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Energy Production and Trade: An Overview of Some Macroeconomic Issues

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Executive Summary

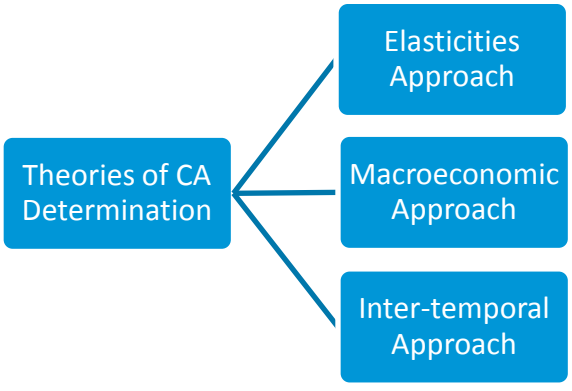
Large increases in American oil and gas production have opened a debate about relaxing export restrictions on crude oil and natural gas. Unfortunately, many of the approaches used to defend opposing positions can be difficult to understand and follow. This paper attempts to review, outline, and clarify some of the key points associated with trade theory, evidence, and data as they relate to energy exports and macroeconomics. The goal is to sketch a framework for thinking about energy production and trade that fits with standard macroeconomic theory, both in international trade and international finance.

Macroeconomic accounting that incorporates interactions with other countries is substantially more complicated than for a closed economy. The complications arise from a need to account for international trade in goods, services, and assets; payments between countries for the use of labor, capital, and land; and any transfers of income or assets across borders. For the United States, all of this information can be found in the national income and product accounts (NIPAs) produced by the Bureau of Economic Analysis (BEA). BEA also provides disaggregated data on trade in energy goods based on estimates compiled by the U.S. Census Bureau.

One particularly well-known statistic found in the NIPA tables is the balance on the current account (CA). The CA balance, which includes the balance of trade, measures transactions in goods, services, and income between U.S. residents and non-residents. By definition, the CA balance is approximately equal in absolute value to the balance on the financial account, which summarizes net U.S. trade in assets. The CA balance is also approximately equal to the difference between domestic savings and investment.

Because of its historical importance, there is a substantial amount of research into the determinants of CA balances. In general, studies find that four or five factors are most important in determining CA balances, both across countries and time. These include fiscal policy, competitiveness, relative productivity, the attractiveness of financial markets, and demographic structure. Theories of current account determination put more or less emphasis on each of these factors [Figure S1].

Figure S1: Common theories of CA determination



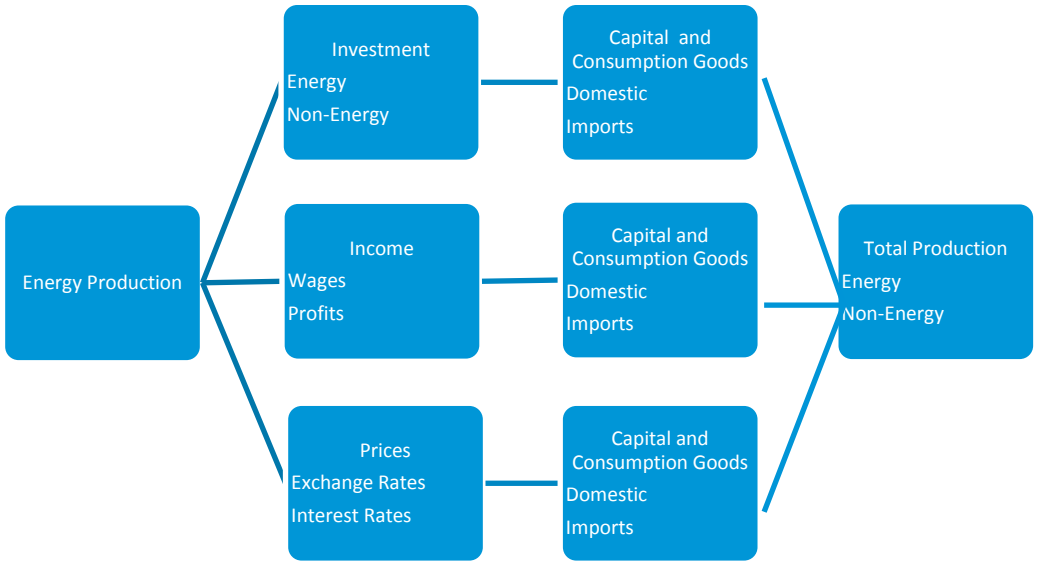
The elasticities approach focuses on the importance of competitiveness in determining the trade balance, and therefore the CA balance. The macroeconomic approach emphasizes that a country's trade balance is by definition the difference between domestic savings and investment, and that it is the drivers of either savings or investment that determine the CA balance. The focus here can be either on domestic savings and investment or foreign savings and investment. The inter-temporal approach occupies a middle ground. Table S1 summarizes theoretical predictions to a hypothetical removal of crude oil export restrictions, assuming no changes in crude oil imports or prices

Table S1: Prediction of each theory to a hypothetical crude oil export scenario

Approach	Prediction
Elasticities	Improvement in the CA balance followed by a gradual deterioration.
Domestic Savings/Investment	Possibly small CA balance changes in either direction in the short-run, but these are unlikely to persist.
Foreign Savings/Investment	Improvement in U.S. CA balance in short-run if global crude oil production remains the same, unclear in long-run.
Inter-temporal	Short-run improvement in the CA balance likely to fall over the long-run unless there is a reduction of non-U.S. savings.

Even though the CA balance is a widely discussed statistic, economic theory does not offer a definitive prediction as to how (or whether) it impacts economic activity. For this reason, understanding and quantifying the economic impacts of energy trade requires consideration of variables beyond the trade balance. Figure S2 outlines an intuitive way to conceptualize how energy trade affects economic activity that emphasizes an economy's total production.

Figure S2: A production-based visualization of how energy trade impacts economic activity

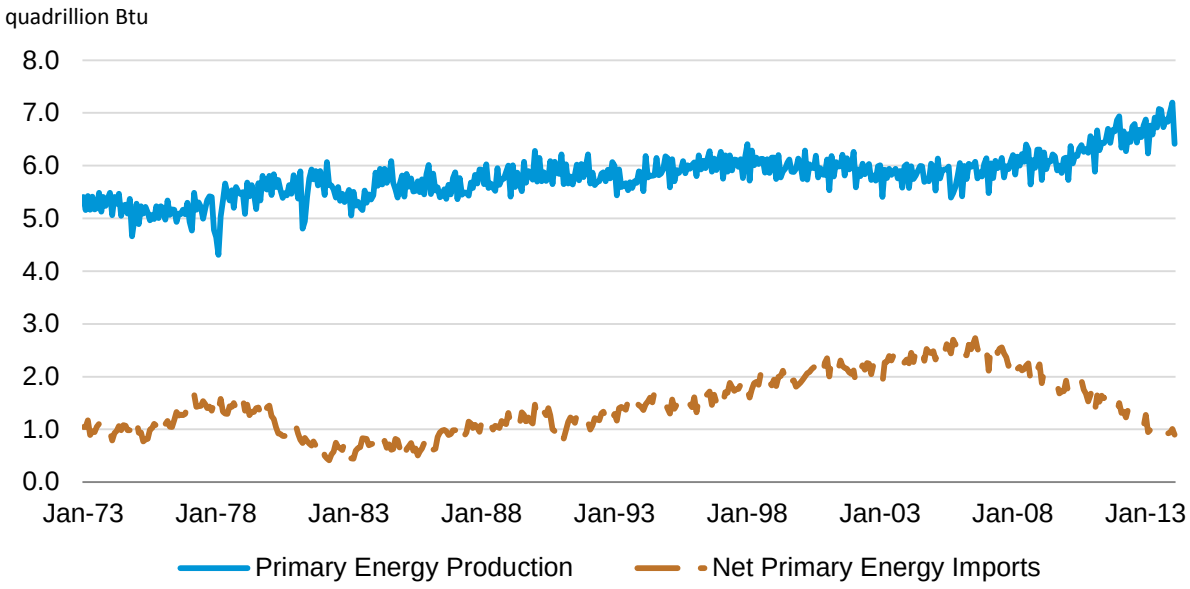


The basic idea is that an initial increase in energy production, possibly for export, is associated with higher investment, income, and a stronger exchange rate. In total, these lead to increased domestic production and imports of capital and consumption goods. The net result is that total production of goods and services in the economy is higher, but by a different amount than the initial energy production increase.

Introduction

In September 2005 American energy production was 5.4 quads [quadrillion British Thermal Units (BTUs)] and net energy imports were 2.4 quads [Figure 1] By September 2013 energy production had risen to 6.7 quads and net energy imports had fallen to 1.1 quads. The driving factors behind these changes are well known –sharp increases in oil and gas production, specifically oil and gas production from shale resources.

Figure 1. U.S. primary energy production and net primary energy imports, Jan 1973 - Feb 2014



Source: EIA

Greater domestic oil and gas production has also opened a debate about relaxing export restrictions on crude oil and natural gas. Current policy effectively bans U.S. crude oil exports through the Energy Policy and Conservation Act of 1975 (exports of petroleum products are generally permitted).[1] There is more scope for exports of natural gas, although the Natural Gas Act of 1938 requires U.S. Department of Energy (DOE) authorization to import or export natural gas to or from the United States.[2]

The debate over energy exports has touched on the economic impacts of loosening trade restrictions, and also implications for energy prices, energy markets, and the U.S. trade balance. In general, proponents of allowing increased U.S. oil and gas exports argue that the economic benefits to energy and related industries outweigh the costs, while opponents counter that both American firms and

[1] For more on these restrictions see Neelesh Nerurkar, "U.S. Oil Imports and Exports," CRS Report for Congress R42465, April 2012 or Phillip Brown, Robert Pirog, Adam Vann, Ian F. Fergusson, Michael Ratner, and Jonathan L. Ramseur, "U.S. Crude Oil Export Policy: Background and Considerations," CRS Report for Congress R43442, March 2014.

[2] The Natural Gas Act of 1938 was amended in 1992 so that exports to countries with which the U.S. has a free trade agreement are considered in the national interest and fast-tracked for approval. See http://energy.gov/fe/downloads/summary-lng-export-applications for details on liquefied natural gas export applications and approvals.

households will be hurt by higher prices. Unfortunately, many of the approaches used to defend these positions can be difficult to understand and follow.

One reason for this is the complexity of the issue. Energy prices, production, and demand are determined both in and outside of formal markets, and are related to many aspects of the economy. Another complication is that the international dimension makes it difficult to conceptualize some of the impacts associated with altering export restrictions. A final difficulty is that analysts use different models, theories, and analytical approaches when considering this issue.

