Rising Income Inequality: Technology, or Trade and Financial Globalization?*

Florence Jaumotte† Subir Lall‡ Chris Papageorgiou§

September 30, 2009

Abstract

We examine the relationship between the rapid pace of trade and financial globalization and the rise in income inequality observed in most countries over the past two decades. Using a panel of 51 countries over a 23 year period from 1981-2003, we find that technological progress has had a greater impact than globalization on inequality. The limited overall impact of globalization reflects two offsetting tendencies: whereas trade globalization is associated with a reduction in inequality, financial globalization—and foreign direct investment in particular—is associated with an increase in inequality. We find that policies aimed at reducing barriers to trade and broadening access to education and credit can allow the benefits of globalization to be shared more equally. A key finding is that both globalization and technological changes increase the returns on human capital, underscoring the importance of education and training in both developed and developing countries in addressing rising inequality.

Keywords: Income inequality, mechanisms, trade globalization, financial globalization, technological progress, FDI.

JEL Classification: F13, G32, O11, O15, O16, O33

*We thank an anonymous referee and the editor, Philippe Aghion, for constructive comments. Special thanks go to Simon Johnson for his detailed comments and suggestions, and Shaohua Chen for sharing with us her expertise on inequality data. We also benefited from discussions with Robert Barro, Nancy Birdsall, Francois Bourgignon, Marcos Chamon, Stijn Claessens, Daniel Cohen, Timothy Callen, Charles Collyns, Angus Deaton, Jörg Decressin, Julian Di Giovanni, Ayhan Kose, Prachi Mishra, Martin Ravallion, Martin Schindler, Antonio Spilimbergo, Petia Topalova, Daniel Waldenström, Shang-Jin Wei, and seminar participants at the Federal Reserve Board, Getulio Vargas Foundation, Sao Paolo, IMF, Indian Council for Research and on International Economic Relations, Paris School of Economics, New Economic School, Moscow and Southern Economic Association Meetings, 2008, Washington DC. Stephanie Denis and Patrick Hettinger provided excellent research assistance. The views expressed in this study are the sole responsibility of the authors and should not be attributed to the International Monetary Fund, its Executive Board, or its management.

†International Monetary Fund, 700 19th Street, N.W. Washington, DC 20431, email: fjaumotte@imf.org.

‡International Monetary Fund, 700 19th Street, N.W. Washington, DC 20431, email: slall@imf.org.

§Corresponding author: Research Department, International Monetary Fund, 700 19th Street, N.W. Washington, DC 20431, email: cpapageorgiou@imf.org, tel: (202) 623-7503, fax: (202) 589-7503.

> Even though average economic well-being has increased considerably over time, the degree of inequality in economic outcomes over the past three decades has increased as well. Economists continue to grapple with the reasons for this trend. But as best we can tell, the increase in inequality probably is due to a number of factors, notably including technological change that seems to have favored higher-skilled workers more than lower-skilled ones. In addition, some economists point to increased international trade and the declining role of labor unions as other, probably lesser contributing factors.
>
> Ben S. Bernanke - June 4, 2008
> Speech at Harvard University

1 Introduction

Technological progress and globalization are widely regarded as two of the main drivers of recent economic growth. One can broadly think of technological progress as the development and spread of new ideas that enhance productivity and efficiency, while globalization as a catalyst of technology that facilitates the diffusion of ideas around the world through, for example, openness to trade and FDI.

Although the majority of technological innovation occurs in a handful of advanced countries (Helpman and Hoffmaister, 1997; World Bank, 2008), developing countries can potentially and disproportionately benefit from imitation of existing technologies. According to a World Bank report, *Global Economic Prospects 2008: Technology Diffusion in the Developing World*,

> "... rapid technological progress in developing countries has helped to raise incomes and reduce the share of people living in absolute poverty from 29 percent in 1990 to 18 percent in 2004. The dismantling of trade barriers in many developing countries over the past 20 years has dramatically increased their exposure to foreign technologies. The ratio of high-tech imports to GDP in developing countries has more than doubled since 1994. The easing of restrictions on FDI has also contributed to technology diffusion within developing countries. FDI is a major source of process technology and 'learning by doing' opportunities. FDI can also have significant spillover effects on domestically-owned enterprises. For example, leading call center companies from France and Spain have paved the way for domestically-owned and export-oriented call centers in Morocco and Tunisia."

Although technology and globalization maybe cornerstones of the unprecedented world growth over the last two decades, what is less clear and fiercely debated is their distributional effects. Rising inequality across most countries over the past two decades poses one of the greatest challenges to economic policymakers in both developed and developing countries. While improvements

in technology, liberal market-oriented reforms and the integration of countries from the former Soviet bloc into the global economy have led to an unprecedented level of integration of the world economy—surpassing the pre-World War I peak—the benefits of the rising incomes and aggregate GDP growth rates associated with globalization have not been shared equally across all segments of the population. Indeed, income inequality has risen in most countries and regions over the past two decades, including in developed countries which were thought to have reached levels of prosperity where inequality would level off as predicted by the Kuznets hypothesis. Since this period has also been associated with unprecedented trade and more recently financial integration, much of the debate on rising inequality has focused on the role that globalization—especially of trade—has played in explaining inequality patterns.

In a speech at the University of California, Irvine, Janet Yellen, President of the Federal Reserve Bank of San Francisco, provides this insightful analysis of the rising income inequality in the U.S.:

> "...globalization and skill-biased technological change may have been working in combination to particularly depress the wage gains of those in the middle of the U.S. wage distribution, accounting for the twist in the trend that I mentioned earlier. The explanation goes like this. The surge in the use of new technologies that began in the mid-1990s led to major changes in the way business was conducted and organized within the U.S. and globally. Technological change and globalization, especially outsourcing, complemented the skills of highly able workers performing non-routine work requiring problem-solving skills. This explains the continued rapid increase in real wages at the top of the distribution. In the middle of the distribution, however, technology and globalization had the opposite effect—substituting for workers performing routine or repetitive tasks and depressing their wages."

Understanding the causes of inequality is fundamental to devising policy measures that can allow the rising prosperity of recent decades to be shared more broadly than has been evident so far. Reducing inequality remains important not just from the point of view of achieving a more egalitarian distribution of income and addressing the welfare and social concerns that widening disparities in income raise. To the extent that rising inequality may reflect a lack of economic opportunity, it may itself limit the growth potential of economies by not allowing all economic agents to fully exploit the new opportunities created by globalization and limiting the productive capacity of an economy by not matching capital and labor as efficiently as possible. Moreover, to the extent that economies are periodically subject to shocks of various kinds that limit growth in the short term, greater inequality makes a greater proportion of the population vulnerable to poverty. Finally, rising inequality if not addressed can also lead to a backlash against economic liberalization

and protectionist pressures, limiting the ability of economies to benefits from globalization.[1]

This paper studies the effects of trade, financial globalization and technology on income inequality in a large panel of 51 countries over a 23 year period from 1981–2003. This paper makes a contribution along several dimensions: First, it uses a large panel dataset across both developed and developing countries while existing papers address within-country experience, but for a specific country under analysis. Second, it tries to identify the separate effects of globalization due to greater trade and greater financial openness, whereas the existing literature thus far has focused primarily on trade with limited attention to financial globalization. In addition, the paper looks at the various subcomponents of trade and financial globalization, including for example exports of manufacturing vs. agriculture, and portfolio debt and equity flows vs. foreign direct investment (FDI). It should be expected that different subcomponents of globalization affect inequality differently. Finally, we assemble a new dataset on income inequality (using the World Bank *Povcal*, and the *Luxemburg Income Studies* databases) that produces greater methodological consistency in survey-based inequality measurements across countries and over time. As a result, inequality facts across a large number of countries can be more accurately and comprehensively documented.

Our main findings are as follows. The available evidence suggest that income inequality has risen in most countries and regions over the past two decades. Nevertheless, at the same time average real incomes of the poorest segments of the population have increased across all regions and income groups. This suggests that inequality has increased in the upper part of the distribution in most countries, a fact consistent with recent evidence in the U.S. and the U.K. Our analysis finds that increasing trade and financial globalization have had separately identifiable and opposite effects on income distribution. Trade liberalization and export growth are found to be associated with lower income inequality, while increased financial openness is associated with higher inequality. However, their combined contribution to rising inequality has been much lower than that of technological change, both at a global level and especially markedly in developing countries. The spread of technology is, of course, itself related to increased globalization, but technological progress is nevertheless seen to have a separately identifiable effect on inequality. The disequalizing impact of financial openness—mainly felt through FDI—and technological progress appear to be

[1]There exist voluminous theoretical and empirical literatures on the effects of within country income inequality. Some of the most influential theoretical contributions include, Alesina and Rodrik (1994), Benabou (1996), Galor and Moav (2004), Galor and Zeira (1993), Greenwood and Jovanovic (1990), Kremer and Chen (2002), and Persson and Tabellini (1994). Prominent contributions from the empirical side include Alesina and Perotti (1996), Barro (2000), Forbes (2000), Perotti (1996), Roine and Waldenström (2008), Piketty (2003), Piketty and Saez (2003), and Sylwester (2000).

working through similar channels by increasing the premium on higher skills, rather than limiting opportunities for economic advancement. Consistent with this, increased access to education is associated with more equal income distributions on average.

There exists a vast empirical and theoretical trade literature on the effects of globalization on inequality. Although, the peak of this vibrant literature was reached in the mid 1990s with a series of major contribution (e.g. Borjas, Freeman and Katz, 1992, 1997; Krugman, 1995; and Feenstra and Hanson, 1996, 1997), there is a renewed interest in the topic (e.g., Krugman, 2008; Broda and Romalis, 2008), including a great body of work on developing countries surveyed in Goldberg and Pavcnik (2007), and a recent spike in theoretical research (e.g. Burstein and Vogel, 2009; Egger and Kreickemeier, 2009; Helpman, Itskhoki and Redding, 2008; Verhoogen, 2008).[2] There also exists a voluminous literature on the effects of financial globalization on growth and volatility (see Prasad et al., 2007; Kose et al., 2009 for comprehensive reviews). However, there has been surprisingly limited attention to the effects of financial globalization on inequality (exceptions include Roine, Vlachos and Waldenström, 2008; and the review articles by Claessens and Perotti, 2007; Demirgüç-Kunt and Levine, 2007). Finally, a related literature investigates the effect of skill biased technical change on inequality (e.g. Berman, Bound and Griliches, 1994; Berman, Bound and Machin, 1998).This paper contributes to the globalization-inequality literature by examining the effects of trade, financial globalization and technology on income inequality in a comprehensive framework using a large panel of countries.

The rest of the paper is organized as follows. Section 2 examines the patterns in inequality and globalization across a broad range of developed and developing countries over the past two decades, and describes the unique inequality dataset that is used in the empirical estimation. Section 3 discusses the channels through which trade and financial globalization may be expected to influence inequality within countries, whereas section 4 analyzes the empirical evidence to identify the main factors explaining inequality. Section 5 discusses the implications of the empirical findings with particular emphasis on plausible mechanisms responsible for the rising income inequality. Section 6 concludes.

2 A Look at Cross-Country Trends

This section reviews the evidence on inequality and globalization over the past two decades, and how they have evolved across income groups.

[2] Also see Ravallion (2004, 2006) for related work on trade globalization and poverty.

2.1 Income Inequality

Cross-country comparisons of inequality are generally plagued by problems of poor reliability, lack of coverage, and inconsistent methodology.[3] We rely on inequality data from the latest World Bank *Povcal* database constructed by Chen and Ravallion (2004, 2007) for a large number of developing countries. This database uses a substantially more rigorous approach to filtering the individual income and consumption data for differences in quality than other commonly used databases, which rely on more mechanical approaches to combine data from multiple sources and render them somewhat less reliable for cross-country studies.[4] The *Povcal* database has been supplemented with data from the *Luxembourg Income Study* (LIS) database, which provides high-quality coverage for advanced economies, and the resulting full sample allows for more accurate within- and cross-country comparisons than are available elsewhere. The end result is a unique dataset that include 51 countries (20 developed and 31 developing) over 1981-2003 that allows us to more comprehensively document inequality facts across a large number of countries.[5]

Given limitations of data availability, the analysis in this paper uses inequality data based on both income and expenditure surveys. Mixing these two concepts makes a comparison of levels of inequality across countries and regions potentially misleading. In general, consumption-based Gini indices tend to show lower inequality and are more commonly used in developing countries in which higher rates of self-employment in business or agriculture (where income fluctuates throughout the year) make measurement of incomes difficult. Among other causes, lower measures of consumption based inequality can result from consumption smoothing across time and greater measurement error for incomes; see e.g., Ravallion and Chen (1996), and Meyer and Sullivan (2006).

When comparing income and consumption based Gini indices, meticulous attention to concepts, definitions, and the details of survey methodology is required to improve comparability, and the World Bank's *Povcal* database used to construct our dataset goes further than other databases in doing this (see Chen and Ravallion, 2004). The database was created using primary data from nationally representative surveys with sufficiently comprehensive definitions of income or

[3]Problems with such data are discussed in Atkinson and Bourguignon (2000), Atkinson and Brandolini (2001), and Deaton and Zaidi (2002).

[4]This database is available via the Internet at iresearch.worldbank.org/PovcalNet. Other databases include, for example, Deininger and Squire (1996) and the World Income Inequality Database (2005), which includes an update of the Deininger-Squire database; the Luxembourg Income Study; and a large number of data series from central statistical offices and research studies.

