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Chasing Pakistan's Missing Trade: Counterfactual Analysis of Inefficient Trade Patterns

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ABSTRACT

Bilateral trade patterns between countries tend to demonstrate very basic patterns based on two simple measures: the size of their respective economies and the physical distance between them. Economists often employ the shorthand term "gravity model" to describe this empirical regularity, borrowing from the literal measure of gravity as directly proportional to the mass of two objects and indirectly proportional to their distance. Under this metaphor, GDP represents mass and distance represents distance. The simple picture generated by gravity models of trade does not generally yield strong implications for policy or commercial strategy, but it does provide the opportunity for simple back-of-the-envelope calculations of counterfactual, or "missing", trade. This paper calculates missing trade opportunities for Pakistan based on specifications gleaned from gravity models of international trade and finds that Pakistan appears to be "missing" over $72 billion in total international trade. Moreover, given their massive size and proximity, gravity models predict that trade between Pakistan and India should be over $30 billion per year, which dwarfs the reported bilateral trade of little more than $2 billion.

Key words: International trade, Economic geography.
JEL Classification: F12, F14.

1. Introduction

This paper calculates missed economic opportunities for Pakistan based on specifications gleaned from gravity models of international trade. Bilateral trade patterns between countries tend to demonstrate very basic patterns based on two simple measures: the size of their respective economies (as measured by Gross Domestic Product, or GDP) and the physical distance between them (often measured by the distance between national capitals.) Economists often employ the shorthand term "gravity model" to describe this empirical regularity, borrowing from the literal measure of gravity as directly proportional to the mass of two objects and indirectly proportional to their distance. Under this metaphor, GDP represents mass, and distance represents the physical space between countries.

The simple picture generated by gravity models of trade does not generally yield strong implications for policy or commercial strategy, but it does provide the opportunity for simple back-of-the-envelope calculations of counterfactual, or "missing", trade. For example, given their massive size and proximity, gravity models predict that trade between Pakistan and India should be over $3 billion per year; in reality, bilateral trade amounts to little more than $2 billion. Pakistan's total exports amount to barely $25 billion.

Recognizing persistent statistical support for the gravity relationship, economists have extended extensive efforts seeking to develop a theoretical underpinning for the approach, following seminal pieces by Anderson (1979), Bergstrand (1985), Deardorff (1998), and Anderson and Van Wincoop (2003). The literature may read as a classic case of "it works in practice, but does it work in theory" to the extent that Anderson (2010) refers to the gravity model as "an intellectual orphan" from textbook economic theory.

Head and Mayer (2013)[1] outline the modern research literature on the subject following Daniel Trefler's path-breaking 1995 analysis[2] that introduced the concept of "missing trade."

That literature review will not be replicated here. Section 2 presents an overview of Pakistan current trade patterns. Section 3 calibrates the gravity counterfactual for Pakistan, and Section 4 offers concluding remarks.

2. Overview of Pakistan Trade Patterns

Snapshot overviews of Pakistan economic data reveal inefficient patterns in its international trade. Consider first Table 1, which compares Pakistan to other large countries – the Brazil, Russia, India, China, and the United States. Despite having the sixth largest population in the world, Pakistan has the 44th largest economy and the 65th most exports.

Table-1. Comparison of Pakistan with other large countries

Country Name	Population	Rank	GDP (current $US)	Rank	Exports (current ($US)	Rank
China	1,357,380,000	1	$9,240,270,452,047	2	$2,440,533,155,296	1
India	1,252,139,596	2	$1,876,797,199,133	10	$465,729,183,312	15
United States	316,128,839	3	$16,768,100,000,000	1	$2,262,200,000,000	2
Brazil	200,361,925	5	$2,245,673,032,354	7	$281,917,585,983	23
Pakistan	182,142,594	6	$232,286,781,111	44	$30,708,292,018	65
Russia	143,499,861	9	$2,096,777,030,571	9	$594,796,636,628	11

Table 2 shows general trade patterns between Pakistan and its top twenty trading partners. Like most countries, Pakistan tends to trade with large, wealthy countries, such as China, USA, Japan, and Germany. Pakistan imports from oil-producing countries, particularly UAE, Saudi Arabia, and Kuwait, while exporting to large consumer markets such as China and the United States.[3]

