IS CHINA'S INTERNATIONAL ECONOMIC POLICY TARGETING AFRICA? AND WHY SHOULD WE CARE?

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I. INTRODUCTION[1]

It is no secret that China's economy has been growing and developing at a rapid rate for many years. Energy is a critical element in this expansion, and oil is an important source of energy. Many observers feel that to feed its need for energy, China has particularly targeted Africa.[2] And to be sure, there have been a number of deals between Chinese oil companies with African governments. But, has the drive for oil led China to *focus* its economic activity on Africa?

In this paper I will look at the bilateral trade between China and other countries from 1990 through 2006. When looking at the overall picture, does it appear that China's trade is predicted by general factors, or is it the case that China has particularly strong trading relationships with African countries that have oil?

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1. *See* Richard J. Stoll, *Is Chinese Foreign Policy Targeting Sub-Saharan Africa?*, THE JAMES A. BAKER III INST. FOR PUB. POL'Y OF RICE U. (Dec. 2, 2011), http://www.bakerinstitute.org/publications/EF-pub-RiseOfChinaStoll-120211-WEB.pdf (The James A. Baker III Institute for Public Policy allows reproduction of the article provided that appropriate credit is given to the Institute.).

2. *See* Peter Brookes, *Into Africa: China's Grab for Influence and Oil*, THE HERITAGE FOUND. (Mar. 26, 2007), http://s3.amazonaws.com/thf_media/2007/pdf/hl1006.pdf; Cindy Hurst, *China's Oil Rush in Africa*, INST. FOR THE ANALYSIS OF GLOBAL SEC., (July 2006), http://www.iags.org/chinainafrica.pdf.

II. WHY IS THIS IMPORTANT TO TEXAS PRACTITIONERS?

While this is an interesting question, why should it be of interest to Texas practitioners? As will be discussed below, China is a major consumer of oil and the time has long since passed when China could supply its energy needs domestically.[3] Consequently, China must look to foreign countries to meet its needs.[4] This can provide both opportunities and difficulties for the oil and gas industry of Texas. And since this industry currently represents over 24 percent of the state economy,[5] its status—whether it is healthy or sick—reverberates throughout the entire state.

One opportunity is straightforward. As China's energy needs grow there is the opportunity to export oil to China.[6] But there is also a more complicated interaction between opportunities and difficulties. The specifics of this interaction depend on what strategy China pursues to meet its energy needs. If the focus is on Africa (the subject of the analysis of this paper), this is likely to reduce opportunities for Texas energy companies in Africa, but (because more Chinese focus in Africa means less focus on other oil-producing countries) it may lead to greater opportunities elsewhere. If the focus is not on Africa, but on other places, there will be more opportunities for Texas energy companies in Africa, and—at a minimum—greater competition for opportunities in other oil-producing countries.

Of course there are many other factors that will have an impact on the Texas energy industry. But the actions of the country with the world's second largest economy, with a high growth rate, and an insatiable need for more and more energy to support this will be an important influence.[7] My goal in this paper is to present some analysis that will shed some light on current (and perhaps future) Chinese behavior.

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3. *See* Hurst*, supra* note 3, at 3.

4. *Id.* at 4.

5. Charles B. Stockdale, *The Most Oil-Rich States*, 24/7 WALL ST. (Apr. 3, 2012, 6:56 AM), http://247wallst.com
/2012/04/03/ten-most-oil-rich-states/3.

6. *See U.S. Exports to China of Crude Oil and Petroleum Products*, U.S. ENERGY INFO. ADMIN.   (Feb.   27,   2013),   http://www.eia.gov/dnav/pet/hist/ LeafHandler.ashx?n=PET&s=MTTEXCH1&f=M (One indication of the possible opportunities for the Texas energy industry: US oil exports to China have increased over 5.5 times from 2006 to 2011.).

7. *See China Overview*, THE WORLD BANK, http://www.worldbank.org/en/country/ china/overview (last visited Jan. 23 2013).
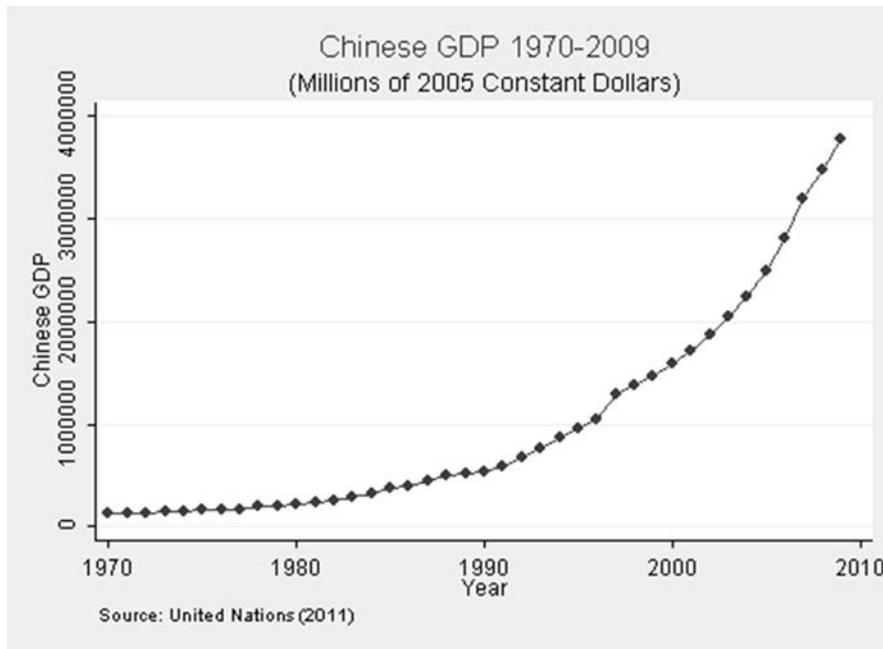
III. CHINESE GROWTH

Figure 1.

