



# The Effects of Offshoring on U.S. Workers: A Review of the Literature

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## *Abstract*

Recent economic literature views offshoring through the lens of a “trade in tasks” framework. Sources have used this framework to examine four main issues related to offshoring: (1) the relative price, productivity, and net effect of offshoring; (2) the different effects of offshoring for high- and low-skilled workers; (3) the different types of offshoring; and (4) the relative importance of offshoring and technological change. Studies tend to find that low-skill workers are harmed by offshoring, while high-skill workers benefit. Similarly, different types of offshoring have either positive or negative impacts on employment in the home country. As a result of this heterogeneity, when discussing offshoring, economists should be clear about the effects and type of offshoring which they are discussing.

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## Introduction

Offshoring occurs when a firm moves part of its supply chain from one country to another. For example, in the 1980s U.S. semiconductor manufacturers typically produced, assembled, tested, and packaged their semiconductors entirely in the United States (Brown, Linden, and Macher, 2006). Today, U.S. semiconductor manufacturers still produce the wafers for their semiconductors in the United States, but the assembly, testing, and packaging steps are usually carried out abroad (USITC, 2017). Similar trends are also seen in other manufacturing industries, such as automobiles, furniture, textiles, and apparel. In 1982 U.S. multinationals had 30 percent of their labor force in foreign affiliates (Harrison and McMillan, 2011). By 2014, the share had increased to 60 percent (Bureau of Economic Analysis, 2017).<sup>1</sup>

The decades of increased offshoring also saw substantial changes in employment in the U.S. manufacturing sector. The number of Americans employed in manufacturing fell from almost 20 million in 1980 to a little over 12 million in 2017 (Bureau of Labor Statistics, 2017). At the same time, inequality increased in the manufacturing sector. The ratio of nonproduction to production workers employed in U.S. manufacturing rose from 35:100 in 1980 to almost 45:100 in 2011 (Feenstra, 2017). The relative wages of nonproduction workers also increased, from 50 percent higher than production workers in 1980 to 85 percent higher in 2011 (Feenstra, 2017). There is also a popular belief that production jobs in manufacturing once allowed even low-skilled workers to acquire high-paying jobs, but that these opportunities are now disappearing.<sup>2</sup>

Offshoring has been put forth as an explanation for this trend. The story typically goes something like this: The costs of offshoring have been falling for decades. This has reduced the relative price to U.S. firms of foreign labor as compared to U.S. labor. This relative price effect then caused firms to increase their demand for foreign labor and reduce their demand for domestic labor. As a result, employment and wages of domestic labor fell.

A large literature has developed to investigate this claim and examine alternative explanations. The literature revolves around five main issues: (1) trade in tasks, (2) the relative price, production, and net effects of offshoring, (3) different effects from offshoring for different workers, (4) different effects from different types of offshoring, and (5) technological change.

First, not only can goods be traded across countries, but the tasks that go into making a good can also be carried out across multiple countries. Thinking of offshoring in this way reveals effects that would be ignored in a framework with only trade in goods.

Second, offshoring affects employment through several different pathways. Although its relative price effect decreases domestic employment, its productivity effect increases it. As a result, the

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<sup>1</sup> When production moves abroad, it may be carried out either by a foreign affiliate that is part of the same multinational enterprise, or by an unaffiliated firm. The business literature typically only refers to the former process as offshoring. However, the industrial organization and international trade literatures refer to the two combined as offshoring (Crinò 2009), and that is the definition we will use in this paper.

<sup>2</sup> Reality is more complex than this simple story. See Levinson (2017) for a detailed discussion of the manufacturing wage premium.

literature has generally found that the net effect of offshoring on domestic employment is either zero or only mildly negative.

Third, offshoring has different effects on different groups. Typically, low-skill workers are harmed by offshoring, while high-skill workers benefit.

Fourth, offshoring is an umbrella term used to describe a variety of different activities, with different impacts. Typically, offshoring of the production of material goods is better for higher-skilled domestic workers than for lower-skilled domestic workers. By contrast, offshoring of services provision generally has the same effect on both types of workers, and this effect is more positive.

Fifth, technological change has also occurred during this time period, and thus is an alternative explanation for the fall in manufacturing employment in the United States. Increased automation has led to the substitution of capital for labor, while skill-biased technological change has reduced the attractiveness of low-skilled workers. The literature has consistently found that offshoring is not the main cause of falling manufacturing employment. However, “not the main cause” covers a wide range of impacts, and there is less agreement on the specific share attributable to either offshoring or technological change.

