1. Overview

My research emphasizes the importance of using very detailed information on countries and firms to assess the impact of globalization. It is characterized by the development of new datasets that shed light on old questions and spur novel areas of research. It strives to combine the intuitions of neoclassical trade theory with insights from “new” trade models to generate richer and more sensible theoretical frameworks for thinking about international trade. Though grounded firmly in international economics, it draws upon tools from a wide range of disciplines. Overall, it is guided by my interest in how the different parts of an economy, from industries to firms to workers to regions, respond to increases in international competition.

My research demonstrates that countries’ production and trade depends upon their relative factor endowments (capital, skill and land abundance). I find that as trade between countries with very different relative endowments opens up, countries’ production adjusts according to comparative advantage. For the United States, this means that trade with low-wage countries induces labor-intensive industries like apparel and footwear to decline at the expense of more capital- and skill-intensive industries like pharmaceuticals. I show that industries like apparel and footwear are unlikely to disappear completely, however, because reallocations within industries mirror those across industries as firms shift their output from low- to high-end goods.

More broadly, my research shows that the adjustments U.S. manufacturing firms make to their product lines are a surprisingly important but virtually ignored driver of U.S. economic activity. I find that one-third of the increase in real U.S. manufacturing shipments between 1972 and 1997 is due to the net adding and dropping of products by incumbent plants, a contribution that is ten times the level associated with net plant entry and exit. I show that two-thirds of U.S. manufacturing firms alter their mix of products every five years, and that two-thirds of those firms both add and drop at least one product. Recently added and dropped products, moreover, account for roughly half of firms’ total output. This research also demonstrates that very little product diversification is the result of merger and acquisition; rather, firms make virtually all adjustments to their product mix at existing facilities.

One of my newest research projects analyzes transfer pricing by multinational firms. I find that U.S.-based multinationals charge unrelated customers an average of 70 percent more for their export products than they receive from their foreign affiliates in the same destination country. This gap between multinationals’ “market” and “transfer” prices increases with firms’ market power and is higher the lower are destination countries’ corporate tax rates. Given the large volume of U.S. and global trade that takes place inside multinational firms, the potential impact of this form of price discrimination is substantial, having the ability to influence government tax receipts, official trade statistics and estimates of inflation and productivity growth via its effect on import and export price indexes.

In another new research agenda, I examine how variation in product quality can be identified even when detailed data about product attributes are not available. This research lies at
the intersection of trade, industrial organization and index number theory, and has led to the
development of a general method for estimating variation in countries’ export quality over time. Preliminary empirical implementation of this method reveals substantial differences in exporters’ relative manufacturing quality growth during the 1980s and 1990s, with China and Ireland, in particular, experiencing relatively rapid gains.

My research also explores the very unequal distribution of income that exists across countries as well as across regions within countries. Determining whether laggard countries or regions can catch up is a core question of development economics. I apply the insights of trade theory to this issue by demonstrating the importance of comparative advantage. Within countries, for example, my empirical analysis of U.S. labor markets shows that labor-abundant regions like Appalachia are much more likely to produce a set of goods that overlaps with low-wage countries like China or Mexico. Across countries, my research demonstrates that land abundance or distance from the center of global economic activity can retard development by suppressing firms’ and workers’ incentives to accumulate human and physical capital.

The remainder of this statement outlines my research in greater detail. Papers are referenced numerically in square brackets. The key to these references appears at the end of the statement.

2. Do Countries Specialize? How?

Historically, empirical research in international trade has taken place at a relatively aggregate level, focusing on countries and industries and assuming, for example, that all countries produce the same set of industries via identical techniques and technology. That approach ignores both product differentiation within industries and the potential heterogeneity of sub-national units such as firms or regions. Gauging the extent to which countries specialize, however, is critical for many issues in international trade, particularly the distributional consequences of trade liberalization. Workers in wealthy countries that produce the same mix of industries produced by poor countries are more exposed to real wage declines as a result of liberalization than rich-country workers producing a distinct set of goods. Failure to account for product differentiation within industries also leads to false conclusions. It has been observed, for example, that most countries export in most industries, and this fact has been used to argue, incorrectly, that exports are not determined by relative endowments.

My research in this area finds far more support for the idea that endowments drive trade (the “factor proportions framework”) than previous empirical work suggests. It is the first to use product-level trade data to test trade models and has sparked others’ interest in the importance of export quality in international trade and development.