Table-2. Pakistan 2013 bilateral trade

Country	Rank	Imports	ImpRank	Imp%	Exports	ExpRank	Exp%	Total	Total %
UAE	1	7,751,512,950	1	18.0%	1,775,142,674	4	7.1%	9,526,656	14.0%
China	2	6,626,322,949	2	15.4%	2,652,223,045	2	10.6%	9,278,546	13.6%
USA	3	1,669,788,770	8	3.9%	3,746,251,834	1	15.0%	5,416,041	8.0%
Saudi Arabia	4	3,847,222,352	4	8.9%	494,058,807	12	2.0%	4,341,281	6.4%
Kuwait	5	3,948,722,209	3	9.2%	96,202,204	40	0.4%	4,044,924	5.9%
Germany	6	1,433,630,738	9	3.3%	1,080,984,427	6	4.3%	2,514,615	3.7%
Afghanistan	7	307,597,654	19	0.7%	1,998,110,368	3	8.0%	2,305,708	3.4%
India	8	1,874,061,902	7	4.3%	402,747,280	16	1.6%	2,276,809	3.3%
Japan	9	1,963,191,093	5	4.6%	184,316,062	27	0.7%	2,147,507	3.2%
Malaysia	10	1,919,737,304	6	4.5%	204,464,378	25	0.8%	2,124,202	3.1%
United Kingdom	11	544,919,953	15	1.3%	1,431,956,495	5	5.7%	1,976,876	2.9%
Indonesia	12	1,208,316,429	10	2.8%	144,380,366	30	0.6%	1,352,697	2.0%
Oman	13	1,124,789,707	11	2.6%	188,795,774	26	0.8%	1,313,585	1.9%
Rep. of Korea	14	858,663,256	12	2.0%	397,265,576	17	1.6%	1,255,929	1.8%
Italy	15	500,328,649	16	1.2%	641,825,571	8	2.6%	1,142,154	1.7%
Netherlands	16	249,308,374	26	0.6%	627,521,027	9	2.5%	876,829	1.3%
Thailand	17	715,669,262	14	1.7%	117,424,064	35	0.5%	833,093	1.2%
Singapore	18	745,528,424	13	1.7%	86,271,324	44	0.3%	831,800	1.2%
Belgium	19	219,506,728	27	0.5%	571,933,779	11	2.3%	791,441	1.2%
Spain	20	177,569,498	30	0.4%	602,477,107	10	2.4%	780,047	1.1%
Total		43,086,241,120			24,944,972,956			68,031,214	

Missing, however, are the exports. Consider Figure 1, which shows that until the turn of the millennium, Pakistan was a relatively export-intensive economy as measured by export contributions to GDP. More recently, India has developed into a much more export-oriented economy.

[1] Head, Keith, and Thierry Mayer. 2013. Gravity equations: Workhorse, toolkit, and cookbook. Handbook of International Economics 4.
[2] Trefler, Daniel. 1995. The case of the missing trade and other mysteries. *The American Economic Review* 85(5): 1029-1046.
[3] The source for all data used in this section is http://comtrade.un.org/data/.

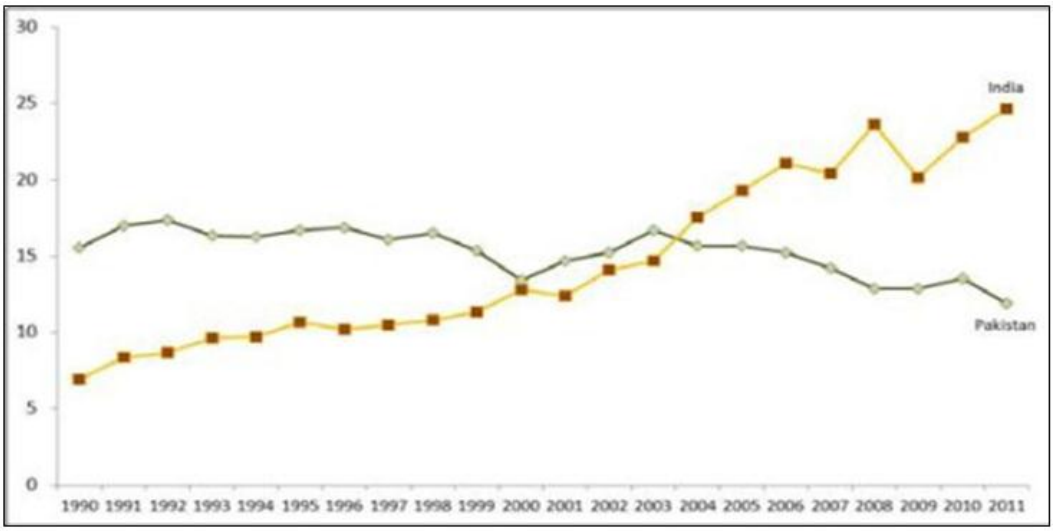

Figure-1. Export of goods and services by Pakistan and India, 1990–2011 (% of GDP)[4]

Moreover, as shown in Figure 2, Pakistan's export-to-GDP ratio of 13.3 percent is one of the smallest in the world, and less than half the global average of 29.9 percent.