The remainder of this paper gives an overview of the literature on each of these topics. Section 2 discusses the trade in tasks framework. Section 3 discusses the relative price, productivity, and net effects of offshoring. Section 4 discusses the different effects of offshoring for high- and low-skilled workers. Section 5 discusses different types of offshoring. Section 6 discusses the relative importance of offshoring and technology in explaining employment trends. Section 7 presents some conclusions.

## **Offshoring as Trade in Tasks**

Historically, trade could be characterized as being the exchange of goods between different countries, and so models of trade used frameworks in which goods are created in different countries from factors of production (like labor and capital) found in those countries. But in their seminal paper, Grossman and Rossi-Hansberg (2008) argue that modern trade is better characterized as a process in which small amounts of value are added in many different locations. This occurs through extensive trade in intermediate forms of the good, as well as through the international location of intangible production tasks, such as design, management, or IT support (Oldenski, 2012).

Grossman and Rossi-Hansberg (2008) propose modeling modern trade using a new framework that they call “trade in tasks.” In it, factors of production are first combined to complete tasks, and then tasks are combined to create goods. The innovation of the new framework is that a single good can be produced from tasks completed in multiple countries, using the lower prices for factors of production in those countries. However, there are costs to offshoring, and some tasks are more costly to offshore than others. These tradeoffs over the location of different tasks determine firms’ offshoring decisions.

The trade in tasks framework makes a number of assumptions and predictions that have been verified in subsequent work. For example, the Grossman and Rossi-Hansberg model predicted the existence of a productivity effect subsequently measured by Amiti and Wei (2009), Ottaviano, Peri, and Wright (2013), and Wright (2014). The model also assumes that task characteristics (like the importance of communicating with customers) help predict the amount of offshoring done by firms in that industry, and this assumption was verified by Oldenski (2012) and Wright (2014). Grossman and Rossi-Hansberg (2008) also predicted that occupations that do tasks that are more easily tradable are more likely to be offshored and thus will experience larger wage drops. The employment effect was empirically found by Crinò (2010), and the wage effect was found by Hummels et al. (2014). As a result of its empirical and theoretical support, trade in tasks is the main framework used for understanding offshoring today.

## **The Relative Price, Productivity, and Net Effects of Offshoring**

### **Understanding the Effects of Offshoring**

A reduction in the cost of offshoring affects a firm's production decisions through two main channels: a relative price effect and a productivity effect.<sup>3</sup> These are analogous to the substitution and income effect in a consumer optimization problem. As in the substitution effect, when the price of an input (like foreign labor) falls, other inputs become relatively more expensive, leading firms to substitute towards the foreign labor whose price fell and possibly away from the domestic labor whose price did not change (more on that "possibly" in the relative price section). However, in addition to the relative price effect, a drop in the price of foreign labor decreases the total cost of producing a unit of the good. This productivity effect increases the quantity of the good demanded and the quantity of all inputs used, including domestic labor. The net effect of a reduction in offshoring costs on domestic labor demand is the sum of the relative price and productivity effects.<sup>4</sup>

### **Relative Price Effect**

We have discussed how offshoring lowers the cost of foreign relative to domestic production and described a story where this leads to substitution away from domestic workers. But such substitution is not inevitable; whether it occurs or not depends on whether foreign and domestic workers are complements or substitutes in the firm's production process. For example, imagine the firm's production process had domestic workers design their products, which were then assembled abroad. In such a case, the two types of labor are complements, because both stages of

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<sup>3</sup> The relative price effect is sometimes referred to as the displacement effect, such as in Ottaviano, Peri, and Wright (2013).

<sup>4</sup> Technically, these are only the partial equilibrium effects of offshoring. In a general equilibrium setting, offshoring would also impact employment through its differential impact on industries with different factor intensities, and through the reduction it causes in the price of final consumer goods. The literature has less to say on these general equilibrium effects, as they are typically assumed to be of second-order importance, but it may represent a fruitful area for future research.

production will expand or contract together when the price of one of the types of labor changes. It is thus an empirical question as to whether this relative price effect has either a positive (complements) or negative (substitutes) effect on domestic employment. A review by Crinò (2009) states that while a large number of studies find that domestic and foreign labor are substitutes, the relationship is weak. More recent research such as Ottaviano, Peri, and Wright (2013) has also found that the two are substitutes.