This paper attempts to review, outline, and clarify some of the key points associated with trade theory, evidence, and data as they relate to energy. The goal is to sketch a framework for thinking about energy production and trade that fits with standard macroeconomic theory, both in international trade and international finance.

The paper begins with a discussion of theories that explain how the balance of trade (more broadly the balance on the current account) is determined. Evidence on these theories is also presented, as is an application to energy exports. This is followed by a section that provides a conceptual framework for understanding how energy exports impact the economy and presents results from a back-of-the-envelope calculation. An appendix to the paper reviews basic concepts: how trade is measured, the relationship between trade in goods and assets, and also discusses data on energy trade.

Energy trade and current account determination

The stock of net foreign assets held by a country, because it can be interpreted as net external wealth, has obvious importance. Historically, this importance has also filtered down to the underlying flows that vary the stock over time. This has led to a large body of research on the implications of current and financial account balances and several well-known theories of their determination.[3] The emphasis in this work has overwhelmingly been on current account balances, in particular current account deficits.[4]

Why does the current account balance matter?

Many analysts believe the current account balance is an important country-level macroeconomic statistic. However, the balance on the current account is generally not considered an economic fundamental in and of itself. Rather, it is the result of interactions between many different variables such as savings, investment, prices, and economic growth. But why is it so widely-discussed?

One reason is that the balance on the current account, especially when in deficit, may be symptomatic of other things. Many economic crises, across time and countries, have been preceded by large CA deficits. Although by no means have all large deficits had such impacts, their association with such crises at least bears watching. There are also macroeconomic concerns with current account deficits. For starters, the trade balance is a component of GDP as calculated by expenditures. And there is evidence that quick reversals of large CA deficits can reduce economic performance.

[3] For more on these see Catherine L. Mann, "Perspectives on the U.S. Current Account Deficit and Sustainability," *Journal of Economic Perspectives*, 16(3), 2002, p. 131-152.

[4] The balance on the financial account has been emphasized less because financial flows in the past were much smaller than they are today. As a consequence the net stock of external assets was smaller, making valuation effects less important as well. However, this has changed in the last twenty to thirty years and the financial account balance has been emphasized more.

This conventional wisdom on the importance of CA balances has oscillated over time.[5] In the aftermath of World War II financial flows between countries were limited and the CA balance effectively represented a country's trade balance. Some argued that an excess of imports over exports restricted the ability of a poorer country to grow. Others subscribed to the view that a positive trade balance leads to greater economic output. During this period the balance on the current account was considered an important number to understand and even maximize.

This changed during the 1960s and 1970s as financial flows between countries increased. Many countries experienced large swings in current account balances during this period, which renewed interest in better understanding the determinants of such changes. Viewing the CA balance through the lens of macroeconomic concepts such as national savings, investment, and GNE supplemented the previous emphasis on trade flows.

The logic follows directly from the definition of the CA balance. Ignoring net factor income and transfers, it is the difference between the value of exports and imports; but the CA balance is also the difference between national savings and investment (or GDP and GNE). From a savings/investment perspective the balance on the current account also represents the imbalance between domestic savings and investment. In particular, CA deficits can follow from attractive investment opportunities relative to available national savings.

This implies that CA deficits may not be a bad thing if the imbalance is driven by investment, as investment is commonly believed to be important for long-run economic growth. Alternatively, a country which is not saving enough to finance its investment can still reap the rewards of such investment through borrowing, without reducing consumption. This logic is captured in the "Lawson Doctrine", named for former British Chancellor of the Exchequer Nigel Lawson, which was popular during this time. The doctrine stresses that current account deficits should not be a concern as long as fiscal accounts are balanced. Interpreted more broadly, it states that CA deficits that reflect private behavior are not a concern.

The Latin American crisis in the early 1980s led to a reevaluation of these views and again put an emphasis on the CA balance as an important statistic. Countries that ran CA deficits, either with rising investment (Brazil and Mexico) or with rising investment and balanced budgets (Chile), all experienced severe economic contractions. This was reinforced by the Asian financial crisis of 1997-1998, where many of the worst-affected countries had large CA deficits.

A large body of research since the Asian financial crisis has led to the current conventional wisdom that CA balances may be important. Many studies have shown that a CA deficit, even a large one, does not necessarily mean a crisis will occur. Instead, greater attention has been devoted to the adjustments from large CA deficits and how they might impact economic activity.[6] This line of research has

[5] See Sebastian Edwards, "Does the Current Account Matter?" NBER working paper 8275, 2002 and Maurice Obstfeld, "Does the Current Account Still Matter," Richard Ely Lecture, January 2012.

[6] See for example Caroline Freund and Frank Warnock, "Current Account Deficits in Industrial Countries: The Bigger They are The Harder They Fall?" NBER Working Paper 11823, 2005 and Sebastian Edwards, "Thirty Years of Current Account Imbalances, Current Account Reversals and Sudden Stops," NBER Working Paper 10276, 2004.

underscored the importance of factors such as the size and persistence of CA deficits, the nature of capital flows, and openness to trade.

Evidence and theories of current account determination

The evolution of beliefs on the importance of CA balances has been supplemented by many empirical studies on the most important determinants of CA balances and corresponding theories.[7] In general, the empirical studies find that four or five factors are most important in determining CA balances, both across countries and time.[8] These are shown in Table 1.

The first of these is fiscal policy, whereby government savings lead to swings in the balance on the current account. Relative prices, often called competitiveness, have also been found to be an important determinant of the CA balance. Differences in prices (including wages) directly impact both import and export demand.

The potential for investment, either due to expectations regarding a country's productivity, credit availability, or the level of attractiveness in its financial markets, is another key factor. Financing greater investment expenditures requires higher domestic savings, greater asset exports, or a combination thereof. This directly impacts the CA balance. Another factor is the demographic structure of a country. Younger countries tend to save more, while older countries have lower savings, and CA balances will reflect this difference. A final factor that is sometimes identified as important for determination of the CA balance is the price of oil.

Table 1. Key empirical determinants of CA balances

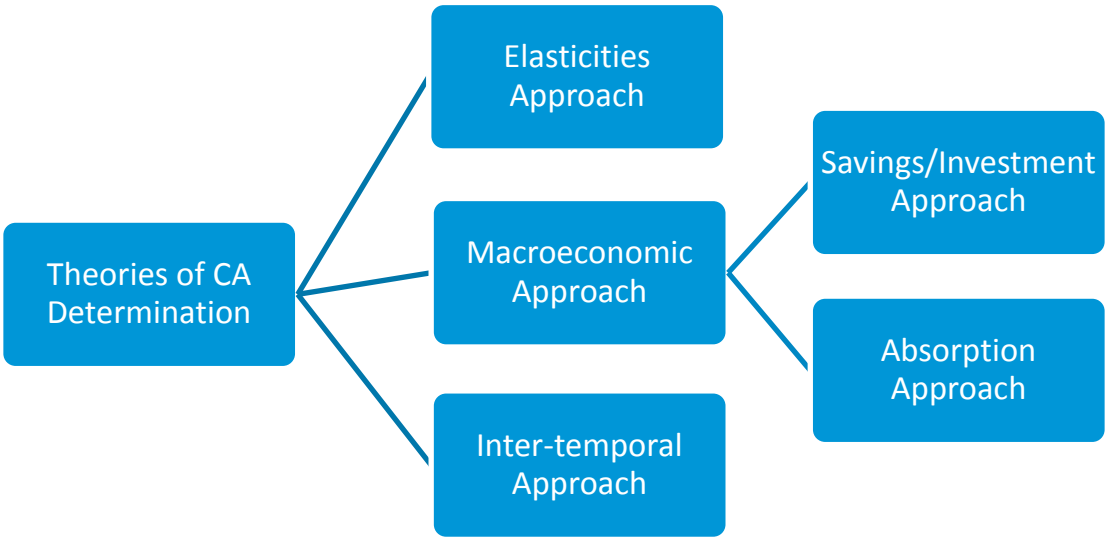
Fiscal Policy
Competitiveness
Relative Productivity
Attractiveness of Financial Markets
Demographic Structure
Oil Price

While these factors are all based on empirical studies, each also plays a role in theories of CA determination. These theories are broadly categorized as emphasizing the role of trade flows or the difference between savings and investment in determination of the CA balance. Each of these perspectives is spelled out in more detail below and Figure 2 shows a summary of the common approaches.

[7] See for example Cesar Calderon, Alberto Chong, and Norman Loayza, "Determinants of Current Account Deficits in Developing Countries," World Bank Manuscript, March 2002 and Menzie D. Chinn and Eswar S. Prasad, "Medium-term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration," *Journal of International Economics*, 59, 2003, p. 47-76.

[8] These are summarized in Jean-Baptiste Gossé and Francisco Serranito, "Long-run Determinants of Current Accounts in OECD Countries: Lessons for Intra-European Imbalances," *Economic Modelling*, 38, 2014, p. 451-462.

Figure 2. Common theories of CA determination



Trade as the driver of the current account balance

Conventional wisdom holds that, all else equal, increasing exports and decreasing imports will lead to an improvement in the balance on the current account. That is, either the CA deficit will shrink or the CA surplus will rise. Such reasoning is behind the elasticities approach to current account determination.

The elasticities approach was most popular in the post-World War II era when financial flows between countries were limited and the CA balance effectively represented a country's trade balance. It emphasizes the relation between relative price and income changes and trade flows.[9] Variations in the value of the CA balance in the elasticity approach are due to changes in the real exchange rate or income. The real exchange rate is used synonymously with competitiveness in popular discussions of the trade and current account balances.

The basic model assumes that a country's trade balance depends on three things: the real exchange rate, domestic income, and foreign income. The real exchange rate is the relative price of goods and services in two countries. It is referred to as the real effective exchange rate when two or more countries are involved. The real exchange rate is a measure of purchasing power in terms of goods and services; its value corresponds to the number of "baskets" of foreign goods and services which can purchased by one such domestic basket.[10] If the real exchange rate rises then each basket of domestic goods and services buys additional baskets of foreign goods and services. This is an appreciation of the real exchange rate, and depreciation works in the other direction.

Under the elasticities approach, the volume of a country's exports are inversely related to the real exchange rate and positively related to foreign income. That is, an appreciation of the real exchange

[9] For more on this see Charles van Marrewijk, "Basic Exchange Rate Theories," CIES Working Paper 0501, University of Adelaide, 2005.

[10] It is defined as the nominal exchange rate, expressed as domestic currency per unit of foreign currency, times the ratio of the foreign to home price levels.

rate means that domestic goods are more expensive for foreigners, so they demand fewer. But if foreign income rises so does the demand for domestic goods. The volume of a country's imports is positively related to the real exchange rate and domestic income. This is because an appreciation of the real exchange rate makes foreign goods cheaper for domestic consumers. Greater domestic income will also raise the demand for foreign goods.