In [1], I show how conventional datasets can be used to test a more general version of the factor proportions framework. This version of the model permits countries to produce distinct sets of industries and implies that the effect of factor accumulation on a given industry’s output varies with a country’s relative endowments. Production of labor-intensive industries like apparel should
rise with capital accumulation in labor-abundant countries like the Philippines but fall with capital accumulation in more capital-abundant economies like Japan, until the latter abandon the industry entirely. My approach to testing the model allows for the possibility that countries specialize within industries. I show how unobserved variation in countries' production within industries can be inferred from their observed factor usage. The fact that “electronics” industry production in the Philippines is far more labor intensive than electronics production in Japan is taken as an indication that the two countries manufacture different goods within electronics, e.g., portable radios versus satellites. Empirical implementation of my test reveals that the more restrictive version of the factor proportions model is easily rejected in favor of one that allows for within-industry specialization.

In [2] I examine product-level trade data directly. Surprisingly, I find that even when products are defined very narrowly, the sets of products diverse countries export are not distinct. The United States, for example, imports men’s cotton shirts from more than 50 disparately endowed trading partners. Rather, one must look even closer, within products. I find a strong relationship between countries' export prices and their capital and skill abundance: men’s cotton shirts from Japan are roughly thirty times more expensive than the identically classified shirt from the Philippines. These results indicate that capital- and skill-abundant countries compete in an unexpected dimension, i.e., they use their endowment advantage to produce goods possessing superior quality or other tangible or intangible attributes than the “same” goods emanating from labor-abundant countries.

The importance of the results in [1,2] and related work in [3] extends beyond their support for the factor proportions framework. They indicate that accounting for product-mix specialization is critical for estimating the technology gap thought to separate developed and developing economies. This is because the aggregate price deflators used to measure cross-country and cross-country-industry total factor productivity likely do not capture the product-level price variation reported here, potentially biasing productivity estimates and the empirical results which rely upon them. These results are also noteworthy in that they contradict “new” trade theory models that imply an inverse relationship between export prices and exporters’ productivity. For these models to be consistent with the evidence I present, skill- and capital-abundant countries must have relatively low productivity, which is implausible.

In [3] I demonstrate that comparative advantage operates not just within industries and within products, but even within firms. This analysis introduces a new measure of U.S. industries’ exposure to international trade, the share of industry imports that originate in countries with very low wages. I use this measure to identify import competition in place of the more conventional import penetration (total imports divided by domestic output) both because it is corresponds more closely with the theory being tested and because it is less likely to suffer from endogeneity.

The data investigated in this paper identify the industry a plant produces but do not reveal the underlying products produced within industries. Guided by the factor proportions framework, I assume that plant factor usage provides information about plants’ unobserved product mix within industries, which should mediate their response to trade liberalization. Plants using a lot of labor relative to capital, for example, should be more susceptible to trade with low-wage countries than
plants in the same industry exhibiting greater capital or skill intensity. This hypothesis is supported by the data. Across industries, I find that plants in industries with greater exposure to low-wage country imports (e.g., apparel) are more likely to shrink or die. Within industries facing the same exposure, I show that relatively capital-intensive plants exhibit relatively better performance in terms of survival and growth than more labor-intensive plants.

The most intriguing result of the paper is that plants appear more likely to climb the quality ladder by switching industries when exposure to low-wage country imports is high. Indeed, I demonstrate that when plants do switch industries, the ones they move into have lower exposure to low-wage country imports and greater capital- and skill-intensity than the ones they leave behind. This last result has motivated a much broader inquiry into product-mix adjustments by U.S. manufacturing firms, described in detail below.

The usefulness of examining product-level trade data in the research conducted for [2,3,4] has prompted me to help increase their availability. In [5], for example, I construct a concordance that can be used to match the product identifiers in the product-level trade data to the industry identifiers used in many production datasets.

3. Regional Development

Explaining the large and persistent differences in income that separate countries or regions within countries is a core issue of economics. I bring the intuitions of trade theory to bear on this topic by demonstrating that regional heterogeneity in terms of factor endowments and proximity to global economic activity can play a role in regions’ ability to catch up with the developed world [6].