[5]Although we are not the first to present income inequality patterns using cross-country data, the limited previous studies have presented only fragmented evidence on cross-country inequality patterns based on substantially smaller set of countries for a shorter time horizon and more questionable data quality.

consumption. Attempts were made to ensure survey comparability over time within countries, although cross-country and within-country comparisons are still not without problems because in many cases it was not possible to correct for differences in survey methods. A portion of our dataset was obtained from an additional thorough screening and "cleaning up" of the *Povcal* database to further enhance consistency and comparability of income and consumption data (of course with the cost of losing a substantial amount of observations).

Based on observed movements in Gini coefficients shown in the top panel of Figure 1, inequality has risen in all but the low-income country aggregates over the past two decades, although there are significant regional and country differences.[6] In addition, while inequality has risen in developing Asia, emerging Europe, Latin America, the Newly Industrialized Economics, and the advanced economies over the past two decades, it has declined in some sub-Sahara African countries. The middle panel of Figure 1 illustrates that among the largest advanced economies, inequality appears to have declined only in France, whereas among the major emerging market countries (bottom panel), trends are more diverse, with sharply rising inequality in China, little change in India, and falling inequality in Brazil.

Perhaps a more detailed picture of inequality is revealed by examining income shares for different country groups, presented in Figure 2. Overall, changes in income shares by quintile (successive subsets with each containing 20 percent of the population) across income levels mirror the evidence on inequality from Gini coefficients. However, the data show that rising Gini coefficients are explained largely by the increasing share of the richer quintiles at the expense of middle quintiles, whereas the income share of the poorest quintile (1) changes little. This is consistent with the idea that inequality has increased in the upper part of the distribution in most of our panel of 51 countries – this fact was emphasized for the U.S. by Autor, Katz and Kearney (2008) and for the U.K. by Machin and Van Reenen (2007). Furthermore, looking at average income levels across quintiles, real per capita incomes have risen across virtually all income and regional groups for even the poorest quintiles (Figure 3 shows per capita income by quintile in selected regions). Across all income levels, the evidence therefore suggests that in an absolute sense the poor are no worse off (with the exception of a few post-crisis economies), and in most cases significantly better off, during the most recent phase of globalization.

In summary, two broad facts emerge from the evidence. First, over the past two decades, income growth has been positive for all quintiles in virtually all regions and all income groups during the

[6]Income country groups are defined in the appendix.

recent period of globalization. At the same time, however, income inequality has increased mainly in middle- and high-income countries, and less so in low-income countries. This recent experience seems to be a clear change in course from the general decline in inequality in the first half of the twentieth century, and the perception that East Asia's rapid growth during the 1960s and 1970s was achieved while maintaining inequality at relatively low levels. It must be emphasized, however, that comparison of inequality data across decades is fraught with difficulty, in view of numerous caveats about data accuracy and methodological comparability.

2.2 Trade openness, financial openness and technological progress

World trade, measured as the ratio of imports plus exports over GDP, has grown five times in real terms since 1980, and its share of world GDP has risen from 36 percent to 55 percent over this period (top panel of Figure 4). A similar picture emerges when trade openness is measured using tariff rates (bottom panel of Figure 4). Trade integration accelerated in the 1990s, as former Eastern bloc countries integrated into the global trading system and as developing Asia—one of the most closed regions to trade in 1980—progressively dismantled barriers to trade. However, it is noteworthy that all groups of emerging market and developing countries, when aggregated by income group (or by region), have been catching up with or surpassing high-income countries in their trade openness, reflecting the widespread convergence of low- and middle-income countries' trade systems toward the traditionally more open trading regimes in place in advanced economies.

Financial globalization has also proceeded at a very rapid pace over the past two decades. Total cross-border financial assets have more than doubled, from 58 percent of global GDP in 1990 to 131 percent in 2004. The advanced economies continue to be the most financially integrated, but other regions of the world have progressively increased their cross-border asset and liability positions (top panel of Figure 5). However, *de jure* measures of capital account openness present a mixed picture, with developing economies showing little evidence of convergence to the more open capital account regimes in advanced economies, which have continued to liberalize further (bottom panel of Figure 5).[7]

Of note, the share of FDI in total liabilities has risen across all emerging markets—from 17 percent of their total liabilities in 1990 to 38 percent in 2004—and far exceeds the share of portfolio equity liabilities, which rose from 2 percent to 11 percent of total liabilities over the same period. Reduced government borrowing needs have also contributed to changing liability structures, with

[7]Both de facto and de jure measures have advantages and disadvantages, and are typically seen as complements rather than substitutes in empirical studies. See Kose et al. (2009) for a discussion.

the share of debt in total liabilities falling across all emerging market and developing country regions. Not surprisingly, the share of international reserves in cross-border assets has also risen, reflecting the accumulation of reserves among many emerging market and developing countries in recent years.

At the same time technological development, as measured (in our study) by the share of information and communications technology (ICT) capital in the total capital stock, has risen rapidly over the past 20 years across all income levels (Figure 6). This is quite important in our analysis as technological progress is going to play a key role in explaining much of the observed rise in cross-country inequality. An important point to note here is that in recognizing that technology is interconnected with globalization, we use ICT capital produced domestically as a proxy of technology to distinguish between the two effects. Clearly this does not completely make our measures of globalization (trade, financial) exclude technology but rather we separate a large portion of technology proxied with ICT capital.[8]

3 Channels Through Which Globalization Affects Inequality

This section discusses the channels through which the globalization of trade and finance could affect the distribution of incomes within a country, setting the stage for the empirical analysis that follows.

The principal analytical link between trade liberalization and income inequality provided by economic theory is derived from the Stolper-Samuelson theorem resulting from the Heckscher-Ohlin model: it implies that in a two-country two-factor framework, increased trade openness (through tariff reduction) in a developing country where low-skilled labor is abundant would result in an increase in the wages of the low-skilled worker and a reduction in the compensation of the high-skilled workers, leading to a reduction in income inequality (see Stolper and Samuelson, 1941). After tariffs on imports are reduced, the price of the (importable) high-skill intensive product declines and so does the compensation of the scarce high-skilled workers, while the price of the (exportable) low-skill intensive good for which the country has relatively abundant factors and the compensation of low-skill workers increases. For an advanced country where high-skill factors are relatively abundant, the reverse would hold, with an increase in openness leading to higher inequality.

[8]We acknowledge the possibility that trade may induce technological shifts and specifically greater investment in ICT (see, Bloom, Draka and Van Reenen, 2009; and Burstein and Vogel, 2009). Therefore, using investment in ICT as a proxy for technology may wrongly assign the effects of trade to effects of technology.

The implications of the Stolper-Samuelson theorem, and in particular the ameliorating effects of trade liberalization on income inequality in developing countries, have generally not been verified in economy-wide studies. A particular challenge has been to explain the increase in skill premium between skilled and unskilled workers observed in most developing countries. This has led to various modifications to the Heckscher-Ohlin model, including the introduction of multiple countries where poor (rich) countries may also import low-skill (high-skill) intensive goods from other poor (rich) countries; the introduction of a continuum of goods, implying that what is low skill-intensive in the advanced country will be relatively highly skill-intensive in a less developed country (see Feenstra and Hanson, 1996); and the introduction of intermediate imported goods used for the skill-intensive product. However, these extensions have themselves presented additional challenges for empirical testing, and none has been consistently established.

As a consequence of these challenges an alternative vibrant literature has emerged arguing that Heckscher-Ohlin model is inconsistent with recent inequality experience around the world, not just related to the fact that inequality increased in developing countries, but also along multiple other dimensions—e.g., factor reallocation seems to occur primarily within rather than across sectors (Berman, Bound and Griliches, 1994); small change in the prices of unskilled to skilled goods accompany large changes in the skill premium (Lawrence and Slaughter, 1993). Recent theoretical and empirical studies try to rethink the effects of trade on inequality in the model of heterogeneous firms and provide quite different insights from the Heckscher-Ohlin model. Recent contributions include Yeaple (2005), Amity and Davis (2008), Burstein and Vogel (2009), Egger and Kreickemeier (2009), Helpman, Itskhoki and Redding (2008), and Verhoogen (2008), just to name a few.

Difficulties in explaining observed increases in inequality by between-sector shifts, gave rise to a parallel and competing literature advocating for evidence of other non-trade factors such as skill-biased technical change. Put differently, alternative explanations for rising skill premia are based on the notion that technological change is inherently skill-biased, attributing the observed increases in inequality (including in advanced economies) on exogenous technology shocks (see e.g. Davis and Haltiwanger, 1991; Berman, Bound and Griliches, 1994; Berman, Bound and Machin, 1998). Any empirical estimation of the overall effects of globalization therefore needs to explicitly account for changes in technology in countries, in addition to standard trade related variables.

An additional important qualification to the implications deriving from the Stolper-Samuelson theorem relate to its assumption that labor and capital are mobile within a country but not internationally. If capital can travel across borders, the implications of the theorem weaken substantially.

This channel would appear to be most evident for FDI, which is often targeted at high-skilled sectors in the host economy (see Cragg and Epelbaum, 1996). Moreover, what appears to be relatively highly skill-intensive inward FDI for a less developed country may appear relatively low skill-intensive outward FDI for the advanced economy. An increase in FDI from advanced to developing countries could thus increase the relative demand for skilled labor in both countries, increasing inequality in both the advanced economy and the developing country. The empirical evidence on these channels has provided mixed support for this view, with the impact of FDI seen as negative, at least in the short run, or inconclusive.

In addition to FDI, there are other important channels through which capital flows across borders, including cross-border bank lending, portfolio debt and equity flows. Within this broader context, some have argued that greater capital account liberalization may increase access to financial resources for the poor, while others have suggested that by increasing the likelihood of financial crises greater financial openness may disproportionately hurt the poor. Some recent research has found that the strength of institutions plays a crucial role: in the context of strong institutions, financial globalization may allow better consumption smoothing and lower volatility for the poor, but where institutions are weak, financial access is biased in favor of those well-off and the increase in finance from tapping global and not just domestic savings may further exacerbate inequality.[9] Thus, the composition of financial flows may matter, and the net impact also be influenced by other factors such as the quality of financial sector institutions.

In summary, analytical considerations suggest that any empirical analysis of the distributional consequences of globalization must take into account both trade and the various channels through which financial globalization operates, and also account for the separate impact of technological change. Moreover, against the background of real-world patterns of trade and financial flows, theory does not provide clear guidance on whether globalization affects inequality in advanced and developing countries differently.

4 Empirical Analysis

In this section we investigate how much of the rise in inequality seen in developing and high-income countries in recent decades can be attributed to increased globalization, and how much to other factors, such as the spread of technology and domestic constraints on equality of opportunity.

[9] While Demirgüç-Kunt and Levine (2007) argue that financial development is more positive for the poorest segment of the population, primarily through its positive effect on overall growth, Claessens and Perotti (2007) find that the outcome can be different as most of the benefits of financial reforms are captured by a small elite.

4.1 Specification

In contrast to most existing studies that focus on within-country variation in inequality in a particular country,[10] this study is unique because it uses a large panel of advanced and developing countries. The analysis relates the Gini coefficient to various measures of globalization and a number of control variables including technological progress. Globalization measures distinguish between trade and financial openness and include both "de facto" and "de jure" measures. Specifically, trade openness is measured by the (unweighted) *average tariff rate* ("de jure" measure), and the *ratios of both non-oil exports and non-oil imports to GDP* ("de facto" measures). Financial openness is measured by the Chinn-Ito index of *capital account openness* ("de jure" measure), the *ratios of various types of financial liabilities (FDI, portfolio equity, and debt) to GDP* and the *stock of FDI assets expressed as a percentage of GDP* ("de facto" measures).[11] The latter, which is closely associated to offshore outsourcing, may be particularly relevant to measure the impact of globalization on inequality in advanced countries, while its value is minimal for most developing and emerging market countries. It is important to caution, however, that offshore outsourcing can be viewed as a measure of trade openness as well (see e.g., Feenstra and Hanson, 1996), and the effect of offshoring on inequality could be interpreted as the effect of trade.)

The analysis also includes a number of control variables that can be important in determining how inequality changes in countries over time and that have seen significant changes in recent years. These include *technological development*, measured by the share of ICT capital in the total capital stock, *access to education*, measured by the average years of education in the population ages 15 and older, and the share of this population with at least a secondary education, *sectoral share of employment*, measured by the shares of employment in agriculture and in industry, *domestic financial development*, measured by the ratio of private credit to GDP, and a set of labor market variables.

To the extent that technological change favors those with higher skills and exacerbates the "skills gap," it could adversely affect the distribution of income in both developing and advanced economies by reducing the demand for lower-skill activities and increasing the premium for higher-skill activities and returns on capital (see, for example, Birdsall, 2007). As shown in Figure 6, ICT

[10] See Goldberg and Pavcnik (2007) for a survey of theoretical and empirical research on the distributional effects of globalization in specific countries.

[11] The Chinn-Ito measure has recently been under a fair amount of criticism primarily stemming from the subcomponents used in its construction. A conceptually superior alternative is the new Schindler index (Schindler, 2009), however, we were not able to use it in our estimation because of its short time series dimension starting after 1995.

capital has risen rapidly over the past 20 years across all income country groups.

For a given level of technology, greater access to education would be expected to reduce income inequality by allowing a greater share of the population to be engaged in high-skill activities. Both educational variables considered in the analysis have tended to increase across all regions, but with considerable cross-country variation.

In developing countries, a move away from the agricultural sector to industry is expected to improve the distribution of income by increasing the income of low-earning groups. Similarly, increase in the relative productivity of agriculture is expected to reduce income disparities by increasing the income of those employed in this sector.[12] The sectoral distribution of employment is measured by the shares of employment in agriculture and in industry.

