Scottish Journal of Political Economy, Vol. 49, No. 5, November 2002

THE IMPACT OF ECONOMIC SANCTIONS ON SOUTH AFRICAN EXPORTS

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Abstract

In the mid-1980s many nations imposed sanctions on South African exports, most of which were subsequently removed during 1991–3. I estimate the effect of eight industrialized economies' sanctions on their imports from South Africa. Outliers are found to strongly influence the parameter estimates. Failure to take account of them leads to the conclusion that sanctions by the (then) European Communities most adversely affected South African exports. In fact, robustness checks reveal that the United States' Comprehensive Anti-Apartheid Act played the largest role, reducing bilateral imports by a third. The broader implications of these findings for estimating gravity equations are discussed.

I Introduction

Despite the long history of using trade policies to further foreign policy goals, opinion is still divided as to the wisdom of doing so (Hufbauer, Schott and Elliott, 1990; Haass and O'Sullivan, 2000).[1] Proponents argue that sanctions, including those on trade flows, create incentives for reform by 'renegade' countries. Critics note that many sanctions regimes are either cosmetic, poorly enforced, or have little influence on the target's policymakers.

In this paper, I examine the effect of one type of economic sanctions—those against the exports of the target economy. Specifically, I estimate the effect of eight industrialised economies' sanctions on South African exports. The former began to impose more severe trade sanctions in 1985 and 1986, and withdrew them after the collapse of the apartheid regime in 1991. Using bilateral trade data for eight years after the collapse of apartheid, I shall examine the extent to which South African exports have recovered after the sanctions were lifted. Furthermore, I employ trade data for eight years before the sanctions were imposed to better identify the effect of sanctions on trade flows. Finally, to ensure a fair degree of comparability, I formed samples of each of the eight

[1] In the case of South Africa, Levy (1999) presents a provocative thesis that state-led trade-based economic sanctions played only a 'trivial' role in toppling the apartheid regime.

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industrialised countries' trade with developing countries that, like South Africa, are classified by the World Bank as middle income. The latter nations' export patterns probably provide a better benchmark for South Africa's exports than do the exports of both the lower income nations and the industrialised countries.

It turns out that the effect of these industrialised nations' sanctions on South African exports depends critically on the composition of the sample in systematic ways. Ignoring the potential biases created by outliers leads to the conclusion that the sanctions imposed by the (then) European Communities had the greatest adverse effect on South African exports. However, this finding is entirely dependent on the inclusion in the sample of bilateral trading relationships where observed imports are (compared to their national incomes) relatively large or relatively small. Removing these bilateral trading partners from the sample results in lower estimated effects of the economic sanctions. What is more, the United States' sanctions are now found to have reduced South African exports the most. The estimates also suggest that South African exports have not recovered after the removal of US sanctions in 1991. In contrast, the end of EC sanctions may have led to some 'bounce back' in South African exports. Overall, though, the impression is that these trade sanctions continue to have effects well after their removal.[2] On the basis of the South African experience, then, the promise of the removal of sanctions if foreign behaviour improves may provide weaker incentives than previously thought, as trade flows need not return to their pre-sanctions levels.

The econometric findings presented in this paper may have broader implications for the estimation of the gravity equations. Like many other applications of the gravity equation, the effect of sanctions is essentially estimated using a dummy variable.[3] Furthermore, I include the standard distance term to (imperfectly) proxy for transportation costs. My econometric findings suggest that the presence of outliers tends to substantially increase the absolute value of the estimated distance parameter and the estimated dummy variable. In fact, the distance elasticity falls 50% once the outliers are excluded, going some way to remedy the implausibly large size of typical gravity-inspired estimates of this elasticity—an anomaly that was pointed out in Grossman (1998). My findings also imply that, when studying North-South trade flows, special care must be taken in assembling (in so far as this is possible) representative samples of bilateral trading partners. Given the growing focus on market access to industrialised economies by developing country exporters, then ensuring that the key estimated elasticities are not inflated by the inclusion of outliers assumes greater importance.

This paper is organised into four further sections. The next section contains a brief overview of the sanctions that were imposed on South Africa during the era of apartheid, and motivates the subsequent empirical analysis. Section III

[2] This may point to considerable hysteresis in trade patterns, perhaps caused by sunk costs associated with developing and maintaining export relationships.

[3] I hasten to add that, in this case, there are good theoretical reasons for using a dummy variable for this purpose, see Section IV.

describes the data collected for this gravity equation-based study. The estimation strategy, findings, and robustness checks are outlined in Section IV. Implications for future research are discussed in Section V.