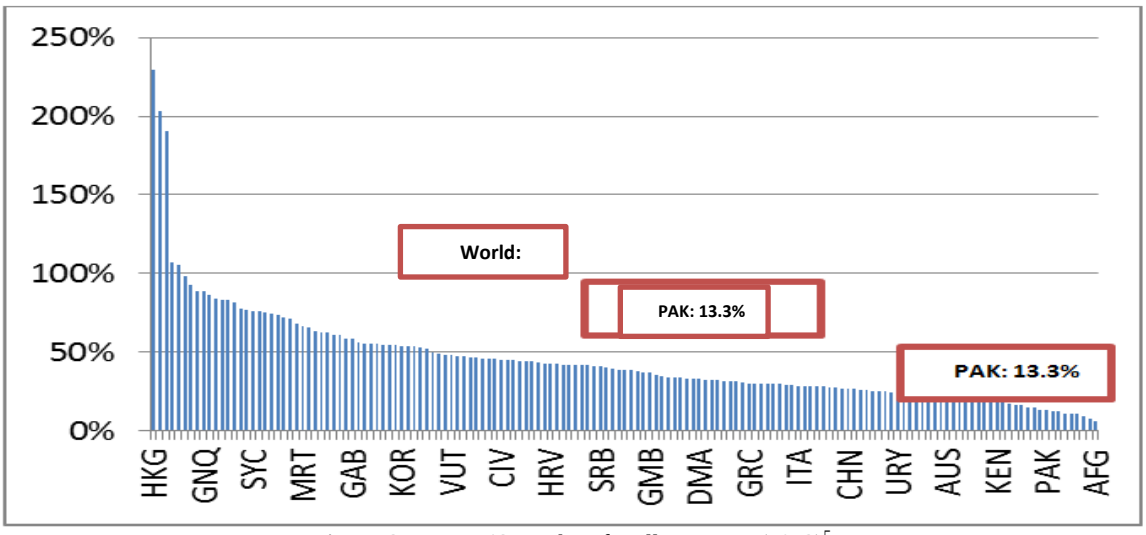

Figure-2. Exports/GDP chart for all countries (2013)[5]

As Table 3 shows, over 22 percent of all Pakistan trade are in Sector 27, specifically "Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes," a reflection of the massive demand for energy in the country that domestic supply cannot meet. In fact, Pakistan's dollar value of mineral fuel imports alone exceeds two-thirds the entire sum of exported goods and services.

Table-3. 2013 Pakistan trade at the Harmonized Coding System (HS) 2-digit level [6]

Sector	Sector Description	Rank	Total Trade	Total%	Imports	Exports
27	Mineral fuels	1	15,774,136,405	22.9%	15,247,355,053	526,781,352
52	Cotton	2	6,380,492,630	9.3%	1,046,709,066	5,333,783,564
63	textile articles	3	3,883,646,603	5.6%	198,161,596	3,685,485,007
84	Nuclear reactors, boilers, machinery	4	3,237,677,290	4.7%	3,058,286,488	179,390,802
85	Electrical machinery and equipment	5	2,796,880,456	4.1%	2,682,333,001	114,547,455
10	Cereals	6	2,414,168,389	3.5%	233,123,737	2,181,044,652
						Continue

[4] Source: Butterfield, William. July 2014. Constraints to Investment, Growth and Poverty Reduction in Pakistan.
[5] Source: Author's calculations
[6] http://unstats.un.org/unsd/tradekb/Knowledgebase/Harmonized-Commodity-Description-and-Coding-Systems-HS