Consider the case of the United States. The U.S. has run a CA deficit, owing primarily to a negative trade balance, since around 1970. Such a trade imbalance in the elasticities approach could either be due to a strong U.S. real exchange rate or income growth in the U.S. that is above that in its trading partners, or some combination of these. Both a stronger real exchange rate and faster U.S. income growth lead to fewer American exports and greater imports, resulting in a negative trade balance.

The directional responses of exports and imports in the elasticities approach are subject to an important assumption from which its name is derived. To illustrate, consider an appreciation of the real exchange rate. From the discussion above there should be an expectation that the volume of imports rises and that of exports falls, reducing the value of the trade balance, and also the value of the CA.

But the value of the trade balance reflects both the prices and volumes of imports and exports (price times quantity). An appreciation of the real exchange rate means that the value of a given level of exports is higher (the price effect). The higher price should lead to lower foreign demand (the volume effect). The underlying assumption is that the volume effect dominates the price effect for exports. A similar story holds on the import side as the value of a given level of imports has fallen, but the volume can rise because they are less expensive for domestic consumers.

How to know when volume effects dominate price effects? The Marshall-Lerner condition shows that volume effects dominate when the sum of the price elasticities of import and export demand exceed one.[11] Studies show that the Marshall-Lerner condition does hold in most countries, but only over the medium-to-long-run. In the short-run it appears that price effects are most important. In the previous example this means real exchange appreciation first improves the CA balance (price effect domination) before leading to a decrease in the balance.[12] This pattern is called the J-curve. It is observed because the behavior of consumers, firms, and governments in adjusting their volume of purchases takes longer than price adjustment.

[11] The price elasticity of import demand is the percentage change in the demand for imports given a one percent change in the price of imports. The price elasticity of export demand is defined analogously.

[12] One possibility is that in the short-run a depreciation of the nominal exchange rate can lead to an improvement in the CA balance. The idea is that in the short-run prices are fixed so a nominal deprecation leads to depreciation in the real exchange rate, which will result in greater exports and fewer imports assuming the Marshall-Lerner condition is met. The lack of this option for countries in the Euro-zone as a means to spur net exports has been much discussed.

Savings and investment as drivers of the CA and FA balances

The elasticities approach is popular because it is both intuitive and straightforward. However, it ignores other factors that have been found to be important for CA balances, namely savings and investment and financial flows. Each of these factors is commonly hypothesized to explain the current U.S. CA deficit.[13]

An alternative to a trade-based explanation of CA balances is that they are driven by the difference between savings and investment in a particular country, sometimes called the savings-investment balance approach. Others might argue these are driven by the difference between GDP and GNE, called the absorption approach. Either way, the primary focus is on the macroeconomic aggregates, and determination of the CA balance centers around savings, investment, and expenditures.

In this theory the driving forces are whatever governs overall savings, investment, or expenditures. Generally these include consumer preferences, domestic fiscal policy, demographic structure, investment opportunities, and the attractiveness of domestic financial markets. In the elasticities approach it is clear how imports and exports are affected by changes in relative prices or income. The macroeconomic approaches are not as straightforward.

The general idea is that the imbalance between savings and investment (or GDP and GNE) causes changes in real interest and exchange rates, and these result in variations in exports and imports of both goods and assets. To illustrate, consider a country with investment flows in excess of domestic savings. Such an imbalance raises the real interest rate higher than it otherwise would have been (on a risk-adjusted basis). This leads to higher foreign demand for domestic assets, and subsequently greater net exports of domestic assets. Because of the higher demand there is also appreciation of the real exchange rate, leading to greater imports and fewer exports of goods and services, and so a trade deficit.

This explanation is domestic in nature and effectively shows how the differences in local savings and investment (or GDP and GNE) are reflected in the CA and FA balances. The rest of the world is essentially passive. The other primary macroeconomic explanation turns this around and is based on foreign savings and investment.

Here, the domestic CA deficit story begins with an excess in savings over investment in the rest of the world (lately this has been Japan, China, and Middle East oil exporters). Investors in these countries view domestic assets as having a higher rate of return on a risk-adjusted basis, and so increase their demand for these assets. This leads to net domestic asset exports, which appreciates the real exchange rate, deteriorating the trade balance.[14]

This view has been attractive to many because it focuses on the behavior of countries in asset markets. These asset markets have grown very large, with gross asset flows (that is the value of purchases or sales of assets) much larger than the corresponding balance on the FA (the net flows).[15] This can be

[13] See CBO, "Causes and Consequences of the Trade Deficit: An Overview," CBO Memorandum, March 2000 and Craig K. Elwell, "The U.S. Trade Deficit: Causes, Consequences, and Policy Options," CRS Report for Congress RL31032, July 2010 for additional detail.

[14] The "global savings glut" hypothesis made famous by Ben Bernanke is an example of this reasoning.

[15] For more on this point see Maurice Obstfeld, "Does the Current Account Still Matter," Richard Ely Lecture, January 2012.

interpreted in many ways, commonly as changes in the portfolio choices of foreign countries with excess savings relative to investment. But it puts the focus on international asset markets, not domestic production and savings.

The Inter-temporal approach

The theories above are not mutually exclusive, but they emphasize different drivers. The first explanation is based more on the microeconomics of trade in goods and services. Here, the imbalance between imports and exports of goods and services drives the current account balance. In contrast, the second explanation identifies macroeconomic concepts, savings and investment (domestic or foreign), as the drivers of the current account balance.

The inter-temporal approach to the current account attempts to incorporate each of these factors, but also to explicitly account for expectations and wealth in determination of the CA balance. The starting point for the inter-temporal approach is that savings and investment are forward-looking decisions based on current and expected prices, income, and wealth.[16] The CA balance is viewed as a variable which allows consumers and firms in a country the flexibility to change their savings and investment behavior in the face of current and expected changes in income and wealth. This is generally called consumption "smoothing", as it allows consumption to stay relatively consistent when income varies.

The idea is that consumers and firms borrow when income is expected to be lower than normal and they save when the opposite is true. They may also borrow when investment opportunities appear to be greater and they may save when such opportunities do not seem as promising. The renewed emphasis on savings and investment is apparent from this description. The inter-temporal framework also allows for the incorporation of valuation effects into a model of current account determination. Such changes in the value of asset stocks manifest themselves in consumer wealth, which is important for decisions about savings and investment.

Where do relative prices enter the model? Both import and export demand depends upon the real exchange rate, and these together influence GDP, investment, and consumption. Unlike the elasticity, savings-investment balance, and absorption approaches it is difficult with the inter-temporal model to draw definitive conclusions about what is driving the CA balance at any point in time. Minimizing variations in consumption across time is an important determinant of the CA balance. But the extent to which this is done, and therefore the CA balance, depends upon investment decisions as well as relative prices.

Standard explanation

Because the inter-temporal model encompasses considerations of relative prices, savings and investment behavior, and decisions over time it has become the framework through which many economists understand current account behavior. But when compared against data in various countries the results are mixed.[17] These failures, along with some of its underlying assumptions, have led many to

[16] Income in this case is GNP, as it includes net factor payments.

[17] The reasons behind this can vary. See for example James M. Nason and John H. Rogers, "The Present-Value Model of the Current Account has been Rejected: Round up the Usual Suspects," *Journal of International Economics*, 68(1), 2006, p. 159-187.

explain CA balances using the language of the trade and savings-investment focused approaches above, while recognizing the theoretical appeal of the inter-temporal approach.[18]

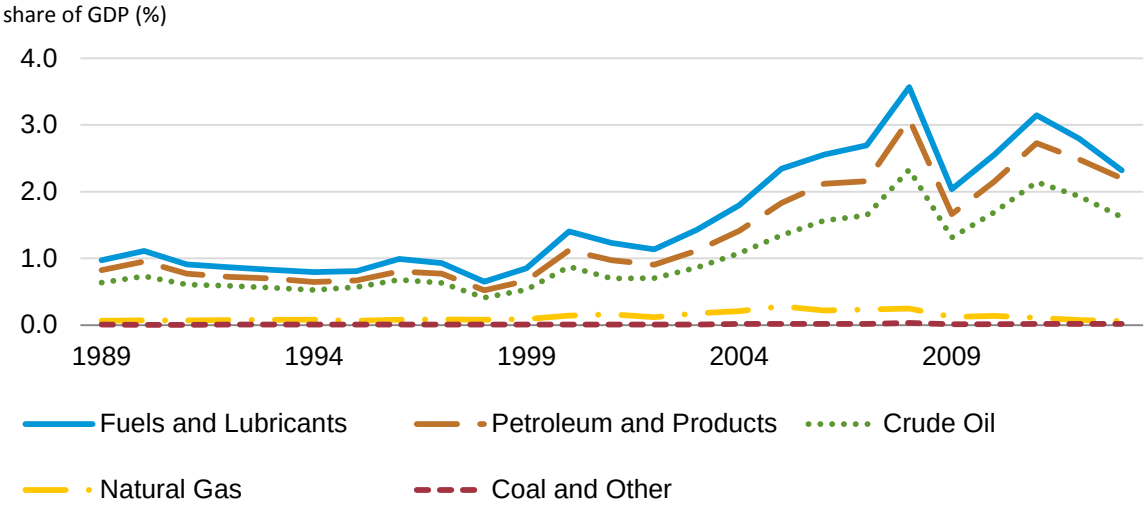
In such an explanation it is competitiveness and differences in economic growth that are most important as determinants of the balance on the current account in the short-run. Changes in wealth due to valuation effects are also increasingly put forward as important in the short-run. Over the medium to longer-run, however, the CA balance is determined by savings and investment. These medium-to-long term explanations can either emphasize domestic savings and investment or foreign savings and investment as the driving forces behind the CA balance. But financial flows play an important part in adjustment of the CA balance to the macroeconomic variables.[19]

Energy trade and the current account balance

The vast majority of discussion and research on CA balance determination is focused on the level of total trade in goods and assets. There has not been much written on how trade in energy goods impacts this balance, either empirically or theoretically. One reason for this is that the energy sector and energy trade is small in most developed countries relative to the overall economy.

Figure 3 shows U.S. imports of various categories of energy commodities since 1989 as a share of GDP.[20] U.S. imports of fuels and lubricants since 1989 has averaged 1.6 percent of GDP. Drilling into this broad category, petroleum and product imports have averaged 1.4 percent of GDP (crude oil is 1.1 percent of the 1.4), natural gas imports averaged 0.1 percent of GDP, and coal less than 0.1 percent.

Figure 3. U.S. imports of select energy commodities as a share of GDP (BEA), 1989-2013



Source: BEA

[18] With regards to the underlying assumptions of the inter-temporal approach, the most common concerns are the manner in which expectations are specified in such models and the use of representative agents.