Even though financial development may reduce income inequality by increasing access to capital for the poor (see Beck, Demirgüç-Kunt and Levine, 2007), this depends on the quality of institutions in a given country. In the context of weak institutions, the benefits of financial deepening may accrue disproportionately to the rich which have higher collateral and/or income, further exacerbating initial inequality in access to finance.

Ideally, our estimation methodology should be motivated by a particular theoretical framework, even if the estimation is not structural. However, there is no formal theory that incorporates the effects of trade and financial globalization, and technology in a model of income inequality. Therefore, our estimation will not be linked directly to any one existing theory, but will incorporate key ingredients of the prominent theories in the literature.

The empirical analysis is based on the following fixed-effects specification:[13]

$$\begin{aligned}\ln(GINI)_{it} = \alpha_0 + \underbrace{\alpha_1 \ln\left(\frac{X}{Y}\right)_{it} + \alpha_2 \ln\left(\frac{M}{Y}\right)_{it} + \alpha_3 (100 - TARIFF)_{it}}_{Trade\ Globalization\ Variables} + \\ \underbrace{+\beta_1 \ln\left(\frac{A}{Y}\right)_{it} + \sum_{j=1}^{3} \beta_j \ln\left(\frac{L_j}{Y}\right)_{it} + \beta_5 KA_{OPEN_{it}}}_{Financial\ Globalization\ Variables} + \\ \underbrace{+\gamma_1 \ln\left(\frac{K_{ICT}}{K}\right)_{it}}_{Technology} + \underbrace{\boldsymbol{\gamma} Z_{it}}_{Controls} + \eta_i + \delta_t + \varepsilon_{it},\end{aligned}$$

[12] In this context, greater flexibility in labor markets that facilitates a move away from low-return occupations to those where opportunities are better can also be expected to improve the distribution of income (see Topalova, 2007).

[13] Using the logarithm of the Gini (rather than the Gini itself) makes this bounded variable behave more like a normally-distributed variable and hence more amenable to ordinary least squares estimation. Robustness of the results was confirmed also using a logistic transformation of the Gini coefficient (making the variable completely unbounded).

where X and M are non-oil exports and imports, respectively, Y is real per capita GDP, $TARIFF$ is the average tariff rate, A and L are financial assets and liabilities, respectively, KA_{OPEN} is the capital account openness index, K_{ICT} is ICT capital, and K is physical capital. Z is a vector of additional control variables which in the benchmark regression include, $\ln\left(\frac{CREDIT}{Y}\right)$ where $CREDIT$ is defined as credit to the private sector by deposit money banks and other financial institutions, POP_{SH} defined as the share of population aged 15 and over with secondary or higher education, H, the average years of education in the population aged 15 and over, $\ln\left(\frac{E_{AGR}}{E}\right)$ and $\ln(\frac{E_{IND}}{E})$, where E_{AGR} and E_{IND} are employment in agriculture and industry and E is total employment. The terms η_i represents a full set of country dummies, δ_t a full set of time dummies, and ε_{it} captures all the omitted factors.

More precisely, for the estimation the left- and right-hand-side variables are demeaned using country-specific means in order to focus on within country changes instead of cross-country level differences.[14] In addition, time dummies are included to capture the impact of common global shocks such as business cycles or growth spurts. The resulting baseline model is estimated using ordinary least squares with heteroskedasticity-consistent standard errors. In subsequent robustness analysis, we also report results from an alternative long-difference specification. In addition, we test robustness of our baseline specification to alternative country subsamples and time horizons, additional control variables, and estimation techniques.

The sample of countries for which all variables used in the regressions were available consists of 51 countries, of which 20 are advanced and 31 are developing and emerging market countries, and the period covered is 1981–2003.[15] Since income and consumption surveys are not conducted annually, the estimations use an unbalanced panel with observations included only for years for which actual data are available. One unique feature of our dataset is that no extrapolation was used.

4.2 Results

The estimation of the model for the whole sample of countries shows that three components of globalization have a significant impact on inequality (column 1 of Table 1). Interestingly, trade and financial globalization appear to have opposite effects: an increase in the export-to-GDP ratio is found to reduce inequality as does a reduction in average tariff rates, while on the financial side,

[14] Using deviations from country-means instead of level data may result in magnified measurement error (Bound and Krueger, 1991). In our estimation, using deviations rather than levels is necessary given that merging consumption and income datasets is significantly more problematic than the potential magnification error.

[15] See the appendix for a list of countries included in the estimation.

the stock of inward FDI (expressed as a ratio to GDP) increases inequality. These effects which are significant at the 5 percent level proved very robust to a number of sensitivity tests (see section 3.3). The model re-estimated dropping the insignificant measures of globalization constitutes our benchmark model (column 2 of Table 1). The coefficient on exports implies that a one standard deviation increase in the export-to-GDP ratio from its sample mean would reduce inequality by 3.4 percent. Similarly, a one standard deviation decrease in tariffs would reduce inequality by 1.7 percent while a one standard deviation increase in inward FDI would increase inequality by 2.7 percent.

In order to better understand the inequality-reducing impact of exports, the export-to-GDP ratio is split by sector of origin (agriculture, manufacturing and services) (column 3 of Table 1). We find that it is the agricultural component of exports that is especially important to reduce inequality. The effects of agriculture, manufacturing, and services exports are statistically not significantly different from one another, but agricultural exports have the largest coefficient and are statistically significant.[16] The coefficient on exports thus seems to reflect the fact that in many developing countries a lot of the poor are still employed in the agricultural sector, so that an improvement in the export prospects of this sector tends to reduce inequality. Tariff reductions on average also seem to benefit the poor relatively more than the rich, suggesting that on average they affected goods which are disproportionately consumed by the poor and/or formal sectors where the better-off part of the population is employed. The inequality-raising impact of inward FDI, although puzzling at first, appeared to make a lot of sense upon examination of data on the sectoral composition of FDI. These suggest indeed that FDI mostly takes place in relatively higher skill- and technology-intensive sectors, and thereby increases the demand for and wages of more skilled workers.

Most of the control variables are also found to be statistically significant and—except for the education variables—these estimates are generally robust. First, technological progress and domestic financial deepening both significantly increase inequality.[17] These effects are in line with the discussion above that technological progress increases the demand for skilled workers and that the benefits of enhanced financial deepening may disproportionately accrue to the rich, which have

[16] In an interesting paper, Loayza and Raddatz (2006) argue that not only the size of economic growth matters for poverty alleviation but also its composition in terms of intensive use of unskilled labor, i.e. the kind of input that the poor can offer to the production process. Our finding that agricultural exports lead to reduction in inequality is consistent with this argument.

[17] There was no evidence of a threshold effect by income level for the result on domestic financial deepening, suggesting that the type of financial system, that is, based on relationship or arm's length, may be a more important determinant of equality of access to finance.

more collateral and/or income. The coefficient on technological progress is significant at the 5 percent level in the benchmark model while that on domestic financial deepening is significant at the 1 percent level. The coefficients suggest that a one standard deviation increase in these variables from their mean level would increase inequality by 1.7 percent in the case of technological progress and by 2.6 percent in the case of domestic financial deepening.

Second, the share of agriculture employment tends to increase inequality, while the share of industry employment reduces it. This is consistent with the idea that labor shifts from agriculture to industry raise the productivity of the agricultural sector where most poor are employed and decrease productivity in industry. Replacing the employment shares by measures of labor productivity in agriculture and industry (column 4 of Table 1) confirms that this is the channel at work. These results are in line with the importance of agricultural exports to reduce inequality. The coefficients on the agricultural and industry employment shares are significant respectively at the 5 and 1 percent levels in the benchmark model. A one standard deviation reduction in the agriculture employment share reduces inequality by 3.3 percent, while a one standard deviation increase in the industry employment share reduces it by 2.3 percent.

Finally, the regression coefficients on education suggest that an increase in the average years of education in the population reduces inequality, presumably because it enables more people to benefit from the opportunities offered by technological progress and FDI. For a given average level of education, however, a larger dispersion as measured by the share of the population with secondary or higher education tends to increase inequality. Depending on the regression, these coefficients are sometimes imprecisely estimated. This is likely reflecting overlap between some control variables. For instance, when the sectoral employment shares are excluded from the regression (column 5 of Table 1), the coefficients on the education variables are very significant. To some extent, the share of employment in industry captures the effect of higher education since the two are likely correlated.

4.3 Robustness

The reported results were tested for robustness in several ways. First, we examine robustness of our results to "long-difference" estimation, i.e. the difference between the latest and the earliest observation for each country. Although our sample is reduced to only 51 observations, it is shown in column 1 of Table 2 that most coefficient estimates are broadly similar to those of the benchmark model, although those of technology and credit are larger – possibly due to the longer run nature of the estimates. The significance of the coefficients is overall better, with significant effects for

inward FDI, technology, credit, and the industry employment share.

In order to address concerns that inequality may itself influence globalization variables, the export-to-GDP ratio and the ratio of the inward stock of FDI to GDP (the two significant "de facto" measures) were instrumented using their lagged value, the export-weighted real GDP of trade partners (a measure of the demand for the country's exports), and a distance-weighted sum of industrial countries' FDI assets (a measure of the supply of FDI).[18] The results proved robust to this test of endogeneity (column 2 of Table 2). We also reestimated the benchmark model with standard errors clustered by country in order to allow for within-country correlation between observations (column 3 Table 2). The main changes are that technology and the agriculture employment share lose in significance, with a p-value of 13 percent.

Next, we estimate the model for two sub-periods, before and after 1995, in order to test whether variables and in particular trade and technology affect inequality differently in earlier and later years.[19] For instance, Autor, Katz and Kearny (2008) show that the inequality experience in the U.S. was quite different in the 1980s versus the 1990s. In order to measure the different effects between the two sub-periods, the regression is augmented with interaction terms between each original regressor and a dummy variable that takes the value one for years post-1995 and zero otherwise. The results reported in column 4 Table 2 show that exports (related to agricultural exports) and the agriculture employment share are strongest in earlier years, when agriculture was more relevant for a larger number of countries. Technology and average years of education are strongest in later years, in line with the rising importance of technology after 1995 and possibly with its complementarity with education. Finally, perhaps surprisingly, there is some evidence that the inequality-increasing effect of inward FDI was stronger in the earlier period. It is interesting to note that when the model was reestimated using standard errors clustered by country, technology in later years (post-1995) and the agriculture employment share in earlier years (pre-1995) remain significant at the 1 percent level (column 5 Table 2).[20]

The benchmark model was also augmented with several measures of labor market, which have often been emphasized as key drivers of income inequality in the U.S. (e.g. Card and DiNardo, 2002). In particular, four variables are incorporated in our benchmark model: i) unemployment rate; ii) a measure of labor market regulations; iii) an indicator of unemployment benefit replace-

[18]The validity of these instruments was confirmed using the Anderson and Hansen tests.

[19]The choice of the cut-off was based on the spread of IT revolution which is commonly thought of to have started in the mid-1990s. There are 128 observations prior to 1995, and 160 afterwards.

[20]Other robustness tests, such as dropping one country at a time from the sample, dropping one variable at a time from the regression where also performed without changing the results qualitatively.

ment rate; iv) a measure of the ratio of minimum to mean wage. For the latter three variables, higher values indicate greater liberalization, i.e. lower regulation, lower unemployment benefit replacement rates, and lower or no minimum wage. Table 3 presents the results from this exercise. It is shown that whereas coefficient estimates for unemployment, labor market regulations, and minimum to medial wage are insignificant (columns 1, 2, and 4, respectively), the coefficient estimate for unemployment benefit replacement rate is negative and significant (columns 3 and 5) consistent with the Card and DiNardo hypothesis. In summary, while there is some evidence that labor market institutions and policies tend to contribute to income inequality, the additional set of labor market variables does not change the main results of the paper.[21]

In the main regression, may be overly restrictive to have common coefficient on trade and technology variables for all countries. Taking out the country-specific means does not seem to be sufficient and there are good theoretical and empirical reasons to believe that inequality response to trade and other variables should be different across countries. We explore the possibility of heterogeneous effects of trade globalization, technological progress, and other variables across country groups (Table 4); results are, however, more tentative as the number of observations used for identification of group-specific effects is much smaller. The first obvious distinction of interest is between advanced countries on the one hand and emerging and developing countries on the other hand. A differentiated effect was allowed for each control variable and each component of trade and financial openness, including two new variables, the share of export destined to developing countries and the share of imports originating in developing countries (these variables were not significant when the full sample was used).

While maintaining common time dummies, interaction terms between the other regressors and a dummy for advanced countries were included to measure the difference between the effects for advanced countries and the estimated average effect for the full sample. A joint test that all the differences are zero was rejected, due mostly to different effects (for advanced and developing countries) of the FDI asset-to-GDP ratio and to a lesser extent of the debt liabilities-to-GDP ratio and the share of imports originating in developing countries. While these three variables are insignificant for the full sample (and particularly for developing countries), they are significantly different from zero for advanced countries. The estimation indicates that FDI assets increase

[21] In addition to labor market variables, other possible explanatory variables (democracy, constraints on the executive, flexibility of regulations, real exchange rate, and terms of trade) were also considered but without changing our results. Although other variables such as government social spending and transfers, migration, and remittances may potentially have important additional effects on the observed inequality outcomes, comprehensive data were not available across many countries and therefore not used in estimation.

inequality in advanced countries, while debt and the share of imports from developing countries contribute to reduce it.