II A Brief Review of the Economic Sanctions Against South Africa[4]

From 1948 to 1994 the Nationalist Party governed South Africa. Upon coming to power, the Nationalist Government enacted three laws that laid the foundation of the apartheid system; specifically, the Prohibition of Mixed Marriages Act in 1949, the Group Areas Act in 1950, and the Population Registration Act also in 1950. This system faced growing international criticism in the 1960s, but the United States, the United Kingdom, and France argued on successive occasions against broad or mandatory economic sanctions against South Africa. Having said that, some countries did begin to restrict their sales of armaments to South Africa during the 1960s.

Disagreements over the merits of economic sanctions against Pretoria continued into the 1970s. An attempt by the Organisation of Arab Petroleum Countries (OAPEC) to impose an oil embargo in November 1973 were rendered ineffective by Iran's decision to continue supplying South Africa with oil. A similar attempt by some United Nations (UN) members to impose an oil embargo failed in 1977. State sanctions against South Africa were principally confined to bans on sporting contacts (the Gleneagles Agreement among the Commonwealth countries), to restrictions on lending to South African government entities (including state-owned enterprises), and against firms not adhering to a voluntary code of conduct by multinational corporations in South Africa. The latter code, essentially a private sector initiative led by the Reverend Leon Sullivan, the first African American board member of General Motors, involved 103 multinational companies in 1978, or so its proponents claimed.

Restrictions on overseas investments in South Africa were first enacted by Sweden in 1979, see Table 1. This was followed by a sequence of measures against the importation of specific South African goods and services. In October 1985 the United States imposed a ban on the importation of krugerrands. In the same month, six Nordic countries imposed broader restrictions on imports from South Africa than the US.[5] One of these Nordic countries, Denmark, went much further in 1986 and banned trade in almost all goods.

The momentum behind trade sanctions against South Africa reached its apogee in 1986 when six members of the Commonwealth Group of nations, the members of the European Community, and the United States all (at different points in time) imposed measures that would reduce their imports from South

[4] The principal source for this section was Hufbauer, Schott and Elliott (2002). For more details, the reader is encouraged to consult the references in this comprehensive overview of South African experience with sanctions.

[5] See Table 1 for the names of the six Nordic countries involved.

Table 1
Summary chronology of sanctions against South African exports and foreign investments into South Africa

November 11, 1962	United Nations General Assembly passes a non-binding resolution (number 1761) to break diplomatic relations with South Africa, to close ports to South African vessels, to forbid vessels flying their flags to enter South African ports, to boycott South African trade, and to suspend landing rights for South African aircraft.
May–June, 1963	Organisation of African Unity is formed and recommends, amongst other actions, economic sanctions against South Africa.
July 1, 1979	A law comes into force in Sweden that prohibits the formation of any new Swedish companies in South Africa or Nambia. Existing Swedish owned multinationals are forbidden to make further investments in fixed assets.
July 24–26, 1985	France proposes a UN Security Council Resolution, which is subsequently passed, that calls for voluntary sanctions against South Africa. These sanctions include, amongst others, bans on new investments and bans on the imports of kruggerands.
October 1, 1985	United States bans the imports of krugerrands.
October, 1985	Foreign ministers of the Nordic Council (Denmark, Sweden, Finland, Iceland, Norway and Sweden) impose sanctions on new investments and on certain imports from South Africa.
Early 1986	Denmark bans imports of coal from South Africa, and then bans 'all' trade in goods and services, except imports of raw phosphate, vermiculite and tanning extracts.
August 4, 1986	Seven members of the Commonwealth group of nations meet in London. Six of the seven agree to restrict their imports of South African agricultural goods, uranium, coal, and iron and steel. The United Kingdom was the nation that did not agree to these sanctions.
September 16, 1986	The European Community (as it then was) votes to ban imports of South African iron, steel, gold and coins. They also ban new investments in South Africa, but permit the reinvestment of retained earnings.
September 19, 1986	Japan bans the imports of South African iron and steel, but not iron ore or coal.
October 2, 1986	United States' Senate votes to override President Reagan's veto of the Comprehensive Anti-Apartheid Act (CAAA). Amongst other measures, this bans the imports into the United States of South African iron, steel, uranium, textiles, agricultural products and goods produced by South African government owned-firms (unless they are regarded as strategic materials for the American military.)
Autumn 1986	Many international companies divest their assets in South Africa, including Barclays Bank (the UK's largest investor in South Africa).
1987	Sweden and Norway impose nearly comprehensive trade and investment bans on South Africa, but (like Denmark noted above) makes limited exceptions for imports of some raw materials.
February 20, 1990	In the wake of Nelson Mandela's release from prison ten days earlier, the British Prime Minister unilaterally lifts the ban on new investments in South Africa. The other members of the European Community do not follow suit.
February, 1991	The European Community's foreign ministers agree to lift economic sanctions against South Africa once the latter's Parliament follows President de Klerk's request and repeals three laws central to the apartheid regime.
June, 1991	South Africa's Parliament repeals the Land Act, the Group Areas Act, and the Population Registration Act. The South African Government releases several political prisoners.
July 10, 1991	President Bush lifts American CAAA-based sanctions against South Africa.
October 23, 1991	Japan lifts economic sanctions against South Africa.
April 7, 1992	The European Community lifts her sanctions against South Africa such that the only remaining in force relate to arms sales.
February 3, 1993	Norway partially lifts her economic sanctions against South Africa, but maintains her embargo on oil and arms sales.