Figure 1 shows the growth of Chinese GDP since 1970. It is really not necessary to go on at great length about this plot; the pattern is clear. China has had a sustained period of economic growth. Two figures summarize this data. First, the average percentage growth rate from 1970 to 2009 is 9.3 percent.[8] Second, across the entire time period, there has only been one year of negative growth.[9] This is truly an impressive performance.

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8. *National Accounts Main Aggregates Database*, UNITED NATIONS STATISTICS DIV., http://unstats.un.org/unsd/snaama/selbasicFast.asp (last updated Dec. 2012) (In the box beneath "1.Step: Select Countries and/or Areas," double click "China, People's Republic of"; then, in the drop-down menu beneath "2.Step: Select Series," select "GDP, at constant 2005 prices - US Dollars"; then, in the box beneath "3.Step: Select Years," highlight from "2009" down to "1970," and click the "Add" button; finally, click the "Submit" button.).

9. *Id.* (indicating that the one year of decline was 1976; the decline was 1.6 percent).

IV. WHY GO AFTER OIL FROM AFRICA?

Energy supplies—particularly oil—are critical to the continued growth and development of China's economy. At first glance, a Chinese emphasis on Africa appears curious since other regions of the world have much larger oil reserves. But Ghazvinian points to a number of reasons why China appears to be devoting so much effort to a region that only contains perhaps 10 percent of the world's oil reserves:[10]

- Significant amounts of African oil (for example, the oil found in the Gulf of Guinea) are light, sweet crude; this is a highly desirable type of oil.[11] In addition, a number of Chinese refineries are configured to handle this type of oil; heavy oil (which is common in the Middle East) is more costly for China to refine.[12]
- Since Africa is surrounded by water, transportation costs are lower and in most cases less risky than shipping via pipelines.[13]
- Most African countries allow production sharing agreements (PSAs). While this means that oil companies must pay the costs of exploration and production, if oil is discovered, the oil company does not have to share revenues with the host government until after the company has recovered its initial costs.[14]
- Most African countries are not members of OPEC (Nigeria and Angola are exceptions; and Gabon was a member until 1995).[15]
- A number of African oil fields are offshore. This puts them at some distance from potential (and actual) sites of internal unrest.[16]
- Where else can China go for new oil? A great deal of the world's known reserves are already locked up.[17]

As a consequence, in 2010, four of China's ten fastest-growing imported crude suppliers were African countries.[18]

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10. JOHN GHAZVINIAN, UNTAPPED: THE SCRAMBLE FOR AFRICA'S OIL 9 (2007).

11. *Id.*

12. Amy Myers Jaffe & Stephen W. Lewis, *Beijing's Oil Diplomacy*, 44 SURVIVAL 115, 124–25 (2002), *available at* http://ipac.kacst.edu.sa/edoc/2006/157460_1.pdf.

13. GHAZVINIAN, *supra* note 11, at 10.

14. *Id.*

15. *Id.* at 11.

16. *Id.*

17. *Id.* at 11–12.

18. Daniel Workman, *China's Top Suppliers of Imported Crude Oil by Country in 2010*, INT'L TRADE (Mar. 5, 2011), http://comunidadecomex.blogspot.com/2011/03/chinas-top-suppliers-of-imported-crude.html.

Most of this reasoning applies to Texas energy companies as well. There are clear risks to initiating or expanding operations in Africa. And there are also great opportunities.[19] But China's actions will have a significant impact on the opportunities for Texas energy companies.

V. CHINA'S FOCUS ON AFRICA

Chinese focus on Africa goes beyond an interest in oil (and other resources). For example, in 2000, China sponsored the First Ministerial Conference of FOCAC, the Forum on China-Africa Cooperation, and 2012 marked the Fifth Ministerial Conference.[20] China declared 2006 "The Year of Africa;"[21] that year's FOCAC ministerial conference involved 48 African countries.[22] In that same year, high-ranking Chinese officials made significant state visits to at least sixteen African countries.[23] Chinese focus on Africa also extends beyond the governmental level; it is estimated that by the end of 2006 there were 750,000 Chinese citizens residing in Africa.[24]

There are numerous popular accounts[25] and scholarly studies[26] that paint a convincing picture of a Chinese presence in Africa that is already significant and still growing. But what if we step back from a focus on China's economic activity in Africa and put it in a broader context? What if we look at Chinese economic activity throughout the world? Using this broader focus does it appear that China is *disproportionately* involved with Africa? I will look at Chinese economic activity for an extended period of time (beginning in 1990) to shed light on this question.

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19. *See* Jeannie Kever, *Despite risk, Africa beckons as 'one of the last frontiers'*, HOUS. CHRON., Jan. 6, 2013, at A1.

20. *See* FORUM ON CHINA-AFRICA COOP., http://www.focac.org/eng (last visited Mar. 29, 2013).

21. Hayley Herman, *South-South Relations: Sino-African Engagement and Cooperation*, FORUM ON CHINA-AFRICA COOP. (July 7, 2010), http://www.focac.org/eng/zxxx/t718472.htm.

22. *See* FORUM ON CHINA-AFRICA COOP., *supra* note 21.

23. SARAH RAINE, CHINA'S AFRICAN CHALLENGES (2009).

24. SERGE MICHEL & MICHEL BEURET, CHINA SAFARI: ON THE TRAIL OF BEIJING'S EXPANSION IN AFRICA 4 (2009).

25. *See, e.g.*, GHAZVINIAN, *supra* note 11; MICHEL & BEURET, *supra* note 25.