15	Animal or vegetable fats and oils	7	2,134,708,962	3.1%	1,979,643,052	155,065,910
61	Apparel and clothing knitted or crocheted	8	2,130,340,505	3.1%	25,019,431	2,105,321,074
29	Organic chemicals	9	2,054,742,585	3.0%	2,015,504,334	39,238,251
39	Plastics and articles	10	2,019,290,009	2.9%	1,569,501,409	449,788,600
72	Iron and steel	11	1,882,686,016	2.7%	1,840,944,247	41,741,769
62	Apparel not knitted or crocheted	12	1,877,179,712	2.7%	22,253,859	1,854,925,853
87	Vehicles other than railway or tramway	13	1,312,426,607	1.9%	1,238,244,902	74,181,705
89	Ships, boats	14	994,133,852	1.4%	981,463,114	12,670,738
55	Man-made fibers	15	950,612,772	1.4%	532,440,046	418,172,726
49	Printed books, newspapers	16	862,458,450	1.3%	857,939,795	4,518,655
71	pearls, precious stones, precious metals	17	853,912,464	1.2%	416,645,063	437,267,401
30	Pharmaceuticals	18	844,142,452	1.2%	674,675,502	169,466,950
25	Salt; sulfur;	19	822,123,869	1.2%	99,302,341	722,821,528
90	Optical, photographic, cinematographic	20	797,884,327	1.2%	449,809,268	348,075,059

Table 4 breaks out the top ten sectors by imports, demonstrating their energy-intensive nature. Almost five percent of Pakistan's imports are in vegetable fats and oils, indicating a food staple that explains Malaysia's position as a top ten trade partner. The counterfactual analysis in Section 4 identifies this trading relationship as an outlier.

Table-4. Ranking Pakistan's imports by sector (2013)

Sector Description and Number		Imports	Percentage
Mineral fuels	27	15,247,355,053	34.8%
Nuclear reactors, boilers, machinery	84	3,058,286,488	7.0%
Electrical machinery and equipment	85	2,682,333,001	6.1%
Organic chemicals	29	2,015,504,334	4.6%
Vegetable fats and oils	15	1,979,643,052	4.5%
Iron and steel	72	1,840,944,247	4.2%
Plastics and articles	39	1,569,501,409	3.6%
Vehicles other than railway or tramway	87	1,238,244,902	2.8%
Cotton	52	1,046,709,066	2.4%
Ships, boats	89	981,463,114	2.2%

Table 5 displays a similar ranking of Pakistan's top ten sectors by exports. Cotton is king. Textiles and apparel also dominate the official figures. Pakistan exported over $2 billion worth of cereals in 2013 and $500 million worth of mineral fuels.

Table-5. Ranking Pakistan's exports by sector (2013)

Sector Description and Number		Exports	Percentage
Cotton	52	5,333,783,564	21.2%
Textiles	63	3,685,485,007	14.7%
Cereals	10	2,181,044,652	8.7%
Apparel and clothing knitted or crocheted	61	2,105,321,074	8.4%
Apparel not knitted or crocheted	62	1,854,925,853	7.4%
Leather	42	743,537,691	3.0%
Salt; sulfur	25	722,821,528	2.9%
Sugars	17	633,568,067	2.5%
Raw hides	41	529,698,371	2.1%
Mineral fuels	27	526,781,352	2.1%

3. Calibrating the Gravity Counterfactual

A minimalist version of the gravity model of international trade provides an accessible counterfactual analysis of Pakistan trade patterns using this basic empirical structure:

(1) Gravity Model: $$TRADE_{i,j} = k^{\beta_0}\left(\frac{GDP_i^{\beta_1} * GDP_j^{\beta_2}}{DISTANCE_{i,j}^{\beta_3}}\right)\varepsilon_{i,j}$$

which, expressed in logs, becomes:

(2) $$\ln(TRADE_{i,j}) = \beta_0 \ln(k) + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) - \beta_3 \ln(DISTANCE_{i,j}) + \ln(\varepsilon_{i,j})$$

where $TRADE_{i,j}$ is the trade volume (exports, imports, or both) between country i and country j, k is a parameter and $\varepsilon_{i,j}$ is a residual.

This model differs from the gravity model incorporated by the Pakistan Ministry of Commerce's report "Pakistan-India Trade Liberalization: the Impact of Non-Tariff Barriers"[7] that focused exclusively on South Asian economies. Such a geographical concentration allows the assumption of sufficient proximity to India among the analyzed countries to cancel the distance parameter in the equation, reducing the analysis to Exports-to-GDP ratio. Given India's existing free trade agreements with Bhutan, Nepal, and Sri Lanka, the report cites the Bangladesh figures as the more accurate comparison for Pakistan-India bilateral trade. By this estimate, Pakistan's exports to India could reach $792 million.