Source: Hufbauer, Elliott and Schott (2002).

Africa. This was followed by a comprehensive trade and investment ban by Norway and Sweden in 1987. As a result of these measures, and in response to adverse public opinion, many leading multinational firms reduced or completely sold off their investments in South Africa. To the extent that multinationals without their former South African subsidiaries ceased or reduced sourcing parts, components, and raw materials from South Africa, then dis-investment may have influenced South African trade flows too.

The release of Nelson Mandela from prison in 1990 was followed by the repeal of the three legal foundations of the apartheid system (mentioned above) in June 1991. This repeal acted as a trigger for the removal of economic sanctions in 1991 by Japan and the United States, in 1992 by the European Community, and in 1993 by Norway. Nelson Mandela was inaugurated as the first President of a democratic South Africa on May 10, 1994.

With this albeit brief overview of sanctions against South Africa in mind, it might be tempting to estimate the effect of sanctions on South African exports during the years 1985/6 to 1991/3 only, which are the years when the sanctions were in force. In a cross-sectional sample one could investigate whether, for these years, nations with sanctions against South Africa tended to import less than one would expect given the typical determinants of bilateral trade flows, as encapsulated by the gravity equation. One difficulty with this approach is that there may be other good reasons why the sanctioning nations tend to import less from South Africa that are not captured in the traditional gravity equation formulation and that influenced imports before the sanctions were put in place. Therefore, if one uses a dummy variable on imports from South Africa to identify the effect of the sanctions regime, one might want to check that this dummy variable does indeed get smaller after the sanctions are put in place. To that end, I have assembled samples on bilateral trade flows before and during the sanctions regime.

Another concern is that the removal of trade sanctions may have a different effect on South Africa's exports than the imposition of those sanctions. For example, concerns about the political stability of South Africa as she became a democracy may have dissuaded foreign firms from sourcing their raw materials, parts, and components from South Africa, even though sanctions were removed during 1991–3. Arguably, such an effect may well attenuate over time—raising interest in the speed with which South African exports might have recovered during the post-sanctions era. To examine these matters, I extended the empirical analysis up until 1999; eight years after the US and Japan ended their sanctions. In sum, the goal of my empirical strategy is to use both cross-sectional and inter-temporal variation in exports to assess the effects of imposing and removing sanctions on South Africa's exports.

III Data Assembled

The overview of the last section, and Table 1, highlighted the timing of the EC, Nordic, Japanese and American sanctions against South African exports. In this study, I will focus on the effects of the following eight nations' sanctions

regimes: Denmark, France, Great Britain, Italy, Japan, Norway, Sweden and the United States. These countries bilateral import data was assembled for the years 1978 to 1999 from the World Bank's Trade and Production Database (Olarreaga and Nicita, 2001). The original source for this trade data is the UN's COMTRADE database.

The World Bank's World Development Indicators volume classifies South Africa as an 'upper middle income' developing economy. To provide a benchmark from which to compare South Africa's exports, I located all those countries classified by the World Bank as upper middle income or lower middle income.[6] There are 38 of the former and 55 of the latter. Many of these 93 countries are small island economies or formerly communist states, both of which are likely to have trading patterns that are either unusual or not driven by market forces. To weed them out, only non-communist economies with national incomes greater than a billion US dollars[7] and populations greater than one million were retained in the sample of exporting nations. Along with South Africa, 30 other middle income developing economies met these criteria in 1978. The exporting nations are listed in Table 2.

TABLE 2
Composition of the annual samples

Importing countries[a]			
Denmark	France	Great Britain	Italy
Japan	Norway	Sweden	United States
Exporting countries[b]			
Algeria	Argentina	Bolivia	Brazil
Chile	Colombia	Costa Rica	Dominican Republic
Ecuador	Egypt	El Salvador	Guatemala
Honduras	Iran	Jamaica	Korea (South)
Malaysia	Mexico	Morocco	Papua New Guinea
Paraguay	Peru	Philippines	South Africa
Sri Lanka	Syria	Thailand	Trinidad and Tobago
Tunisia	Uruguay	Venezuela	

Notes:
[a]All importing countries had some form of sanctions regime against South African exports during 1986–1991.
[b]Exporting countries selected were those which satisfied the following criteria:
1. The World Bank classifies them as 'lower middle income' or 'upper middle income' in the World Development Indicators.
2. The economy had a GDP in excess of one billion US dollars (in 1995 constant dollars) throughout the entire sample.
3. The economy has a population greater than a million throughout the entire sample period.
4. The economy was never part of the Eastern bloc or communist.