26. *See, e.g.*, Hurst, *supra* note 3; BO KONG, CHINA'S INTERNATIONAL PETROLEUM POLICY (2010); RAINE, *supra* note 24; CHINA INTO AFRICA: TRADE, AID, AND INFLUENCE (Robert I. Rotberg ed., 2008).

VI. CHINESE INTERNATIONAL ECONOMIC ACTIVITY

In order to proceed, I need to find a measure of the level of economic interaction between states. As with most things of interest to scholars of international relations, there is no direct measure of the concept. So we are forced to find indirect measures; these are called indicators. The indicator most commonly used by international relations scholars to represent the economic interaction between states (countries) is international trade. Although it is not a perfect indicator, it has a number of advantages. One is that governments and international agencies (for example, the International Monetary Fund) keep track of these data for their own purposes (tariffs, taxes, etc.). That means that trade data is relatively easy to find for most countries and also exists for an extended period of years. A second advantage is that since state A's imports from state B are state B's exports to state A, we have a "double check" on trade values. However, the corresponding import and export figures are generally not identical. Imports are typically recorded as cost, insurance and freight—CIF—while exports are usually recorded as free on board—FOB. Third, in the current era, trade and foreign investment tend to be linked.[27] So, if we know the amount of trade from one state to another, we have a good idea of the foreign investment from one state to another. For all these reasons, trade is a good indicator of the economic relations between countries. Below, I will describe the particular trade dataset that I will use in the analysis. But now, I turn to how I will model the trade relationship between a pair of countries.

VII. HOW MUCH TRADE SHOULD WE EXPECT BETWEEN A PAIR OF STATES?

My approach to determining whether China is disproportionately focusing its economic attention on African and/or developing countries with oil is as follows:

- Predict the level of bilateral trade between China and other countries assuming there is nothing special about the pair of countries (including the fact that the other country has large reserves of oil).

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27. BARRY NAUGHTON, THE CHINESE ECONOMY: TRANSITIONS AND GROWTH 378 (2007).

- Determine whether dyads involving African countries with oil are systematically under-predicted by the model.
- Incorporate additional variables in the model that represent oil resources and whether the country is African. Predict the level of bilateral trade between China and other countries using this model.
- Determine if the additional variables help the accuracy of the model.

Next I discuss a simple model of bilateral trade.

A. *A Simple Gravity Model*

The gravity model is a simple model developed in the early 1960s to account for the level of trade between a pair of countries.[28] It "has long been one of the most successful empirical models in economics" despite the fact that it is usually viewed as "an intellectual orphan, unconnected to the rich family of economic theory."[29] It has also been used by political scientists.[30]

I now provide a brief description of the logic and components of a simple version of the gravity model. Suppose we wanted to predict the level of trade between two states: A and B. Assume we know nothing about the specifics of the overall relationship between the two of them and nothing about the specific items that are traded between them (for example, the rarity of the items or how important they are to the economies of each state). Under these circumstances, what factors could we use to predict trade? A simple gravity model uses:

- Previous level of trade between A and B. Like many economic and political variables, dyadic trade is not likely to fluctuate

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28. JAN TINBERGEN, SHAPING THE WORLD ECONOMY: SUGGESTIONS FOR AN INTERNATIONAL ECONOMIC POLICY 262–63 (Twentieth Century Fund, 1962).

29. James E. Anderson, *The Gravity Model*, 3 ANN. REV. ECON. 133, 134 (2011), *available at* https://www2.bc.edu/james-anderson/GravityModel.pdf.

30. Omar M.G. Keshk, Brian M. Pollins & Rafael Reuveny, *Trade Still Follows the Flag: The Primacy of Politics in a Simultaneous Model of Interdependence and Armed Conflict*, 66 J. POL. 1155, 1160 (2004); Omar M.G. Keshk, Rafael Reuveny & Brian M. Pollins, *Trade and Conflict: Proximity, Country Size, and Measures*, 27 CONFLICT MGMT. & PEACE SCI. 3, 6 (2010). These two articles directly inform my work.

dramatically from year to year. The level of A and B's trade this
year is very likely to be similar to their level last year.[31]
- The size of the economies of the two states. Bigger economies are
  capable of producing higher levels of exports. They are also
  capable of consuming higher levels of imports.
- The distance between the two states. Two states that are a great
  distance away from one another will have lower levels of trade due
  to higher levels of transportation costs.
- These factors interact together in a multiplicative fashion.[32]

While I (and many others) would argue that each of these relationships
is inherently reasonable, one can easily think of situations in which this
model would not produce accurate predictions. Consider the United States
and Cuba. While the Cuban economy is not large, the United States has the
largest single country economy in the world.[33] And Cuba is only a short
distance (by sea) from the United States. So a gravity model would expect
(predict) a significant amount of trade between the two countries. But we
know that is not true. The United States has maintained a trade embargo on
Cuba since the early 1960s.[34] This is one example where a critical factor
that determines trade (the political relationship between the two countries)
is totally absent from the gravity model. So the model should greatly
overpredict US-Cuban trade.

Consider, as well, states that have a great need for a specific item (for
example, oil). Oil reserves are not randomly located throughout the world.
If you need oil, you have to import it from wherever it is available. If
China really is concentrating its efforts to import significant amounts of oil
from developing countries in Africa, and if it is working hard to establish
significant economic relations with these countries, then the gravity model
should significantly *underpredict* Chinese trade with these countries. This

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31. In the original presentation of the gravity model, lagged trade was not included.
TINBERGEN, *supra* note 29. However, recent studies, such as the one in *Trade Still Follows
the Flag* by Keshk, Pollins, and Reuveny, have included lagged trade for the reason I noted
in the text. Keshk, Pollins & Reuveny, *supra* note 31, at 1161. Note that some scholars also
include the populations of both states in addition to their GDPs. Unfortunately, because of a
high degree of multicollinearity, I had to drop the population variables from my estimations.

