Skill bias, trade, and wage dispersion[☆]

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ABSTRACT

Wage ratios between different percentiles of the wage distribution have moved in parallel and then diverged in the U.S. in the last 50 years. In this paper, I study the theoretical response of wage ratios to skill-biased technical change and trade integration. I build a simple model of heterogeneous technology and heterogeneous workers that features complementarities between the quality of ideas and abilities. I show that changes to the skill bias of technology and to trade costs can both reproduce the observed pattern since (i) they have similar asymmetric effects on productive vs. unproductive firms, and (ii) positive assortative matching in the labor market transmits this asymmetry across high and low skill workers. Focusing on the different channels through which skill-biased technical change and trade integration operate suggests ways to disentangle the magnitude of each.

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1. Introduction

Wage inequality in the United States has grown since the sixties, both across observable characteristics (e.g. college/high school premium, see Murphy and Welch, 1992) and within them (residual inequality, see Juhn et al., 1993). This growth has not been uniform throughout the whole wage distribution: a widespread increase in inequality until the late eighties has then evolved into a polarization of the wage distribution, with inequality increasing in the right tail and flattening out, or even decreasing, in the lower tail[1] (see Card and DiNardo, 2002; Piketty and Saez, 2003, 2004, and Autor et al., 2005, 2006, 2008).

Skill-biased technical change has been considered the most prominent candidate for an explanation (e.g. Bound and Johnson, 1992; Autor et al., 1998, 2003), while international trade integration has been found to contribute to a significant but minor part of this change (Borjas et al., 1991; Feenstra and Hanson, 1996, 1999). However, most trade-based explanations have been looking for the consequences of

exchanges between countries with different skill prices, whereas for a long time international trade has mainly occurred between countries with similar endowments (Baldwin and Martin, 1999). Motivated by this evidence on the behavior of inequality and trade patterns, I ask: can skill-biased technical change and trade integration between *identical* countries produce the same observed pattern for inequality? I show that because of positive assortative matching in the labor market, the answer is yes. I then argue that focusing on the specific channels of each mechanisms, one can gain further insights into how to disentangle them. My example will concentrate on the intra-firm rent distribution.

My starting point is the well-established finding that this growth in inequality is due to a large increase in the relative demand for skills that has occurred, especially since the late seventies, in the U.S. economy.[2] Wage inequality, as measured for example by the standard deviation of log-wages, or as the ratio between the values at the 90th vs. the 10th percentile in the distribution ($p90/p10$ ratio), has increased sharply until 1987, and increased modestly afterwards.[3] This deceleration hides a strong increase in the right tail ($p90/p50$) and a constant or decreasing inequality in the lower tail ($p50/p10$) of the distribution,[4] and it emphasizes the necessity to study the evolution of wage inequality in different regions of the skill distribution.

Several studies have documented empirically and justified theoretically how the properties of substitution and complementarity of computers with different tasks and abilities can generate these

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[1] The ratio of wages at the 50th vs. 10th percentile, and 90th vs. 50th percentile in the distribution, grew each approximately 10% from 1973 to 1987. After that, the lower tail flattened, while the upper tail continued to grow 10% more through 2004.

[2] See for example Katz and Murphy (1992) for a discussion of labor demand and supply forces. Juhn et al. (1993), among other things, also discuss the different timings in the evolution of total and residual wage inequality.

[3] See Card and DiNardo (2002).

[4] Autor et al. (2005, 2006, 2008) provide evidence on the polarization of the wage distribution. Piketty and Saez (2003, 2004) provide evidence on the behavior of wage ratios among top earners.

patterns.[5] On the other hand, international trade has been tested as if imports increased the supply of unskilled labor.[6] Some studies have expected trade to reallocate labor force towards sectors with comparative advantage. These reallocations are typically found to be weak and dominated by reallocation of labor force within sectors.[7] Other studies have then considered the consequences of outsourcing of low skill intensive tasks to unskilled labor abundant countries, which would look like intra-industry trade, finding larger effects.[8] These approaches are, for that period, at odds with most of the world trade being between developed countries with similar endowments.[9]

In light of this evidence, my contribution focuses the attention squarely on intra-industry trade, and builds a simple model of trade and labor markets capable of incorporating skill-biased technical change. I consider two identical economies with varieties characterized by heterogeneous efficiencies in their technology, in the spirit of Melitz (2003) and Bernard et al. (2003). I extend this framework along the lines of Lucas (1978), by assuming that workers are heterogeneous in their ability to run any firm (if they choose so), while being identical as production workers at the firms' production lines. A firm is then made up by an idea, a manager, and production workers. Complementarities between technology and ability imply positive assortative matching between managers and technological efficiency,[10] producing a "superstars" effect as in Rosen (1981). The occupational choice implies that the wage of the manager if she was a production worker plays the role of the fixed cost to access the domestic market, giving rise to increasing returns to scale at the firm level (as in Krugman, 1979), even in a closed economy. A fixed cost of exporting produces the endogenous selection of most productive firms in the foreign market, and trade is assumed to be balanced.[11]

With these assumptions, I eliminate by design any effect of trade on inequality through deficits or exchanges with countries relatively more endowed with unskilled labor, thus avoiding the most common arguments against trade-based explanations for the evolution of inequality. However, the economy features a wage function that depends on the individual ability, microfounded in a simple model of the labor market: hence, I can study the equilibrium response of wage ratios to trade integration and skill-biased technical change at different points in the skill distribution. I model trade integration as a reduction in the iceberg cost of export, and skill-biased technical change as an increase in the contribution of ideas to firm-level productivity, whereby, because of complementarities, high skill managers gain more than proportionally relative to low skill managers.