[6]Thus, I will be comparing South Africa's exports with those of other middle income countries; that is, with other nations that the World Bank classifies are at the same stage of development as South Africa.

[7]Throughout this paper, all dollars values are converted to 1995 US dollars; hence purging the effect of inflation.

I assembled for each year 1978–1999 the full bilateral trade matrix between the 8 importers and the 31 exporting developing economies, yielding 248 bilateral observations of imports by so-called Northern countries from the 'South'. Import data was converted to 1995 US dollars using the US price deflator—estimates of which can be found on the World Bank's World Development Indicators CD-ROM. As will become clearer in the next section, a modern version of the gravity equation will be used in the econometric estimation. This approach will require national income data on the importer, the exporter, and the 'world' (here taken to be totality of all non-communist trading nations). This data was downloaded from the World Bank's World Development Indicators CD-ROM and converted to 1995 dollars. Bilateral distance data, specifically the Great Circle distance in kilometres between the capitals of each bilateral pair, were downloaded from a commonly used source of data for gravity equation studies on the World Wide Web.[8]

In sum, for each year from 1978 to 1999 I have assembled a cross-sectional sample of traditional gravity variables that relate the imports by each of the eight industrial nations from each of 31 middle income developing economies, one of which happens to be South Africa.

IV Estimation

In recent years significant progress has been made in formulating gravity equations so that frictions (such as borders, distance, and tariffs) can be better taken into account and consistent parameter estimates obtained. (See Feenstra, 2002, for a careful review of the relevant papers.) One such formulation can be found in Redding and Venables (2000). Denoting the imports of country i from country j by M^{ij}, the national income of nation k by $Y^k(k = i, j)$; world national income by Y^W; bilateral trade barriers by τ^{ij}; the price index in nation k by $P^k(k = i, j)$; and the elasticity of substitution by σ; they derive the following expression for bilateral trade flows:

$$M^{ij} = \left(\frac{Y^i Y^j}{Y^W}\right)\left(\frac{\tau^{ij}}{P^i P^j}\right)^{1-\sigma}. \tag{1}$$

In this formulation (1), relative prices, bilateral trade barriers (modelled in an ad valorem manner), and the relative size of nation i's income in world income, determine what proportion of exporter j's nations income is shipped to nation i. Now, suppose that i's government declares that a certain number of j's tradeable sectors cannot be bought by nation i's consumers and producers. Denote the share of j's national output that is 'sanctioned' by i in this manner be given by s^{ij}, $0 < s^{ij} < 1$. Assuming these nations have no impact on the price level in nations i and j, then j will now ship goods to i with the

[8] The source of this distance data is: http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/Data/Gravity/dist.txt

following value:

$$M^{ij} = \left(\frac{Y^i(1-s^{ij})Y^j}{Y^W}\right)\left(\frac{\tau^{ij}}{P^iP^j}\right)^{1-\sigma}$$

$$= (1-s^{ij})\left(\frac{Y^iY^j}{Y^W}\right)\left(\frac{\tau^{ij}}{P^iP^j}\right)^{1-\sigma} \quad (2)$$

Rearranging and logarithms yields:

$$\ln\left(\frac{M^{ij}Y^W}{Y^iY^j}\right) = \ln(1-s_{ij}) + (1-\sigma)\ln(\tau_{ij}) - (1-\sigma)\ln(P^i) - (1-\sigma)\ln(P^j). \quad (3)$$

Assuming measurement error in the dependent variable, one can add a well behaved error term to the right hand side of (3); resulting in an expression that will form the basis of econometric estimation.

A few comments are in order before proceeding with estimation. First, the price indices are country-specific and can therefore be captured (in any given cross-sectional sample) by distinct dummy variables.[9] Second, for South Africa (the only country in our samples who faces sanctions), the effect of an importer *i*'s sanction regime is given by $\ln(1-s^{ij})$, which can be captured by a dummy variable that is specific to both nation *i* and *j*. Third, we will proxy for τ^{ij} by the distance between nation *i*'s and *j*'s capital cities, using the data on distance described earlier. Ideally, this proxy will capture the frictions introduced by international transportation costs.[10]

More importantly, in equation (3) the effect of sanctions are picked up through a term that is common to a pair of countries. In gravity models that incorporate home bias or non-traded goods sectors,[11] the terms which enter into the expression for bilateral trade flows are invariably country-specific, not country-pair specific. In our case, the impact of home bias and of non-trade goods would be absorbed into the country-specific dummies being estimated, suggesting that the latter should not be interpreted too literally as relative price indices.

