0.28)
Origin x Group F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Group x Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Destination x Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Origin x Group x Destination F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Origin x Time F.E.	No	Yes	No	Yes	No	Yes
Observations	2 855	2 854	2 855	2 854	2 855	2 854
R-squared	0.96	0.96	0.9	0.9	0.97	0.97

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from KwaZulu Natal and the Western Cape only; sample period is from January – July 2021. Data is aggregated to origin-group-destination-time level, with balanced panel. Standard errors reported in parentheses. For all specifications, standard errors are clustered at the origin-destination level. The dependent variable is the total value of exports of products of a given level of differentiation per origin-destination pair in a given month in Column (1) and (2), the number of distinct HS6 product varieties of a given level of differentiation per origin-destination pair in a given month in Column (3) and (4), and the average value of each HS6 product variety of a given level of differentiation per origin-destination pair in a given month in Column (5) and (6). The dependent variables are expressed in levels. Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1.

As a brief supplementary exercise, the presence of heterogeneity in the effect of the unrest episode across destination countries was tested for. Particularly, triple differences specifications similar to that in Equation (17) are estimated - but with the $Unrest_{ot}$ indicator first interacted with a dummy representing whether the destination country is of high or low-income and then interacted with the distance variable. The estimated coefficient on the triple differences variable across all of these specifications is insignificant – suggesting that there is no difference in the impact of the unrest episode on exports toward countries of varying income levels and no difference in the impact on exports toward countries of differing proximity to their point of origin.

Taking the results presented in Section 7.2.1 altogether, the unrest period appears to have resulted in a clear reduction in export values in the affected region during the crisis period. Specifically, the unrest episode resulted in an *average* reduction in export values across products of 14% and a *total* reduction in export values of 13% during the unrest period, *ceteris paribus*. This total decline in export values appears to have been driven primarily by a significant decline in the extensive margin during the unrest episode.

However, the results in Table 7 and A8 both conform and contradict various parts of *hypothesis H3*. First, contrary to *hypothesis H3* and the theoretical predictions of the Chaney (2008) model, the unrest episode appears to have only resulted in a significant decline in total export values of differentiated goods. This relatively larger effect for differentiated goods accords with the Chaney (2008) model following an increase in fixed costs. Then, the significance of the negative extensive margin effect for differentiated goods accompanied by the significance of the negative intensive margin effect for undifferentiated goods concords to *hypothesis H3* and various empirical studies (Persson, 2008; Persson, 2013; Ranjan & Lee, 2003; Sadikov, 2007; Tang, 2006). Specifically, the additional costs appears to have resulted in the elasticity of substitution magnifying the extensive margin whilst dampening the intensive margin – consistent with the predictions of the Chaney (2008) model following a variable costs increase. Additionally, the effect of the unrest episode on exports was not significantly different for high relative to low-income destination countries; as well as countries that are relatively distant in proximity.

7.2.2 Export Performance After the Unrest Episode

The remainder of this paper looks to document whether the unrest episode had any medium-term impacts on exports in exposed regions after the violence had subsided. To this end, the specifications in (13), (15) and (16) are estimated, but with the $Unrest_{ot}$ indicator augmented by changing the underlying $Post_t$ variable to take a value of 1 for each of the months subsequent to the unrest episode, and 0 otherwise. In these specifications, observations from July 2021, as well as each month in the post-unrest period that precede the particular month being analysed, are excluded from the sample. These specifications therefore estimate the impact of the unrest episode on exports in affected regions during each of the months after the unrest episode relative to export values in the pre-unrest period (January – June 2021) and the unaffected region. In this case, a positive coefficient on the post-unrest period would signify that export growth in the affected region exceeded expectations based on exports in

counterfactual region. This would be consistent with the hypothesis of a recovery associated with the postponement of exports that were constrained during the crisis. An insignificant coefficient, meanwhile, would signify a recovery – but just back to normal trends (the unrest episode had a short-run impact, but also a permanent loss in exports – consistent with *hypothesis H2*). A negative coefficient would signify a persistent negative impact of the crisis on export flows.

The results of these estimations are presented in Table 8, where each coefficient depicts the impact of the unrest episode on the value of exports, number of exported product varieties and average value of each traded product variety in each month subsequent to the unrest episode in Panel A, Panel B and Panel C, respectively. These difference-in-differences estimates, as well as those for the two months prior to the unrest episode, are also depicted graphically in the event study graphs in Figure 4.

In Panel A, the coefficients across Columns (2) – (6) suggest that, after controlling for various fixed effects, aggregate export values in the affected region in any of the months of the post-unrest period were not significantly different from those in the pre-unrest period and export values in the unaffected region. This result is unsurprising, based on the rapid recovery of export values depicted by Table 1 and Figure A4 in the midpoint growth decomposition analysis in Section 6. However, since none of the coefficients on the difference-in-difference indicator are positive in any period subsequent to the unrest episode, it appears that the negative effect of the unrest episode represented a permanent loss of exports rather than a mere backlog that was cleared in the months once the supply chain and logistic disruptions had subsided – consistent with the predictions in *hypothesis H2*.