32. The multiplicative effect is achieved by taking the natural log of all of these variables
before estimating the equation.

33. *See   Country   Comparison*,   CIA: THE   WORLD   FACTBOOK,
https://www.cia.gov/library/publications/the-world-factbook/rankorder/2001rank.html   (last
visited Mar. 29, 2013).

34. *See History of U.S. Policy*, CUBA POLICY FOUND, http://www.cubafoundation.org/
policy-2.html (last visited Mar. 29, 2013).

is because the size of the other states' economies is generally small and the distance between China and these countries is large, so the gravity model would predict only a modest amount of trade.

B. Incorporating African Countries with Oil

If China is targeting countries in Africa, this leads to a very different prediction as to the level of dyadic trade between China and other countries. It suggests that the following should have an important effect on the level of trade:

- The level of oil reserves within the other country
China's need for oil should lead it to engage in extensive economic relations with states that are believed to have large amounts of oil. A good proxy (indicator) for this is the amount of proven oil reserves in the state.
- Whether the country is in Africa
China would find it easy to exert influence over these countries. This would be true for several reasons. First, China has the third largest single country economy in the world.[35] Consequently, its economic power and resources should give it the tools to have a powerful presence in these countries including a significant trading relationship.   Second, since the earliest days of the Peoples' Republic of China, it has portrayed itself as a member of the developing world. While some may question this characterization today, China has worked hard to promote this view and argue that it has a great deal in common with developing countries such as those in Africa. Furthermore, China and most African countries saw (and still see) themselves as non-aligned countries, while most Middle Eastern oil producers were anti-Communist and sided with the West.   This meant the Chinese-African connection was politically compatible. This should facilitate the development of close relations between China and the countries of Africa.
- If the country has significant oil reserves *and* is located in Africa, there should be an even greater trading relationship with China
This argument notes that the status of the country and the presence of oil reserves should *interact* together and lead China to be particularly focused on this set of countries (i.e., the impact should be greater than the additive impact of the two factors separately).

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35. *Country Comparison*, *supra* note 34.

- If the country has one or more oil investment deals with China
  While the presence of oil reserves in a country is an indication of the potential for extensive economic relations, oil investment deals represent a tangible commitment from China. Such commitments should be associated with a significant economic relationship between the countries.
- If the country has one or more oil investment deals with China *and* is located in Africa
  Countries that share these characteristics should be particularly important to China and, therefore, have extensive economic relationships with it.

Note that this perspective is very different from that of the gravity model. Specific characteristics of countries (their location and whether they have oil) have a large influence on the trading relationship between China.

VIII. OPERATIONALIZATION

This study will involve all Chinese dyads (i.e., China paired up with every other state[36] in the world) and span the years 1990 through 2006. The end point is dictated by the limits of the trade dataset that I will use (discussed below). The starting point is admittedly a bit arbitrary, but it is not capricious. The 1980s, particularly the latter part of the decade, was a time of inward focus in China. Inflation and internal unrest were significant issues;[37] these issues culminated in the Tiananmen Square massacre in 1989.[38] With the end of the Cold War, Africa received much less attention from the West.[39] In the early 1990s the Chinese government realized that their domestic oil production was going to fall and that oil imports would be

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36. I use the Correlates of War Project definition of a state. For the period of time under study, a state is defined as an entity that is a member of the United Nations or (a) has a population greater than 500,000, and (b) receives diplomatic missions from at least two major powers. *Interstate System, 1816-2008*, CORRELATES OF WAR, http://www.correlatesofwar.org/COW2%20Data/SystemMembership/2008/System2008.html (last visited Mar. 29, 2013).

37. *See generally* RAINE, *supra* note 24 (examines emerging challenges resulting from China's relations with African nations).

38. *See* Nicholas D. Kristof, *China Erupts . . . The Reasons Why*, N.Y. TIMES (June 4, 1989), http://www.nytimes.com/1989/06/04/magazine/china-erupts-the-reasons-why.html?ref=tiananmensquare.

39. Li Anshan, *China's New Policy toward Africa*, *in* CHINA INTO AFRICA, *supra* note 27, at 21, 32.

necessary to continue to sustain their economic growth.[40]   So, it was at about this time (1990) that China began to extend itself internationally (both because it turned outward and the end of the Cold War broke down the antagonistic bipolar system), and at the same time, the West was contracting its involvement in Africa. Below are the operationalizations of the variables for the gravity model.

A. Dyadic Trade

The trade data is from the Correlates of War Project.[41]   The primary source of their trade data is the International Monetary Fund (IMF).[42]   Its data runs through 2006.[43]   Data is measured in current dollars.

B. GDP Data

The GDP data is from the United Nations database.[44]   GDP is measured in current dollars.

C. Distance

The distance data is from country capital to country capital. This data was calculated using the program EUGene.[45]

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40. *See* Mark Finley, *The Oil Market to 2030—Implications for Investment and Policy*, 1 ECON. ENERGY & ENVTL. POL'Y 25, 35 (2012) (discusses how China's import dependence has grown since the early 1990s), *available at* http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/reports_and_public ations/statistical_energy_review_2011/STAGING/local_assets/pdf/The_Oil_Market_2030.p df.

41. KATHERINE BARBIERI, OMAR M.G. KESHK & BRIAN M. POLLINS, CORRELATES OF WAR PROJECT TRADE DATA SET CODEBOOK, VERSION 2.01 (2008), *available at* http://correlatesofwar.org/COW2%20Data/Trade/Trade_Codebook_2.01.pdf;   *see   also* Katherine Barbieri, Omar M.G. Keshk & Brian M. Pollins, *Trading Data: Evaluating Our Assumptions and Coding Rules*, 26 CONFLICT MGMT. & PEACE SCI. 471 (introduces the new Correlates of War Trade Data Set).