The sanctions variable should probably be interpreted liberally in the following sense. Private sector agents, whether firms or consumers, may well

[9] The full set of exporter and importer dummy variables are, in this case, completely collinear. Consequently, I set the price index for the United States (an importer) to one. Thus all other price indices can be thought of as being relative to the US price index.

[10] Only one bilateral pair (the United States and Mexico) share a common border in my samples. Following conventional practice, I included a country pair specific dummy variable to pick up the influence on American imports of sharing a common border with Mexico. As this estimated parameter is not relevant for assessing the effects of each importers' sanctions against South Africa, it is not reported in what follows. I can confirm that this parameter was positive and statistically significant in every regression performed.

[11] See Anderson (1979) for details.

demonstrate their disapproval with the apartheid regime by not purchasing some (or indeed any) goods from South Africa. Firms, in particular, may be especially sensitive to adverse publicity which could result from sourcing goods from South Africa. For this reason, we might expect to see estimates of the so-called sanction variable being non-zero in the years before the state sanctions are imposed. Of course, by comparing the size of this estimated parameter before and during the sanctions regime, one can see whether the state-imposed sanctions further reduced South African exports. *A priori*, it might be the case that the state sanctions merely codified existing private sector reluctance to buy South African goods, in which case there may be no statistically significant change in the magnitude of the estimated sanctions parameter. Likewise, the end of formal state sanctions may not lead to a reduction in the implied sanctions parameter if firms have already found alternative sources for their raw materials, parts and components, and find little incentive to switch back to South African suppliers. Worse still, if this effect is reinforced by fears about the political stability of the newly democratic regime, then the estimated sanctions parameter may well point to even lower South African exports after formal sanctions were removed.

Given the EC members in my samples imposed (in principle) the same set of sanctions at the same point in time, I have estimated a common sanctions parameter for them. Likewise, I have estimated a common sanctions parameter for the two Nordic nations in my samples. With Japan and the US having separate sanctions parameters, this implies that there are four distinct sanctions parameters. Table 3 reports year-by-year estimates of these four sanctions parameters. I divided up the years 1978–1999 into a pre-sanctions regime 1978–1985; the sanctions regime 1986–1991; and a post-sanctions regime 1992–1999; which more or less corresponds to the beginning and end of the sanctions by these industrialised countries against South Africa. In Table 3, which includes all 248 bilateral pairs in each annual sample, only the sanctions parameters for the EC nations are negative and statistically significant throughout 1977–1999. Even though European firms and consumers appear to have shied away from buying South African goods before formal sanctions were imposed, European Community sanctions led to even lower South African exports to France, Italy, and Great Britain. This can be seen by comparing the median value of the sanctions parameter in 1978–85 (−0·581) with its value during 1986–1991 (−0·703). The removal of EC sanctions led to only a small increase in the estimated sanctions parameter, suggesting that the sanctions effects on South African exports has endured into the late 1990s. The estimated sanctions parameters for the other countries tend to increase over time, irrespective of the imposition and removal of sanctions—which is odd. Perhaps not too much should be made of the latter finding, as the sanctions parameters are in fact so imprecisely estimated that they are statistically insignificant. On this first cut, then, the estimation results suggest that European Community sanctions were the only ones to adversely affect South African exports.

To examine the robustness of this finding, I systematically removed the outliers to see if they had any influence on the parameter estimates. The

TABLE 3
Parameter estimates of the sanction variable 1978–1999, using full bilateral sample in each year
Cutoff equals 0·000