### **Productivity Effect**

Research has generally found the productivity effect of offshoring to be large. Amiti and Wei (2009) find that offshoring accounts for around 15 percent of the labor productivity growth from 1992 to 2000. Ottaviano, Peri, and Wright (2013) find that a 1 percent increase in the share of offshore employment is associated with a 1.7 percent increase in aggregate employment (offshore plus domestic). Wright (2014) find a smaller productivity effect in which the productivity effect of an increase of 1 percentage point in the extent of offshoring offsets 69 percent of the negative relative price effect on domestic employment.

### **Net Effect**

The net effect of a reduction in offshoring costs on domestic employment is the sum of the relative price and productivity effects. Although the consensus on the relative price effect means that offshore and domestic labor are gross substitutes, they may be either net substitutes or net complements, depending on the size of the negative relative price effect compared to the size of the positive productivity effect.

Research yields mixed results on the effect of offshoring when all types of labor are combined. Ottaviano, Peri, and Wright (2013) find that offshoring has a statistically insignificant effect on domestic employment. In the industries most exposed to offshoring, they find that native employment has not suffered, but rather has benefited, due to an expansion of these domestic industries relative to others. Similarly, Hufbauer, Moran, and Oldenski (2013) find that when a U.S. firm expands the workforce at its foreign affiliates by 10 percent, that firm increases its U.S. workforce, U.S. capital expenditures, U.S. research and development (R&D) spending, and U.S. exports by 4 to 5 percent.

By contrast, Wright (2014) finds that the productivity effect only offsets 69 percent of the relative price effect, so that on net, offshoring does reduce low-skilled native employment. However, this net effect accounts for only about 6 percent of the average annual decline in production (low-skilled) workers, or 69,000 out of the 1.2 million jobs lost. On the other hand, note that while these are the impacts on U.S. workers on average, research has generally found that the effects vary for different groups of workers and for different types of offshoring.

## **Different Effects of Offshoring for High- and Low-Skilled Labor**

### **Why Offshoring Has Different Effects for High- and Low-Skilled Labor**

One of the key areas of public concern about offshoring is how it may harm low-skilled workers. In particular, firms may have greater incentives to offshore the tasks of low-skilled workers than high-skilled ones. This is driven by the different tasks that high- and low-skilled workers do, and the different costs of offshoring these tasks.

From a firm's perspective, offshoring a task reduces some costs but increases others. Offshoring to a low-income country will typically reduce labor costs, due to lower wages in the foreign country. However, it will also increase other costs, due to the expense of monitoring and coordinating workers. A profit-maximizing firm will offshore a task if the net effect is to reduce costs. However, different tasks require more or less monitoring and coordination. As a result, offshoring is most likely to be cost effective for tasks where domestic wages are high relative to foreign wages, and the task requires little monitoring or coordination.

Different tasks have different wage ratios and require different amounts of monitoring. In particular, firms are more likely to offshore stages of production that involve more routine tasks and less communication (Oldenski 2012). Since low-skilled jobs are correlated with more routine tasks, this means that low-skilled jobs are more likely to have their tasks offshored. This leads to larger relative price impacts, as well as larger productivity effects (Grossman and Rossi-Hansberg 2008).

However, while this story explains why the impact of offshoring could be different for low-skilled workers than on high-skilled workers, it does not measure these differences. In order to answer that question, we review the empirical literature and what it has found.

### **Empirical Evidence on the Effects for High- and Low-Skilled Labor**

The literature has generally found offshoring to have different effects for high- and low-skilled labor. Many papers find that offshoring benefits high-skilled workers more than low-skilled workers. Research has also typically found that the absolute effects on low-skilled workers are negative. However, there is less agreement on the effects of offshoring on high-skilled workers. The trade in tasks framework is a plausible explanation for this lack of consensus.

