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The world's interconnected demographic/fiscal transition

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ABSTRACT

Will incomes of low and high skilled workers continue to diverge? Yes, according to our paper's dynamic, six-good, five-region – U.S., Europe, N.E. Asia (Japan, Korea, Taiwan, Hong Kong), China, and India, general equilibrium, life-cycle model. The model, which endogenizes specialization and features incomplete factor-price equalization, predicts a near doubling of the ratio of high- to low-skilled wages over the century. Increasing wage inequality arises from a traditional source – a rising worldwide relative supply of unskilled labor, reflecting Chinese and Indian productivity catchup. But growing wage inequality can be greatly mitigated if China and India dramatically improve the skill mix of successive cohorts via improved education.

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1. Introduction

Rising income inequality is of growing concern in the U.S. and other developed countries. As [Piketty and Saez \(2003\)](#) and [Gordon and Dew-Becker \(2007\)](#) show, the share of income received by the top U.S. income decile rose from 27 percent in the 1960s to roughly 45 percent today.¹ What explains this trend? The answer depends on who one asks. [Lawrence \(2008\)](#) and [Gordon and Dew-Becker \(2007\)](#) point to superstar agglomeration economies and CEO manipulation that has raised income inequality even within the top decile. [Bound and Johnson \(1992\)](#) and [Hornstein et al. \(2005\)](#) trace diverging incomes to skill-biased technical change. [Card and DiNardo \(2002\)](#) and [Lemieux \(2006\)](#) emphasize real reductions in the minimum wage and changes in labor force composition. And [Feenstra and Hanson \(1996, 1999\)](#), [Sachs and Shatz \(1996\)](#), and [Wood \(1998\)](#) point to globalization. Our focus here is the impact of global aging and its associated fiscal stresses on the evolution of wage inequality. To address this issue, we abstract from other major determinants of inequality, past and future. This is not to deny these forces but rather to isolate the demographic channel which, itself, requires a highly complex framework. The findings of the model we use in this paper should therefore not be taken as definitive predic-

tions of future inequality but rather as informed suggestions of demographics potential, if partial role.

To answer this paper's central question – how will wage inequality progress in the future? – we develop a dynamic, general equilibrium life-cycle model featuring competition among five regions – the U.S., the EMU, Northeast Asia (Japan, Korea, Taiwan, and Hong Kong), China, and India. Each of these regions produces six goods, three of which are traded. The goods are produced with capital and low-, middle-, and high-skilled labor.

The model pays careful attention to region-specific differences in demographics, fiscal conditions, and productivity and incorporates time-varying incomplete specialization and factor price equalization. The model generates more wage inequality over time. Indeed, it generates a near doubling of the ratio of high- to low-skilled wage rates over the century. The source of this rising wage gap arises from a traditional source – an increase in the worldwide relative supply of unskilled labor thanks to Chinese and Indian productivity catchup. In calibrating the model, we assume that the productivity of new cohorts of workers in regions other than the U.S. reaches the U.S. level over time. We set this catch-up period at 10 years for the EMU and Northeast Asia, 15 years for China, and 75 years for India. Once catch-up of new cohorts occurs, it takes a generation for all older worker cohorts in non-U.S. regions to be replaced by younger ones that are as productive as American workers.

New worker cohorts in a given region are assumed to enter the labor force with the same skill mix as older workers in that region. Hence, China and India, whose current work forces are disproportionately low skilled, continue to generate new worker cohorts that are disproportionately low-skilled. But as the productivity of

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¹ These figures are from [Gordon and Dew-Becker \(2007\)](#). See [Hornstein et al. \(2005\)](#), [Eckstein and Nagypal \(2004\)](#), and [Autor et al. \(2006, 2008\)](#) for additional evidence of rising U.S. wage inequality.

Chinese and Indian workers, of all three skill types, rises and ultimately reaches the U.S. level, the world experiences a major increase in its relative endowment of low-skilled and, to a lesser extent, middle-skilled workers.

These changes in relative world-wide factor endowments spell increasing wage-rate inequality. In 2005, our model's base year, the wage, measured in efficiency units, of high-skilled workers is 5.9 times higher than that of low-skilled workers. At the end of the century, it's 9.9 times higher. The ratio of the high-skilled wage rate to the middle-skilled wage rate starts at 2.0 in 2005 and ends at 2.3 in 2100.

China's and India's very high saving rates help maintain a healthy world-wide ratio of capital to labor. But this fails to prevent the low-skilled wage rate, measured in efficiency units, from falling in absolute terms – by 35 percent – over the century. In contrast, the high-skilled wage rate rises by 8.3 percent. Middle-skilled workers experience small decreases in their wage rates, again measured in efficiency units. In 2100, they are 6.1 percent lower than in 2005. Shutting down trade with China and India materially improves the prospects of low-skilled workers, but comes at a high economic price to developed regions' economies, whose long-run GDPs are reduced by almost 10 percent. Another casualty is the wage-rate of high-skilled workers, which end up 12 percent lower than occurs with free trade.