[19] There is an important caveat to this short versus long-run description. This occurs if the competitiveness or economic growth impacts that occur in the short-run permanently change the structure of the economy. In this case, called hysteresis, the long-run CA balance depends upon past CA balances.

[20] These are the nominal share of nominal GDP and are calculated based on data from the U.S. BEA.

Empirical studies which have considered the impact of energy trade on the CA balance focus on oil. The general approach is to trace the impacts of an unexpected change to the oil price, oil supply, or oil demand on the current account balances of different country groupings.

The results of these studies are relatively consistent. An unexpected rise in the price of oil, whether for demand or supply reasons, leads to a temporary impact on CA balances. Such a price change leads to deterioration in the CA balances of oil importers and an improvement in the CA balances of oil exporters.[21] These effects slowly dissipate over time. There are also changes in the stocks of net foreign assets across countries through valuation effects.[22]

While these studies provide some insight on how current account balances respond to changes in oil prices, they leave unresolved how changes in the volume of energy trade will impact such balances. The theories of CA balance determination outlined above provide a good starting point when considering this scenario. To illustrate, consider a change in policy whereby the U.S. allows crude oil exports. For simplicity, assume that the level of crude oil imports does not change as a result of the policy shift, and neither do domestic or international prices. Table 2 provides a summary.

Table 2. The response of the U.S. current account balance to a hypothetical removal of export restrictions on crude oil according to various theories of CA determination (assuming no changes in crude oil imports or prices)

Approach	Prediction
Elasticities	Improvement in the CA balance followed by a gradual deterioration.
Domestic Savings/Investment	Possibly small CA balance changes in either direction in the short-run, but these are unlikely to persist.
Foreign Savings/Investment	Improvement in U.S. CA balance in short-run if global crude oil production remains the same, unclear in long-run.
Inter-temporal	Short-run improvement in the CA balance likely to fall over the long-run unless there is a substantial reduction of non-U.S. savings.

In the trade-based view this leads directly to an improvement in the balance on the U.S. current account, as the value of exports rises. This improvement will shrink over time because the exports will generate higher income, and also because the real exchange rate will appreciate. Greater income from exports of crude oil increase import demand for other goods and services, reducing the initial improvement of the CA balance. And real exchange rate appreciation reduces this as well by further raising U.S. import demand and simultaneously lowering foreign demand for U.S. goods and services.

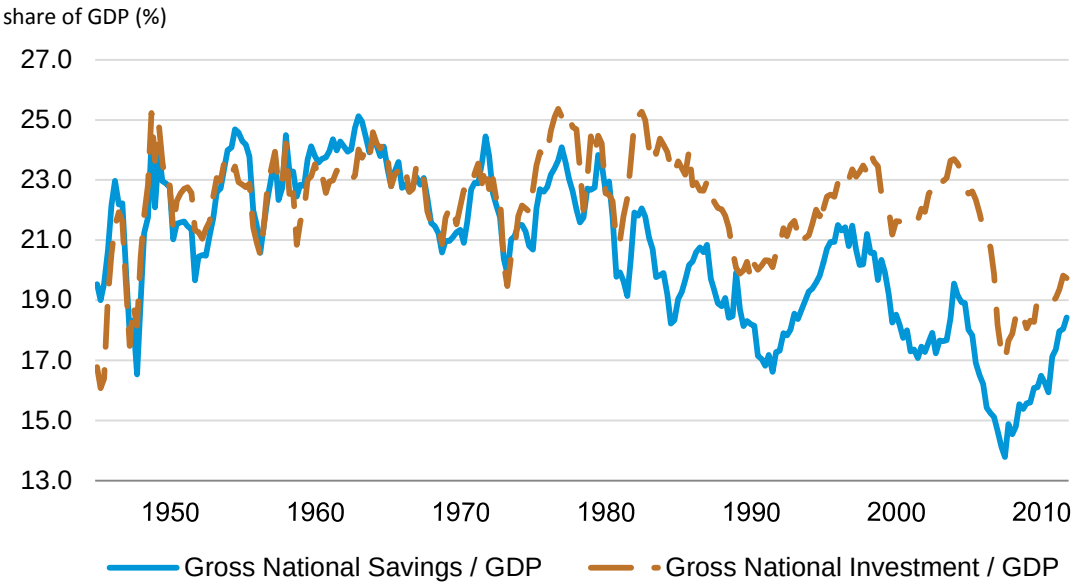
The savings and investment approach to CA balance determination tells a much different story (the absorption approach is similar). Removing crude oil export restrictions will only change the U.S. CA balance if domestic savings and/or investment respond as well. Figure 4 displays U.S. savings and

[21] See Chapter II, IMF World Economic Outlook 2006, "Oil Prices and Global Imbalances".

[22] See Lutz Kilian, Alessandro Rebucci, and Nikola L. Spatafora, "Oil Shocks and External Balances," *Journal of International Economics*, 77(2), 2009, p. 181-194 and Jean-Pierre Allegret, Valerie Mignon, and Audrey Sallenave, "Oil Price Shocks and Global Imbalances: Lessons from a Model with Trade and Financial Dependencies," CEPII Working Paper 2014-01, January 2014.

investment as a share of GDP since 1947.[23] Since 1947 gross savings has averaged 20.6 percent of U.S. GDP, while gross investment has averaged 22.1 percent of GDP. In terms of nominal 2013 GDP, this corresponds to 3.52 and 3.78 trillion dollars, respectively, or investment in excess of savings to the tune of 256 billion 2013 dollars on average.

Figure 4. U.S. gross national savings and investment as a share of GDP, 1947-2013



Source: BEA

What impact will crude oil exports have on U.S. savings and investment? In the near-term, both savings and investment will likely respond a small amount. Greater income will lead to more savings, but it will also lead to more import demand, and constructing the necessary infrastructure for the exports will raise investment. Even these changes are likely to be small in relation to aggregate savings and investment. It is also unclear whether there would be any change in the difference between savings and investment, which is the value that equates to the current account balance.

Additionally, there is also no reason to expect that a higher crude oil export level will lead to permanent changes in either savings or investment. The factors that drive such behavior over long periods of time, summarized above in Table 1, are unlikely to change substantially because of greater crude oil exports. Thus, a scenario of higher U.S. crude oil exports may alter the CA balance in the short-run (in either direction), but such changes are unlikely to persist over time.

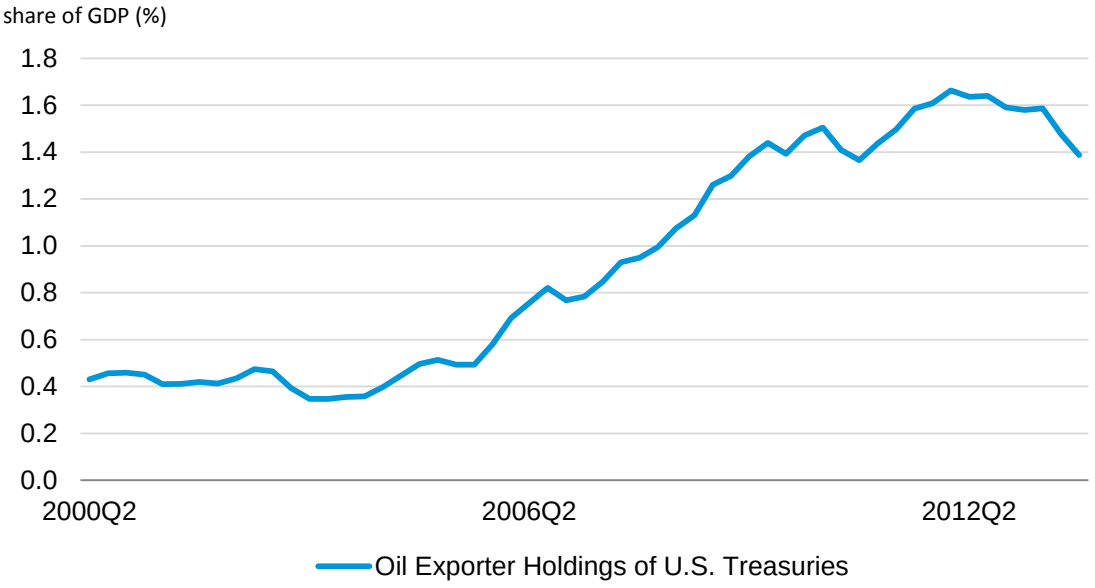
The impact of U.S. crude oil exports on global savings and investment, however, is more uncertain. The impacts on investment in both the short and long-run are likely to be negligible. In contrast, global

[23] Nominal data on gross savings and investment are from Table 5 of the BEA's NIPA (domestic capital account) and nominal GDP is from Table 1. Gross savings and investment both include the corresponding government savings and investment.

savings may change if the U.S. is producing a larger amount of oil. The response of global savings depends to a large extent upon production responses in OPEC countries.

While such responses generally change the price of oil, consider a scenario where OPEC reduces production by the exact amount that U.S. exports increase, so that global supply remains constant. Such a response reduces revenue to OPEC producers and shifts it to the U.S. Because U.S. savings is lower than that of OPEC, global savings will be reduced. This leads to a smaller difference between non-U.S. savings and investment, which corresponds to less demand for U.S. assets, resulting in an improvement of the CA balance. The duration of this reduction depends upon how long OPEC chooses or is able to constrain production.

Figure 5. Oil exporter holdings of U.S. treasury securities as a share of GDP, 2000Q2-2013Q4



Source: U.S. Treasury

Figure 5 shows that demand for U.S. Treasuries from oil exporters has increased over the last 13 years relative to U.S. GDP.[24] These peaked at almost 1.7 percent in the first quarter of 2012, and have since declined to just below 1.4 percent of U.S. GDP.[25] The figure only includes Treasury securities and not the entire portfolio of U.S. assets that belongs to oil exporters. However, it illustrates that oil exporter demand for U.S. assets is large enough to influence the U.S. CA balance, which have ranged from roughly -2 to -6 percent of GDP over this time period.

[24] Data on Treasury holdings are from the Treasury International Capital (TIC) system of the U.S. Treasury; the CA balance comes from the BEA. Oil exporters include Ecuador, Venezuela, Indonesia, Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates, Algeria, Gabon, Libya, and Nigeria.

[25] The correlation between their respective growth rates over the same time period is 0.99.