As just noted, researchers have generally found that high-skilled workers gain more from offshoring than low-skilled workers do. Feenstra and Hanson (2001) show that offshoring is associated with increases in the share of wages paid to high-skilled workers. Feenstra and Hanson (1999) find that offshoring was responsible for 15 percent of the rise in relative wages of nonproduction workers in 1979–1990. Crinò (2012), Crinò (2010), and Crinò (2009) find that offshoring boosted the relative demand for skilled workers. In particular, Crinò (2009) reviews the available literature and concludes that offshoring was an important determinant of rising wage inequality during the 1980s. Grossman and Rossi-Hansberg (2008) argue that the relative-

price effect should reward high-skilled labor but harm low-skilled labor, for the usual (Stolper-Samuelson) reasons: when a good's price falls, the return of the factor used intensively in its production also falls. And Harrison and McMillan (2011) find that offshoring has positive employment effects for manufacturers whose workers do different tasks at home and abroad, and negative employment effects when they do similar tasks. One slight exception is Antràs, Garicano, and Rossi-Hansberg (2006), who develop a theoretical model where it is possible for offshoring to lower wage inequality, if skilled management is abundant, communication costs are high, and skill overlap is large.

Papers have typically found the absolute impact of offshoring on low-skilled workers to be negative. Hummels et al. (2014) finds that if a manufacturer doubles its offshoring, its unskilled workers can expect the present value of their wages over the next five years to fall by 11.5 percent. Wright (2014) finds that offshoring to China is responsible for 6 percent of the average annual decline in low-skilled worker employment from 2001 to 2007, or 69,000 out of 1.2 million jobs lost. Crinò (2012) finds that certain types of offshoring harm low-skilled workers.<sup>5</sup>

The net effect of offshoring on high-skilled workers is more contentious. Hummels et al. (2014) find that if a firm doubles its offshoring, its skilled workers can expect the present value of their wages over the next five years to fall by 1.4 percent. But this result is sensitive to exactly how high-skilled is defined. For some definitions of high skill, workers actually receive net benefits. Wright (2014) examines the impact of offshoring to China following its accession to the World Trade Organization. Wright finds that offshoring to China had a negative impact on low-skilled workers but increased the employment of high-skilled workers by 1 percent. Combining the effects for both low- and high-skilled worker types, offshoring to China increased U.S. employment by 2.6 percent.

## **Evidence for the Trade in Tasks Explanation**

Differences in tasks for different jobs can explain offshoring's differential effects on high- and low-skilled workers. Hummels et al. (2014) find that the impact of offshoring on workers depends on the tasks in their occupation. Oldenski (2012) looks specifically at services offshoring and finds that routine jobs are offshored, but non-routine jobs are not, leading to high-skilled, high-paying jobs being performed in the United States, while low-skilled, low-paying jobs are moved abroad. Ottaviano, Peri, and Wright (2013) find that offshoring leads to increased polarization in native and immigrant specialization, mainly by pushing natives toward more complex jobs, effectively hollowing out the task spectrum.

Trade in tasks could also explain the disagreement over the impact of offshoring on high-skilled workers: Hummels et al. (2014) find that while occupations with routine tasks experience larger wage drops, occupations with math, language, or social science tasks gain, and workers with natural science or engineering tasks are unaffected.

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<sup>5</sup> Specifically, Crinò (2012) finds that material offshoring harms low-skilled workers but service offshoring does not. This distinction between service and material offshoring is explained in section 5.

## **Different Types of Offshoring**

A number of different phenomena are lumped together under the label “offshoring.” This is likely because the underlying phenomenon, trade in tasks, is difficult to observe directly. As a result, other dimensions of the issue may be studied instead as proxies for unobservable task trade. The literature has focused on two such dimensions: the income level of the country being offshored to, and whether the job being offshored is related to materials (tangible goods) or services.

These observable characteristics are likely correlated with certain tasks. For example, some task types are more likely to be offshored to high-income countries than low-income ones. Similarly, when services are offshored, different tasks are more likely to be offshored than in materials offshoring.

### **Income Level of Offshoring Country**

Several papers have found that offshoring to high-income countries has negative effects on U.S. employment. Crinò (2009) argues that the main substitute for domestic labor is foreign labor in high-income countries, not foreign labor in low-income countries. Similarly, Harrison and McMillan (2011) find that if home and foreign tasks are similar, foreign and domestic employees are substitutes: a 1 percentage point fall in affiliate wages is associated with reductions in parent employment of between 0.0 and 0.6 percent. However, if tasks are different, then they are complements: a 1 percentage point decline in low-income affiliate wages is associated with increases in parent employment of between 0.1 and 0.8 percent.