My research demonstrates that endowment-driven specialization takes place across regions within countries as well as across countries. As a result, regions within a country may be asymmetrically exposed to international trade via the particular mix of goods they produce. In contrast to my work with countries, I find evidence of regional specialization by examining regional variation in relative factor prices rather than relative factor endowments. Prices and endowments are, of course, related. The reason that regions with disparate factor endowments are expected to produce different bundles of goods is because of endowments’ influence on wages: labor-abundant regions offer relatively low wages compared to the prices of other factors and are therefore attractive to firms producing labor-intensive goods. Direct tests of factor price equality across countries are difficult because data comparing the wages of comparable workers across countries are generally unavailable.

In [7] I introduce a method for identifying relative factor price equality that is valid under general assumptions about production, markets and factors. Critically, it controls for variation in the quality or composition of factors across regions and industries and therefore permits a test of whether quality-adjusted factor prices are indeed equal. Application of this method reveals significant differences in relative skilled wages in both 1982 and 1992 across the 181 labor markets.
that make up the United States. Surprisingly, these differences are increasing with time, indicating sluggish U.S. labor-market integration. Between 1972 and 1992, for example, the quality-adjusted skill premium of labor-abundant Nashville relative to skill-abundant New York City rose from 30 to 36 percent.

I find that these differences in relative wages coincide with labor markets’ industrial structure: the larger the difference in two labor markets’ estimated relative skilled wages, the smaller the number of industries they produce in common. Across time, greater changes in labor markets’ relative skilled wages are associated with a larger number of added and dropped industries.

These results imply that the exposure of otherwise identical U.S. workers to international trade may depend upon the particular labor market in which workers reside: because skill-scarce labor markets like Nashville are more likely to produce goods in common with labor-abundant trading partners like Mexico and China, the real wages of unskilled workers in Nashville may respond more readily – and negatively – to product-price declines associated with trade liberalization than unskilled workers in New York City. Subsequent research in [8,9,10] documents similar evidence of regional heterogeneity within the United Kingdom and Mexico.

Endowments also influence regions’ incentives to acquire capital or skill and therefore grow their way out of poverty. In [11] I demonstrate theoretically and empirically that certain kinds of land abundance can “soak” up capital and delay the emergence of manufacturing. In [12] I investigate the influence of countries’ distance from global economic activity on skilled wages and therefore incentives to educate. I show that because firms in remote locations pay greater trade costs on both exports and intermediate imports, distance reduces the amount of value added left to remunerate domestic factors of production. If skill-intensive sectors have higher trade costs, more pervasive input-output linkages, or stronger increasing returns to scale, remoteness depresses the skill premium and thereby impedes skill deepening. Empirical analysis demonstrates that cross-country variation in skill abundance is negatively correlated with remoteness. It also shows that the world’s most peripheral countries are becoming increasingly economically remote over time.

4. Product Switching and Aggregate Manufacturing Growth

In [13,14] I show that multiple-product firms dominate U.S. manufacturing and that their product-mix adjustments are responsible for a large fraction of micro- and macroeconomic growth. I find that roughly one-third of the increase in real U.S. manufacturing shipments between 1972 and 1997 is due to the net adding and dropping of products by incumbent plants. This contribution dwarfs that of plant net entry, i.e., plant births minus plant deaths, which accounts for just 4 percent of the overall change. Despite these relative magnitudes, investigation of product switching receives almost no attention even as theoretical and empirical research into plant entry and exit thrives.

My research into the importance of product switching as well as its causes and consequences is made possible by my construction of a unique new longitudinal dataset that tracks U.S. manu-
facturing output at the firm-product level across quinquennial Manufacturing Censuses from 1972 to 1997. As noted above, this project is motivated by my initial finding that U.S. manufacturing firms appear to climb the quality ladder in response to trade with low-wage countries.

Changes in firms’ product mix are frequent, widespread and substantial. Two-thirds of U.S. manufacturing firms add or drop a product every five years while 45 percent of firms do both. These results emphasize the significance of changes in firms’ extensive margins – i.e. adjustments to the number of goods produced – as drivers of firm and aggregate output growth. They are all the more striking given that the definition of a product in the data I use is relatively coarse, e.g., capturing “passenger cars” but not distinguishing the mini-vans, SUVs, or sedans contained within that product category. As a result, my findings likely underestimate the importance of the extensive-margin.