Another distinction of interest is between different developing regions: the main two developing regions represented in the sample are developing Asia and Latin America (only a few African and Middle Eastern countries are included due to data limitations). Due to the even smaller sample sizes involved for these subgroups, a differentiated effect by developing region (developing Asia, Latin America, and other) was tested only for the export-to-GDP ratio, the stock of inward FDI (as a share of GDP) and the technological progress variables. A joint test that all differences are zero was rejected, due to the different effect of technological progress in developing Asia and Latin America. The disequalizing effect of technological progress is stronger in Asia than on average in the full sample and weaker in Latin America (actually insignificantly different from zero). This possibly reflects the greater share of technology intensive manufacturing in Asia than in Latin America.

The Gini coefficient is known to be sensitive to transfers that displace the rank orders of more individuals thus making it more sensitive to the middle of the distribution than to changes at either the top or the bottom (Kakwani, 1980). Given that our analysis suggests that inequality has increased primarily in the upper part of the distribution, the inequality patterns we illustrate could be biased downwards. For this reason and to gain further insight into the impact of globalization on inequality, the empirical model was also estimated using the income shares of the five quintiles of the population as dependent variables (Table 5). Most of the results from the estimations using Gini coefficients are confirmed, although the estimates at the quintile level are less precise for tariff liberalization and technological progress. In line with the changes observed in the income shares of quintiles, the effects on the bottom four quintiles are qualitatively similar and in the opposite direction from that on the richest quintile. Export growth is associated with a rise in the income shares of the bottom four quintiles and a decrease in the share of the fifth (that is, the richest) quintile. Similarly, a reduction in the share of agricultural employment (which raises the sector's productivity of labor) is also associated with a rise in the income share of the bottom four quintiles, whereas it has the opposite effect on the income share of the richest quintile. The benefits of tariff reduction are mostly concentrated in the income shares of the three bottom quintiles, offset by a decrease in the income share of the top quintile. In contrast, financial globalization, technological progress, and greater financial deepening benefit mainly the income share of the richest 20 percent of the population.

5 Discussion

The results of the previous section's empirical analysis imply that the main factor driving the recent increase in inequality across a very broad range of countries has been technological change. Technological progress alone explains nearly 0.35 percent of the 0.45 percent annual average increase in the Gini coefficient from the early 1980s (top panel of Figure 7). Globalization and financial deepening together contributed another 0.1 percent a year. The estimations suggest that increased access to education and a shift in employment away from agriculture contributed 0.1 percent a year towards a reduction in the Gini coefficient. The small net adverse impact of globalization on inequality is a result of two offsetting forces. While the globalization of trade has in the aggregate tended to reduce inequality, financial globalization, and FDI in particular, has tended to exacerbate the trend towards rising inequality.

The results of estimations run separately for developed (middle panel of Figure 7) and developing countries (bottom panel of Figure 7) suggest that the impact of globalization on inequality differs between these two groups of countries. Among developed countries, where the Gini coefficient has risen by an average of 0.6 percent every year over the sample period, the adverse impact of globalization is somewhat larger than that of technological progress. Among developing countries, however, where the Gini coefficient has risen by about 0.3 percent a year on average, technology has been the main driving force while globalization has in fact provided a small counterweight by tending to reduce inequality.

What explains the above patterns in inequality, as well as the marked differences between developed and developing countries? To answer this question, it is useful to look at the channels through which globalization and technology operate in terms of their impact on the distribution of income.

The beneficial effects of trade on inequality in developing countries are particularly noticeable for agricultural exports, given agriculture still employs a large share of the workforce. Opening up of trade in agriculture, increases the income of those who are dependent on agriculture for their livelihood in developing countries. Moreover, the shift of underemployed agricultural workers to manufacturing or services also increases the relative productivity of agriculture, raising the income of those who continue to remain dependent on agriculture, and are typically among the lowest earning workers in developing countries. This could be seen as support for the Heckscher-Ohlin model of trade in countries where agriculture plays a large role in the economy.

For developed countries, imports from developing countries are associated with a reduction

in inequality. This is consistent with lower paying low-end manufacturing jobs being substituted by higher paying service sectors in the expanding retail and consumer finance sectors. As might be expected, imports from other advanced economies do not have the same beneficial impact on inequality because higher-end imports are likely to affect higher paying domestic employment that may not be readily substituted by new service sector employment opportunities.

In both developed and developing countries, financial globalization–and FDI in particular–are associated with increases in income inequality. In both groups of countries, inward FDI is associated with rising inequality, while in developed countries outward FDI also has an additional negative impact. What explains this pattern? From the point of view of the host country, FDI tends to take place in higher skill and higher technology sectors. As a result, while FDI increases employment and income, this tends to favor those who already have relatively higher skills and education. In developed countries, FDI often goes into skill intensive and high technology sectors, raising the incomes of those who are better educated and tend to already have higher incomes, further exacerbating income inequality. In developing countries, the bulk of FDI goes into low-end manufacturing and natural resource sectors, increasing employment opportunities and income for those who have higher skills than for example agricultural workers. As result, in both developing and developed countries, inward FDI increases the relative demand for higher skilled workers. Outward FDI in developed economies predictably tends to increase inequality by reducing employment opportunities in relatively lower skill sectors.

The impact of technology on inequality is closely related to that of FDI. Technological progress, in both developed and developing countries, increases the premium on skills and tends to substitute away low-skill inputs (Birdsall, 2007). Technological progress thus increases the relative demand for higher skills, thereby exacerbating inequality in income. In developed countries, the use of technology is widespread in both manufacturing and services, affecting a substantial segment of the economy. Among developing countries, the adverse effect of technology on income inequality is more evident in Asia than in Latin America. Manufacturing is a greater share of the economy in many Asian countries than in Latin American countries, and impact of new technology affects a greater share of the population in the former.

The adverse impact of financial deepening on inequality suggests that while overall financial deepening is associated with higher growth, a disproportionately larger share of increased finance goes to those who already have higher incomes and assets which can serve as collateral. The better off are thus able to take greater advantage of increased finance to further increase their income and

earnings potential.

Overall, the results suggest that both globalization and technology tend to increase the returns to skills in both developed and developing countries. While incomes have increased across all segments of the population in virtually all regions and countries, the incomes of the already well off have increased by disproportionately more during the recent era of globalization. Greater access to education and training can increase the share of the population that can take advantage of the opportunities to improve living standards from both globalization and technology. The results of this paper confirm that while these two important factors have made a positive contribution to income, not just at the aggregate level but even at the level of different subgroups of the population, better access to education and training could allow the undeniably positive benefits of globalization and technology to be shared more broadly. In the same vein, broader access to finance would also benefit the poorer segments of the population, and it is not just aggregate financial deepening but how broadly it is available that matters.

The results of the analysis provide empirical support to the notion expressed by Bernanke that technological change played a major role in increasing inequality, while globalization played a smaller role.[22] At the same time, our findings are at odds with arguments made by several economists (focusing primarily on country cases; summarized in Goldberg and Pavcnik, 2007) that the increase in international trade contributes to the rise in inequality and that the conclusions of this literature should be revised.[23]

The research presented in this paper could be extended along several dimensions. First, it is important to examine the impact that government policies, and fiscal policies in particular, have on the distribution of income. While one can conjecture that certain types of redistribution policies could ameliorate the adverse distribution of income, to date no comprehensive database of government policies across countries exists that would allow for an empirical examination of the impact of government policies. A second line of enquiry would be to examine the impact of FDI in different sectors, where the distributional consequences might be expected to vary. Finally, the impact of technological progress can expected to vary by sector and type of technology. This too, is however, limited by the availability of comprehensive data across countries and over time, suggesting that extensions of this type would have to be limited to a single country or a relatively

[22] See Bernanke (2008).

[23] Country studies can certainly take advantage of more disaggregated and more detailed data to study the effects of globalization on inequality. And some of the results from these case studies reveal a more intricate picture of the globalization- inequality interrelationship that cannot be captured in cross-country studies. However, country studies can not capture the broad relationship as each study focuses instead on some parameters of particular interest.

small group of countries.

6 Conclusion

Estimates using a new and more reliable dataset on inequality and detailed measures of globalization suggest that the observed rise in inequality across both developed and developing countries over the past two decades is largely attributable to the impact of technological change.[24] The contribution of increased globalization to inequality has in general been relatively minor. This reflects two offsetting effects of globalization: while increased trade tends to reduce income inequality, FDI tends to exacerbate it. Both globalization and technological progress tend to increase the relative demand for skills and education. While incomes have increased across all segments of the population in virtually all countries in the sample, incomes of those who already have higher levels of education and skills have risen disproportionately more.

The implication of these findings is that broader access to education will allow a greater segment of the population to take advantage of the opportunities from globalization and technological change. While these changes have increased incomes across countries and helped reduce poverty, the benefits would be even greater, allowing for a faster reduction in poverty, if the distribution of skills became more equal. This suggests that the returns to investment in education for all countries has risen in the recent era of globalization.

[24]The dataset used in the study is available in its entirety via the Internet at http://www.chrispapageorgiou.com/.

References

Aleksynska, M. and M. Schindler, forthcoming, "Labor Market Institutions in Advanced and Developing Countries: A New Panel Database," IMF Working Paper, forthcoming.

Alesina, A. and R. Perotti, 1996, "Income Distribution, Political Instability, and Investment," *European Economic Review* 40, 1203-1228.

Alesina, A. and D. Rodrik, 1994, "Distributive Politics and Economic Growth," *Quarterly Journal of Economics* 109, 465-490.

Amiti, M. and D.R. Davis, 2008, "Trade, Firms, and Wages: Theory and Evidence," NBER Working Papers No. 14106.

Atkinson, A.B. and F. Bourguignon, 2000, "Introduction: Income Distribution and Economics," in Handbook of Income Distribution, Vol. 1, ed. by A.B. Atkinson and F. Bourguignon (Amsterdam: Elsevier).

Atkinson, A.B., and A. Brandolini, 2001, "Promises and Pitfalls in the Use of Secondary Data-Sets: Income Inequality in OECD Countries as a Case Study," *Journal of Economic Literature* 39, 771-800.

Autor, D.H., L.F. Katz and M.S. Kearney, 2008, "Trends in U.S. Wage Inequality: Revising the Revisionists," *Review of Economics and Statistics* 90, 300-323.

Barro, R.J., 2000, "Inequality and Growth in a Panel of Countries," *Journal of Economic Growth* 5, 5-32.

Barro, R.J. and J.-W. Lee, 2001, "International Data on Educational Attainment: Updates and Implications," *Oxford Economic Papers* 53, 541-563.

Beck T., A. Demirgüç-Kunt and R. Levine, 2000, "A New Database on Financial Development and Structure," *World Bank Economic Review* 14, 597-605.

Beck T., A. Demirgüç-Kunt and R. Levine, 2007,"Finance, Inequality, and the Poor," *Journal of Economic Growth* 12, 27-49.

Benabou, R., 1996, "Inequality and Growth," *NBER Macroeconomics Annual* 11, 11-74.

Bernanke, B.S., 2008, "Remarks on Class Day 2008," Harvard University, available at http://www.federalreserve.gov/newsevents/speech/bernanke20080604a.htm.

Berman, E., J. Bound and Z. Grliliches, 1994, "Changes in the Demand for Skilled Labor within U.S. Manufacturing: Evidence from the Annual Survey of Manufactures," *Quarterly Journal of Economics* 109, 367-397.

Berman, E., J. Bound and S. Machin, 1998, "Implications of Skill-Biased Technological Change: International Evidence," *Quarterly Journal of Economics* 113, 1245-1279.

Birdsall, N., 2007, Discussion of *Impact of Globalization on the World's Poor*, Nissanke, M. and E. Thorbecke, WIDER Book Lunch, Washington, DC.

Bloom, N., M. Draca and J. Van Reenen, 2009, "Trade induced technical change? The impact of Chinese imports on innovation and Information Technology," working paper, LSE.

Bound, J. and A.B. Krueger, 1991, "The Extent of Measurement Error in Longitudinal Earnings Data: Do Two Wrongs Make a Right?" *Journal of Labor Economics* 9, 1-24.

Borjas, G.J., R.B. Freeman and L.F. Katz, 1992, "On the Labor Market Effects of Immigration and Trade" , in *Immigration and the Work Force: Economic Consequences for the United States and Source Areas*, eds. G.J. Borjas and R.B. Freeman, University of Chicago Press, 213-244.

Borjas, G.J., R.B. Freeman and L.F. Katz, 1997, "How Much Do Immigration and Trade Affect Labor Market Outcomes?", *Brookings Papers on Economic Activity*, 1997, 1-67.

Broda, C. and J. Romalis, 2008, "Inequality and Prices: Does China benefit the Poor in America?" working paper, University of Chicago.

Burstein A. and J. Vogel, 2009, "Globalization, Technology, and the Skill Premium" working paper, UCLA.

Card, D. and J.E. DiNardo, 2002, "Skill Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles," *Journal of Labor Economics* 20, 733-783.

Chen, S. and M. Ravallion, 2004, "How Have the World's Poorest Fared since the Early 1980s?," *World Bank Research Observer* 19, 141-169.

Chen, S. and M. Ravallion, 2007, "Absolute Poverty Measures for the Developing World, 1981-2004," World Bank, Policy Research Working Paper 4211.

Chinn, M. and H. Ito, 2006, "What Matters for Financial Development? Capital Controls, Institutions and Interactions," *Journal of Development Economics* 81, 163-192.

Claessens, S. and E.C. Perotti, 2007, "Finance and Inequality," *Journal of Comparative Economics* 35, 748-773.

