A Concurrent Evaluation Of Trends In Commodity Exports, Economic Growth And Environmental Quality In The US

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ABSTRACT

Economic growth is a logical motivation and empirically determinable outcome of increasing exports. There are, however, corresponding losses in environmental resources. This paper examines both consequences of recent US exports

Keywords: International Trade, Economic Growth, Environmental Impacts.

INTRODUCTION

Global Evidences Of Trade Impacts

Many nations as well as regional pockets within nations have prospered from the additional revenues generated from export trade. The virtues of international trade in boosting national economic growth are routinely extolled in courses of economic theory. Japan's rise as one of the richest nations in the world is a famous example of export-led-growth (see, e.g., Kreinin, 2005). As well, since the 1980s, this concept has been aptly demonstrated by South Korea, Singapore, Hong Kong and Taiwan. These countries, now known as the four "Asian Tigers", used export earnings to dramatically reduce their gaps in standards of living with the West. More recently, China and India have begun to combine technology with exports, sparked by offshoring opportunities available from high-wage developed economies, to achieve a consistent 7 – 10% annual growth in GDP.

While national success stories of export led growth are quite visible, there are parallel regional economic possibilities under the same strategy. Exports provide an important source of regional growth in a time when national markets are sluggish and add jobs that are higher wage earners. The higher wage and procurement activities from exports have beneficial spillover effects in the regional economy. In this age of internet proliferation and instant global outreach, many regions even consider international trade as an economic survival strategy.

International trade theory suggests that exports provide the means for cashing in the regional comparative advantage in resource ownership, capital or know-how. Export trade is the obvious choice when there is evidence of demand and higher international prices. Trade is also a serious option when the domestic market is slow, and when inter-regional competition erodes operating margins for local businesses. Finally, export promotion is a strategic option to defend market share against competing nations and regions that leverage export revenues (see, e.g., Choi and Harrigan, 2003).

The common barriers to exporting are the added marketing efforts, investments, as well as new performance and certification standards. There are also risks embedded in the international distribution system and currency exchange regimes. There are also cultural and environmental consequences of exporting. It is perhaps not prudent to overlook the threat of irreversible change in regional practices and knowledge-based processes – the value of which is not determinable. There are also many examples of depleting environmental resources from an over emphasis on exports (Ackermann et al., 2003).

Trade Rationale: Macro And Local Outlooks

The economic benefits of free international trade are widely accepted in mainstream theory and may be seen as economy-wide in nature (macroeconomic impacts) or local (regional impacts). At the nation level, international trade spurs economic growth by cashing in on comparative advantage between trading nations, where both partners benefit (Burfisher et al., 2001). Since such transactions are based on optimal resource allocations, they logically generate consumer surpluses compared to restricted trade situations (Kreinin, 2005). Several researchers have suggested that trade also results in environmentally benign technology transfer (Carpentier, 2004).

At the disaggregated or regional level, it can lead to spurts in economic growth in pockets engaged in international trade. It also is associated with higher wages and better incomes for factor owners due to local procurement activities (Runge, 1995). Trade also relates to improvements in production processes, material and technology use, and best management practices. This often has spillover effects in the region, implying that productivity improvements also results in businesses that are associated with or adjacent to trading operations. Trade can also be an excellent survival strategy for businesses facing seasonal demand cycles and price competition via cross-price effects between international and domestic sales (Devarajan, 1995).

RESEARCH OBJECTIVES

The policy issue of determining optimal trade levels that create a balance between economic growth and environmental protection stems from the underlying concern that absolute openness in international trade may result in the creation of regional pollution havens. There are 2 sets of prevailing hypotheses relating to trade and pollution. There is the popular "pollution haven" hypothesis that foresees increased concentrations in less developed countries, since such nations would be more driven by the prospect of growth in relation to conservation. The second hypothesis is rather more complex and suggests that dirty capital intensive processes will migrate to capital rich regions. Researchers have addressed these concern using both theoretical and empirical models that investigate the pollution concentration effects of the scale and composition of international trade. For example, Antweiler and others report small changes in pollution concentration when output composition is altered by trade growth, while trade induced technology and scale changes lead to less pollution. Also, empirical research by Grossman, Krueger, Tobey and others have faulted the simple pollution haven theory (Antweiler, et al. 2001).