Then, as shown in Panel B and Figure 4.2, the number of products exported in August (one period after the unrest episode) was significantly lower in the affected region relative to the pre-unrest period and unaffected region – pointing to a somewhat lingering impact of the crisis on product-destination trade relationships. However, the coefficients in Columns (3) – (5) indicate that the extensive margin was not significantly different from the pre-unrest period, indicating that it returned to normal levels following the unrest period[25]. As such, the prohibitive effects of the unrest period appear to have resulted in a temporary exit from a select few destination-product markets, which exporters subsequently re-entered once the violence

[25] The only significant positive effect was in Column (6) for December. While it is unclear exactly what drove this effect, it may be due to some exogenous factor or some time-variant origin characteristic.

and transport disruptions had subsided. Finally, in Panel C and Figure 4.3, the coefficients suggest that the unrest episode had no significant impact on the intensive margin in any periods during or after the unrest episode.

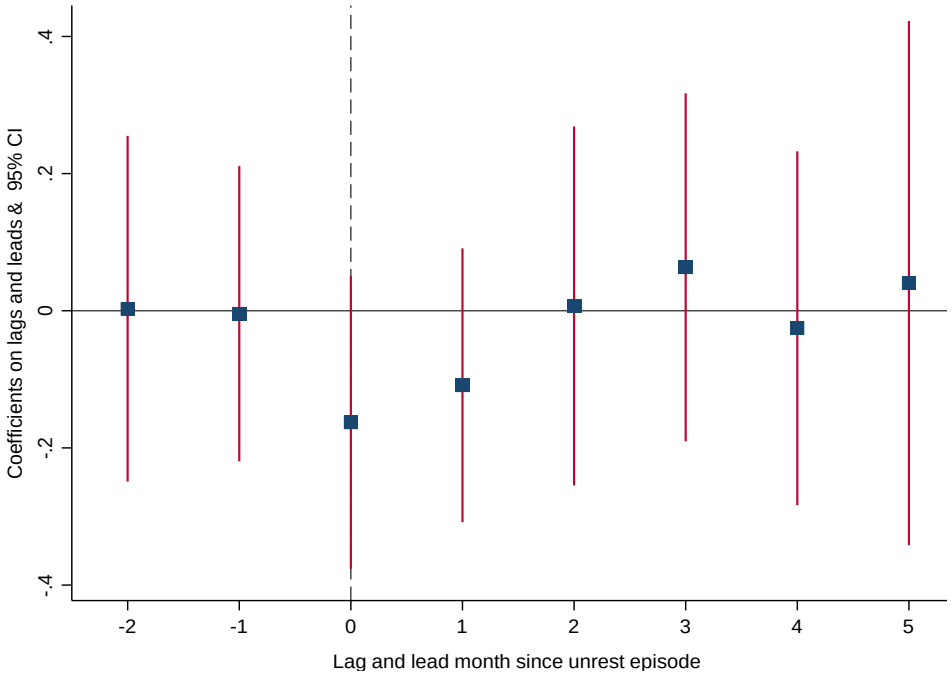
Table 8: PPML Regression of the Total Export Value and the Extensive and Intensive Margin on the Unrest Indicator For Each Month Subsequent to the Unrest Episode at the Origin-Destination Level

Panel A: Aggregate Exports						
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	*Unrest period*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Unrest	-0.14*	-0.13	0.00	0.05	-0.02	0.04
	(0.08)	(0.11)	(0.13)	(0.23)	(0.13)	(0.18)
Observations	2 374	2 394	2 437	2 399	2 420	2 409
R-squared	0.97	0.97	0.97	0.97	0.97	0.96
Panel B: Extensive Margin						
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	*Unrest period*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Unrest	-0.36***	-0.15*	0.13	0.16	0.23	0.22**
	(0.11)	(0.09)	(0.11)	(0.11)	(0.14)	(0.1)
Observations	2 374	2 394	2 437	2 399	2 420	2 409
R-squared	0.89	0.89	0.89	0.89	0.89	0.89
Panel C: Intensive Margin						
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	*Unrest period*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Unrest	-0.22	0.16	-0.3*	-0.27	-0.03	0.14
	(0.16)	(0.13)	(0.2)	(0.17)	(0.2)	(0.14)
Observations	2 374	2 394	2 437	2 399	2 420	2 409
R-squared	0.95	0.95	0.95	0.94	0.97	0.95

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from KwaZulu Natal and the Western Cape in 2021. Data is aggregated to origin-product-destination-time level, with balanced panel. Standard errors reported in parentheses. Each column shows different iterations of the unrest variable, where the treatment indicator is interacted with a dummy for that particular month, whilst the months prior to the unrest preceding the particular month being analysed are dropped from the sample. Panel A shows the impact of the unrest episode on aggregate export values throughout the post-unrest period, Panel B shows the impact of the unrest episode on the number of distinct HS6 product varieties of a given level of differentiation per origin-destination pair in a given month and Panel C shows the impact of the unrest episode on the average value of each HS6 product variety of a given level of differentiation per origin-destination pair in a given month. The dependent variables are expressed in levels. Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1. Origin, destination-time, and origin-destination fixed effects are included in each specification.