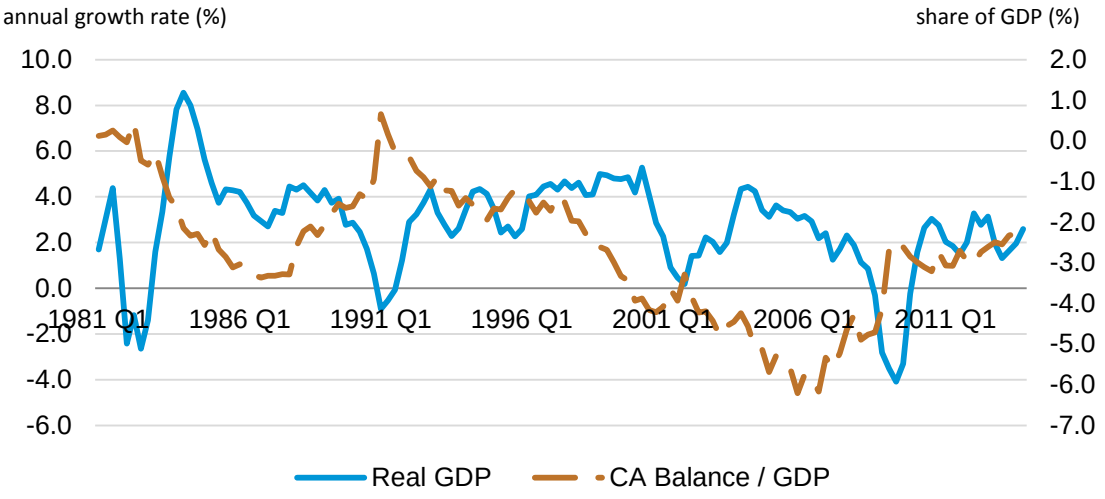
The standard view of macroeconomists on how crude oil exports will affect the U.S. CA balance is based on the inter-temporal approach and combines the explanations above.[26] According to this view, there is likely to be a small improvement in the CA balance as the trade effects dominate in the short-run. But over time as there is real exchange rate improvement, as the income variations and greater investment show up in larger U.S. import demand for goods and services, and because underlying national savings will not vary due to crude oil exports, the CA balance will change little because of such trade.

A caveat to this analysis is if there is anything associated with crude oil exports that could permanently impact either the U.S. real exchange rate, or domestic or non-U.S. global savings and investment. One possibility is that allowing crude oil exports permanently alters the non-U.S. savings and investment balance, thereby changing demand for U.S. assets. A related possibility, more likely with natural gas, is that higher production levels lead to productivity gains in other sectors of the economy.[27] This could result in appreciation of the U.S. real exchange rate, greater investment, and faster economic growth.

Energy trade and economic activity

The balance on the current account is a widely discussed statistic, but economic theory does not offer a definitive prediction as to how (or whether) it impacts economic growth. While the elasticities approach ties this balance directly to net exports as described above, the savings and investment and inter-temporal theories do not assume a direct link. Figure 6 illustrates this point for the United States by plotting the growth rate of real GDP against the U.S. CA balance as a share of GDP. The CA balance reflects net exports for the U.S. because net factor payments are small over this time period.

Figure 6. Growth rate of real U.S. GDP (Left axis) and the U.S. CA balance as a share of GDP (Right axis), 1981-2013



Source: BEA

[26] See Robert Z. Lawrence, "Implications of Reduced Oil Imports for the U.S. Trade Deficit," Council on Foreign Relations Energy Report, January 2014.

[27] See Vipin Arora, "A Note on Oil and Gas Production from Shale and Long-Run U.S. Economic Growth," MPRA Paper 54757, 2014.

The correlation is -0.06, indicating little or no contemporaneous correlation between the variables. There are periods, such as the mid-2000s, where a larger current account deficit relative to GDP is associated with an increasing rate of real GDP growth, and there are periods where these variables move in the same direction.[28] Such observations do not rule out a causal link between the trade balance and GDP, but they do show that such a relationship is not straightforward.

For this reason, understanding and quantifying the economic impacts of energy trade should consider more than just changes in the trade balance. Rather, it should include the resulting variations in investment, income, and prices as well.

Conceptualizing the impacts of energy trade on the economy

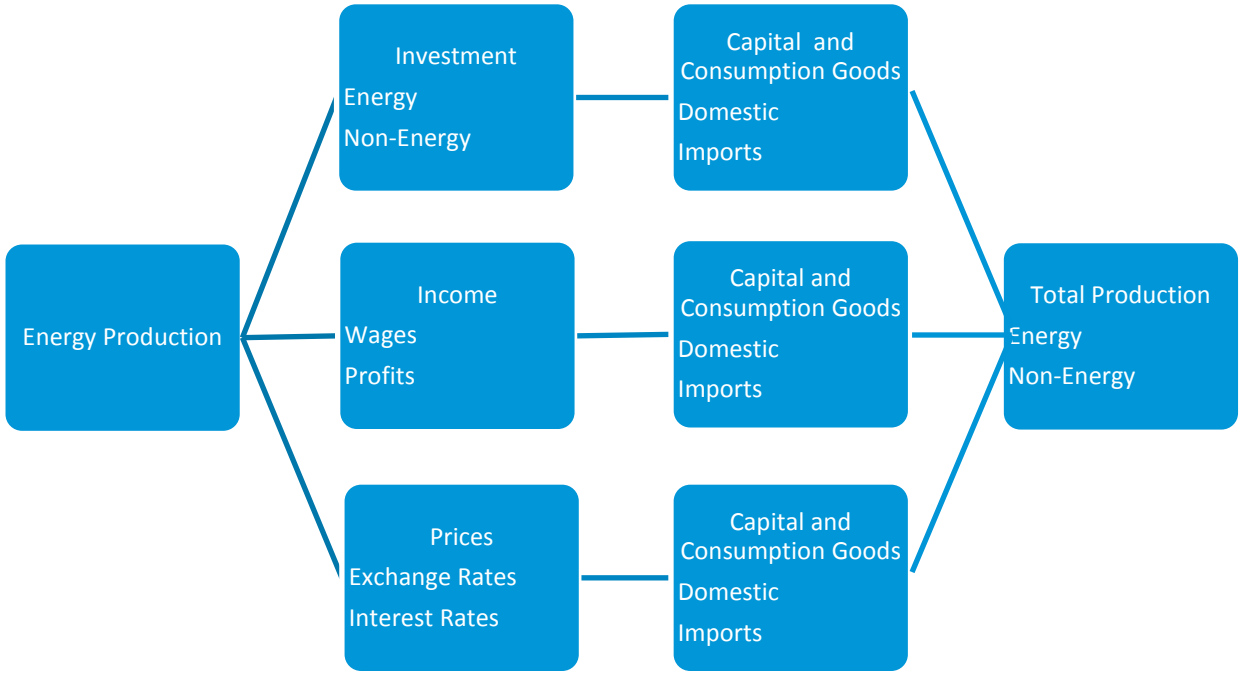
An intuitive way to conceptualize how energy trade affects economic activity is by focusing on changes in the total production of goods and services in an economy. Such a perspective is equivalent to considering changes in total expenditures (which directly incorporates the trade balance).[29]

The benefit of focusing on total production is that it aggregates changes in expenditures occurring throughout the economy because of energy trade. Any production changes due to energy trade can then be related to variations in both expenditures and income throughout the economy. The basic idea is outlined in Figure 7.

[28] Evidence on the macroeconomic consequences of current account balances is focused on reversals, relatively quick changes in the current account balance from deficit to surplus. See Diego Valderrama, "What are the Risks to the United States of a Current Account Reversal?" FRBSF Economic Letter Number 2006-29, October 2006. The economic impacts of reversals vary. Some countries show slower growth after reversals in their current accounts, while others do not. These differences hold across both developed and developing countries. See for example Caroline Freund and Frank Warnock, "Current Account Deficits in Industrial Countries: The Bigger They are The Harder They Fall?" NBER Working Paper 11823, 2005 and Sebastian Edwards, "The End of Large Current Account Deficits, 1970-2002: Are There Lessons for the United States?" NBER Working Paper 11669, 2005 and Sebastian Edwards, "Thirty Years of Current Account Imbalances, Current Account Reversals and Sudden Stops," NBER Working Paper 10276, 2004. A consistent theme across studies that compare reversals in industrial countries is that adjustments of larger deficits are longer and associated with slower growth. Such reversals are also associated with depreciation of the real exchange rate. See the results in Tables 6 and 7 of Sebastian Edwards, "The End of Large Current Account Deficits, 1970-2002: Are There Lessons for the United States?" NBER Working Paper 11669, 2005.

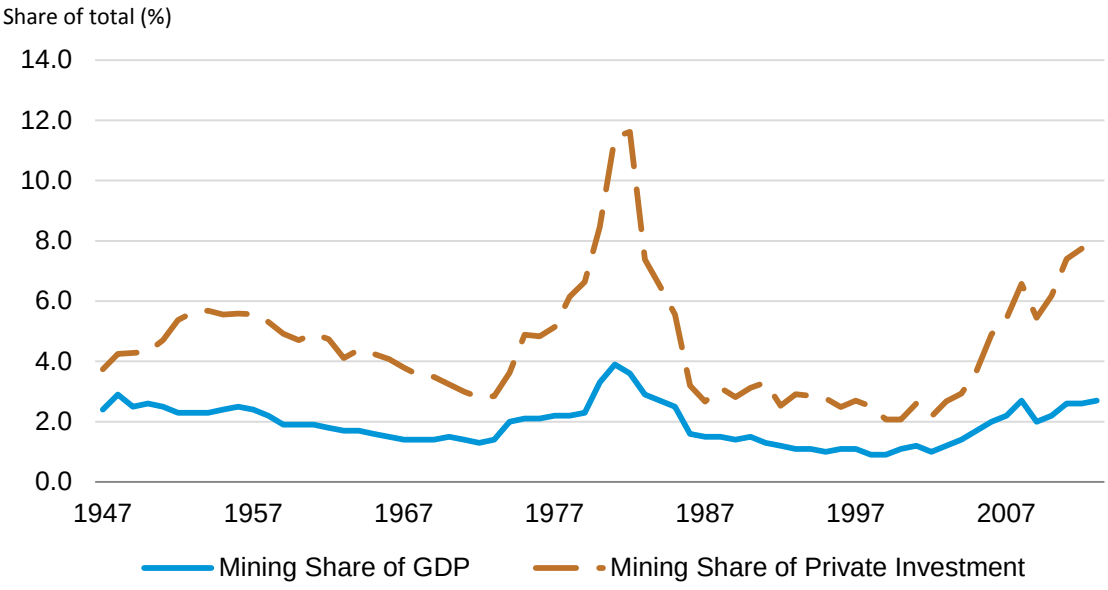
[29] By definition this total production, calculation of GDP as value added, is equivalent to income payments and other costs incurred in the production of those goods and services, as well the sum of goods and services sold to final users. That is, GDP calculated via income and expenditures.