42. BARBIERI, KESHK, & POLLINS, *supra* note 42, at 2.

43. *Id.* at 1.

44. United   Nations   Statistics   Division,   UN   DATA, http://data.un.org/Data.aspx?d=SNA&f=group_code%3a101 (last updated Oct. 11, 2012).

45. D. Scott Bennett & Allan C. Stam, *EUGene: A Conceptual Manual*, 26 INT'L INTERACTIONS: EMPIRICAL & THEORETICAL RES. INT'L REL. 179 (2000).

D. Oil Reserves

Proven reserves are taken from the tab "Oil – Proved reserves" in the spreadsheet that accompanies the BP Statistical Review of World Energy.[46]

E. Africa

This variable is coded one if the state is in Africa.

F. Oil Investments

The Energy Forum of the Baker Institute has collected data on Chinese oil investments from 1992 to 2011.[47]

IX. ANALYSIS

I conducted two series of regression analyses predicting dyadic trade with China. The first series of analyses are for the years 1990-2006 and contain:

- Gravity model.
- Gravity model with fixed effects.
- Gravity model plus African dummy, oil reserves, and their interaction.
- Gravity model plus African dummy, oil reserves, and their interaction with fixed effects.

The second series of analyses are for the years 1993-2006 and contain:

- Gravity model.[48]

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46. BP, BP STATISTICAL REVIEW OF WORLD ENERGY, 6 (June 2012), *available at* http://www.bp.com/assets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/ statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy _full_report_2012.pdf.

47. To gain access to the Baker Institute's research programs and publications, see *Center for Energy Studies*, RICE U. BAKER INST., http://www.bakerinstitute.org/programs/ energy-forum (last visited Mar. 29, 2013).

48. The analysis of the gravity model is repeated because the time period for the second set of analyses is not the same as the time period for the first set of analyses.

- Gravity model plus African dummy, yearly oil investment deals, and their interaction.
- Gravity model plus African dummy, yearly oil investment deals, and their interaction with fixed effects.
- Gravity model plus African dummy, total number of oil investments, and their interaction.
- Gravity model plus African dummy, total number of oil investments, and their interaction with fixed effects.

The first set of analyses (using oil reserves) represents African states that are *potential* partners with China. The second set of analyses (using oil investment deals) represents African states that are *actual* partners with China. Note that the following two variables are constant for a dyad and therefore drop out of fixed effects estimation: distance and the variable that indicates the country is in Africa.

A. *Gravity Model, Africa, and Oil Reserves*

Table 1. Predict Dyadic Trade with China, 1990-2006:
Gravity Model, Africa, and Oil Reserves

	Gravity Model	Gravity, FE	Oil, Africa	Oil, Africa, FE
Lag: Ln(Trade Data)	0.904*** (0.0074)	0.552*** (0.0147)	0.879*** (0.0083)	0.553*** (0.0148)
Lag: Ln(Chinese GDP Data) (0.0593)	0.281*** (0.0417)	0.870*** (0.0588)	0.319*** (0.0418)	0.882***
Lag: Ln(Other State GDP Data)	0.0371*** (0.0070)	0.730*** (0.104)	0.0470*** (0.0071)	0.702*** (0.109)
Ln(capital distance)	-0.181*** (0.0394)		-0.135*** (0.0407)	
Ln(Oil reserves)			0.0435*** (0.0165)	-0.0447 (0.124)
African dummy			-0.248*** (0.0471)	

(Africa)(Oil reserves)			0.0840 (0.0582)	0.113 (0.199)
Constant	0.351*** (0.488)	-5.976*** (0.432)	-0.0658 (0.496)	-5.902*** (0.448)
Observations	2,339	2,339	2,313	2,313
R-squared	0.911	0.747	0.913	0.749
Number of dyads		155		155

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1 presents the results using the gravity model and those additional estimations that include oil reserves. The results are clear cut. In each regression, all the variables that are part of the gravity model are in the expected direction and are statistically significant. The oil reserve dummy is significant and positive, which is consistent with the idea that China seeks extensive economic relationships with countries that have oil. As for the two other variables that are part of the alternative perspective, while the dummy variable for Africa is significant, it is negative. This is not the expected result; it indicates that, all else being equal, China trades *less* with countries in this region. The interaction between the African dummy and oil reserves is positive but not significant.

An additional step to assess the fit of the gravity model is to examine its residuals. Residuals are defined as the observed value from the regression minus the predicted value.[49] Recall that none of the variables in the gravity model represent Africa, oil reserves, or, most importantly, the interaction between these two variables. If China was disproportionately economically engaged with African countries that have oil, then there should be a large number of cases with these characteristics that have very big positive residuals. That is, just using a gravity model, trade should be

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49. *See generally* MERRIAM-WEBSTER, WEBSTER'S THIRD NEW INT'L DICTIONARY OF THE ENGLISH LANGUAGE 1931 (Philip Babcock Gove et al. eds., 3rd ed. 2002), *available at* http://www.merriam-webster.com/dictionary/residual (a residual is "the difference between results obtained by observation and by computation from a formula or between the mean of several observations and any one of them").

greatly under-predicted; so the difference between the observed and predicted value should be positive.

I identified the cases with extreme residuals[50] and then determined how many of them were (a) African countries, and (b) African countries with oil. Tables 2 and 3 show the number of extreme residuals for each of these categories, and also compare the proportions with the overall proportion of such cases in the entire dataset. Remember, each case is a country-year.