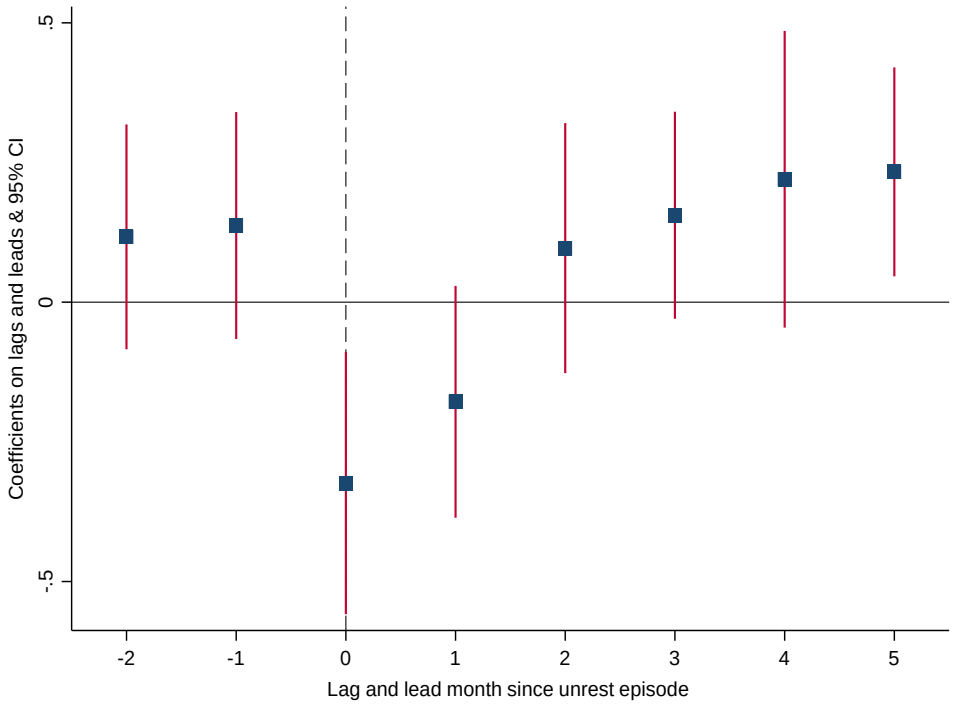
Figure 4: Event Study Graph Illustrating Dynamic Treatment Effects for the Aggregate, Extensive and Intensive Margin of Exports

4.1 Aggregate exports



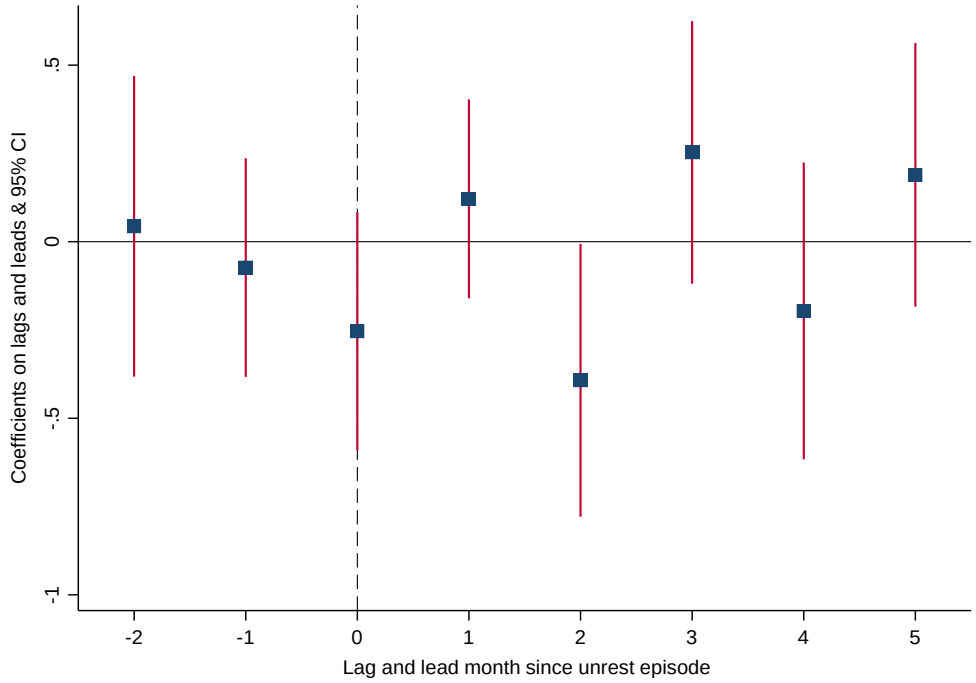
Source: Own calculations using SARS (2022) data.
Note: Navy squares represent estimated coefficients, maroon spikes represent confidence intervals.

4.2 Extensive margin



Source: Own calculations using SARS (2022) data.
Note: Navy squares represent estimated coefficients, maroon spikes represent confidence intervals.

4.3 Intensive margin



Source: Own calculations using SARS (2022) data.
Note: Navy squares represent estimated coefficients, maroon spikes represent confidence intervals.

To investigate whether the recovery dynamics of differentiated and undifferentiated products differed in the aftermath of the civil unrest episode, Table 9 presents the results of estimating Equation (17) with the augmented $Unrest_{ot}$ and triple differences variable at the origin-group-destination level. As such, the coefficient on the $Unrest_{ot}$ variable identifies the effect of the unrest episode on exports of undifferentiated products whilst the coefficient on the triple differences variable reflects the marginal impact of the unrest episode on differentiated relative to undifferentiated goods in the month being analysed.