Figure 7. A production-based visualization of how energy trade impacts economic activity



To illustrate, consider again the crude oil export scenario where U.S. oil production rises. The most straightforward impact is that rising production of crude oil varies output in the oil and gas extraction sector, the far left of Figure 7.

Figure 8. Mining share of U.S. GDP and share of U.S. total private investment, 1947-2013



Source: BEA

Figure 8 shows that these increases in production can be large.[30] The share of GDP that is accounted for by the mining sector (including oil and gas extraction, coal production, and mining support) has fluctuated substantially. It reached almost 4 percent of GDP in 1981, and then fell below 1 percent of GDP in 1998, before recovering to over 2.5 percent in 2013. Mining's share of U.S. GDP averaged 1.9 percent from both 1947 to 2013 and 2000 to 2013.

In order to achieve such production levels in the mining sector, equipment, infrastructure, and workers are required. Increasing the amount of equipment associated with oil and gas extraction, as well as the infrastructure necessary for transportation and export, raises firm investment. Figure 8 also shows that mining investment is a non-negligible component of total private investment.[31]

Mining investment's share of total private investment has a similar shape to mining's share of U.S. GDP, in that it peaks in the early-1980's (1982, 11.6 percent), falls to historical lows in the late-1990's (1999, 2.1 percent), and then rises again through 2012 (7.7 percent). Investment in other sectors may also increase. There will be many industries outside of the energy complex that benefit from greater crude oil production; transportation and distribution are two notable examples.

How is this related to total production of goods and services in the economy? As shown at the top of Figure 7, such investment leads to the production of both capital and consumption goods. Capital goods are those that do no wear out quickly and can be used to produce other goods and services. Most consumption goods do not share these traits. As indicated in Figure 7, some of the additional goods will be domestically produced, while others will be imported.

Thus, increases in oil production due to energy trade will be associated with higher mining and other investment. Such investment raises total production of goods and services in the economy, including additional energy production, because it requires both capital and consumption goods.

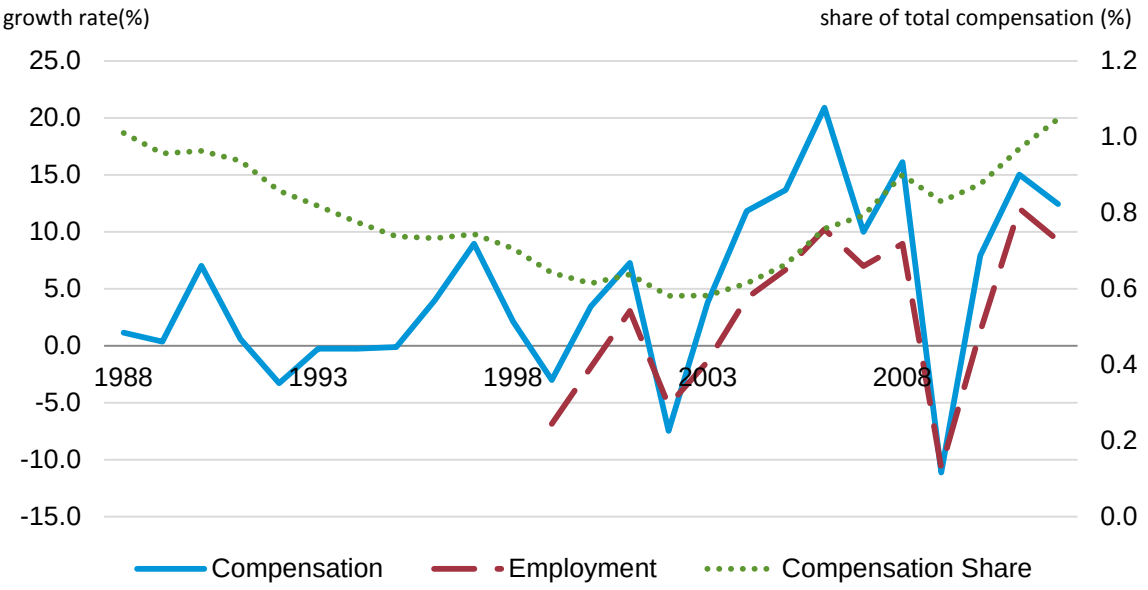
The crude oil production increase also requires more workers. The left axis of Figure 9 shows employment growth in the mining sector since 1999 as oil and gas production has risen.[32] Although volatile, the recent trend has been increases in mining employment growth, with an average increase of 2.6 percent from 1999-2012.

[30] Data are from the BEA's GDP-by-Industry accounts.

[31] Data are from the BEA's fixed assets accounts, table 3.7ESI, and are of mining investment in private fixed assets as a share of the total in current dollars.

[32] Data are from the BEA's GDP-by-Industry accounts. Compensation is originally in millions of current dollars and employment is the growth rate of thousands of full and part-time employees.

Figure 9. Mining compensation and employment growth rates (Left axis) and compensation Share (Right axis), 1988-2012



Source: BEA

This has coincided with rising income for workers in the mining sector. Figure 9 (left axis) shows that compensation in this sector grew by an average of 4.8 percent from 1988 to 2012. And mining's total share of U.S. compensation (right axis) has also grown, averaging 0.8 percent from 1988 to 2012, but rising to 1.1 percent in 2012.

In addition to the increased income paid to workers, there will also be rises in profits. Firms producing domestic oil, and those associated with such production, are likely to be the primary beneficiaries; but those selling capital and other goods may benefit as well. Government revenues will also rise due to increased tax collection and royalties. And private landowners will also see gains in their royalty income. Refiners that currently enjoy a discount on crude oil prices, primarily in the Midwest, are likely to see their profits fall. The net result will be increases in economy-wide profits, as shown in the middle row of Figure 7.

Income growth in the economy leads to greater consumption by individuals, and also higher investment from firms and consumers (housing). This results in more production of both capital and consumption goods, as highlighted in Figure 7. As before, some of this increase will be met domestically and the remainder imported.

Thus, increases in oil production due to energy trade will be associated with income growth in the economy. Such income growth leads to greater levels of consumption and investment, raising production of both capital and consumption goods, and the total production of goods as a result.

While these income changes are directly observable, others may also exist due to the removal of trade barriers. Theoretically, traditional models of international trade conclude that trade generates increases in the total value of production. That is, the level of income rises, but not necessarily the rate of

growth.[33] This general result holds across many different model classes, although modifications can give different conclusions in either direction. Additionally, the evidence on trade and growth is very large, but generally supports the notion that trade liberalization is beneficial for economic activity.[34]

The bottom row of Figure 7 shows that the initial crude oil production increase will change different prices throughout the economy. Because energy exports will rise in this scenario by assumption, the real exchange rate responds. In this case there is likely to be an appreciation of the real exchange rate, because of greater demand for U.S. currency. This can lead to a reduction in the exports of non-energy goods, and possibly increase imports.[35] The result is changes in domestic production and imports of capital and consumption goods, as displayed in Figure 7, and subsequent variations in the economy's total production of goods and services.[36]

In summary, focusing on changes in the total production of goods and services in the economy is a powerful way to analyze the impacts of energy trade. A simple example shows that greater energy production is associated with higher investment, income, and a stronger real exchange rate. In total, these lead to increased domestic production and imports of capital and consumption goods. The net result is that total production of goods and services in the economy is higher, but by a different amount than the initial energy production increase.

Rough quantitative estimates

Focusing on production gives a relatively clear way to think about how energy trade impacts the economy. It also provides a way to quantify the economic impacts of different energy trade scenarios. To illustrate using a back of the envelope calculation, consider again the U.S. crude oil export scenario.[37]

Assume that crude oil production in the United States is on average 1.2 million barrels per day (mbd) higher than it would be without exports from 2016-2030.[38] Also suppose that in the peak year, investment rises by 66 billion dollars, and disposable income is 400 dollars higher for each person. In that peak year, assume that the income from the additional crude oil sales raises either consumption or investment by an equivalent amount, and that all of the disposable income is consumed as well.

The result is that GNE in the peak year rises by around 270 billion dollars. About 44 billion of this comes from greater crude oil revenue (assumed to be either consumed or invested); roughly 66 billion is due to

[33] For an overview see Ricardo A. Lopez, "Trade and Growth: Reconciling the Macroeconomic and Microeconomic Evidence," *Journal of Economic Surveys*, 19(4), 2005, p. 623-648.

[34] See for example Romain Wacziarg and Karen Horn Welch, "Trade Liberalization and Growth: New Evidence," *The World Bank Economic Review*, 22(2), 2008, p. 187-231 and references therein.

[35] If this process continues it can shrink non-energy sectors of the economy that are export-dependent. This is commonly referred to as "Dutch Disease".

[36] Interest rates can also change with crude oil exports, but this depends more upon how changes in energy prices impact inflation. In this scenario energy prices do not change by assumption.

[37] For an estimate of the quantitative impacts of U.S. natural gas exports see Vipin Arora and Yiyong Cai, "U.S. Natural Gas Exports and Their Global Impacts," *Applied Energy*, 120, 2014, p. 95-103.

[38] The numbers are taken from IHS, "US Crude Oil Export Decision: Assessing the Impact of the Export Ban and Free Trade on the US Economy," IHS Energy/IHS Economics Report, May 2014.

investment; and the remaining 160 billion is because all of the disposable income is used for consumption.[39] The total of these contributions is about 1.5 percent of nominal 2013 U.S. GDP.

Will GDP rise by this amount? No, because the response of imports to the rise in expenditures needs to be incorporated as well. A rough estimate for the U.S. import elasticity of income (the percent change in imports given a 1 percent change in income) is 1.8.[40] Once imports are accounted for the net result is that nominal GDP will be about 1 percent higher because of the additional crude oil production. And the additional crude oil production is due to removal of export restrictions.

This is a very rough estimate that relies on unrealistic assumptions, and likely includes double counting.[41] Even still, it is not far from existing estimates. In their 2014 study, IHS estimates that removing U.S. export restrictions on crude oil will raise real U.S. 0.7 percent above a no-export baseline in their peak year of 2018. The value calculated above differs from this because GDP in 2018 is larger than GDP in 2013, and also because IHS uses real GDP.

The example highlights that simple approximations using the conceptual framework outlined in the previous section are relatively straightforward.

Appendix 1: Accounting for trade in goods and assets

Macroeconomic accounting that incorporates interactions with other countries is substantially more complicated than for a closed economy. The basic framework remains the same in that macroeconomic activity can be measured by summing expenditures on goods and services, the value added at each stage in the production of goods and services, or income payments to the owners of labor, capital, and land. However, the complications arise from a need to account for international trade in goods, services, and assets; payments between countries for the use of labor, capital, and land; and any transfers of income or assets across borders.[42]

All of this information can be found in the U.S. national income and product accounts (NIPAs) produced by the Bureau of Economic Analysis (BEA). The NIPAs present the value and composition of U.S. output and the types of incomes generated in its production. The international transactions in the NIPAs come from the international transactions accounts (ITAs), also a BEA product, which summarizes transactions between U.S. residents and nonresidents. A portion of the ITAs contains information on the value of trade in goods and services, including trade in energy commodities, products, and equipment. The BEA also produces the U.S. international investment position accounts (IIPAs), which contain information on net external American assets.