To capture the response in any region of the skill distribution, I frame the discussion in terms of wage ratios between two marginally different managers. In the paper, I show that while trade integration and skill-biased technical change operate on local wage ratios through partially different channels, they produce a similar asymmetric effect across firms: low productivity firms face tougher competition, while firms at the high end of the productivity range increase their earnings. Because of positive assortative matching in the labor market, this asymmetry is transmitted across low and high skill managers. I prove that, under some assumptions, there exist unique thresholds abilities above which local inequality increases, and below which local inequality decreases. Whether the wage ratio between two abilities s' and s'' increases or decreases will depend, for both trade and skill-biased technical change, on the position of these abilities s' and s'' with respect to those thresholds. Only studying the evolution of wage dispersion in different regions of the wage distribution is not sufficient to disentangle the source of the pattern.

This observational equivalence may help explain why international trade has been attributed only a limited role in the evolution of inequality observed in the last 50 years. However, I do not aim to propose uni-causal explanations and dismiss the importance of skill-biased technical change or of other channels of trade integration[12]: on the one hand, my model only applies to the manufacturing sector, which has been explicitly studied in this literature,[13] but is certainly not the largest part of the economy; on the other hand, trade with developing countries has grown in importance in recent years,[14] and my model addresses – by choice – only intra-industry trade-based on love-for-variety motivations. Rather, I intend to emphasize why intra-industry, balanced trade can by itself produce quite articulated behavior on economy-wide wage ratios by proposing a very simple extension of the recently developed theoretical literature on firm-level heterogeneity and trade.

If skill-biased technical change and trade integration can both rationalize the pattern for inequality in the U.S. economy that the literature has documented, what can tell the two causes apart? I propose to exploit the differences in the way skill-biased technical change and trade integration operate. My focus is on the intra-firm rent distribution, where I call "rent" the sum of profits and the manager's wage, less the opportunity cost of ideas and managers in the alternative occupation (zero and the production worker wage, respectively).[15] In the paper, I show that the share of the rent received by the manager is only a function of the relative contribution of managers and ideas to the firm-level productivity. The intra-firm rent distribution is not modified by trade integration because trade costs influence the marginal contribution of managers and ideas in the same way (thus, only competitiveness across firms is affected). Hence, changes in inequality not accompanied by change in the intra-firm rent distribution must be attributed to trade. On the other hand, changes in the intra-firm rent distribution must imply changes in local inequality caused by skill-biased technical change. This result is very dependent on the functional form assumptions, and only provides partial conditions. However, it serves the purpose of illustrating a more general point: progress can be made by explicitly spelling out the different mechanisms through which these two forces operate, and focusing on their different implications at firm level.

[5] Bound and Johnson (1992) provides an empirical comprehensive approach. Autor et al. (1998) show evidence of the relation between wage inequality and the timing and diffusion of computers across industries; Autor et al. (2003) investigate the role of computers, skills and tasks in the production function.

[6] For example, Borjas et al. (1991) and Murphy and Welch (1992) convert net imports into labor supply equivalents, first assuming that the impact of imports and exports is the same across skill groups, and then assuming that only imports affect the net supply of unskilled workers.

[7] For example, Bound and Johnson (1992) look for reallocations of workers between industries due to shift in product demand, and actually find that these shifts are slightly *reducing* the demand of college graduates. This finding leads them to look for the consequences of skill-biased technical change on within-industry changes in demand. Weak reallocations across and strong skill-upgrading within detailed sectors in manufacturing industry are also reported in Berman et al. (1994).

[8] Feenstra and Hanson (1996, 1999) calculate a measure of intermediate input outsourcing at sector level. To this end, they use data from input–output matrices to infer the total impact of imports on any given sector.

[9] For example, Baldwin and Martin (1999) document that two-thirds of contemporary world trade occurs among rich countries with similar factor endowments, and three-fourths of this share is two-way trade within narrowly defined industries. See also Helpman (1999), for a discussion.

[10] Sattinger (1979) is the first to propose this framework. This paper generalizes his contribution, introducing a fully-fledged general equilibrium model where the outside options are endogenously determined. Sattinger (1993) gives a review and a motivation for using assignment models to study wage distributions.

[11] The paper is thus consistent with size, skill, wage and productivity premia of exporters (e.g. Bernard and Jensen, 1995, 1997, 1999) and positive size-wage relation across firms (e.g. Oi and Idson, 1999).

[12] Also, skill-biased technical change and trade integration are by no means the only two explanations put forth. For example, deunionization and declining real minimum wages have also been studied (see for example DiNardo et al., 1996 and Lemieux, 2006).

[13] See Berman et al. (1994).

[14] See for example Krugman (2008).

[15] For related literature on how wages and profits are distributed within firms, see for example Blanchflower et al. (1996), who infer the existence of sharing rules by merging CPS and the NBER productivity database, and Abowd et al. (1999), who propose a statistical decomposition of employer-employee matched dataset.