Cragg, M.I. and M. Epelbaum, 1996, "Why Has Wage Dispersion Grown in Mexico? Is it the Incidence of Reforms of the Growing Demand for Skills?" *Journal of Development Economics* 51, 99-116.

Davis, S.J. and J. Haltiwanger, 1991, "Wage Dispersion Between and Within U.S. Manufacturing Plants, 1963-1986," NBER Working Papers No. 3722.

Deaton, A. and S. Zaidi, 2002, "Guidelines for Constructing Consumption Aggregates for Welfare Analysis," LSMS Working Paper No. 135 (Washington: World Bank).

Deininger, K. and L. Squire, 1996, "New Ways of Looking at Old Issues: Inequality and Growth," *The World Bank Economic Review* 10, 565-591.

Demirgüç-Kunt, A. and Levine, R., 2007, "Finance and Opportunity: Financial Systems and Intergenerational Persistence of Relative Incomes," working paper, The World Bank, Brown University.

Egger, H. and U. Kreickemeier, 2009, "Firm Heterogeneity And The Labor Market Effects of Trade Liberalization," *International Economic Review* 50, 187-216.

Fajnzylber, P. and D. Lederman, 1999, "Economic Reforms and Total Factor Productivity Growth in Latin America and the Caribbean (1950–95)—An Empirical Note," Policy Research Working Paper No. 2114 (Washington: World Bank).

Feenstra, R.C. and G.H. Hanson, 1996, "Globalization, Outsourcing, and Wage Inequality," American Economic Review 86, 240-245.

Feenstra, R.C. and G.H. Hanson, 1997, "Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras," *Journal of International Economics* 42, 371-393.

Forbes, K., 2000, "A Reassessment of the Relationship between Inequality and Growth," *American Economic Review* 90, 869-887.

Galor, O. and J. Zeira, 1993, "Income Distribution and Macroeconomics," *Review of Economic Studies* 60, 35-52.

Galor, O. and O. Moav, 2004, "From Physical to Human Capital Accumulation: In-equality and the Process of Development," *Review of Economic Studies* 71, 1001-1026.

Goldberg, P.K. and N. Pavcnik, 2007, "Distributional Effects of Globalization in Developing Countries," *Journal of Economic Literature* 45, 39-82.

Greenwood, J. and B. Jovanovic, 1990, "Financial Development, Growth and Income Distribution," *Journal of Political Economy* 98, 1076-1107.

Helpman, E. and A. Hoffmaister, 1997, "North-South R&D Spillovers," *The Economic Journal* 107, 134-149.

Helpman, E. O.Itskhoki and S. Redding, 2008, "Wages, Unemployment and Inequality with Heterogeneous Firms and Workers," NBER Working Papers No.14122.

Jorgenson, D.W. and K. Vu, 2005, "Information Technology and the World Economy," *Scandinavian Journal of Economics* 107, 631-650.

Kakwani, N.C., 1980, "On a Class of Poverty Measures," Econometrica 48, 437-446.

Kose A., E.S., Prasad, K. Rogoff, and S.-J. Wei, forthcoming, 2009, "Financial Globalization: A Reappraisal," *IMF Staff Papers* 56, 8-62.

Kremer, M. and D. Chen, 2002, "Income Distribution Dynamics with Endogenous Fertility," *Journal of Economic Growth* 7, 227-258.

Krugman, P., 1995, "Growing World Trade: Causes and Consequences," *Brookings Papers on Economic Activity,* 327-377.

Krugman, P., 2008, "Trade and Wages, Reconsidered," *Brookings Papers on Economic Activity*, 103-154

Lane, P.R. and G.M. Milesi-Ferretti, 2006, "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970-2004," *Journal of International Economics* 73, 223-250.

Lawrence, R.Z. and M.J. Slaughter, 1993, "International Trade and American Wages in the 1980s: Giant Sucking Sound or Small Hiccup?" in Martin Neil Baily and Clifford Winston (eds), *Brookings Papers on Economic Activity*: Microeconomics 2, 161-226.

Loayza, N. and C. Raddatz, 2006, "The Composition of Growth Matters for Poverty Alleviation," World Bank Policy Research Working Paper 4077.

Machin, S. and J. Van Reenen, 2007, "Changes in Wage Inequality," Center for Economic Performance, Special Paper No. 18.

Meyer, B., and J. Sullivan, 2006, "Three Decades of Consumption and Income Poverty," National Poverty Center Working Paper Series No. 06-35, University of Michigan.

Nehru, V. and A. Dhareshwar, 1993, "A New Database on Physical Capital Stock: Sources, Methodology and Results" (in English), *Revista de An´alisis Econ'omico* 8, 37-59.

Perotti, R., 1996, "Growth, Income Distribution, and Democracy: What the Data Say," *Journal of Economic Growth* 1, 149-187.

Persson, T. and G. Tabellini, 1994, "Is Inequality Harmful for Growth?" *American Economic Review* 84, 600-621.

Piketty, T., 2003, "Income Inequality in France, 1900-1998," *Journal of Political Economy* 111, 1004-1042.

Piketty, T. and E. Saez, 2003, "Income Inequality in the United States, 1913-1998," *Quarterly Journal of Economics* 118, 1-39.

Prasad, E.S., K. Rogoff, S.-J. Wei, and A. Kose A., 2007, "Financial Globalization, Growth and Volatility in Developing Countries," in A. Harrison (ed.), pp. 457-516, *Globalization and Poverty.* NBER, Chicago.

Ravallion, M., 2004, "Competing Concepts of Inequality in the Globalization Debate," *Brookings Trade Forum*, 1-38.

Ravallion, M., 2006, "Looking Beyond Averages in the Trade and Poverty Debate," *World Development*, 34, 1374-1392.

Ravallion, M. and S. Chen, 1996, "What Can New Survey Data Tell Us About Recent Changes in Distribution and Poverty?" World Bank Policy Research Working Paper No. 1694.

Roine, J., J. Vlachos and D. Waldenström, 2008, "The Long-Run Determinants of Inequality: What Can We Learn from Top Income Data?" working paper, Stockholm School of Economics.

Roine, J. and D. Waldenström, 2008, "The Evolution of Top Incomes in an Egalitarian Society: Sweden 1903-2004," *Journal of Public Economics* 92, 366-387.

Schindler, M., 2009, "Measuring Financial Integration: A New Dataset," *IMF Staff Papers* 56, 222-238.

Sylwester, K., 2000, "Income Inequality, Educational Expenditures, and Growth," *Journal of Development Economics* 63, 379-398.

Shirahase, S, 2001, "Japanese Income Inequality by Household Types in Comparative Perspective," Luxembourg Income Study Working Paper 268. Syracuse, NY: Syracuse University. July. http://lisweb.ceps.lu/publications/liswps/268.pdf.

Stolper W.F. and P.A. Samuelson, 1941, "Protection and Real Wages," *Review of Economic Studies* 9, 58-73.

Topalova, P., 2007, "Trade Liberalization, Poverty, and Inequality: Evidence from Indian Districts," in A. Harrison (ed.), pp. 291-336, *Globalization and Poverty.* NBER, Chicago.

Verhoogen, E., 2008, "Trade, Quality Upgrading and Wage Inequality in the Mexican Manufacturing Sector," *Quarterly Journal of Economics* 123, 489-530.

World Income Inequality Database, 2005, United Nations University – World Institute for Development Economic Research (WIDER).

World Bank World Development Report, 2006, *Equity and Development.*

World Bank, Global Economic Prospects, 2008, *Technology Diffusion in the Developing World.*

Yeaple, S.R., 2005, "A Simple Model of Firm Heterogeneity, International Trade, and Wages," *Journal of International Economics* 65, 1-20.

Appendix

This appendix provides further details on the construction of the variables and the data sources used in the paper.

A1. Variable definitions and data sources

Gini Index

The primary source for the Gini index data is the World Bank *Povcal* database. For Mexico and Poland, the consumption-based Gini indices and quintile income shares were extrapolated historically for the period prior to 1992—for which only income-based measures are available—by assuming that the changes in consumption-based measures are identical to the observed changes in income-based measures that are available for that period. A similar process was applied to Peru's data prior to 1990, applying the changes in the observed consumption-based measures for earlier years to the income-based Gini index available from 1990 onward. For Argentina and Uruguay, the data cover only urban areas because of the high rate of urbanization in these two countries. For China and India, data with full country coverage (combining urban and rural data from the World Bank *Povcal* database) were provided by Shaohua Chen of the World Bank. When *Povcal* data were not available (mainly for advanced economies), the data from the Luxembourg Income Study were used, as provided in the World Income Inequality Database, Version 2.0b, May 2007 (WIDER).

These data are mostly available only until 2000. The following other sources were also used to increase coverage for advanced economies: data for Australia are from the Australian Bureau of Statistics; data for Germany are from the Deutsches Institüt für Wirtschaftsforschung; data for France are from the European Commission; household inequality data for Hong Kong SAR are from the Hong Kong Census and Statistics; household Gini index data for Japan are from Shirahase (2001); income share data for Japan measuring household consumption inequality and excluding agricultural households are from the Family Income and Expenditure Survey provided by the Japanese Statistics Bureau (all included in WIDER); and household inequality data for Korea were provided by Professor Kyungsoo Choi of the Korea Development Institute. The regressions used only actual (not interpolated) observations.

Trade Globalization

De facto trade openness is calculated as the sum of imports and exports of (non-oil) goods and services over GDP. The data are from the World Economic Outlook database (April 2007). Sectoral trade data on agriculture, manufacturing, and services are from the World Bank's World

Development Indicators database (April 2007). De jure trade openness is calculated as 100 minus the tariff rate, which is an average of the effective tariff rate (tariff revenue/import value) and of the average un-weighted tariff rate. The data are from a database prepared by IMF staff. Each component of the implied 100 minus tariff rate is interpolated linearly for countries with data gaps less than or equal to seven missing observations between 1980 and 2004. When data for either component (the effective tariff rate or the average unweighted tariff rate) are shorter than for the other, the shorter series is extrapolated using the growth rate of the longer series. Finally, for countries with only one of the two components, only the available one is used.

Financial Globalization

De facto financial openness is calculated as the sum of total cross-border assets and liabilities over GDP. Data on financial globalization are from the "External Wealth of Nations Mark II" created by Lane and Milesi-Ferretti (2006). The components of de facto financial openness in percent of GDP include (for both assets and liabilities) (1) FDI, (2) portfolio equity, (3) debt, (4) financial derivatives, and (5) total reserves minus gold (assets only). De jure financial openness refers to the capital account openness index (KAOPEN) from Chinn and Ito (2006). The index is based on principal components extracted from disaggregated capital and current account restriction measures in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.

Capital Stock and ICT Capital

Fajnzylber and Lederman (1999) is the source of the capital stock series for the entire economy. This data set extends the capital stock series estimated by Nehru and Dhareshwar (1993) by adding the annual flow of gross fixed capital formation and assuming a 4 percent depreciation rate of the preexisting stock of capital. Fajnzylber and Lederman (1999) was further updated to recent years using the same methodology. Jorgenson and Vu (2005) provides series on IT investment using national expenditure data for computer hardware, software, and telecommunications equipment. A perpetual inventory method applies varying depreciation rates to estimate the IT capital stock. This method assumes a geometric depreciation rate of 31.5 percent and a service life of seven years for computer hardware, 31.5 percent and five years for software, and 11 percent and 11 years for telecommunications equipment.

Private Credit

Each country's financial depth is estimated by its ratio of credit to the private sector by deposit money banks and other financial institutions to GDP. The source is the Financial Structure database prepared by Beck, Demirgüç-Kunt, and Levine (2000) and revised in March 2007. Data for China are based on IMF staff calculations.

Education

Data on educational attainment of the population ages 15 and older are from the Barro-Lee (2001) data set. The series used are the average schooling years in the population, and the share of the population with secondary and/or higher education.

Employment

Data on employment are from the World Bank's World Development Indicators database (April 2006). The shares in agriculture and industry are interpolated linearly for countries with data gaps of seven or fewer missing observations between 1980 and 2005. For Bolivia, data are from the International Labor Organization's LABORSTA database for 1988–2001 and from the Instituto Nacional de Estadística for 2002–05. For Ecuador, data for 1988–2005 are from the International Labor Organization's LABORSTA database. For Morocco, data for 1999–2002 are from the Direction de la Politique Economique Générale. For Paraguay, data for 1991–2005 are from the Departamento de Cuentas Nacionales y Mercado Interno, Gerencia de Estudios Económicos. For China, data for 1980–2004 are from the National Bureau of Statistics. For India, data for 1980–2004 are taken from the National Sample Survey Organization. For Taiwan Province of China, data for 1980–2005 are from the CEIC database.

Labor Market Variables

Labor market regulations: is an indicator of regulation of credit, labor, and business. Its scale is 1 to 10 with higher ratings indicating less regulations. The source is the CATO Institute. *Unemployment benefit replacement rate:* is the ratio of the unemployment benefit a worker receives relative to the worker's last gross earnings. The source is Aleksynska and Schindler (forthcoming). *Ratio of minimum to mean wage:* is the ratio of monthly nominal minimum wage, in local currency, relative to the mean wage, also nominal in local currency. The source is Aleksynska and Schindler (forthcoming).