[39] In these calculations the population is 400 million and the oil price is $100.

[40] See Catherine L. Mann, "Perspectives on the U.S. Current Account Deficit and Sustainability," *Journal of Economic Perspectives*, 16(3), 2002, p. 131-152.

[41] In general these benefits are likely to be reduced over time as exchange rates appreciate, there are potential monetary policy reactions, and as savings and investment behavior become more of a constraint on the current account balance, and also consumption and investment decisions.

[42] See Chapter 16 of Robert C. Feenstra and Alan M. Taylor, *International Economics*, 3rd Edition, Worth MacMillan, 2014 for a detailed overview.

Measuring economic activity

Summing an economy's expenditures is the most common approach to measuring economic activity. In a country where there is no trade (a closed economy) this total, called gross national expenditure (GNE), is equal to the sum of (i) [consumption] spending by consumers on final goods and services; (ii) [investment] spending by firms and consumers on final goods and services which add to the domestic capital stock; and (iii) [government consumption] spending by the public sector on final goods and services.[43]

GNE does not provide a full picture of domestic macroeconomic activity, however, because it includes spending on final goods and services produced in foreign countries. It also does not account for goods produced domestically that are sold in foreign countries. GNE can be adjusted by incorporating the trade balance (TB). The trade balance, also called net exports, is the difference between the value of all exported goods and services produced domestically and the value of all imported goods produced in a foreign country. Adding net exports to GNE yields gross domestic product (GDP) calculated based upon the expenditure approach.[44]

GDP can also be calculated under the product approach, by summing the value-added at each stage in the production of domestic goods and services. This is the difference between the value of all goods and services produced in an economy and the value of intermediates used in that production. The product and expenditure approaches to GDP illustrate that it is intended to measure expenditure and production within the borders of a country.

GDP, and macroeconomic activity more generally, can also be calculated by adding up income payments to the owners of labor, capital, and land using the income approach.[45] In the case of GDP these payments are those related to production within the borders of a given country, and are made to both domestic residents and foreigners. An alternative measure of macroeconomic activity, called gross national income (GNI), accounts for the income of U.S. residents that is due to production, irrespective of where that production occurs.

GNI is calculated by adjusting GDP for trade in factor services. Trade in factor services occurs when one country is paid income by another for use of labor, capital, or land that are in service in the second country. A country exports factor services when a different country uses its labor, land, or capital (and correspondingly receives factor income), and it imports factor services in the reverse case. Net factor income (NFI) is defined as income received from exports of factor services less payment for imports of factors services. GNI is the sum of GDP and net factor income.[46] Gross national disposable income (GNDI) is another measure that can be used, and it adds the net value of income transfers (NIT) to GNI.

[43] The BEA defines final goods and services as those that are consumed and not used in a later stage of production, those that are sold to foreign residents, those that are durable goods and structures used to produce other goods and last more than a year, and those that may be inventoried for future consumption. These are distinct from intermediate goods and services, those which are used as inputs in the production process and which will not be used to contribute to future production.

[44] The BEA measures GDP using this expenditure approach in the national income and product accounts.

[45] The U.S. BEA calls GDP calculated using the income approach gross domestic income (GDI).

[46] Technically, the U.S. BEA calculates GNI as the sum of GDI and net factor income.

Table A1. Summary of macroeconomic measures

Measure	Calculation
GNE	Sum of private consumption (C), private investment (I), and government consumption and investment (G) GNE = C + I + G
GDP	Sum of GNE and net exports of goods and services (X – M) GDP = GNE + X - M
GNI	Sum of GDP and net factor income (NFI) GNI = GDP + NFI
GNDI	Sum of GNI and net income transfers (NIT) GNDI = GNI + NIT

GNE, GDP, GNI, and GNDI are all measures of macroeconomic activity, but focus on different things. Their definitions are summarized in Table A1. GNE and GDP are focused on activity within the borders of a country, whereas GNI and GNDI center on activity due to the residents of a country. This distinction can be more or less important depending upon the country of interest. For the U.S., all of these measures are available from the NIPAs.

The U.S. NIPAs

The U.S. Bureau of Economic Analysis is responsible for producing the national income and product accounts.[47] The NIPAs present the value and composition of national output and the types of incomes generated in its production.[48] The NIPAs are organized conceptually to represent the production, income and outlays, and savings and investment for four sectors of the economy: businesses, households, government, and foreign.[49] The representation of these categories (production, income and outlays, and savings and investment) are gathered in what the BEA calls accounts, and each sector has its own account, for a potential total of 12 (three categories time four sectors).

For each sector, the production account records the value of the production that is attributable to that sector, and the uses of the income arising from that production. The income and outlay account records the sources of the sector's income, its current outlays, and its saving. The saving and investment account (also known as the capital account) records the sector's gross saving and gross investment. While there could be up to 12 accounts, the BEA consolidates the production, income and outlays, and savings and investment accounts for all sectors into seven summary accounts. These seven summary accounts are the framework behind presentation of the NIPAs and are listed in Table A2.

[47] The NIPAs are one of three major elements of U.S. national economic accounts. The other two are the BEA's industry accounts and the financial accounts of the United States prepared by the Board of Governors of the Federal Reserve System. The BEA also produces U.S. international accounts, as well as regional accounts for states and metropolitan areas in the United States.

[48] For an introduction see BEA, "Measuring the Economy: A Primer on GDP and the National Income and Product Accounts," 2007 at www.bea.gov/national/pdf/nipa_primer.pdf. The NIPA handbook (http://www.bea.gov/national/pdf/allchapters.pdf) has full details of the methodology.

[49] The BEA uses outlays instead of expenditures because outlays include interest and transfer payments.

Table A2. NIPA summary accounts

Account	Name
1	Domestic Income and Product Account
2	Private Enterprise and Income Account
3	Personal Income and Outlay Account
4	Government Receipts and Expenditures Account
5	Foreign Transactions Current Account
6	Domestic Capital Account
7	Foreign Transactions Capital Account

The first summary account is related to production for business and households; the next three to income and outlays for business, households, and government, the fifth summarizes production for the foreign sector; the sixth savings and investment for business, households, and government; and the final summary account shows savings and investment for the foreign sector. These summary accounts as a whole use the principle of double-entry: a credit in one account is a debit somewhere else. For example, production by a business is a credit to the production account, but a debit in the personal income and outlays account when the good or service is purchased by a household.

The NIPAs can be used to obtain or estimate all of the measures of economic activity discussed above, namely GNE, GDP, GNI, and GNDI. For example, GNE can be calculated based on the information in summary account one (domestic production and income). Estimates of GDP are also available in this summary account. The trade balance required to move from GNE to GDP comes from the fifth summary account (foreign transactions current account). The foreign transactions current account also contains the data for net factor payments, which can be used to calculate GNI once GDP is available. And the seventh summary account (foreign transactions capital account), provides the values for net income transfers which can be used to calculate GNDI from GNI.

One feature of the NIPAs that can be confusing is the distinction between the seven summary accounts and the actual published NIPA tables. There are approximately 360 NIPA tables organized in seven sections. These are listed in Table A3. The structure of the NIPA table sections is a slightly consolidated version of the summary accounts, but roughly follows their order. The first section includes summary income and product tables; the second section has tables on personal income and outlays; the third section contains tables on government receipts and expenditures; the fourth on transactions with the rest of the world; the fifth section provides tables on domestic savings and investment. The final two sections of tables contain information not shown in the summary accounts, including income and employment by industry (section 6) and other supplemental tables (section 7).[50]

[50] There is also an eighth section with seasonally unadjusted estimates.

Table A3. NIPA table sections

Section	Name
1	Domestic Product and Income
2	Personal Income and Outlays
3	Government Current Receipts and Expenditures
4	Foreign Transactions
5	Savings and Investment
6	Income and Employment by Industry
7	Supplemental Tables

The U.S. ITAs

In moving from GNE to GDP, from GDP to GNI, and from GNI to GNDI, estimates for the trade balance, net factor income, and net income transfers are required. Values for each of these concepts can be found in the fourth section of NIPA tables, those on transactions with the rest of the world. These NIPA tables are based on the BEA's international transactions accounts, sometimes referred to as the Balance of Payments (BOP), which summarize transactions between U.S. and foreign residents.[51]

These transactions can be grouped broadly between those related to the production of goods and services (the current account), transactions in financial assets and liabilities (the financial account), and those related to transfers of income and other transactions (the capital account). A sample example of this breakdown is shown in Table A4.[52]

The current account (CA) measures transactions in goods, services, income, and net unilateral income transfers between U.S. residents and nonresidents. Said another way, the current account provides the value of the trade balance (net transactions in goods and services), net factor income (net transactions in income), and net income transfers (net unilateral income transfers). The balance on the CA is the sum of the TB, NFI, and NIT [line 30]. This balance summarizes the net flow of all international market transactions in goods, services, factor services, and income transfers.

The capital account (KA) covers minor asset items, such as non-financial non-produced assets (copyrights, trademarks, etc.), as well as gifts of assets. These are all grouped into a category called capital transfers, and thus the balance on the capital account is the difference between the value of exports and imports of capital assets, what the ITAs refer to as capital account transactions [line 36].

[51] For an introduction to the ITAs see Christopher Bach, "A Guide to the U.S. International Transactions Accounts and the U.S. International Investment Position Accounts," BEA Briefing, February 2010: www.bea.gov/scb/pdf/2010/02 February/0210_guide.pdf. For full details see U.S. International Transactions Accounts: Concepts and Estimation Methods at https://www.bea.gov/international/concepts_estimation_methods.htm.

[52] According to the BEA, financial assets encompass international claims payable in money. Examples include loans, bank deposits, drafts, acceptances, notes, government and private debt and equity securities, inter-company accounts, and financial derivatives. In the case of direct investment, physical or real assets held for the production of income are considered as if they were financial claims on the country in which the asset is located.

The financial account (FA) records transactions between U.S. residents and nonresidents that involve financial assets and liabilities. The major organizing principle in the FA is the distinction between U.S.-acquisition of assets abroad [line 19] and foreign acquisitions of assets in the U.S [line 24]. U.S.-acquired assets abroad include U.S. official reserve assets, direct and portfolio investment assets, and other investment assets. Foreign-acquired assets in the U.S. are divided between direct, portfolio, and other investment assets.