However, several other empirical studies have proven that trade flows have functional relationships with factor endowments and openness. The composition, scale and techniques of trade dictate the use of clean versus dirty technology. Also, the income effects of trade often result in cleaner technology. The migration of pollution has been examined, for example, by an empirical model by Copeland and others that uses trade between North (rich, developed nations) and South (poor developing nations) to show that the former tend to specialize in cleaner technology over time. By isolating scale and composition effects, this model shows that free trade increases global pollution, particularly when the North expands their production possibility frontiers. However, pollution goes down when there are unilateral transfers from North to South or when the production possibility frontiers of the South expand (Copeland et al., 1994).

Other questions pertinent to the trade and environment discussion are whether pollution is a function of consumption choices made due to the availability of free trade, and whether any imposed restrictions result in shrinking production possibility frontiers. An implication of this would be that regional economic groups such as the EU could use the trade-pollution argument to advance their own environmental agendas (Drake-Brockman, 2003).

The compelling results of researchers, on both sides of the debate, opens up a chasm between real concerns about trade and the environment. The inverted-U (bell-shaped) environmental Kuznets curve, which plots environmental quality on the Y-axis and national income on the X-axis, reiterates that environmental concerns will be addressed differently at different stages of development. As well, WTO driven free-trade doctrines pose a conflict with desired environmental standards that are highlighted by some trade induced ecological disasters in recent times. For example, the use of *purse seine* nets for tuna fishing in Mexico led to an inadvertent decline in dolphin populations. This prompted US environmental groups to call for boycott of Mexican tuna, and an attempt by the US government to force Mexico to ban *purse seine* nets. Similarly, export-induced expansion of the shrimping industry in Thailand led to decline of the turtle population and deterioration of the nation's mangrove forests. Once again, environmental groups in developed nations tried to intervene to change existing practices. Both cases were successfully appealed to the WTO on trade restriction and national sovereignty grounds (Esty, 2001).

Commodity based exports from the US raise many concerns about the true resource price of farm sector produce and the questionable wisdom of degrading domestic land and water for foreign consumption. In a sense, every unit of agricultural commodity that is exported takes with it some nutrient endemic to the supply location. In the farm sector, these concerns relate to the loss of top-soil, compacting and acidification of soil, and water pollution from fertilizer and pesticides. There are also the potential ecological threats from intensive fishing, animal farming, use of GMOs, hormones and radiation (Henderson et al., 1996).

So, the ideal scenario would be to allow "free trade" within a multilateral regulatory regime, assuming that such a set of rules can be obtained at a low transaction cost. Recent empirical research has found that trade does not automatically lead to growth in the presence of excessive regulation. In fact, regression results have shown that free trade actually lowers living standards, within a heavily regulated economy, because it prevents optimum resource flow. In such situations, an emphasis on trade would signal a wrong composition. On the other hand, regulatory reform can reap the benefits of trade liberalization (Drake-Brockman, 2003).

Given the above premise, it is interesting to identify, measure and signal the regional factors that stimulate growth. As well, it is important to understand the regional changes that may result from a major export initiative.

This research addresses the first issue by isolating factors that show a causal relationship with exports. This has policy implications for devising strategies that stimulate export-enabling factors at the various levels. The second issue is to determine the environmental consequences of export growth. At the policy level, this analysis can reveal states and regions that have optimal trade-offs between conservation and growth.