Table 2. Africa vs. Rest of Cases: Overall Dataset and Extreme Residuals

African State?	Overall Dataset	Extreme Residuals
No	1552 (66.4%)	33 (57.9%)
Yes	787 (33.6%)	24 (42.1%)
Totals	2339	57

Note: Only cases that were used in the regression analysis for the gravity model are included in the table (missing data removed a number of cases from the regression analysis).

Table 2 shows that in the overall dataset there are 787 Africa cases (one case per African country per year). This is about one third of the total dataset. If African cases were no different than the overall dataset, then we would expect the proportion of bad predictions—extreme residuals—for African cases would be the same as the proportion of African cases in the dataset—34%. Table 2 shows that the proportion of bad predictions for African cases is a bit higher than that; it is 42.1%. This suggests that there is something beyond the concepts of the gravity model that accounts for trade with African countries. As I said earlier, if what is happening is that China is trading more with African countries than expected, then most of the extreme residuals should be positive. However, an examination of the 24 extreme residuals reveals that they are evenly split between positive and

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50. By construction, residuals have a mean of zero. The residuals of the gravity model estimation have a standard deviation of about .86. I defined an extreme residual as having a value of 2 or above, or a value of -2 or less.

negative. Consequently, the pattern of mispredictions is not consistent with the notion that China is disproportionately engaged in Africa.

Table 3. African Countries with Oil vs. Rest of Cases: Overall Dataset And Extreme Residuals

African State with Oil?	Overall Dataset	Extreme Residuals
No	2137 (92.4%)	49 (92.4%)
Yes	176 (7.6%)	4 (7.6%)
Totals	2313	53

Note: Only cases that were used in the regression analysis for the gravity model are included in the table (missing data removed a number of cases from the regression analysis).

In Table 3, I do the same comparison as in Table 2, but the comparison is with African countries with oil. The situation with extreme residuals for countries with oil is straightforward. All residuals are negative. This means that the extreme residuals of gravity model represent *over predictions* of trade. Admittedly, this only involves four cases. But, it is totally inconsistent with the argument that China is disproportionately engaging in economic activity with this subset of countries.

Taken together, the foregoing analysis shows that the gravity model is a surprisingly good predictor of Chinese trade, despite the inclusion of additional variables that are consistent with the argument that China is targeting African countries with oil. In the next analysis, I will shift from looking at countries that are of *potential* interest if China is pursuing energy security (countries that have oil reserves) to examining countries that are of *actual* interest by including measures of the actual energy engagement of China.

B. Africa, and Oil Investment Deals

While the conclusions from the first set of analyses are reasonably clear-cut, some additional work would help clarify the findings and put them on a firmer foundation. The second set of analyses has a structure

similar to the first. All estimations start with the base of the gravity model and add additional variables that are meant to tap some of the characteristics that are associated with assertions that China is disproportionately targeting African countries with oil. I begin by discussing the non-gravity model variables that will be included.

I continue to include the dummy variable for African countries since it is a simple and direct indicator of the arguments for a Chinese foreign policy of targeting Africa. In the previous analyses the level of oil reserves was used. This is an indicator of *potential* Chinese interest. That is, if the arguments for Chinese targeting are correct then the potential set of African countries of interest are those with oil. But China also has a number of *direct energy interests* in the region: the set of countries with which China has made one or more oil deals. So, instead of using a variable with oil reserves, I use several different variables representing the oil investment deals that China has with each country.[51]

Data on Chinese oil investment deals are available beginning in 1992 (since I lag variables this means the subsequent analysis will be conducted over the time period 1993-2006). Potentially, there are a number of ways to use such data. But, in the absence of a body of previous work using such data, it is prudent to begin with several simple measures. In the analysis that follows, I use two different indicators. The first is the number of investment deals concluded in each year. This represents new involvements. The second is the total number of deals to date. This is an indication of the level of Chinese involvement in oil in that country. As with other variables in the analyses, these variables are lagged a year and, of course, they are logged. Figure 2 plots the number of new deals each year. It displays both the total number of deals and the number of deals in Africa.

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51. This data was collected by the Baker Institute Energy Forum. I want to thank Amy Jaffe, Director of the Baker Institute Energy Forum, James Coan, Research Associate & Assistant to the Director, Baker Institute Energy Forum, and several Baker Institute Energy Forum interns for making this data. Making data is a long, difficult, and boring process. We should be grateful to those individuals who put in the effort to provide us with this vital service. *See* BAKER INST., http://bakerinstitute.org (last visited Feb. 1, 2013).

Figure 2.

Total Number of Chinese Oil Investments Per Year
1992-2011
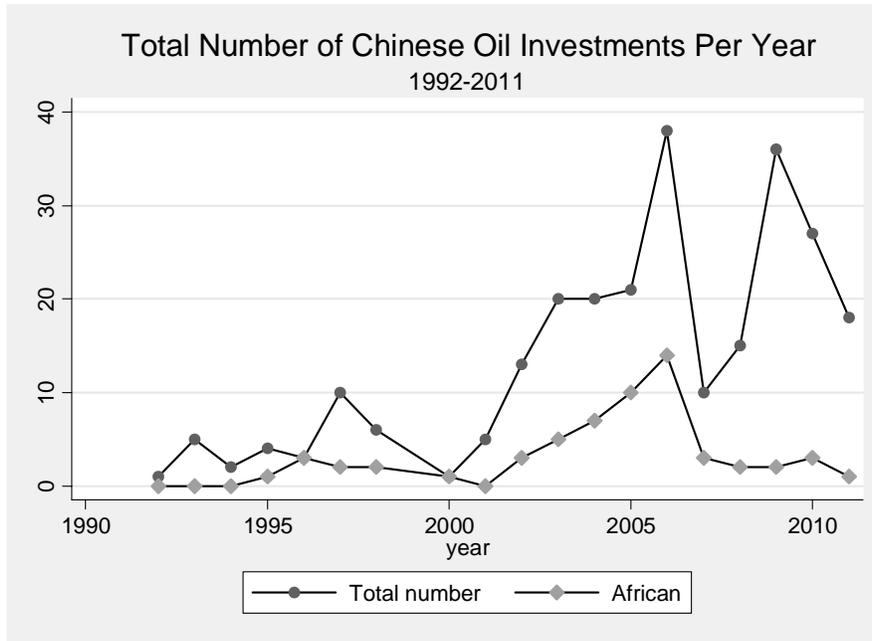
As can be seen, there is a rough trend of increasing the total number of deals through time. But, the picture in Africa is a bit different. There is an increase in deals through time, but it spikes in 2006. Of course, the number of deals ignores a lot of other information, such as the amount of the investment and the subsequent amount of oil discovered. But, incorporating this kind of information is not easy. Deals can be signed but not carried out. Deals can be changed. Oil may or may not be found. These complications have led me, for the time being, to focus on the simplest possible indicators of Chinese oil investment.