In the FA, U.S. purchases of foreign assets are preceded by a positive sign, as are foreign purchases of U.S. assets.

Table A4. Sample ITA table

Table 1.1. U.S. International Transactions

[Millions of dollars]

Bureau of Economic Analysis

Line		2012	2013
	Current account		
1	**Exports of goods and services and income receipts (credits)**	3085260	3178744
2	Exports of goods and services	2216540	2280194
3	Goods	1561689	1592784
4	Services	654850	687410
5	Primary income receipts	762885	780120
6	Investment income	756531	773425
7	Compensation of employees	6354	6695
8	Secondary income (current transfer) receipts /1/	105835	118429
9	**Imports of goods and services and income payments (debits)**	3546009	3578998
10	Imports of goods and services	2754145	2756586
11	Goods	2303785	2294453
12	Services	450360	462134
13	Primary income payments	559892	580466
14	Investment income	545088	564897
15	Compensation of employees	14804	15569
16	Secondary income (current transfer) payments /1/	231972	241945
	Capital account		
17	**Capital transfer receipts and other credits**	7668	0
18	**Capital transfer payments and other debits**	764	412
	Financial account		
19	**Net U.S. acquisition of financial assets excluding financial derivatives (net increase in assets / financial outflow (+))**	171418	644763
20	Direct investment assets	375537	408243
21	Portfolio investment assets	239773	489877
22	Other investment assets	-448352	-250260
23	Reserve assets	4460	-3097
24	**Net U.S. incurrence of liabilities excluding financial derivatives (net increase in liabilities / financial inflow (+))**	601973	1017669
25	Direct investment liabilities	217777	294972
26	Portfolio investment liabilities	746996	490943
27	Other investment liabilities	-362799	231753
28	**Financial derivatives other than reserves, net transactions /2/**	7064	2248
	Statistical discrepancy		
29	**Statistical discrepancy /3/**	30353	30008
29a	Of which: Seasonal adjustment discrepancy	.....	.....
	Balances		
30	**Balance on current account (line 1 less line 9) /4/**	-460749	-400254
31	Balance on goods and services (line 2 less line 10)	-537605	-476392
32	Balance on goods (line 3 less line 11)	-742095	-701669
33	Balance on services (line 4 less line 12)	204490	225276
34	Balance on primary income (line 5 less line 13)	202993	199654
35	Balance on secondary income (line 8 less line 16)	-126138	-123515
36	**Balance on capital account (line 17 less line 18) /4/**	6904	-412
37	**Net lending (+) or net borrowing (-) from current- and capital-account transactions (line 30 plus line 36) /5/**	-453845	-400666
38	**Net lending (+) or net borrowing (-) from financial-account transactions (line 19 less line 24 plus line 28) /5/**	-423492	-370658

An intuitive way to think about the FA is as net asset exports, or the difference between the value of American asset exports and asset imports. Asset exports are the value of domestic financial assets received by foreigners, while asset imports are the value of foreign financial assets received by U.S. residents. In Table A4 the FA balance is positive because asset exports exceed asset imports.

A positive value for the FA balance means that the value American asset exports exceed the value of imports; a negative value implies the reverse. A positive value also means that the external liabilities of the United States are higher (because it is a foreign claim on the U.S.), and a negative value the reverse.

As with the NIPAs, the ITAs use the concept of double-entry. The underlying principle is that every international transaction consists of a trade of equal value. The items traded can be goods, services, factor services, or assets, but whatever is exchanged between the parties must be of equal value. This means that whenever a transaction generates a credit in the CA, FA, or KA, it must also generate a corresponding debit in one of these accounts. Aside from any statistical discrepancies, the balance on the ITA (or the BOP) sums to zero.

As a simple example, suppose a French citizen purchases a U.S.-manufactured bicycle for 100 euros. This transaction shows up in both the current and financial accounts of the U.S. The U.S. CA balance will rise by 100 euros because net exports are higher by this amount. But the FA will fall by 100 euros as well because the euros are considered an asset import. The overall balance of payments, or balance on the ITAs, will still sum to zero. The underlying balances on the CA and FA both change by the 100 euros, but in opposite directions.

U.S. energy trade statistics

The current account of the ITAs and section four of the NIPAs provide estimates of the values of U.S. imports and exports of goods and services at a very aggregate level. The goods aggregates are based on more detailed data on U.S. trade in goods compiled by the BEA.[53]

The disaggregated BEA data comes from estimates of goods imports and exports compiled by the U.S. Census Bureau (Census).[54] The raw Census data is referred to by the BEA as on a Census basis, and is adjusted by the BEA to make it consistent with definitions used with the ITAs (balance of payments concepts). This adjusted data is used to generate the values in the ITAs and is referred to as on a balance of payments basis.[55]

Although export and import data can be classified in many ways, the BEA reports exports and imports on a balance of payments basis under an "end-use" classification system. In this system individual commodities are categorized by their end-use; initially six broad end-use categories, and then further subdivided into roughly 140 more. Each of the broad categories has a code (0-5), and then the subcategories fall under the higher-level code. The lowest level subcategories have five digits. Table A5 lists the import and export enduse codes for basic energy commodities.

[53] See http://www.bea.gov/international/detailed_trade_data.htm.

[54] Census trade data is available at http://www.census.gov/foreign-trade/data/.

[55] The largest adjustments for exports are (1) an addition for goods procured in U.S. ports by foreign ocean and air carriers, (2) a deduction for service receipts for repairs and alterations of foreign-owned equipment, and (3) an addition for low-value transactions. The largest adjustments for imports are (1) an addition for goods procured in foreign ports by U.S. ocean and air carriers, (2) an addition for inland freight in Canada and Mexico, and (3) an addition for goods purchased abroad by U.S. military agencies.

Table A5. Import and export enduse codes for common energy commodities

Imports		Exports	
Code	Description	Code	Description
1	Industrial supplies and materials	1	Industrial supplies and materials
10	Fuels and lubricants	11	Fuels and lubricants
100	Petroleum and products, excluding gas	110	Coals and related fuels
10000	Crude oil	11010	Metallurgical grade coal
10010	Fuel oil	11020	Coal and fuels, other
10020	Petroleum products, other	111	Petroleum and products, excluding natural gas
10030	Liquefied petroleum gases	11100	Crude oil
101	Fuels, n.e.s.-coal and gas	11110	Fuel oil
10100	Coal and related fuels	11120	Petroleum products, other
10110	Gas-natural	11130	Natural gas liquids
103	Nuclear Fuel Materials and Fuels	112	Gas-natural
10300	Nuclear fuel materials	11200	Gas-natural
104	Electric energy	113	Nuclear fuel materials and fuels
10400	Electric energy	11300	Nuclear fuel materials
		114	Electric Energy
		11400	Electric energy

Consider the import enduse codes as an example. Energy products and commodities fall under the broad category of industrial supplies and materials (code: 1) and then fuels and lubricants (10). Crude oil and petroleum products fall under petroleum and products, excluding gas (100), whereas coal, gas, and other energy commodities fall under fuels (101).[56] At their lowest (5-digit) level, the BEA balance of payments basis statistics include data on the value of trade in the following energy items: crude oil, natural gas, electric energy, fuel oil, other petroleum products, coal and other fuels except gas, nuclear materials and fuels, and liquefied petroleum gases. Equipment associated with energy commodities and production falls under the broad enduse category of capital goods, except automotive (2).

The U.S. international investment position accounts (IIPAs)

The FA and KA balances summarize the net flow of assets between U.S. residents and nonresidents over a given time period. These asset flows supplement or deduct from the value of the existing net U.S. stock of assets. For this reason it is common to see the CA balance equated to changes in the net stock of assets. Details of this stock are gathered in the U.S. international investment position accounts (IIPAs). The organization of U.S. assets and liabilities in the IIPAs is the same as in the ITAs. Table A6 shows an example IIPA table.

The balance on the IIPAs, the U.S. net international investment position (IIP), is the value of U.S.-owned financial assets abroad less the value of foreign-owned assets in the United States at the end of a calendar year. The IIP is sometimes considered a rough measure of an economy's external wealth and is

[56] A list of enduse codes is available at https://www.census.gov/foreign-trade/reference/codes/index.html#enduse.

also referred to as net foreign assets. A negative IIP indicates a country is a net debtor to the rest of the world, while a positive IIP means the country is a creditor. At the end of 2013 the U.S. IIP was -5.38 trillion [line 1, in current dollars].

Table A6. Sample IIPA table

Table 1.1. U.S. Net International Investment Position at the End of the Period

[Millions of dollars] NOTE: End of quarter positions begin in the fourth quarter of 2005.

Line	Type of investment	2012	2013
1	**U.S. net international investment position (line 4 less line 12)**	-4578245	-5382996
2	Net international investment position excluding financial derivatives (line 5 less line 13)	-4636021	-5456542
3	Financial derivatives other than reserves, net (line 6 less line 14)	57776	73546
4	**U.S. assets**	22520346	23709843
5	Assets excluding financial derivatives (sum of lines 7, 8, 10, and 11)	18900585	20890008
6	Financial derivatives other than reserves, gross positive fair value (line 9)	3619761	2819835
	By functional category:		
7	Direct investment at market value	5938327	7080058
8	Portfolio investment	7967014	9183060
9	Financial derivatives other than reserves, gross positive fair value	3619761	2819835
10	Other investment	4422876	4178557
11	Reserve assets	572368	448333
12	**U.S. liabilities**	27098591	29092840
13	Liabilities excluding financial derivatives (sum of lines 15, 16, and 18)	23536606	26346551
14	Financial derivatives other than reserves, gross negative fair value (line 17)	3561985	2746289
	By functional category:		
15	Direct investment at market value	4670942	5790551
16	Portfolio investment	13978875	15503192
17	Financial derivatives other than reserves, gross negative fair value	3561985	2746289
18	Other investment	4886789	5052808

The level of the IIP can change for two reasons. The first is due to asset flows between the U.S. and other countries. These flows are summarized each quarter in the ITAs as the sum of the balance on the FA and KA, or alternatively as the balance on the CA (omitting the statistical discrepancy). A negative CA balance (positive FA/KA balance) indicates a decrease in the level of the IIP due to the flows, while a positive CA balance implies the reverse. For example, from 2012 to 2013 the combined FA/KA balance was -60.5 billion dollars (the difference between the current account balances at the end of each year, line 30 in Figure A4).

This differed from the 804.7 billion dollar decrease in the U.S. IIP from 2012 to 2013 (the difference between the net international investment position at the end of each year, line 1 in Figure A6). The 865.2 billion dollar difference (the CA balance improved, but the investment position deteriorated) is the other reason the IIP can change: valuation effects. These are changes in value of the existing stock of external assets and liabilities, and can occur because of variations in the underlying prices of the assets or because of movements in exchange rates.