Table 5 shows counterfactual trade patterns for Pakistan's top ten total trade partners that confirms these predictions. The Predicted Trade column represents values derived from a gravity analysis applied to the GDP and distance between capital cities for Pakistan's top ten trade partners. As can be seen, Pakistan's actual trade in 2013 was over-represented by UAE and Kuwait by almost 60 percent, and under-represented by China, the United States and Germany by half or more in each case. These figures suggest that Pakistan diverges from international norms due to an over-reliance on imports of energy goods and an inability to produce (or, at least, to sell) goods for consumption in large, wealthy countries. Thus, export-oriented growth strategies for Pakistan should consider the adage: to grow wealthy, countries should produce the kind of goods that wealthy countries produce.

Table-6. Counterfactual Trade Patterns for Pakistan[8]

Country	GDP (current US$)	Dist. (km)	Predicted Trade (US$)	Reported Trade (US$)	Difference
UAE	402,340,106,796	1956	3,867,070,910	9,526,655,624	-59%
China	9,240,270,452,047	3880	18,489,723,134	9,278,545,994	99%
USA	16,768,100,000,000	9877	11,051,330,088	5,416,040,604	104%
Saudi Arabia	748,449,600,000	3582	3,281,615,435	4,341,281,159	-24%
Kuwait	175,830,502,498	2420	1,718,588,084	4,044,924,413	-58%
Germany	3,730,260,571,357	5102	7,297,797,743	2,514,615,165	190%
Afghanistan	20,309,671,015	370	2,421,139,526	2,305,708,022	5%
India	1,876,797,199,133	691	33,523,174,761	2,276,809,182	1372%
Japan	4,919,563,108,373	5972	7,597,375,437	2,147,507,155	254%
Malaysia	313,159,097,401	4512	1,388,019,351	2,124,201,682	-35%
Total			90,635,834,469	43,976,289,000	106%

In addition, Pakistan's reported trade with India, its closest neighbor, is less than one-tenth of what the predicted counterfactual, suggesting upwards of thirty billion dollars in "missing" trade between the two countries. The aggregate trade for Pakistan's top ten current trading partners increases by 106 percent with over $46 billion in missing trade. Assuming the share of the reported trade by these partners extend to the counter-factual trade patterns, Pakistan's total international trade predicts could approximate $140.2 billion, an increase of over $72 billion from current figures.

4. Concluding Remarks

International trade has been a central feature of South Asia since the dawn of civilization. The Indus River basin, on which modern Pakistan sits, maintained extensive trading networks with the regions that are now modern Iran, India, and Afghanistan as far back as 3000 BCE. For many reasons mostly

[7] Government of Pakistan Ministry of Commerce Report No. 2 October 2012

[8] GDP data collected from the World Bank's World Development Indicator (WDI) tables. Distance data collected between national capitals using http://www.distance-between.info/. For the sake of exposition, unitary coefficients are assumed, consistent with Anderson (2010)'s review of the empirical literature.

unrelated to economic forces, that historical trading relationship has severely diminished. This paper has attempted to quantify some of the missing trade in modern Pakistan.

This paper cites only official trade data as reported by the United Nations' Comtrade data-base and the World Bank's World Development Indicators. However, un-reported shadow trade between the two neighbors could explain the extreme values of "missing" trade. Extending the gravity metaphor, the sheer mass of economic production and population straddling the borders between the two countries suggests that fundamental forces should be pulling such trade; under this expectation, the man-made non-economic barriers to trade counter what Paul Krugman (1997) refers to as "social physics."[9] Moreover, as the Pakistan Ministry of Commerce's report "Pakistan-India Trade Relations: A Sectoral Analysis"[10] discusses, the two countries have revealed comparative advantages in many different sectors, suggesting substantial opportunities to exploit gains from trade for mutual benefit.

A minimalist version of the gravity model of international trade predicts the level of missing trade to be approximately $140.2 billion, an increase of over $72 billion from current figures. The model further predicts that trade between Pakistan and India should be over $30 billion per year; reported bilateral trade amounts to little more than $2 billion. One interesting avenue for future research could be to replicate the above analysis on foreign direct investment to identify the sectors and regions in which Pakistan may be under-capitalized.

[9] Krugman, Paul. 1997. Development, geography, and economic theory. Vol. 6. The MIT Press.
[10] Government of Pakistan Ministry of Commerce Report No. 3 October 2012