DATA AND ANALYSIS

Time series data on exports at the overall US level, and at disaggregated levels was used for the analysis. The dataset of detailed dollar values of annual exports for the period 1960 through 2004 was purchased on DVDs from the US Census Bureau's Foreign Trade Statistics division. Quantitative data on the state commodity exports were obtained from the ERS/USDA State Exports database (1973-2003). The EPA collects, and makes available on their website, annual emissions data for 3 criteria air pollutants (CAPs), namely, Carbon Monoxide (CO), Sulfur Dioxide (SO_2), and Particulate Matter of size 10micron and 2.5micron (PM10 and PM2.5). The *EPA AirData* website also provides data on 3 important promoters of CAPs, namely, Volatile Organic Compounds (VOCs), Nitrogen Oxides (NO_X) and Ammonia (NH_3). Annual pollution data in short tons per pollutant was obtained from USEPA's web-based data retrieval systems (1970-2003). The annual data for NH_3 was available only after 1990, so it was not used in the growth calculations, although NH3 is a significant pollutant from the farm sector.

The first cut analysis examined whether the averages and Compounded Annual Growth Rates (CAGR) of GDP, total and commodity exports displayed any obvious patterns at the overall US economy level, as shown in Table 1.

Table 1: Economic Trends and Exports in the US: 1970 – 2003 ($ millions)

from	to	GDP CAGR	Average	Exports CAGR	Average	Commodity CAGR	Average
1970	1974			20.87%	79,136		16,034
1975	1979		2,240,401	14.03%	166,032	9.99%	25,583
1980	1984	9.24%	3,265,098	1.73%	279,734	-1.55%	39,231
1985	1989	6.70%	4,727,164	13.93%	373,225	6.17%	32,086
1990	1994	4.88%	6,204,937	7.06%	615,315	2.14%	41,489
1995	1999	6.20%	8,188,833	5.02%	896,113	-2.67%	54,872
2000	**2003**	3.82%	10,274,686	-1.55%	1,019,616	3.45%	53,230

The total time series data ranging from 1970 – 2003 for GDP, exports and commodity exports has been summarized into 7 class intervals of 5 years each, and average values and compounded annual growth rates (CAGR) were calculated for each class and between classes respectively. The CAGRs for none of the 3 variables display a steady secular trend. The highest growth of GDP was during 1980-84 (9%), that of exports was during 1985-90 (14%) and that of commodities was during 1975-179 (10%). There is a low positive linear relationship between growth of GDP and exports, a moderate positive relationship between growth of exports and commodities, and a moderate negative relationship between growth of GDP and commodities. Decomposition of growth does not suggest a significant linear relationship between exports and GDP during the last 35 years. There is a suggestion that increase in commodity exports may, in fact, slow down GDP growth.

The time series data on the 6 pollutants were similarly examined over 5 year class intervals, and remarkably, all pollutants showed a declining trend (please see Table 2). This is completely expected since the data is after 1970, ever since these pollutants were tracked and controlled by the EPA. Over the 32 year study period, the greatest decline was registered by SO_X and CO whose levels dropped by 50% during the time, being particularly targeted by the EPA. Note that since the 1990s, SO_X emissions trading has been an environmental success story of the US. In recent times, even NO_X, VOC and PM_X levels have been declining rapidly.

Table 2: Pollution Trends in the US: 1970 - 2002 (million short tons)

from	to	CO CAGR	CO Mean	NO_X CAGR	NO_X Mean	PM10 CAGR	PM10 Mean	SO_2 CAGR	SO_2 Mean	VOC CAGR	VOC Mean
1970	1974	-1.34%	198	0.07%	27	-37.91%	4	-0.93%	31	-1.46%	34
1975	1979	-0.32%	188	0.83%	27	-0.41%	8	-1.00%	28	0.87%	32
1980	1984	-1.21%	180	-0.34%	27	-3.03%	6	-2.38%	24	-1.57%	29
1985	1989	-2.39%	172	-0.37%	26	-0.30%	41	-0.54%	23	-1.73%	27
1990	1994	-3.53%	142	-0.18%	25	0.77%	28	-1.93%	22	-1.64%	23
1995	1999	-2.51%	121	-2.19%	24	-2.32%	24	-1.47%	18	-3.93%	20
2000	**2002**	-1.06%	111	-3.37%	22	-3.41%	23	-3.09%	16	-2.80%	17

The next sequence of concurrent analysis deals with investigating associations between the GDP, total and farm exports and the 7 chosen pollutants, over the 32 year time series. Table 3 presents the mean levels of the variables during the study period, and the matrix linear associations between the variables. Overall, farm and total exports levels show a strong positive correlation with GDP levels. Most pollutants displayed moderate to strong negative correlations with GDP. Somewhat expectedly, PM_X and NH_3 have positive associations with farm exports, while other pollutants are negatively associated. SO_2, NO_X and VOCs were negatively associated with total exports. The association within pollutants are reported but not discussed since they are as expected; for example, VOC and SO_X display a very strong association.