		Economy and parameter estimates							
		European Union		Nordic countries		Japan		United States	
	Year	Parameter estimate	*p*-value	Parameter estimate	*p*-value	Parameter estimate	*p*-value	Parameter estimate	*p*-value
	1978	−0·548	0·031	−0·498	0·044	0·103	0·363	−0·138	0·318
	1979	−0·517	0·030	−0·421	0·062	−0·168	0·2700	−0·143	0·300
	1980	−0·411	0·081	−0·219	0·227	0·167	0·716	O·101	0·636
	1981	−0·614	0·020	−0·164	0·290	0·100	0·631	0·163	0·709
	1982	−0·442	0·067	−0·298	0·155	0·122	0·661	0·170	0·719
	1983	−0·800	0·008	−0·272	0·204	0·297	0·184	0·037	0·456
	1984	−0·675	0·026	−0·348	0·157	0·100	0·387	0·116	0·369
	1985	−0·694	0·012	−0·235	0·222	0·014	O·518	0·134	0·669
	1986	−0·595	0·015	−0·287	0·148	0·082	0·383	0·047	0·569
	1987	−0·769	0·003	−0·314	0·126	0·116	0·336	−0·101	0·357
	1988	−0·683	0·008	−0·107	0·353	0·190	0·747	0·109	0·650
	1989	−0·753	0·034	−0·024	0·477	0·219	0·702	0·098	0·594
	1990	−0·722	0·008	0·040	0·553	0·363	0·887	0·225	0·773
	1991	−0·058	0·026	−0·058	0·423	0·114	0·647	0·091	0·619
	1992	−0·584	0·034	0·077	0·596	0·317	0·841	0·212	0·748
	1993	−0·485	0·098	−0·036	0·462	0·380	0·845	−0·105	0·389
	1994	−0·465	0·107	0·018	0·520	0·233	0·734	0·008	0·508
	1995	−0·517	0·094	0·141	0·641	0·360	0·821	0·245	0·734
	1996	−0·770	0·018	0·275	0·775	0·649	0·962	0·348	0·831
	1997	−1·190	0·000	0·111	0·623	0·400	0·871	0·305	0·806
	1998	−0·859	0·010	0·065	0·570	0·360	0·837	0·285	0·782
	1999	−1·158	0·000	−0·170	0·277	0·153	0·703	−0·029	0·460
Median parameter estimate	1978–1999	−0·645		−0·136		0·160		0·100	
	1978–1985	−0·581		−0·285		−0·043		0·032	
	1986–1991	−0·703		−0·083		0·152		0·095	
	1992–1999	−0·677		0·071		0·360		0·229	
Negative parameter estimates	Number (max 22)	22		15		6		7	
	With *p*-value <0·05 (max 22)	17		1		0		0	

logarithmic nature of the dependent variable might generate outliers out of those bilateral pairs which have a much smaller observed trade flow than the size of their national incomes might suggest. In this case, the value of the dependent variable might barely be positive, a fact which is exacerbated by taking the logarithm of a number close to zero. Furthermore, a large level of recorded imports by an industrialised economy from a much poorer developing economy might create an outlier with a large dependent variable. To examine this matter, I ranked the 248 data points in each year's sample by the value of the dependent variable; giving the highest observed value of dependent variable a label of one and the lowest observation a label of 248. I then employed a cutoff $0 < c < 1$, and excluded from a sample those observations whose labels lied in the ranges $[0, 248c]$ and $[248(1-c), 248]$. I re-estimated all of the parameters for each year and for each of the following values of $c = \{0{\cdot}01, 0{\cdot}025, 0{\cdot}05, 0{\cdot}1\}$. Therefore, with the maximum value of $c(= 0{\cdot}1)$, I am essentially eliminating from the sample the 10% of observations with the highest values of the dependent variable, and the 10% of observations with the lowest values of the dependent variable. The parameter estimates in Table 3 can be thought of as the case when $c = 0$. This exercise will reveal how sensitive the sanctions are to changes in the sample composition.

Table 4 reports the estimated parameters for each value of c. Comparing across values of c and across the four sanctions regimes, some of the results are quite striking. The impact of the EC sanctions regime suffers a considerable reversal of fortune as c increases. For higher values of the cutoff, the value of the estimated sanctions parameter rises when sanctions are imposed—the opposite of what we found when $c = 0$ and the opposite of what the proponents of sanctions presumably thought would happen! More importantly, the number of negative and statistically significant parameters collapses in the EC case as the cutoff rises. When c is less than or equal to 0·025, all the estimated sanctions parameters for the years 1986–1991 were negative and statistically significant (indicating that the combined effect of state-led sanctions and private sector behaviour clearly reduced South African exports.) When $c = 0{\cdot}1$, however, we can only make a comparable claim for two out of six of these estimated annual elasticities. So much for the robustness of the previous findings on the EC sanctions regime.

In contrast, the effect of the US sanctions regime seems to have been underestimated by the inclusion of outliers in Table 3, the case when $c = 0$. Each increase in c results in a lower median estimate for the sanctions parameter over 1978–1999. Furthermore, when $c = 0{\cdot}1$, the estimated sanctions parameters tend to become statistically significant more often as the years go by. In 1978–1985, no annual sanctions parameter was both negative and statistically significant. During 1992–1999, seven out of eight were. Finally, the median value of the estimated sanctions parameter is lower for the US after the sanctions period than before it. One interpretation of these findings is that once American firms divested their subsidiaries in South Africa, they found new suppliers and that relationship-specific investments in those suppliers (or other costs reasons) make it unprofitable for US firms to switch back to sourcing from South Africa again.