In arguing that changes in world wide factor endowments will increasingly undermine the prospects of low- and, to a lesser extent, middle-skilled workers, we do not claim that this troubling aspect of globalization has been the dominant force raising income inequality in recent decades. As [Lawrence \(2008\)](#) and [Gordon and Dew-Becker \(2007\)](#) show, increases in the relative remuneration of the top 1 percent of earners explains much of what has been happening. Their explanations include superstar-agglomeration economies and compensation extraction by top management. Such explanations ring true, and these factors may continue to exert an influence on relative pay. But they are likely to be a side show to the main event, namely the ongoing arrival of hundreds of millions of low- and middle-skilled Chinese and Indian workers increasingly able to compete on equal terms with low- and middle-skilled workers in the developed world.

Increasing wage inequality is not, however, inevitable. If Chinese and Indian education policies limit growth in the world's relative supply of unskilled workers, the exacerbation of wage inequality can, as we show, be substantially mitigated. Indeed, if China and India end up producing workers with the same skill mix as the U.S., relative wages over the century will remain essentially unchanged. Hence, one way for the developed world to improve the lot of its low-skilled workers is to help improve China's and India's educational and on-the-job training systems.²

Our calibration of regional skill shares seeks to approximate, albeit very roughly, current wage inequality in the various regions. I.e., it is not based exclusively on college completion rates or other proxies for the population's true underlying skill distribution. How countries' true skill mixes have evolved and will change through time is, itself, a challenging research project. In the U.S., college completion rates have risen from 20 percent in the 1970s to over 30 percent today. But whether this represents true improvement in the degree of young Americans' knowledge and working capacities is an open question. In the limit, it may simply reflect degree-completion inflation – a variant of the well known problem of grade inflation. Moreover, we have no clear knowledge about the degree of past versus current versus future on-the-job training. Certainly, the decline in lifetime employment in the U.S. would

militate against the same degree of internal worker training as occurred in the past. In sum, our region-specific handle on current skill distributions and how they may change over the coming decades should be taken for what it is – a sober judgement call tempered by what seems to be reasonable sensitivity analysis. Indeed, our results based on the maintenance of our assumed current skilled distributions are presented as our “base case” not to overly exaggerate this assumption's plausibility, but rather to let us look first at demographic change on its own. Finally, we have opted not to incorporate endogenous human capital formation, as in [Heckman et al. \(1998\)](#), to maintain the models tractability.

Ours is far from the first model to explore the effects of increasing economic integration of developing countries on worldwide production and trade and its impact on wage inequality in a global, general equilibrium setting. For example, [Wang and Schuh \(2002\)](#) analyze the consequences of liberalizing trade policies between the Chinese Economic Area (Taiwan, Hong-Kong and China) and their major trading partners in developed and developing countries. They find that bilateral or multilateral agreements increase economic welfare for the trading partners (with the largest gains for the Chinese Economic Area occurring when the U.S. is included into these agreements) but leads to welfare losses for those countries who are left out. Thus trade liberalization is in the interest of the developed as well as the developing regions. [Zhu and Trefler \(2005\)](#) show that the technological catch-up of developing countries may exacerbate global wage inequality through international trade effects. And they document the empirically relevance of these channels for existing developing countries. However, our approach is different since it assumes common technology and takes into account various demographic and fiscal policy effects, which become increasingly important in the future.

There is a large number of studies that analyze the impact of demographic changes on economic growth and the sustainability of social security systems in computable general equilibrium (CGE) models. Most of them focus on the consequences for national savings rates and the overall economy in industrialized countries, see e.g. [Braun et al. \(2009\)](#) who concentrate their analysis on the savings rate in Japan where the population is currently experiencing a very large aging process. However, the very rapid demographic changes in countries like China inspired studies that focus on the booming developing economies. For example, [Wang et al. \(2004\)](#) analyze the level of the implicit debt of the Chinese pension system and reform proposals to finance the pension system in the light of a rapid aging population.

Since the timing and extent of future demographic changes differ between countries these developments will affect worldwide relative factor endowments and thus international capital flows and world trade patterns. There are several multi-region models that focus on the impact of demographic changes on capital flows between industrialized countries and on their current account balances, see e.g. [Domeij and Flodén \(2006\)](#) or [Fehr et al. \(2005\)](#). They hardly pay any attention on how China, India, and other developing countries in eastern Asia will influence economic developments in the industrialized world. But as [Fehr et al. \(2007\)](#) show China with its high growth and savings rates has a major effect on world capital markets and therefore may provide capital to support the aging industrialized economies.

How demographic changes affect economic growth in the developing regions, worldwide relative factor supplies and thus world wide trade patterns has more or less been neglected in these studies. However, [Wei and Hao \(2010\)](#) and [Bloom et al. \(2010\)](#) find in their empirical analysis that past demographic developments especially the fertility decline helped to improve the worker-to-population ratio and thus to boost economic growth in China and India. [Bloom et al. \(2010\)](#) point out that this effect was more pronounced in China but it will help India in the future. They conclude

² Certainly, China has been taking a very active role at the government level in promoting higher education with its fast-track program of building new universities.

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