I show that the patterns of product adding and dropping observed in the data are hard to explain purely in terms of shocks to firms or products, e.g., demand shocks that promote the ascendance of “hot” products and the abandonment of unpopular ones. Instead, the data emphasize the importance of firm-product specific shocks in fostering product-mix dynamics, and highlight the need for a new generation of theoretical models to analyze them.

This research also provides fresh insight into the importance of mergers and acquisitions. Contrary to conventional wisdom, I find that product diversification is not synonymous with merger and acquisition. In fact, fewer than 1 percent of firms’ product additions between 1972 and 1997 occur via the acquisition of another firm’s plant(s). Rather, the vast majority of product extensions by continuing firms are done within existing facilities already owned by the firm. While product switching does not imply ownership changes, I do find that changes in ownership are often associated with product switching: 95 percent of firms that are involved with an ownership change alter their product mix.

My research into product switching is ongoing and it, in conjunction with the research on multinationals described below, is supported by a three-year National Science Foundation grant.

5. New Models of International Trade

In [15], I develop a new model of international trade that pulls together and extends the two major strands of the international trade literature. This joining of “old” and “new” trade theory yields new – and more sensible – predictions about the distributional consequences of trade liberalization.

In “old” trade theory, international trade according to comparative advantage raises welfare by allowing countries to import goods using relatively fewer resources than would be required to produce them domestically. This framework emphasizes the interaction of countries’ heterogeneous factor endowments with their industries’ heterogeneous factor usage but, via assumptions of perfect competition and constant returns to scale, generally ignores the role of firms.

The most recent “new” trade theory models, in contrast, stress the role of firm productivity,
horizontal product differentiation and consumer love of variety in explaining why only some firms export and why countries engage in significant intra-industry trade, e.g., the exchange of U.S. Fords for German Volkswagens. They show that international trade raises welfare by inducing a reallocation of economic activity away from low-productivity firms and towards high-productivity firms as trade costs fall. These models ignore comparative advantage, however, by focusing on symmetric countries, a single industry and a lone factor of production.

Though some of my research [2] contradicts aspects of “new” trade theory, I have in [16] found evidence supporting a positive relationship between falling trade costs and the relative growth of high-productivity firms. Constructing a new dataset that tracks the evolution of U.S. tariffs and transportation costs at industry level, I show that industries with greater declines in trade costs experience the largest gains in productivity as relatively low-productivity firms die and relatively high productivity firms expand via exporting.

My combination of “old” and “new” trade theory in [15] provides the first model that simultaneously explains why some countries export more in certain industries than in others, why nonetheless two-way trade is observed within industries, and why, within industries engaged in these two forms of trade, some firms export and others do not.

Results in [15] both challenge and strengthen existing intuitions. In the factor proportions framework, for example, trade liberalization results in a simple transfer of employment from the comparative disadvantage industry to the comparative advantage industry. Though [15] finds a similar pattern with respect to industries’ net changes in employment, the reallocation of firms within industries leads to gross job creation and destruction in all industries as trade costs fall, a new and more realistic implication.

Another contrast with the factor proportions framework involves the real-wage effects of trade liberalization. In “old” trade theory, the relatively abundant factor experiences real-wage gains while the relatively scarce factor suffers real-wage losses. In [15], however, the price declines associated with industries’ productivity growth inflate the real-wage gains of relatively abundant factors and dampen, or even potentially overturn, the real-wage losses of relatively scarce factors. As a result, it is theoretically possible that all factors gain from trade.

On the other hand, I find that the behavior of heterogeneous firms magnifies comparative advantage, a central message of “old” trade theory. Because the industry productivity growth associated with falling trade costs is strongest in countries’ comparative advantage industries, trade liberalization causes countries’ relatively efficient industries to become even more relatively efficient.

In [17] I extend the model in [15] to allow firms to produce multiple products and consider firms’ decisions to adjust their product mix in response to trade liberalization. Preliminary results suggest that trade liberalization encourages firms to focus on their “core competencies” by reducing the range of products they manufacture while increasing the range of products they export. Here, as well, effects are more pronounced in countries’ comparative advantage industries relative to their comparative disadvantage industries. In addition, the paper demonstrates that the transfer of resources across product lines within firms provides an additional source of welfare gains from
6. Export Quality

One of my newest research agendas [18,19] seeks greater understanding of the factors that induce export quality variation across countries as well as the consequences that changes in export quality have for countries’ growth and development. Progress in this area is hampered the fact that data comparing countries’ export quality do not exist. Researchers have responded to this constraint by equating price and quality. Export prices may vary for other reasons, however, including comparative advantage or currency misalignment. Shirts from the Philippines may be cheaper than shirts from Japan not just because they are inferior but because the Philippines has relatively low costs or because Japan has an over-valued yen.