TABLE 4
Sensitivity of sanctions parameter to outliers, various cutoffs

European Union										
					Negative parameter estimates					
	Median value of estimated sanctions parameter				Number			Number with p-value <0·05		
Cutoff	1978–1999	1978–1985	1986–1991	1992–1999	1978–1985	1986–1991	1992–1999	1978–1985	1986–1991	1992–1999
0·000	−0·645	−0·581	−0·703	−0·677	8	6	8	6	6	5
0·010	−0·651	−0·591	−0·718	−0·714	8	6	8	6	6	6
0·025	−0·704	−0·541	−0·658	−0·844	8	6	8	8	6	8
0·050	−0·573	−0·565	−0·579	−0·490	8	6	8	5	5	5
0·100	−0·317	−0·499	−0·317	−0·250	8	6	8	6	2	1
Nordic countries										
					Negative parameter estimates					
	Median value of estimated sanctions parameter				Number			Number with p-value <0·05		
Cutoff	1978–1999	1978–1985	1986–1991	1992–1999	1978–1985	1986–1991	1992–1999	1978–1985	1986–1991	1992–1999
0·000	−0·136	−0·285	−0·083	0·071	8	5	2	1	0	0
0·010	−0·166	−0·321	−0·124	−0·009	8	6	4	1	0	0
0·025	−0·297	−0·322	−0·277	−0·287	8	6	8	1	0	2
0·050	−0·272	−0·350	−0·339	−0·086	8	6	4	1	3	1
0·100	−0·074	−0·465	0·033	0·028	8	3	4	6	2	0

Japan

	Median value of estimated sanctions parameter				Negative parameter estimates: Number			Negative parameter estimates: Number with p-value <0·05		
Cutoff	1978–1999	1978–1985	1986–1991	1992–1999	1978–1985	1986–1991	1992–1999	1978–1985	1986–1991	1992–1999
0·000	0·160	−0·043	0·152	0·360	4	2	0	0	0	0
0·010	0·111	−0·053	0·114	0·274	5	2	1	0	0	0
0·025	−0·023	−0·039	−0·039	−0·019	5	4	5	0	0	0
0·050	−0·070	−0·141	−0·032	−0·018	7	4	4	0	0	0
0·100	−0·133	−0·151	−0·072	−0·065	8	3	7	1	0	1

United States

	Median value of estimated sanctions parameter				Negative parameter estimates: Number			Negative parameter estimates: Number with p-value <0·05		
Cutoff	1978–1999	1978–1985	1986–1991	1992–1999	1978–1985	1986–1991	1992–1999	1978–1985	1986–1991	1992–1999
0·000	0·100	0·032	0·095	0·229	4	1	2	0	0	0
0·010	0·026	0·032	0·026	0·019	4	1	4	0	0	0
0·025	−0·112	−0·106	−0·073	−0·134	7	5	8	0	0	2
0·050	−0·181	−0·150	−0·126	−0·498	7	5	8	0	0	4
0·100	−0·389	−0·245	−0·407	−0·578	6	6	8	0	5	7

The sensitivity analyses in Table 4 do suggest that outliers are not responsible for the finding that, by and large, the Nordic and Japanese regimes had no statistically significant effect on South African exports. I also examined whether exporters that were abnormally close or abnormally far away from the importers might constitute outliers also. To examine this matter, I sorted each year's samples by the distance between each pair of countries, and repeated the above exercise for the same values of c. In short, I found no patterns between the estimated parameters and the proportion of distance-based outliers that were excluded from the samples (the value of c.)[12]

Another payoff from varying cutoff c is to discern how sensitive the estimated distance parameter is to the presence of outliers. As noted earlier, this is interesting in the light of Grossman's (1998) observation that the estimated distance elasticities in most gravity equations are far too high. Table 5 presents the relevant summary statistics. Starting from the benchmark case of $c = 0$, we can see that the median value of the distance parameter during 1978–1999 was −1·296. What is more, by 1992–1999 the median estimated parameter has fallen to −1·406. Increasing the value of c systematically reduces the absolute value of the size of the estimated distance elasticity. Furthermore, when $c = 0{\cdot}05$ or 0·1, any fall in the distance elasticity over time is much smaller or non-existent. In sum, these findings suggest that outliers may play an important part of the explanation for anomalous values of the estimated distance parameters that are typically observed in gravity equations.[13]

It is not just the statistical significance of the estimated parameters that are affected by outliers; the economic significance of my findings on the effectiveness of sanctions regimes depend on whether outliers are adequately taken care of. In Table 6 I report what the median estimated parameters for each sanctions regime

TABLE 5
Sensitivity of the distance parameter to outliers, various cutoffs

	Median value of estimated distance parameter				
Period	Cutoff = 0	Cutoff = 0·01	Cutoff = 0·025	Cutoff = 0·05	Cutoff = 0·1
1978–1999	−1·296	−1·213	−1·112	−0·940	−0·670
1978–1985	−1·231	−1·187	−1·124	−0·959	−0·636
1986–1991	−1·221	−1·203	−1·100	−0·905	−0·684
1992–1999	−1·408	−1·366	−1·106	−0·955	−0·680
Number of bilateral pairs in a sample	248	245	237	225	199

[12] Considerations of space preclude me from reporting these findings in detail here. I will make these findings available to anyone who requests them.