In Panel A, the coefficients on the $Unrest_{ot}$ variable in Columns (2) – (6) indicate that total export values of undifferentiated products in the affected region were not significantly different from the total value of exports of undifferentiated products in any of the months following the unrest period relative to the pre-unrest period and unaffected region, *ceteris paribus*. The marginal effect on total exports of differentiated goods is insignificant in every period following the unrest episode. As such, total export values of both differentiated and undifferentiated products recovered relatively quickly, although only back to normal trends. The short-term reduction in total exports that occurred during the unrest period therefore

appears to have represented a permanent loss of both differentiated and undifferentiated exports – in concordance with *hypothesis H2*.

For the relative recovery dynamics on the extensive margin, the insignificant coefficients in Panel B indicates that the unrest episode did not have a persistent effect on the number of distinct product varieties of affected undifferentiated exports relative to unaffected undifferentiated exports, *ceteris paribus*. Similarly, the insignificance of the coefficient on the triple differences variable across all specifications depicted in Columns (2) – (6) indicates that the unrest episode did not have a differential impact on the number of exported differentiated products relative to its effect on the number of exported undifferentiated products in any of the periods following the unrest. As such, it appears that exporters of both differentiated and undifferentiated products immediately re-entered those product-destination relationships that had been destroyed during the unrest episode.

Finally, Panel C presents the estimates for the intensive margin effect for differentiated relative to undifferentiated products. The insignificance of the coefficients on the unrest and triple differences variable in all but one of the specifications reported in Columns (2) – (6) indicates that the unrest episode did not have an impact on the average value of both differentiated and undifferentiated products exported in the 4 of the 5 months following the unrest.

Table 9 PPML Regression of the Total Export Value and the Extensive and Intensive Margin on the Unrest Indicator For Differentiated and Undifferentiated Products in Each Month Subsequent to the Unrest Episode at the Origin-Group-Destination Level

Panel A: Aggregate Exports						
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	*Unrest episode*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Unrest	0.02	-0.34	-0.08	-0.06	-0.19	-0.1
	-0.16	(0.21)	(0.24)	(0.2)	(0.13)	(0.24)
Unrest x Differentiated	-0.35*	0.36	0.15	0.26)	0.32	0.2
	(0.21)	(0.22)	(0.33)	(0.24)	(0.24)	(0.31)
Observations	2 855	2 904	2 905	2 898	2 897	2 866
R-squared	0.96	0.96	0.95	0.96	0.96	0.95
Panel B: Extensive Margin						
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	*Unrest episode*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Unrest	-0.14**	-0.06	0.02	0.01	0.12**	0.21***
	(0.06)	(0.06)	(0.05)	(0.06)	(0.05)	(0.05)
Unrest x Differentiated	-0.02	-0.02	-0.03	-0.01	-0.03	-0.09
	(0.08)	(0.09)	(0.08)	(0.08)	(0.09)	(0.08)
Observations	2 855	2 904	2 905	2 898	2 897	2 866
R-squared	0.9	0.9	0.9	0.9	0.9	0.9
Panel C: Intensive Margin						
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable	*Unrest episode*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Unrest	-0.35***	-0.25	-0.12	-0.15	-0.29*	0.04
	(0.12)	(0.15)	(0.17)	(0.15)	(0.17)	(0.23)
Unrest x Differentiated	0.51**	0.05	0.05	0.45*	0.77**	0.19
	(0.26)	(0.22)	(0.24)	(0.24)	(0.3)	(0.34)
Observations	2 855	2 904	2 905	2 898	2 897	2 866
R-squared	0.97	0.97	0.97	0.97	0.97	0.96

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from KwaZulu Natal and the Western Cape in 2021. Data is aggregated to origin-group-destination-time level, with balanced panel. Standard errors reported in parentheses. Each column shows different iterations of the unrest variable, where the treatment indicator is interacted with a dummy for that particular month, whilst the months prior to the unrest preceding the particular month being analysed are dropped from the sample. Panel A shows the impact of the unrest episode on aggregate export values throughout the post-unrest period, Panel B shows the impact of the unrest episode on the number of distinct HS6 product varieties of a given level of differentiation per origin-destination pair in a given month and Panel C shows the impact of the unrest episode on the average value of each HS6 product variety of a given level of differentiation per origin-destination pair in a given month. The dependent variables are expressed in levels. Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1. Origin-group, destination-time, and origin-product-destination fixed effects are included in each specification.

8. Concluding Remarks

This paper studies the impact of the civil unrest episode that occurred in South Africa's KwaZulu Natal region in July 2021 on export flows using monthly customs transaction data. Using a difference in differences identification strategy comparing before and after changes in affected exports with that of non-affected exports, the midpoint growth decomposition and regression estimates report a significant negative effect on aggregate export values subject to the shock of the civil unrest episode, which occurred primarily through a decline in the extensive margin. Specifically, the results show that, after controlling for various origin, destination and product-specific factors, the unrest episode resulted in an average reduction in export values across products of 14% and a total reduction in export values of 13%, all else equal. This negative effect occurred primarily due to a reduction in the net extensive margin, with the number of exported product varieties to each destination declining by 30.23% due to the unrest episode, *ceteris paribus*. The intensive margin effect, meanwhile, was insignificant.