Table 4. Predict Dyadic Trade with China, 1993-2006: Oil Investments, Africa, Total Oil Investments.

	Gravity model	Deals, Africa	Deals, Africa, FE	Total Deals, Africa	Total Deals, Africa, FE
Lag: Ln(Trade Data)	0.946*** (0.00670)	0.933*** (0.0073)	0.499*** (0.0180)	0.931*** (0.0073)	0.498*** (0.0180)
Lag: Ln(Chinese GDP Data)	0.303*** (0.0457)	0.327*** (0.0459)	1.179*** (0.0677)	0.324*** (0.0461)	1.181*** (0.0700)
Lag: Ln(Other State GDP Data)	0.0165*** (0.00612)	0.0239*** (0.0063)	0.651*** (0.106)	0.0251*** (0.0063)	0.641*** (0.106)
Ln(capital distance)	-0.0663* (0.0340)	-0.0232 (0.0384)		-0.0222 (0.0351)	
African Dummy		-0.176*** (0.0404)		- 0.187*** (0.0390)	
Ln(Number of deals)		0.0496 (0.200)	-0.0230 (0.190)		
(Africa)(Number of deals)		0.270 (0.406)	0.0524 (0.387)		
Ln(Total number of deals)				0.0091 (0.0662)	-0.0336 (0.1000)
(Africa)(Total number of deals)				0.199 (0.122) `	0.2207 (0.1638)
Constant	-1.218** (0.483)	- 1.625*** (0.406)	- 7.528*** (0.455)	- 1.595*** (0.492)	- 7.478*** (0.463)

Observations	1,982	1,982	1,982	1,982	1,982
R-squared	0.940	0.940	0.766	0.940	0.767
Number of dyads			155		155

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of these new analyses are displayed in Table 4. I begin by repeating the analysis using the gravity model over the shorter time period. These results are consistent with those presented in Table 2. All the variables that are part of the gravity model are statistically significant and in the predicted direction. But, note that the log of distance has declined in significance from the results presented in Table 1.[52] As in the previous analysis, the dummy variable for Africa is significant, but negative. All else being equal, the level of Chinese trade with these countries is *lower* than its trade with the rest of the world. As well, none of the variables that tap China's energy interests are significant. If China's economic involvement is indexed by its dyadic trade, there is no tendency for China to be disproportionately involved with those countries in Africa that supply it with oil.

X. DISCUSSION

In this paper, I have found that a simple gravity model does a very good job of accounting for Chinese trade. While the predictions from this model are not perfect, an examination of the gravity model's mispredictions (the residuals) does not support the argument that Africa is a particular focus of Chinese economic activity. As well, incorporating several sets of variables that are indicators of the reasons why China is supposed to be targeting these countries shows these additional variables contribute very little to the fit of the model. Why is this the case? Before discussing some

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52. It is beyond the scope of this paper to conduct an extensive exploration of the reasons for this. But I might speculate that as China grows economically, distance plays a smaller and smaller role in its trade relationships.

of the issues with the research presented here that may have obscured a Chinese focus on Africa, let me present a simple picture of Chinese trade patterns for the time period under study; this is displayed in Figure 3.

Figure 3.
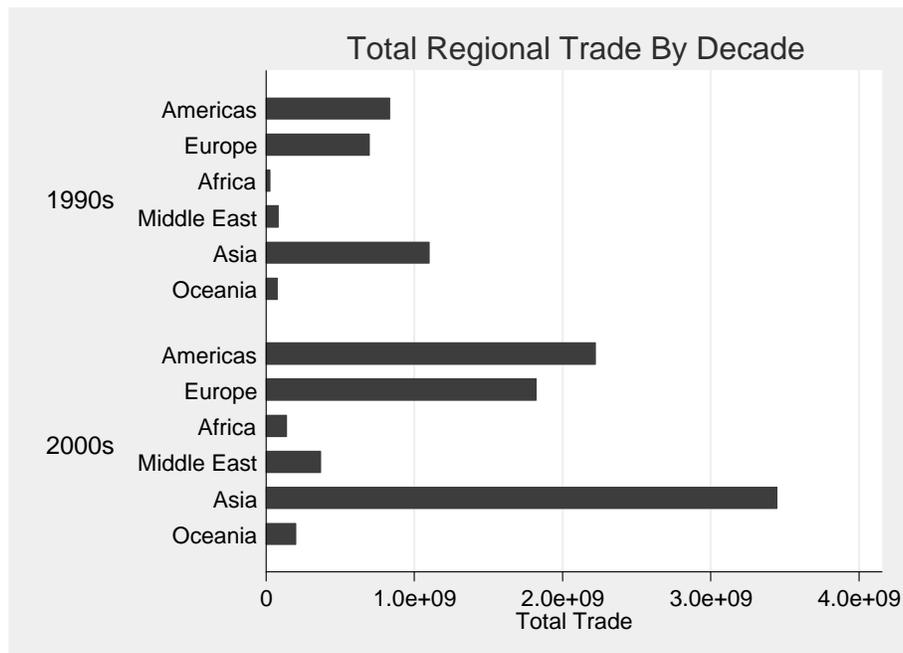
The implications of Figure 3 are straightforward. First, there has been a tremendous increase in the amount of Chinese trade. Second, the ranking of trade by region is unchanged; for example, Asia is the region with the largest amount of trade with China in both decades. Third, although there has been a tremendous increase in trade with Africa, it remains the region with the *smallest* amount of trade with China. By focusing only on Africa we see the great growth in economic activity. But, when put in comparative perspective, we see that China is more engaged economically with every other region in the world. This is consistent with the analyses in this paper. But, it is also important to consider the possible weaknesses of the work presented here.