A2. Income country groups and estimation sample

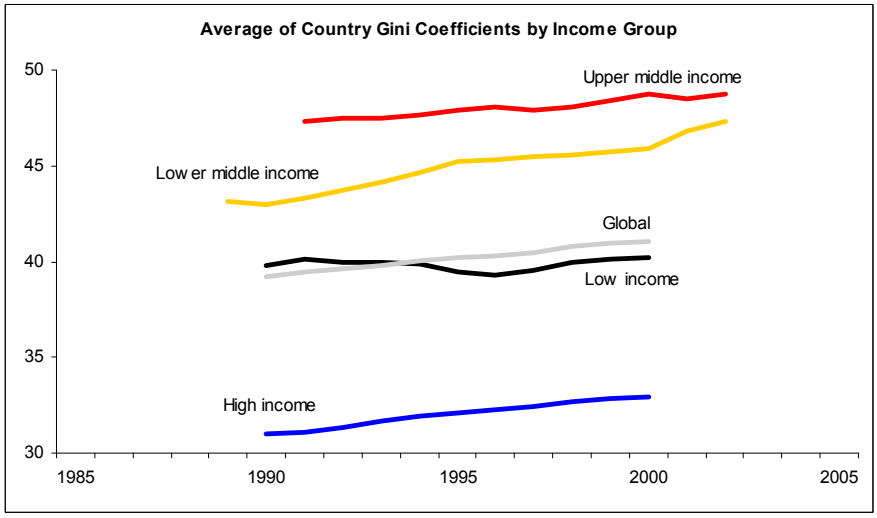
Income country groups: Aggregates by income level use the following countries: The groups are low income, $875 or less; lower-middle income, $876–$3,465; upper-middle income, $3,466–$10,725; and high income, $10,726 or more. Taiwan Province of China is included in the high-income group.

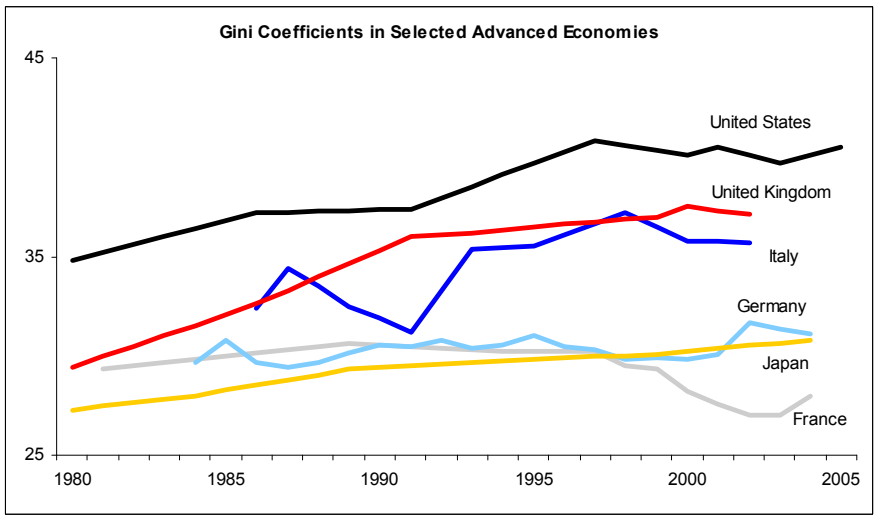
Countries used in estimation: The sample of countries for which all variables used in the regressions were available consists of 51 countries, of which 20 are advanced economies and 31 are developing economies. Based on data availability, the following countries are included:

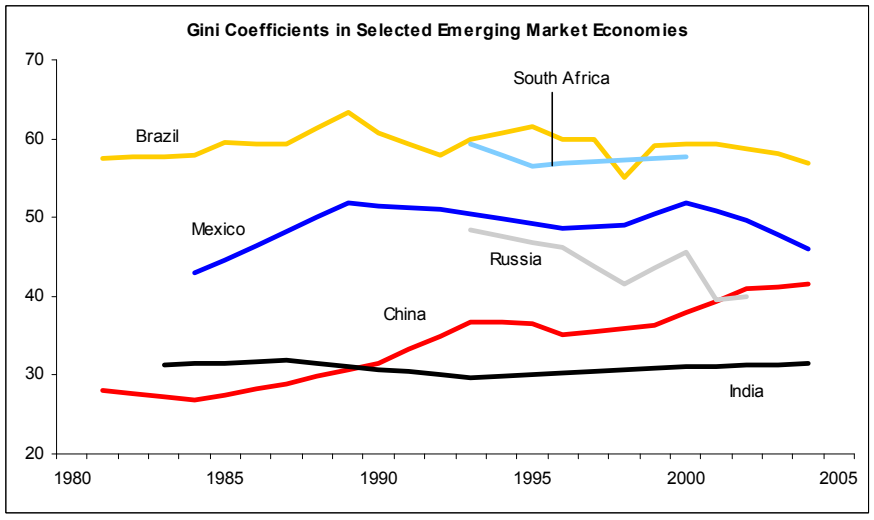
Advanced economies: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, Korea, the Netherlands, Norway, Singapore, Spain, Sweden, the United Kingdom, and the United States.

Developing economies: Argentina, Bangladesh, Bolivia, Brazil, Chile, China, Costa Rica, Ecuador, Egypt, El Salvador, Ghana, Guatemala, Honduras, India, Indonesia, the Islamic Republic of Iran, Kenya, Malaysia, Mexico, Pakistan, Panama, Paraguay, Peru, the Philippines, Sri Lanka, Thailand, Turkey, Uganda, Uruguay, Venezuela, and Zambia.

Figure 1: Income inequality within income country groups and selected countries

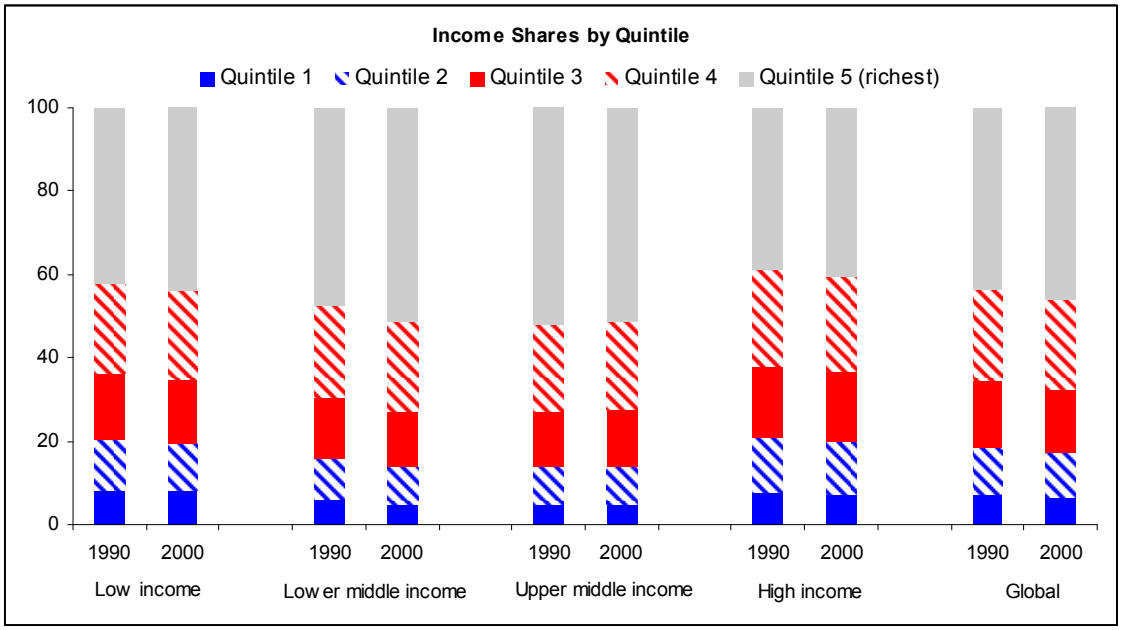






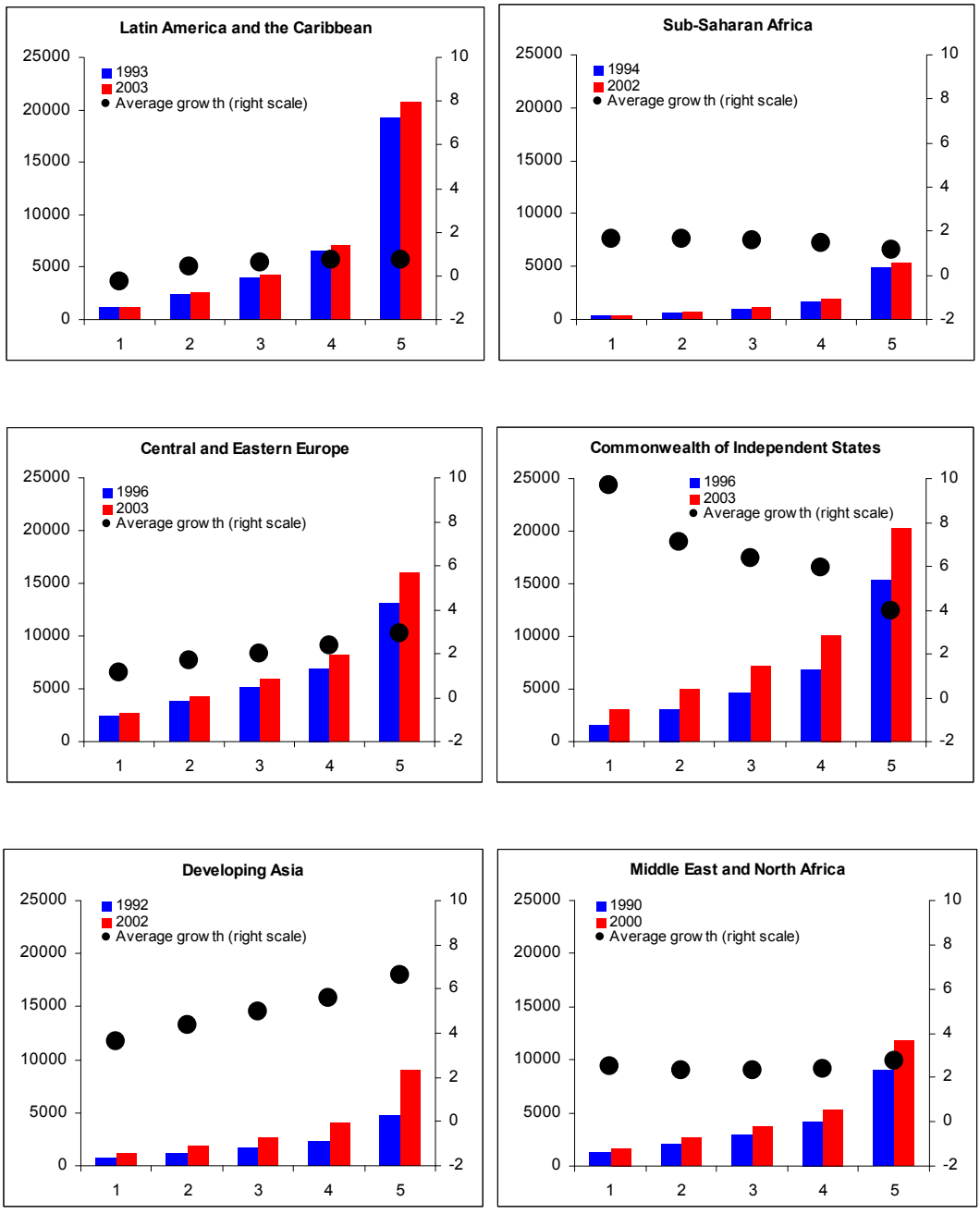
Notes: Income country groups are defined in the appendix. Trends after 2000 are based on earnings data for full-time, year-round workers. Trends for pre-1992 Germany are based on data for West Germany.

Figure 2: Income shares within income country groups



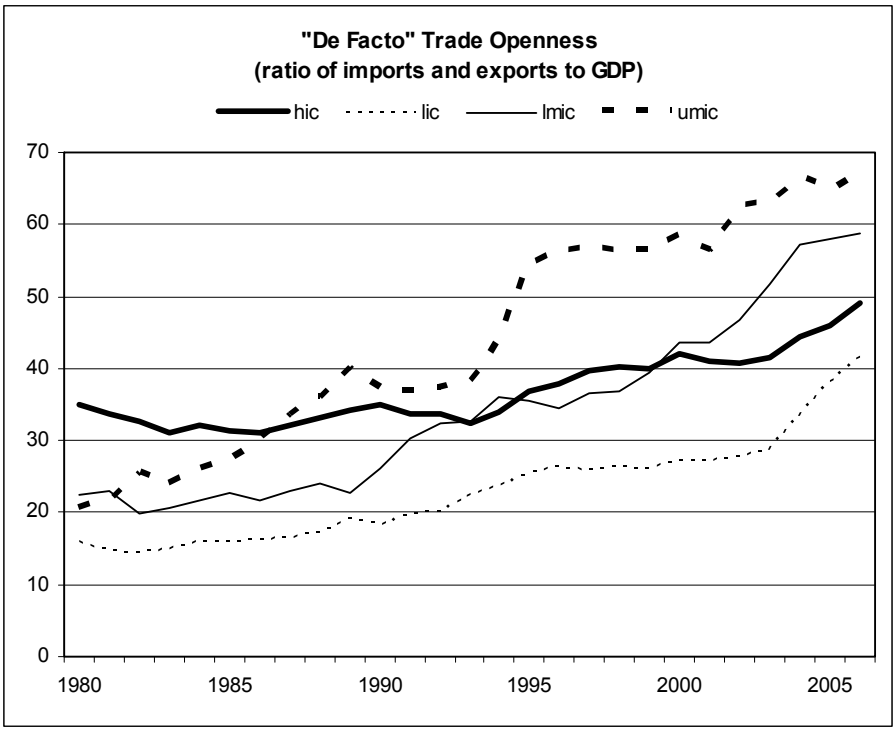
Notes: Income country groups are defined in the appendix.