In [18] I introduce a general method for identifying product quality, i.e., any tangible or intangible attribute of a product that increases consumer valuation. The intuition for my approach is straightforward: holding observed export prices constant, countries exhibiting trade surpluses must be offering higher quality (i.e., lower quality-adjusted prices) than countries running trade deficits. If the ratio of Japanese to Philippine shirt prices is constant, but the Japanese trade surplus in shirts vis a vis the world is rising, Japanese shirt quality is increasing.

Direct application of this intuition is complicated by the possibility that firms produce, and consumers value, horizontally differentiated varieties, e.g., red and blue shirts. In such a setting, Japan’s rising net trade in shirts may solely reflect an increase in the number of exported varieties. To isolate the impact of quality, I pin down the number of varieties by assuming they are negatively correlated with countries’ quality-adjusted prices. Justification for this assumption can be found in the theoretical model described above [13], which shows that countries produce more varieties in their comparative advantage industries, i.e., the industries in which they exhibit relatively low prices.

The use of countries’ trade balances with the rest of the world to identify consumer demand imposes a practical constraint on the implementation of my method. Currently, the most reliable time-series information on countries’ global net trade is recorded at a more aggregate level than countries’ export prices. To deal with this mismatch, I develop a theoretically appropriate, but unobservable, bilateral “impure” price index comparing countries export product prices within an industry.

Identifying quality then requires three steps. First, I demonstrate that the bilateral impure price indexes, although unobservable, are bounded by observable Paasche and Laspeyres indexes defined over countries’ common exports to a third country. Based on those bounds, I estimate an impure-price-index number for each country-industry. Second, I show that the quality-adjusted-price component of countries’ impure industry price indexes can be inferred from their industry trade balance with the world. In the final step, I use this last result to strip away the pure price component of the impure price index to estimate changes in countries’ relative product quality over
Preliminary results highlight significant variation in countries’ relative manufacturing quality growth between 1980 and 1997, with China and Ireland experiencing particularly rapid relative gains. Going forward, I plan to generate and use more detailed quality comparisons across industries within manufacturing. This research was recently awarded a three-year National Science Foundation grant.

7. Multinationals

A substantial portion of international trade takes place within multinational firms, yet relatively little is known about the products they import and export. To ameliorate this situation, I am using raw data from the U.S. Customs Bureau to construct a dataset that tracks the millions of import and export transactions that crossed a U.S. border between 1992 and 2000. For each transaction, I can observe the identity of the exporting or importing U.S. firm, that firm’s attributes, the value and quantity of each product shipped, the destination or source country, and whether or not the transaction takes place between related parties.

These data are uniquely suited to advancing our knowledge in many areas of international trade, in particular the factors determining the boundaries of multinational firms, the extent to which exchange rate shocks are passed through to local consumers, and the prevalence of using trade to substitute for domestic factors of production.

My first working paper using these data [20] expands our understanding of trading firms by examining a number of new dimensions of their activity. I find U.S. trade to be highly concentrated, with the top 1 percent of trading firms in 2000 (about 2200 firms) accounting for 81 percent of all imports and exports. I show that most importers and exporters trade relatively few narrowly defined products (e.g. men’s cotton shirts) and that they trade with a relatively small number of high-income countries. I also demonstrate that the small number of firms with the highest product and trading-partner intensity employ a disproportionately large number of workers and account for the preponderance of trade.

My second working paper using these data [21] investigates the internal versus external pricing behavior of multinational firms. I find that there is a large positive gap between U.S.-based firms’ arm’s length and related party export prices and that the size of this gap varies systematically with firms’ market power as well as destination-countries’ corporate tax rates, product tariffs and real exchange rates. In addition to its implications for tax collection, official trade statistics and measures of productivity, this price discrimination may contribute to multinationals’ observed superior performance. Indeed, multinational affiliates’ ability to purchase intermediate inputs from overseas parents at relatively low prices may explain why they are larger, more productive and pay higher wages than local firms.

Like my work on quality, this research is ongoing.
8. References