However, these aggregate results are found to mask heterogeneity at the product level. The findings in this paper suggest that the significant, negative effect on aggregate export values was only present for differentiated relative to undifferentiated goods, with this effect appearing to be primarily driven by a decline in the extensive margin. Then, the unrest episode is found to have had a significant negative extensive margin effect for differentiated and undifferentiated goods; although the effect is larger for differentiated goods (15.6% for differentiated goods relative to 5.82% for undifferentiated goods). For the intensive margin, only undifferentiated goods exhibited a significant negative effect. The relatively larger sensitivity of differentiated products to trade costs, particularly at the extensive margin, is consistent with the Chaney (2008) model following an increase in fixed costs. Simultaneously, the larger negative extensive margin effect for differentiated goods accompanied by the larger negative intensive margin effect for undifferentiated goods accords with the predictions of the Chaney (2008) model for an increase in variable costs. Additionally, the unrest episode was found to have no differential effect on export flows toward high relative to low-income destination countries; as well as countries that are relatively distant in proximity.

In the short to medium-term aftermath of the unrest episode, the results in this paper suggest that the significant, negative effect of the unrest episode on export values as well as the extensive margin was temporary and only present during the unrest episode. As such, there was no significant difference in the values of these variables for affected relative to unaffected

exports once the unrest episode had subsided. This suggests that export values returned to normal trends in the aftermath of the unrest episode, although the loss of exports that occurred during the unrest episode appears to represent a permanent loss of exports. Moreover, exporters promptly re-entered those product-destination relationships that had been destroyed during the unrest episode; and that the strength of those relationships was not affected by this period.

The results in this paper are simultaneously consistent with and contradictory to the relevant literature. First, the unrest episode being associated with a significant decline in export values as well as the relatively quick subsequent recovery is largely consistent with studies on the relationship between supply shocks and export flows. However, most studies on the relationship between supply shocks and export flows find a dominant intensive margin effect contrary to the dominant extensive margin effect found in this study (Ahsan & Iqbal, 2019; Behrens et al., 2013; Benguria, 2021; Besedes & Murshid, 2017; Blyde & Martincus, 2013; Bricongne et al., 2012; Bricongne et al., 2021; Haddad et al., 2010; Minondo, 2021). The dominance of the extensive margin effect however is not necessarily surprising, as the prohibitive effects of the unrest episode – such as road and port closures – may however have primarily resulted in an increase in fixed costs, with exporters being unable to export at all and thereby resulting in the destruction of export relationships altogether.

In general, the results in this paper highlights that domestic turmoil and an increase in export costs can cap the extent to which exporters are able to participate in foreign markets. Moreover, it suggests that violence and disruptions of this nature can result in a substantial loss of revenue for businesses, in this case exporters, that may not necessarily be recovered after these periods of instability have come to an end. A suitable avenue for future research which would be able to capture and quantify some of these effects would be to conduct a similar analysis using firm-level data, an approach which would permit the researcher to estimate the revenue and employment effects of the unrest episode, as well as whether these disruptions had any effect on firms survival in foreign markets. In addition, another limitation of this study that could be explored in future research could be to determine whether exporters withdrew from export activity entirely during the period of unrest, or whether these firms rather rerouted their products through other ports. This will have policy implications, because although rerouting somewhat mitigates the impacts of the crisis (as exporters are able to maintain their export relationships), it is still costly – particularly for smaller exporters.

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Appendix

Table A1: Number of Exported Products By Rauch (1999) Conservative Classification, January - July 2021

Category	Characteristics	Number of transactions
Homogenous	Organized exchange	7 608
Semi-homogenous	Reference-priced	87 288
Heterogenous	Differentiated	432 684

Source: Own calculations using SARS (2022) data. Table shows the number of transactions of each product type according to the classification by Rauch (1999). Sample is restricted to the time period between 2017 – July 2021 and only considers the treatment (KwaZulu Natal) and control (Western Cape) regions.

Table A2: Number of Exported Products By Rauch (1999) Liberal Classification, January – July 2021

Category	Characteristics	Number of products
Homogenous	Organized exchange	13 176
Semi-homogenous	Reference-priced	105 816
Heterogenous	Differentiated	408 588

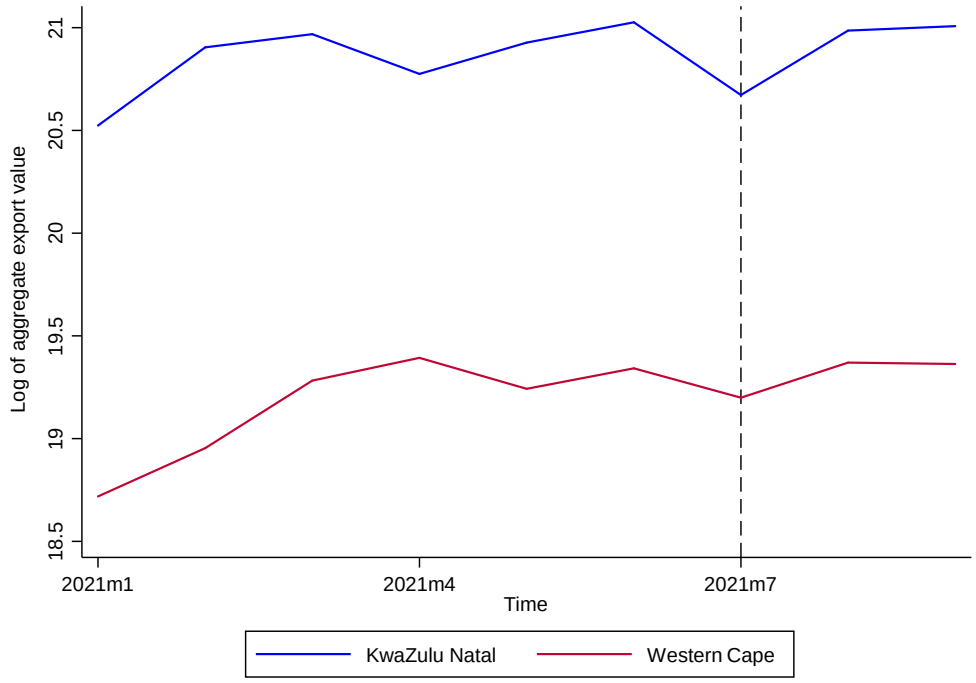
Source: Own calculations using SARS (2022) data. Table shows the number of transactions of each product type according to the classification by Rauch (1999). Sample is restricted to the time period between 2017 – July 2021 and only considers the treatment (KwaZulu Natal) and control (Western Cape) regions.