Finally, the state level GDP (called GSP or Gross State Product here) is analyzed vis-à-vis farm exports with the view to address the question of export led growth versus the notion of losing the local land and water resources via farm exports. A *cluster analysis* has been used to classify the 51 states into 9 cells of a contingency table based on the criteria of high, medium and low GSP growth versus high, medium and low growth of farm exports. (Please see Table 4.) Almost 50% of the states may be classifies as “normal” which, in this analysis, implies that their GSP growth category matches the category of farm export growth. North Carolina is the only state that has high GSP growth with low growth in farm exports, while Pennsylvania and Wyoming have high growth in farm exports with low GSP growth.

Table 3: Linear Association of Income and Export Variables

	Mean	GDP	Farm Exports	Total Exports	CO	NH_3	NO_X	PM 2.5	PM 10	SO_2
GDP	5,916,670									
Farm Exports	39,074	0.82								
Total Exports	474,301	0.98	0.90							
CO	161,738	-0.98	-0.87	-0.99						
NH_3	4,505	-0.20	0.15	0.05	0.06					
NO_X	25,634	-0.94	-0.70	-0.89	0.89	0.48				
PM2.5	6,999	-0.46	-0.77	-0.54	0.60	-0.02	0.25			
PM10	18,832	0.36	0.30	0.50	-0.49	0.04	-0.48	0.74		
SO_2	23,521	-0.96	-0.89	-0.93	0.92	0.19	0.88	0.48	-0.58	
VOC	26,439	-0.99	-0.86	-0.98	0.98	0.18	0.91	0.53	0.96	0.96

Table 4: Spatial Pattern of the Influence of Farm Exports on Income Growth

		11	31	9	51
GSP Growth	**High > 7.5 %**	NC	NV, AR, FL,DE, GA, CO, VA, WA	NH, UT	11
	Medium 6 - 7.5 %	SC, AL, MO	TX, VT, MD, TN, CT, MN, ID, NM, OR, SD, AR, HI, WI, NE, KS, NY	CA, MS, NJ, RI, MA	25
	LOW < 6 %	MS, LA, IN, MT, IL, OK, OH	WV, KY, IA, AK, MI, ND	PA, WY	15
		Low < 4 %	**Medium 4 - 8 %**	**High > 8 %**	

Growth Of Farm Exports

CONCLUSIONS

This research has investigated the associations of economic indicators with environmental variables. It has also examined trade composition vis-avis growth. The time series data on these variables do not establish any strong associations between exports and economic growth at the overall US economy level. On the other hand, there are positive correlations between exports and declining pollutants. This is perhaps due to a combination of better regulations and control by the EPA as well as the composition effect of export trade. A key concern in the trade and environment literature is that local resource wealth gets depleted by farm sector exports, since it may be argued that some of the richness from the land and water is carried away by the commodities. However, the economic stimulus provided by exports would logically impart the counter-balance. This research has shown that about half the states indeed appear to have the right balance. About half of the remaining states actually appear to be reaping greater benefits from exports than they lose from depleting resources. However, about 25% of the states show low economic growth, but appear to be on the high end of exporting their land and water resources.

An interesting question that emerged during this study was whether local techniques and knowledge get eroded with trade, given that the most efficient technology would survive in an open trade regime. This may be done by concurrently examining exports and the rate of change of technology. Finally, this research can be extended by investigating the regional indicators of trade potential. This could be useful for designing incentive structures to promote trade with the scale and composition appropriate for an optimal trade-off between growth and conservation.

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