### **Material and Service Offshoring**

Firms may offshore many different parts of their production process. If they offshore the production of a physical good that is then imported, that is called material offshoring. However, if they offshore some service (such as IT support, product design, or R&D), that is called service offshoring. Material offshoring was the predominant type of offshoring before 1990, while service offshoring became much more prominent afterward (Feenstra, 2017).

These two types of offshoring are distinct, as workers engaged in either of these activities are responsible for very different tasks. As a result, we might suspect that these two types of offshoring could have dissimilar effects on workers. Moreover, since workers engaged in services are typically more high-skilled than those in production, these different types of offshoring could easily impact high- and low-skilled workers differently.

Researchers looking at this issue have generally found more positive effects for service offshoring than material offshoring. Crinò (2009) conducts a thorough review of the literature up through 2008. This study finds that material offshoring worsens wage inequality between skilled and unskilled workers. However, while service offshoring shifts workforce composition towards high-skilled labor, it has at most a small negative impact on total employment. More recent research has produced mostly similar results. Crinò (2012) finds that both material and service offshoring raise demand for high- and medium-skilled workers relative to low-skilled workers,

although the effects are small. Sitchinava (2008) finds that material offshoring during 1989–1996 increased the relative wages for skilled workers. Service offshoring had an inconsistent impact, increasing the relative wage of skilled workers in 1989–1996 but decreasing it in 1997–2004. Amiti and Wei (2009) find that services offshoring was responsible for 10 percent of labor’s productivity growth, and material offshoring was responsible for 5 percent.

## **Technological Change as an Alternative Explanation for the Decline of Domestic Manufacturing**

### **Changing Views on Technology versus Offshoring**

Economists initially identified technological progress as the main cause of the increase in the relative demand for skilled labor in the United States recent decades. This can occur through skill-biased technological change, where new technologies tend to complement skilled workers but substitute for unskilled workers (Crinò 2009). Or increased automation could lead to a substitution away from all types of labor, towards capital. By either of these processes, the rapid technological progress in computers since the 1980s could explain why the demand for skilled labor increased during that time period. Crinò (2009) reviews a number of empirical studies from 1994 to 2003 that confirm this prediction.

This initial work identified a number of facts that seemed to rule out offshoring as an explanation. As noted by Feenstra (2017), a simple Heckscher-Ohlin model would require offshoring to generate different relative wage effects in the home and foreign country. But that was not what was observed. Studies such as Berman, Bound, and Machin (1998) confirmed that the shift towards skilled workers seen in the U.S. also occurred abroad.

However, international trade literature has proposed new mechanisms by which offshoring could produce labor demand effects that are consistent with these observations: (1) offshoring could itself cause skill-biased technical change; (2) it could cause skill-biased scale effects that act similarly to technical change; or (3) it could be specifically material offshoring that is the cause of the labor market changes (Crinò 2009). By these mechanisms, offshoring may produce labor effects similar to those of skill-biased technological change. This has resulted in a reevaluation of the relative impact of offshoring and skill-biased technological change.

### **Empirical Evidence on Technology versus Offshoring**

Recent research has shown that offshoring is responsible for some of the decline in U.S. manufacturing, but that most of the decline is due to other factors. The literature before 2008 generally finds that material offshoring increased the employment and wage share of skilled workers, but studies rarely held it responsible for most of the observed changes (Crinò 2009). More recently, Harrison and McMillan (2011) find that that offshoring is not the primary driver of declining domestic employment of U.S. manufacturing multinationals between 1977 and 1999: it is primarily due to other factors including, but not limited to, technological change (of either type). Goos, Manning, and Salomons (2014) argue that technological change is more important than offshoring. Autor and Dorn (2013) argue that technological change plays a central

role in explaining wage and employment polarization, but offshoring does not. However, Sitchinava (2008) finds that while offshoring was an important driver of growing wage inequality during 1989–2004, the role of skill-biased technological change is inconclusive.

## **Conclusion**

Offshoring is a complex economic issue with many subtle aspects. A simple model may oversimplify the offshoring phenomenon and thus miss key mechanisms or outcomes. By using the trade in tasks framework, we are able to think about the problem in a way that keeps the necessary details but omits the unnecessary ones. Continued application of this framework in future work will increase our understanding of the key issues in offshoring: (1) the relative price, productivity, and net effect of offshoring; (2) the diverging effects of offshoring for high- and low-skilled workers; (3) the different types of offshoring; and (4) the relative importance of offshoring and technological change.

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