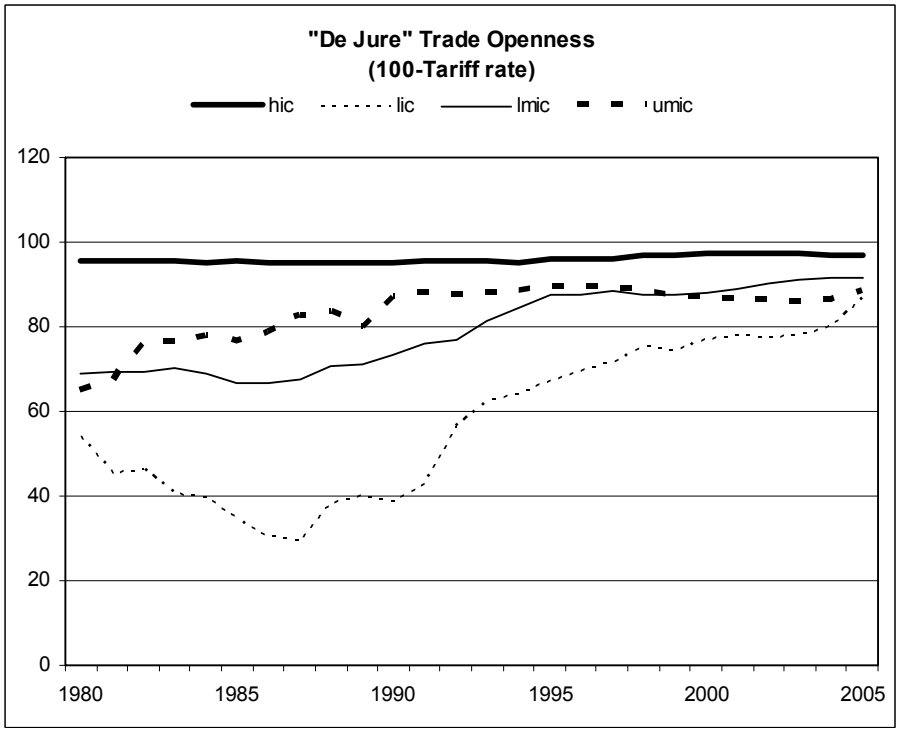
Figure 3: Icome by quintile in selected regions



Notes: Income or consumption share data are applied to per capita real GDP levels from PWT 6.2 to calculate per capita income by quintile.

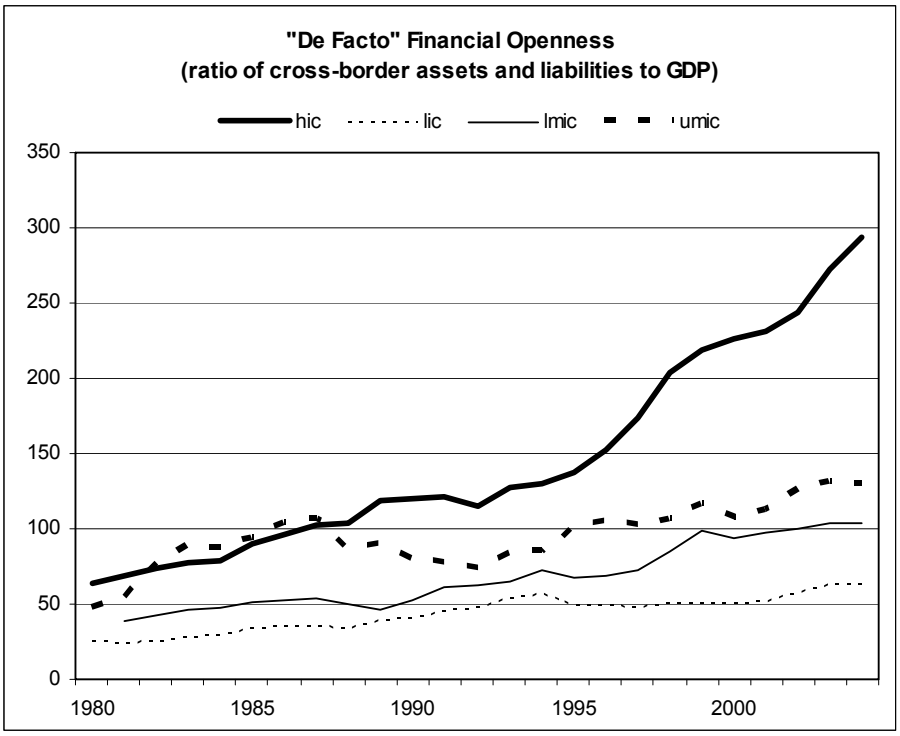
Figure 4: Trade liberalization within income country groups

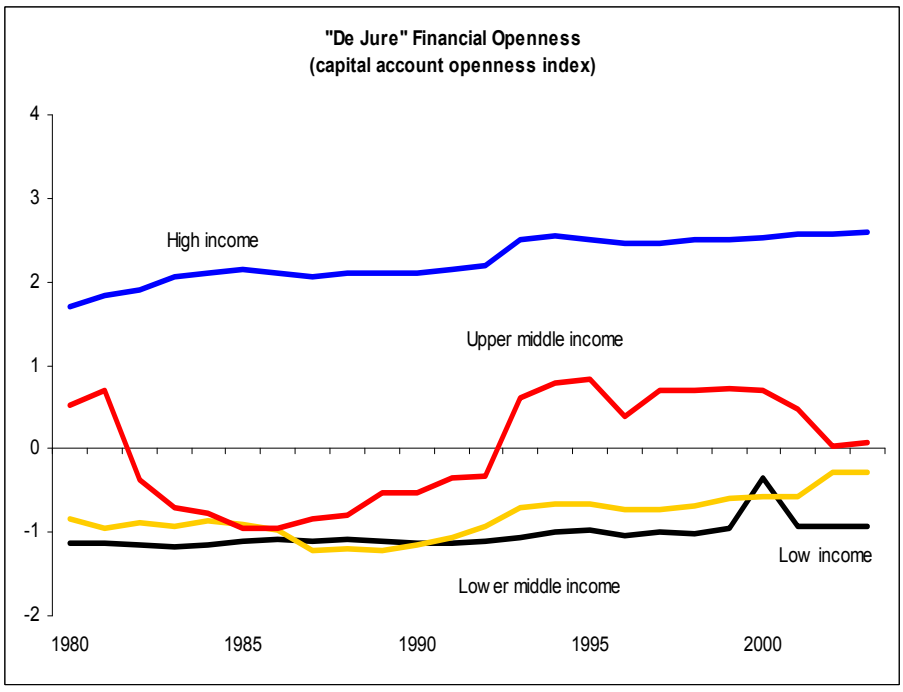




Notes: Income country groups are defined in the appendix. hic = high income countries, lic = low income countries, lmic = low-middle income countries, and umic = upper-middle income countries. Tariff rates are calculated as the average of the effective rate (ratio of tariff revenue to import value) and of the average un-weighted tariff rates.

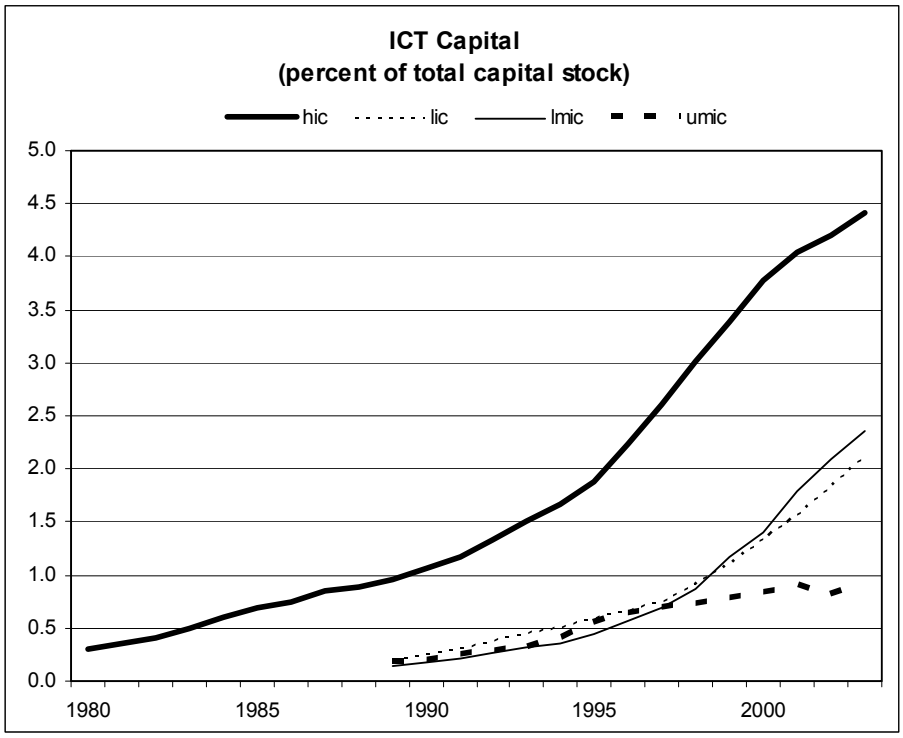
Figure 5: Financial liberalization within income country groups





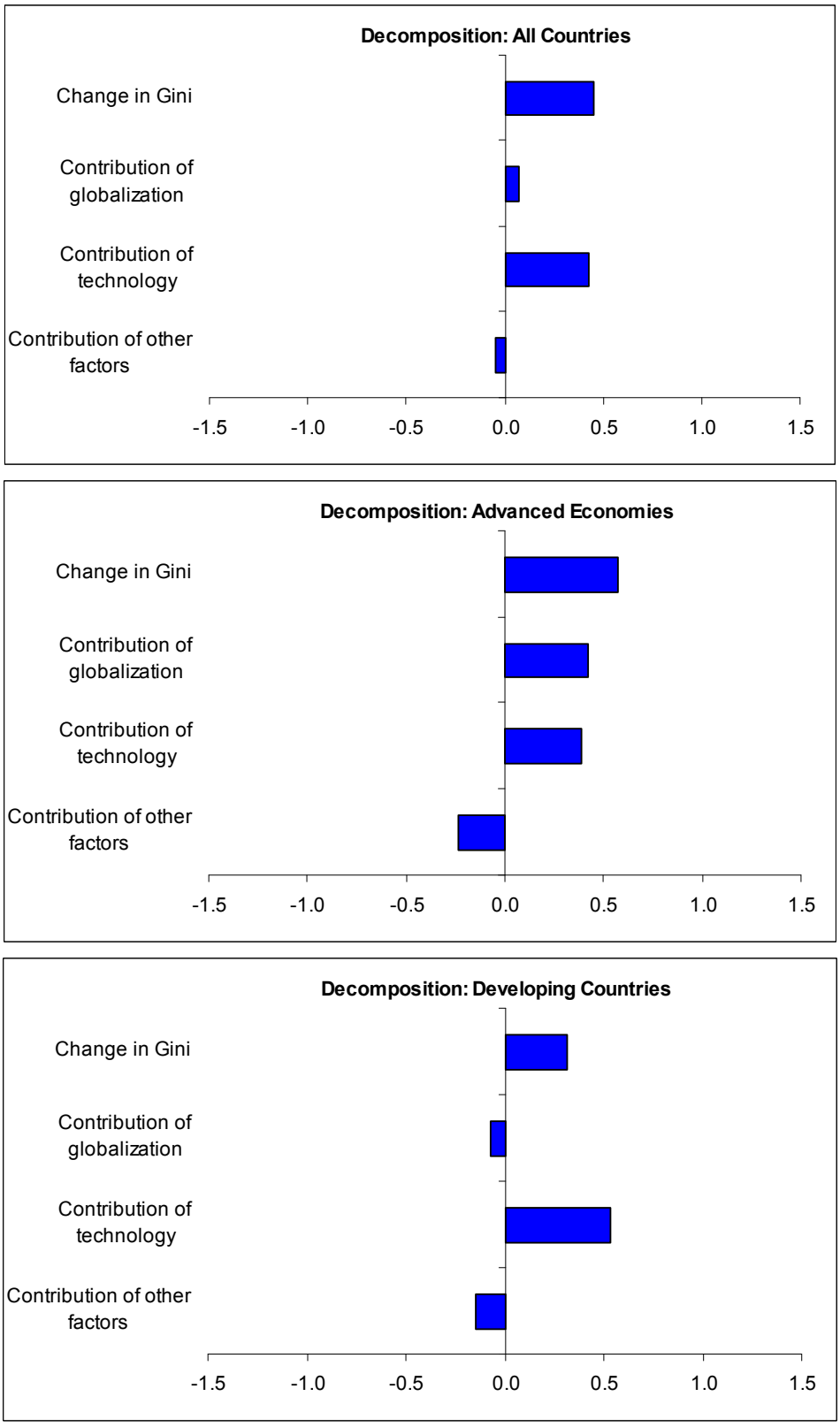
Notes: Income country groups are defined in the appendix. hic = high income countries, lic = low income countries, lmic = low-middle income countries, and umic = upper-middle income countries. De jure financial openness, measuring a country's degree of capital account openness, is based on principal components extracted from disaggregated capital and current account restriction measures.

Figure 6: Technological development within income country groups



Notes: Income country groups are defined in the appendix. hic = high income countries, lic = low income countries, lmic = low-middle income countries, and umic = upper-middle income countries. ICT data are from Jorgenson and Vu (2005).