Table A3: Growth Rate in Monthly Export Value by Province, January – June 2021

Province	Growth Rate in Monthly Export Value January - June 2021
KwaZulu Natal	1.32%
Gauteng	0.94%
Western Cape	1.51%
Northern Cape	-0.59%
Eastern Cape	5.51%
North-West Province	3.14%
Limpopo	16.79%
Mpumalanga	1.02%
Free State	5.15%

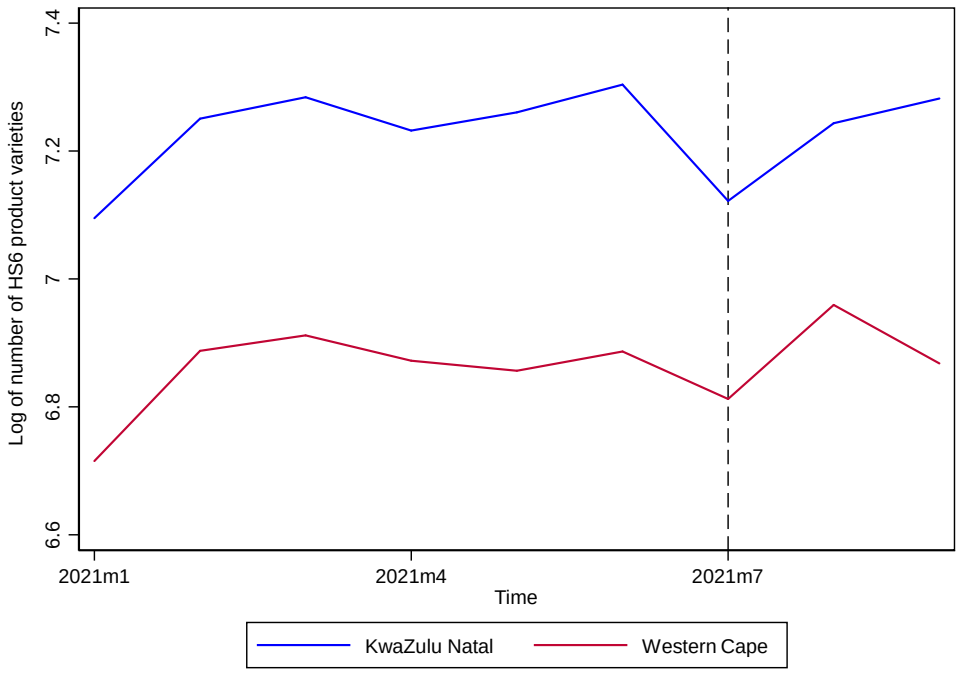
Source: Own calculations using SARS (2022) data. Figures represent simple month-to-month growth rate in six months preceding unrest episode.

Figure A1: Log of Total Aggregate Export Value by Treatment and Control Region For Manufacturing Sector Over Time, 2021



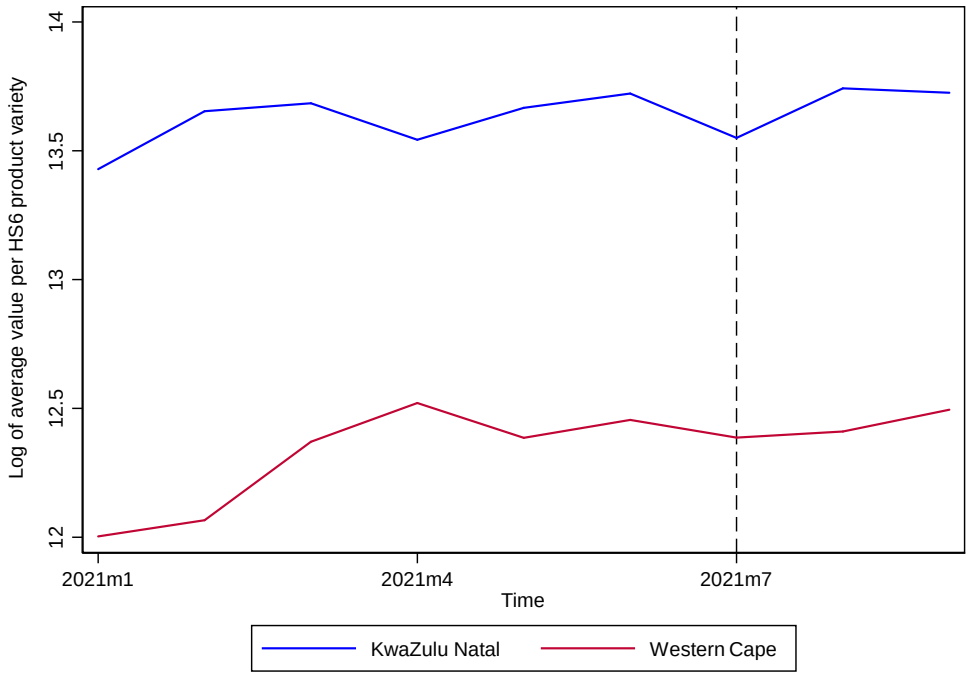
Source: Own calculations using SARS (2022) data. Reference line set at the onset of the unrest episode to denote end of pre-crisis period.