Earlier in the paper, I argued that trade is a widely-used measure of economic activity and that economists have noted that it correlated with

other forms of economic activity.[53] This makes dyadic trade a good stand-in (indicator) of the broader economic relationship between countries. But, nevertheless, it may be an inadequate indicator for this study. The results of the analysis might be different if a more all-encompassing measure of Chinese economic involvement was the dependent variable.

The analyses in this paper presume a simple and direct link between the putative causes of Chinese economic activity (for example, the amount of oil in the country or the number of oil investment deals) and its effects (high levels of trade). Since this paper is a preliminary effort, I felt that it was important to begin with the simplest approach. But, that approach may be inadequate and only a more sophisticated one will uncover the expected relationship between African oil and Chinese economic involvement. For example, it may take years for the impact of oil reserves (or oil deals) to have an impact on overall Chinese economic activity.

A final point is that the analyses presented here assume that Chinese economic activity is conducted as if it were directed by a single rational actor. This assumption is commonplace in the international relations literature (and with many other academics and policy makers, as well). But, that assumption may be a poor way to model Chinese economic activity. China has four major oil companies: China National Petroleum Corporation (CNPC), China Petroleum and Chemical Corporation (Sinopec), China National Offshore Oil Corporation (CNOOC), and China National Chemicals Import and Export Corporation (Sinochem).[54] It is possible that each company (note that all of them are profit-making entities) has different goals and/or operates differently from the others. So, there is no "China"; there are four independent actors. That would call for a very different (and vastly more complicated) model.

XI. CONCLUSION

China is growing rapidly and has done so for an extended period of time. One of the keys to maintaining and increasing this growth is energy. But, China's energy needs cannot be met by its own resources. It must look outside its borders to obtain enough energy. Many observers have noted that China is increasingly involved in Africa. It appears to many that China

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53. *See* BARRY NAUGHTON, THE CHINESE ECONOMY: TRANSITIONS AND GROWTH 377–78 (2007) (discusses how trade correlates with other economic activities).

54. KONG, *supra* note 27, at 13–14.

is particularly focused on countries in this region that have oil. And, there is plenty of evidence that supports this assertion.

But, the analysis presented here offers a simpler view of what predicts Chinese economic activity (as measured by dyadic trade). A gravity model does a good job of accounting for their trade from 1990-on. As well, including additional variables that are indicators of a Chinese focus on Africa and oil, did not improve the predictions. In fact, the analysis of this study suggests that China is *less* economically engaged in Africa than it is in other regions of the world. At least in its broad contours, Chinese international economic policy does not play favorites. The overall volume of Chinese trade is well-predicted by simple factors that are unrelated to politics, history of friendship or enmity, and special needs.

The plain truth is that, while Chinese trade showed tremendous increases (trade for the years of the 2000s in this study is about 190 percent higher than trade for the entire decade of the 1990s), the rank order of trade among the regions has not changed (refer back to Figure 3). It is true that Chinese trade with Africa as a whole has increased by over 350% from the decade of the 1990s to the 2000s. But this only means that Africa moved from 1% of total Chinese trade to 1.7% of total Chinese trade. Contrast this to trade with the number one ranked region—Asia. It increased from 39% of total trade to 42%.

What does this mean for Texas practitioners? The analysis in this paper shows that while China is importing a great deal of oil from Africa, the overall economic relationship between China and this continent is not as close as a number of observers have claimed. Consequently, there may be more opportunities for Texas energy companies in Africa than most observers assume. But, these opportunities carry significant risks[55] and these risks must be weighed carefully. Not every opportunity should be seized.

There is a flip side to the fact there may be more opportunities in Africa. While China's economic influence in Africa may be somewhat less than is commonly assumed, China is actively engaged throughout the world. In particular, China is heavily involved economically in Asia, the Americas, and Europe. Consequently, while Texas practitioners may find more opportunities in Africa than they anticipate, they may find much more competition in other regions.

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55. Kever, *supra* note 20.

This article is not the last word on what motivates Chinese behavior in its quest for energy and its overall economic relations. But, I hope it does illustrate that we should not just accept the conventional wisdom but subject it to systematic investigation. The results of this kind of work can shed some light on the world and at the very least force us to confront the conventional wisdom. In this case, the results suggest that the opportunities for Texas practitioners may be somewhat different than those people who focus on China's quest for energy assume.

China is a rapidly growing power. It needs energy to sustain its growth and Africa is a logical source for this; we can expect that Chinese involvement in Africa will increase. But, this should not obscure the greater truth: China is simply becoming a more important international actor. This makes China a competitor to the United States. We can expect it to contend with the United States across a variety of arenas like natural resources, investments, and overall political influence. We can also expect that China's actions will create both opportunities and problems for Texas practitioners.