Figure 7: Decomposition of the change in income inequality



Notes: Income country groups are defined in the appendix. The contribution of each variable is computed as the annual change in the variable times the relevant regression coefficient on the variable.

Table 1: Income inequality panel regressions

(dependent variable: natural logarithm of Gini)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Model Specification	Full Model	Benchmark Model	Sectoral Exports	Sectoral Productivity	Excluding Sectoral Empl. Shares
Trade globalization					
Export-to-GDP ratio	-0.066	-0.057		-0.048	-0.056
	(2.18)**	(2.56)**		(2.15)**	(2.41)**
Agricultural exports			-0.03		
			(2.49)**		
Manufacturing exports			-0.002		
			(0.10)		
Service exports			-0.006		
			(0.38)		
Import-to-GDP ratio	0.011				
	(0.38)				
100 minus tariff rate	-0.002	-0.002	-0.003	-0.002	-0.003
	(2.27)**	(2.52)**	(2.71)***	(2.61)***	(2.50)**
Financial globalization					
Ratio of inward FDI stock to GDP	0.039	0.040	0.038	0.035	0.039
	(2.92)***	(3.01)***	(3.06)***	(2.57)**	(2.96)***
Ratio of inward portfolio equity stock to GDP	-0.0001				
	(0.15)				
Ratio of inward debt stock to GDP	0.002				
	(0.12)				
Ratio of outward FDI stock to GDP	0.0005				
	(0.39)				
Capital account openness index	-0.001				
	(0.17)				
Technology					
Share of ICT in total capital stock	0.032	0.031	0.027	0.030	0.033
	(1.87)*	(1.98)**	(1.62)	(2.03)**	(2.01)**
Control variables					
Credit to private sector (% of GDP)	0.049	0.051	0.049	0.050	0.042
	(3.38)***	(3.49)***	(3.81)***	(3.54)***	(3.06)***
Population share with at least a secondary education	0.003	0.003	0.002	0.004	0.004
	(1.42)	(1.47)	(0.77)	(1.82)*	(2.08)**
Average years of education	-0.219	-0.216	-0.182	-0.328	-0.359
	(1.17)	(1.20)	(1.00)	(1.84)*	(1.91)*
Agriculture employment share	0.05	0.05	0.052		
	(2.00)**	(2.05)**	(2.21)**		
Industry employment share	-0.102	-0.095	-0.098		
	(2.50)**	(2.78)***	(2.26)**		
Relative labor productivity of agriculture				-0.037	
				(1.67)*	
Relative labor productivity of industry				0.128	
				(3.03)***	
Observations	288	288	284	279	288
Adjusted R-squared (within)	0.29	0.3	0.31	0.32	0.27

Notes: Heteroskedasticity-robust t-statistics are in parentheses; *denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share 5 percent level, and *** denotes significance at the 1 percent level. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share with at least a secondary education. The left- and right-hand-side variables are demeaned using country-specific means (equivalent to doing a panel estimation with country fixed effects) and the equations include time dummies. FDI = foreign direct investment; ICT = information and communications technology.

Table 2: Income inequality panel regressions: specification robustness

(dependent variable: natural logarithm of Gini)

Model Specification	*(1)* Long Difference Estimation	*(2)* IV Estimation	*(3)* Benchmark Model Clustered Std. Err. by Country	*(4)* Before & After 1995 (B&A)	*(5)* B&A Clustered Std. Err. By Country
Benchmark model variables					
Export-to-GDP ratio	-0.007	-0.055	-0.057	-0.092	-0.092
	(0.14)	(2.16)**	(2.11)**	(2.86)***	(2.40)**
100 minus tariff rate	-0.003	-0.003	-0.002	-0.003	-0.003
	(1.41)	(2.98)***	(2.79)***	(2.14)**	(2.27)**
Ratio of inward FDI stock to GDP	0.053	0.029	0.04	0.056	0.056
	(1.93)*	(2.03)**	(2.29)**	(2.55)**	(2.46)**
Share of ICT in total capital stock	0.102	0.047	0.031	-0.002	-0.002
	(1.92)*	(3.16)***	(1.54)	(0.1)	(0.1)
Credit to private sector (% of GDP)	0.103	0.041	0.051	0.048	0.048
	(2.41)**	(2.58)***	(3.60)***	(2.33)**	(2.40)**
Population share with at least a secondary education	0.005	0.002	0.003	0.001	0.001
	(1.37)	(0.84)	(1.29)	(0.42)	(0.43)
Average years of education	-0.263	-0.16	-0.216	0.028	0.028
	(0.79)	(0.87)	(1.09)	(0.11)	(0.11)
Agriculture employment share	-0.026	0.058	0.05	0.093	0.093
	(0.49)	(2.49)**	(1.55)	(2.84)***	(2.72)***
Industry employment share	-0.15	-0.096	-0.095	-0.074	-0.074
	(1.75)*	(2.90)***	(2.57)**	(1.41)	(1.38)
Variables interacted with post-1995 dummy					
Export-to-GDP ratio				0.08	0.08
				(1.99)**	(2.10)**
100 minus tariff rate				0	0
				(0.07)	(0.07)
Ratio of inward FDI stock to GDP				-0.038	-0.038
				(1.48)	(2.02)**
Share of ICT in total capital stock				0.072	0.072
				(2.42)**	(3.36)***
Credit to private sector (% of GDP)				0	0
				(0.01)	(0.01)
Population share with at least a secondary education				0.003	0.003
				(0.69)	(0.87)
Average years of education				-0.559	-0.559
				(1.74)*	(2.57)**
Agriculture employment share				-0.074	-0.074
				(1.62)	(1.99)*
Industry employment share				-0.053	-0.053
				(0.75)	(0.77)
Observations	51	285	288	288	288
Adjusted R-squared (within)	0.23		0.30	0.32	0.32
Anderson Test		188.1			
p-value		[0.00]			
Hansen Test		2.01			
p-value		[0.37]			

Notes: Heteroskedasticity-robust t-statistics are in parentheses; *denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share 5 percent level, and *** denotes significance at the 1 percent level. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share with at least a secondary education. The left- and right-hand-side variables are demeaned using country-specific means (equivalent to doing a panel estimation with country fixed effects) and the equations include time dummies. FDI = foreign direct investment; ICT = information and communications technology.

Table 3: Income inequality panel regressions: additional labor market variables

(dependent variable: natural logarithm of Gini)

Model Specification	*(1)* Unemployment Rate	*(2)* Survey Indicator of Labor Market Regulations	*(3)* Unemployment Benefit Replacement Rate	*(4)* Including Ratio of Min to Mean Wage	*(5)* Including All Three Labor Market Variables
Benchmark model variables					
Export-to-GDP ratio	-0.056	-0.057	-0.064	-0.055	-0.06
	(2.52)**	(2.51)**	(2.64)***	(2.18)**	(2.42)**
100 minus tariff rate	-0.003	-0.002	-0.003	-0.002	-0.002
	(1.91)*	(2.50)**	(2.67)***	(1.87)*	(2.21)**
Ratio of inward FDI stock to GDP	0.048	0.04	0.039	0.044	0.046
	(3.28)***	(2.81)***	(3.03)***	(3.10)***	(3.22)***
Share of ICT in total capital stock	0.022	0.031	0.031	0.037	0.035
	(1.34)	(1.98)**	(1.86)*	(2.17)**	(1.92)*
Credit to private sector (% of GDP)	0.054	0.051	0.049	0.047	0.05
	(3.63)***	(3.39)***	(3.53)***	(3.03)***	(3.18)***
Population share with at least a secondary education	0.002	0.003	0.002	0.003	0.003
	(1.07)	(1.49)	(1.17)	(1.72)*	(1.43)
Average years of education	-0.132	-0.216	-0.151	-0.36	-0.296
	(0.68)	(1.21)	(0.83)	(2.03)**	(1.64)
Agriculture employment share	0.055	0.05	0.041	0.058	0.047
	(1.94)*	(2.03)**	(1.65)	(1.88)*	(1.52)
Industry employment share	-0.061	-0.095	-0.098	-0.059	-0.076
	(1.27)	(2.78)***	(2.65)***	(1.26)	(1.59)
Additional labor market variables					
Unemployment rate	0.0001				
	(0.14)				
Labor market regulation		-0.001			-0.068
		(0.01)			(0.97)
Unemployment benefit replacement rate			0.191		0.167
			(2.03)**		(1.69)*
Ratio of minimum to median wage				-0.027	-0.03
				(0.73)	(0.76)
Observations	267	288	263	257	251
Adjusted R-squared (within)	0.32	0.3	0.3	0.31	0.3

Notes: Heteroskedasticity-robust t-statistics are in parentheses; *denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share 5 percent level, and *** denotes significance at the 1 percent level. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share. All explanatory variables are in natural logarithm, except the tariff measure, the capital account openness index, and the population share with at least a secondary education. The left- and right-hand-side variables are demeaned using country-specific means (equivalent to doing a panel estimation with country fixed effects) and the equations include time dummies. FDI = foreign direct investment; ICT = information and communications technology.

Table 4: Income inequality panel regressions: regional heterogeneity
(dependent variable: natural logarithm of Gini)

	(1) Advanced Versus Developing Economies	*(2)* Regional Technology Effect
Benchmark model variables		
Export-to-GDP ratio	-0.063	-0.071
	(2.23)**	(3.17)***
100 minus tariff rate	-0.002	-0.004
	(2.24)**	(3.53)***
Ratio of inward FDI stock to GDP	0.031	0.041
	(2.28)**	(3.03)***
Share of ICT in total capital stock	0.035	0.037
	(2.12)**	(2.11)**
Credit to private sector (percent of GDP)	0.058	0.041
	(3.94)***	(3.29)***
Population share with at least a secondary education	0.001	0.002
	(0.35)	(0.82)
Average years of education	-0.100	-0.124
	(0.54)	(0.65)
Agriculture employment share	0.074	0.052
	(2.59)**	(2.31)**
Industry employment share	-0.090	-0.139
	(2.23)**	(3.96)***
Additional variables for advanced economies		
Share of imports from developing economies	0.018	
	(0.57)	
Share of imports from developing economies *		
dummy for advanced economies	-0.104	
	(2.20)**	
Ratio of inward debt stock to GDP	0.014	
	(0.78)	
Ratio of inward debt stock to GDP *		
dummy for advanced economies	-0.083	
	(2.65)***	
Ratio of outward FDI stock to GDP	0.000	
	(0.31)	
Ratio of outward FDI stock to GDP *		
dummy for advanced economies	0.069	
	(2.68)***	
Different regional technology effect		
Share of ICT in total capital stock*		
dummy for developing Asia		0.033
		(1.99)**
Share of ICT in total capital stock *		
dummy for Latin America and the Caribbean		-0.028
		(1.91)*
Observations	282	282
Adjusted R-squared (within)	0.32	0.35

Notes: T-statistics are in parentheses; * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level. All explanatory variables are in natural logarithm, except the tariff measure and the population share with at least a secondary education. The left- and right-hand-side variables are de-meaned using country-specific means (equivalent to doing a panel estimation with country fixed effects), and the equations include time dummies. The equations are estimated jointly using the seemingly unrelated regressions estimator. FDI = foreign direct investment; ICT = information and communications technology.

Table 5: Quintile income shares regressions

(dependent variable: quintile income share)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Test All Coefficients Equal to Zero [p-value]
Export-to-GDP ratio	0.439	0.631	0.690	0.492	-2.220	
	(2.47)**	(3.52)***	(3.68)***	(2.58)***	(3.57)***	[0.02]**
100 minus tariff rate	0.021	0.020	0.017	0.013	-0.070	
	(2.16)**	(2.04)**	(1.67)*	(1.32)	(2.12)**	[0.28]
Ratio of inward FDI stock to GDP	-0.400	-0.385	-0.326	-0.163	1.241	
	(3.91)***	(3.74)***	(3.02)***	(1.48)	(3.47)***	[0.00]***
Share of ICT in total capital stock	-0.177	-0.223	-0.218	-0.207	0.830	
	(1.32)	(1.65)*	(1.54)	(1.44)	(1.77)*	[0.59]
Credit to private sector (percent of GDP)	-0.373	-0.625	-0.709	-0.437	2.136	
	(3.30)***	(5.47)***	(5.94)***	(3.59)***	(5.39)***	[0.00]***
Population share with at least a secondary education	-0.035	-0.025	-0.028	-0.003	0.094	
	(1.76)*	(1.26)	(1.31)	(0.16)	(1.35)	[0.14]
Average years of education	1.844	1.041	1.020	0.128	-3.99	
	(1.11)	(0.62)	(0.58)	(0.07)	(0.69)	[0.80]
Agriculture employment share	-0.460	-0.789	-0.981	-0.568	2.777	
	(1.76)*	(2.98)***	(3.55)***	(2.02)**	(3.02)***	[0.00]***
Industry employment share	1.081	0.866	0.603	0.084	-2.623	
	(3.07)***	(2.43)**	(1.62)	(0.22)	(2.12)**	[0.09]*
Observations	271	271	271	271	271	
Adjusted R-squared (within)	0.34	0.36	0.33	0.18	0.35	

Notes: T-statistics are in parentheses; * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level. All explanatory variables are in natural logarithm, except the tariff measure and the population share with at least a secondary education. The left- and right-hand-side variables are de-meaned using country-specific means (equivalent to doing a panel estimation with country fixed effects), and the equations include time dummies. The equations are estimated jointly using the seemingly unrelated regressions estimator. FDI = foreign direct investment; ICT = information and communications technology.