Figure A2: Log of Total Number of HS6 Product Varieties Exported by Treatment and Control Region For Manufacturing Sector Over Time, 2021



Source: Own calculations using SARS (2022) data. Reference line set at the onset of the unrest episode to denote end of pre-crisis period.

Figure A3: Log of Average Value Per HS6 Product Variety Exported by Treatment and Control Region For Manufacturing Sector Over Time, 2021



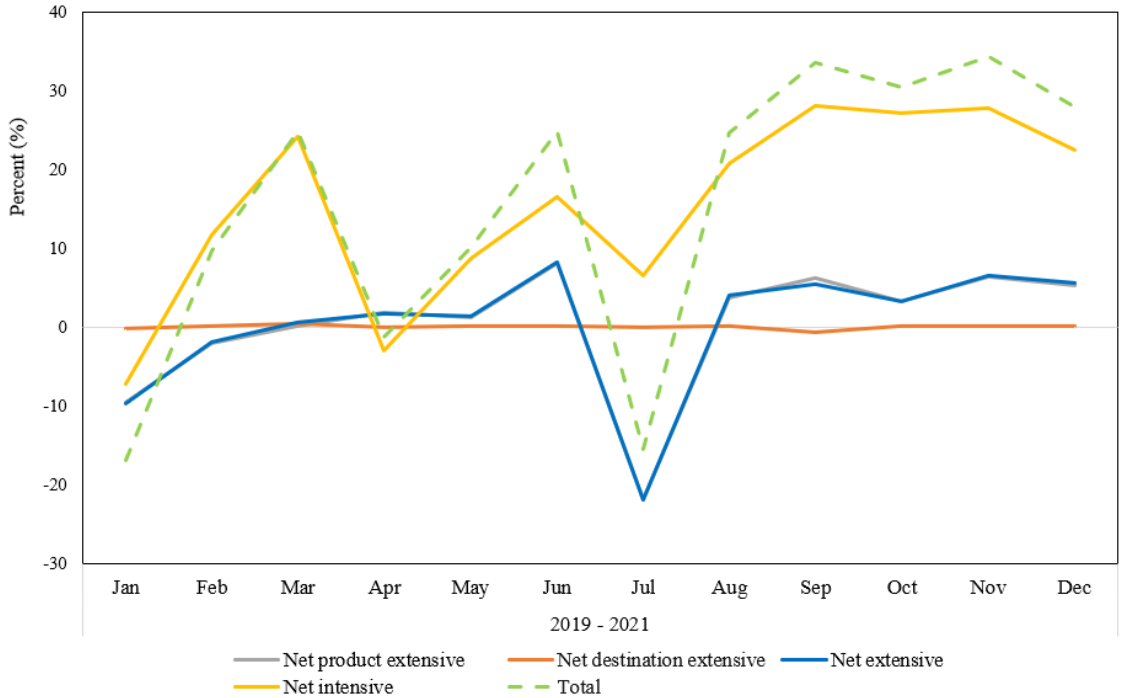
Source: Own calculations using SARS (2022) data. Reference line set at the onset of the unrest episode to denote end of pre-crisis period.

Table A4: Parallel Trends Test for Pre-Unrest Period (January – June 2021) of Aggregate Export Value, Number of HS6 Products Exported and the Average Value Per HS6 Product in Treatment and Control Region

	Aggregate export value	Extensive margin (no. products)	Intensive margin (avg. value per product)
	(1)	(2)	(3)
Independent variable	PPML	PPML	PPML
Trend * Treatment	0.001	0.009	-0.004
	(0.01)	(0.00)	(0.02)
Observations	48 198	48 198	48 198
R-squared	0.85	0.89	0.83
Origin F.E.	Yes	Yes	Yes
Product x Time F.E.	Yes	Yes	Yes
Destination x Time F.E.	Yes	Yes	Yes
Origin x Destination F.E.	Yes	Yes	Yes

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from seaports in KwaZulu Natal and the Western Cape, from January – June 2021. Data is aggregated to origin-destination-time level, with balanced panel. Standard errors reported in parentheses. Standard errors are clustered at the origin-destination level. The dependent variable is the total value of exports per origin-destination pair in a given month in Column (1), the number of HS6 product varieties in Column (2) and average value per HS6 product variety in Column (3). Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1.

Figure A4: Net Margins Contribution to 24-Month Mid-Point Growth in KwaZulu Natal, 2021



Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from KwaZulu Natal and the Western Cape from seaports only.