[13] Given Loungani, Mody and Razin, (2002) finding that the estimated distance elasticity tends to fall (in absolute value) when better proxies for communications costs are included in gravity equations, an interesting question is whether a combination of these proxies and elimination of outliers would result in estimated distance elasticities that Grossman (1998) suggested were plausible.

TABLE 6
Implied effects of sanctions on South African exports

Economy or economies	Cutoff equals 0·00				Cutoff equals 0·100			
	Implied median percentage reduction in South African exports				Implied median percentage reduction in South African exports			
	1978–1999	1978–1985	1986–1991	1992–1999	1978–1999	1978–1985	1986–1991	1992–1999
European Union	−47·51	−44·07	−50·47	−49·19	−27·17	−39·29	−27·17	−22·12
Nordic countries	−12·67	−24·80	−7·92	7·36	−7·13	−37·16	3·30	2·79
Japan	17·35	−4·21	16·42	43·33	−12·41	−14·02	−6·90	−6·29
United States	10·46	3·25	9·91	25·67	−32·23	−21·69	−33·44	−43·87

Notes:
Shaded area indicates when United States' and Japan's sanctions against South African exports were in effect. As noted in Table 1, the European Community did not lift its sanctions on South African exports until the early part of 1992, and Norway waited until 1993 to do likewise.

implied for changes in South African exports before, during, and after the sanctions regime of 1986–1991. If one includes the outliers in the samples (case $c = 0$), then the trade impact of formal state sanctions and private refusals to buy South African goods cut EC imports from South Africa in half. In this case, the trade-impact of EC sanctions is much much larger than the Nordic, Japanese or American sanctions. However, once outliers are excluded, the EC sanctions regime is found to reduce South African exports by 27%; still a sizeable impact but not a 50% cut. In contrast, US sanctions are found to reduce the apartheid regime's exports the most; essentially by a third. When the outliers are removed ($c = 0{\cdot}1$), the EC and US diverge in one other respect—in terms to what happens to South African exports after sanctions are removed. Removal of American sanctions is associated with even lower levels of South African exports (compare a 43·87% reduction in 1992–1999 with a 33·44% reduction in 1985–1991); whereas in the three EC states considered here, removal of sanctions lead to a small recovery of South African exports (compare a 27·17% reduction during the sanctions era with a 22·12% reduction in the post-sanctions era.) On the basis of these estimates, then, compared to other middle income developing economies, South African exports to the US market have fallen further behind since the elimination of sanctions. If prior export success lays the foundation for future export growth, then it appears that the US sanctions regime may well have had adverse consequences for South African exports long after that sanctions regime was dismantled.

V Implications for Future Research

To obtain a better sense of the impact of state-imposed sanctions on South African exports, I have examined the import patterns of eight industrial economies before, during, and after sanctions were imposed. Doing so revealed little statistically significant evidence of the effect of Japanese and Nordic sanctions on South African exports. In contrast, I found that the American sanctions regime cut South African exports by a third. Although the average estimated impact of (then) European Community's sanctions on South African exports was to reduce the latter by a quarter, in only two out of the six sanctions years was this estimated effect statistically significant. Overall, then, only in the case of the United States does considerable and fairly robust evidence point towards statistically significant effects of her sanctions regime on South African exports during 1986–1991.

This paper's findings could have more general implications for the estimation of North-South bilateral trade flows. My analysis of outliers suggests that the absolute value of both the distance elasticity and the sanctions parameter (which is nothing more than a dummy variable) are consistently higher when bilateral pairs with abnormally large or abnormally small trade flows are included in the sample.[14] Eliminating the 10% of bilateral pairs with the largest and the smallest

[14] The conventional habit of assigning a dollar of trade flows to those bilateral trading partners that record zero trade—so that the logarithm of the 'assigned' trade flow is zero rather than undefined—may well be creating the very outliers that this paper's results suggests are so potentially troubling.

bilateral trade flows (admittedly scaled by national incomes in my case) reduced the estimated distance elasticity by a third. Removing outliers equivalent to another 10% of the sample, resulted in the estimated distance elasticity falling in half (compared to the case when no outliers were removed.) These are substantial changes in the estimated parameters, presumably with important implications for how much 'distance matters'. Future research may want to explore whether the estimated elasticities of other frictions—such as tariffs—are equally sensitive to the inclusion of outliers in samples of North-South trade flows. Indeed, more robust estimates of these elasticities might shed new light on the relative importance of the factors that are responsible for the latest wave of international market integration as well as on the likely impact of future trade liberalisation.

ACKNOWLEDGEMENTS

The author wishes to thank Alessandro Nicita for supplying the trade data for this paper in a useable form. Any errors are the author's own.

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Date of receipt of final manuscript: 3 July 2002.