Table A5: Probit Regression of the Probability of Bilateral Export Flows Between a District Office and Destination Market, 2021

	Pr(*Trade$_{od}$*)
	(1)
Independent variable	Probit
Unrest	-0.14**
	(0.07)
Time fixed effects	Yes
Origin fixed effects	Yes
Destination fixed effects	Yes
R-squared	0.5
Observations	307 489

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from KwaZulu Natal and the Western Cape only from seaports only. Data is aggregated to origin-destination-time level, with balanced panel. Standard errors reported in parentheses. Standard errors are clustered at the origin-destination level. The dependent variable is a binary variable which takes a value of 1 if a particular origin-destination relationship exists in a given time period and 0 otherwise.

Table A6: OLS Regression of the Total Export Value on the Unrest Indicator and Various Covariates at the Origin-Product-Destination-Time Level

	Log of export value				
	OLS	OLS	OLS	OLS	OLS
Independent variable	(1)	(2)	(3)	(4)	(5)
Unrest	-0.12	0.06	0.06	-0.01	-0.23***
	(0.3)	(0.16)	(0.17)	(0.09)	(0.08)
Log of destination country income	0.22**	0.21***	0.21***		
	(0.1)	(0.05)	(0.05)		
Log of destination country population	-0.06	-0.03	-0.03		
	(0.09)	(0.06)	(0.06)		
Log of distance	1.1***	0.14	0.14		
	(0.37)	(0.21)	(0.21)		
Common border	1.65**	0.58	0.58		
	(0.7)	(0.49)	(0.48)		
Common colonizer	-0.11	-0.14	-0.14		
	(0.36)	(0.17)	(0.17)		
Colonial relationship	-0.21	-0.07	-0.07		
	(0.36)	(0.15)	(0.15)		
Common language	-0.78***	0.11	0.11		
	(0.28)	(0.14)	(0.14)		
t = July 2021	0.18	-0.02			
	(0.22)	(0.16)			
Treatment Region	0.57***				
	(0.21)				
Origin x Product F.E.	No	Yes	Yes	Yes	Yes
Product x Time F.E.	No	No	Yes	Yes	Yes
Destination x Time F.E.	No	No	No	Yes	Yes
Origin x Product x Destination F.E.	No	No	No	No	Yes
Observations	35 559	34 775	34 775	58 758	46 212
R-squared	0.15	0.61	0.61	0.61	0.86

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from seaports in the KwaZulu Natal and the Western Cape only, from January – July 2021. Data is aggregated to origin-product-destination-time level, with balanced panel. Standard errors reported in parentheses. Standard errors are clustered at the origin-destination level. The dependent variable is the total value of exports per origin-destination pair in a given month. Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1.

Table A7: OLS Regression of the Total Export Value and the Extensive and Intensive Margin on the Unrest Indicator and Various Fixed Effects at the Origin -Destination-Time Level

	Aggregate export value	Extensive margin (no. products)	Intensive margin (avg. value per product)
	(1)	(2)	(3)
Independent variable	OLS	OLS	OLS
Unrest	-0.13	-0.16*	0.03
	(0.14)	(0.1)	(0.17)
Origin F.E.	Yes	Yes	Yes
Destination x Time F.E.	Yes	Yes	Yes
Origin x Destination F.E.	Yes	Yes	Yes
Observations	1 674	1 674	1 674
R-squared	0.93	0.87	0.87

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions from KwaZulu Natal and Western Cape only; sample period is from January 2021 – July 2021. Data is aggregated to origin--destination-time level, with balanced panel. Heteroskedasticity-robust standard errors reported in parentheses. The dependent variable is the log of the total value of exports per origin-destination pair in a given month in Column (1), the log of number of distinct HS6 product varieties per origin-destination pair exported in a given month in Column (2) and the log of the average value of each HS6 product variety exported per origin-destination pair in a given month in Column (3). The dependent variables are expressed in levels. Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1.

Table A8: PPML Regression of the Total Export Value and the Extensive and Intensive Margin on the Unrest Indicator and Various Fixed Effects at the Origin-Group-Destination-Time Level in Differentiated and Undifferentiated Product Subsamples

	Aggregate export value		Extensive margin (no. products)		Intensive margin (avg. value per product)	
	(1)	(2)	(3)	(4)	(5)	(6)
	PPML	PPML	PPML	PPML	PPML	PPML
Independent variable	*Diff.*	*Undiff.*	*Diff.*	*Undiff.*	*Diff.*	*Undiff.*
Unrest	-0.27***	-0.02	-0.17***	-0.06*	0.3*	-0.29**
	(0.97)	(0.16)	(0.06)	(0.04)	(0.16)	(0.11)
Origin x Group F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Group x Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Destination x Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Origin x Group x Destination F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1 145	1 246	1 145	1 246	1 145	1 246
R-squared	0.97	0.96	0.92	0.7	0.95	0.98

Source: Own calculations using SARS (2022) data. Sample includes manufacturing transactions originating from KwaZulu Natal and the Western Cape only; sample period is from January – July 2021. Data is aggregated to origin-group-destination-time level, with balanced panel. Standard errors reported in parentheses. For all specifications, standard errors are clustered at the origin-destination level. The dependent variable is the total value of exports of products of a given level of differentiation per origin-destination pair in a given month in Column (1) and (2), the number of distinct HS6 product varieties of a given level of differentiation per origin-destination pair in a given month in Column (3) and (4), and the average value of each HS6 product variety of a given level of differentiation per origin-destination pair in a given month in Column (5) and (6). The dependent variables are expressed in levels. Stars represent significance of coefficients using a t-test, *** P<0.01, ** P <0.05, * P < 0.1.