`Rotational labor mobility is the biggest global economic opportunity

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Abstract. The next thirty years will see unprecedented demographic differences between rich countries, with shrinking labor forces but an increasing number of elderly people and (some) poorer countries-particularly in Africa and South Asiawhere demographic momentum will create a continued increase in youth. This creates a massive win-win-win opportunity for demographic arbitrage in which ageing, labor scarce, high productivity, countries to create a variety of legal pathways for movers, including vastly increased rotational mobility. This helps ageing countries cope with the economic, employment, and fiscal strains of ageing; helps movers increase their earnings and life prospects massively; and helps youth bulge countries expand employment opportunities and foreign exchange earnings. I estimate that expanding legal pathways for rotational labor mobility in core skill occupations to meet the demographic labor force gaps in the ageing, democratic, rich industrial countries (ADRI countries) could add 6 trillion dollars in additional wages to the global economy by 2050. (And this is over and above gains from increases in the usual "permanent" or "pathway" channels of migration). The net present value over the years 2020 to 2050 of increased rotational labor mobility could be 35 trillion dollars—larger by a factor of 10 than the NPV of all development assistance.

Introduction¹

Over the 30 years, from 2020 to 2050, the thirty-one ageing, democratic, rich, industrial (ADRI) countries² will experience rapid population ageing. In the UN Zero Migration scenario the population 65 years and older (65+) in Italy, for instance, will grow by 5.4 million (39 percent) but the population 15-64 will *fall* by 12.4 million between 2020 and 2050. The labor force to those 65+ ratio will likely fall from an already historical low of 1.8 to only .9. Without migration there will be less than one worker in Italy for every person over 65.

In contrast, Sub-Saharan Africa and South Asia will see their labor force aged population grow by 1.1 billion between 2020 and 2050. The major challenge for these countries is to create adequate earning opportunities for their growing young population.

Differences create opportunities for mutually beneficial exchange. These radically different medium-term demographic futures create the possibility for "age arbitrage"—in which the young in youth bulge countries are able to move via multiple legal pathways, including on rotational arrangements, to augment the labor force in ageing societies.

The primary obstacle to reaching the full benefits (for senders, movers, and hosts) of this mutually beneficial exchange are the daunting political consequences of the massive size of the emerging demographic labor force gaps. I define the demographic labor force gap (DLFG) as the difference between the labor force to keep LF/65+ ratios at some "sustainable" level in 2050 and the zero migration (hence pure demography driven) projections of the labor force.

Estimates are that if Italy, for instance, were to keep its LF/65+ ratio constant via allowing more of traditional "pathway" migration then by 2050 over 45 percent of its population would be from non-ADRI countries (this would be in addition to the migration within ADRI countries), and Italy is not atypical. The fears of the social, cultural, and political changes that would or could be caused by migration of this magnitude puts the issue off the table as "not an option" for coping with ageing. At the same time, this denial of the increasing scarcity of workers to meet the needs of an ageing society is pushing the movement of people into other channels that create political tensions and backlash with the impression that migration is "out of control"—and this while non-ADRI movement is still relatively small.

I argue that the mechanism that threads the needle of meeting the labor force needs in ageing societies and which allows them to maintain their existing "social contract" with the elderly with democratic politics is the increased use in ADRI countries of "rotational" labor mobility in which people are legally allowed to work for fixed terms and then return to their country of origin.

I estimate that if two-thirds of the demographic labor force were met by rotational labor mobility this would allow over 200 million additional migrants the opportunity to work and add

¹ I thank Archita Misra for her research assistance that kickstarted this paper.

² I focus on ageing, democratic, rich industrial countries which excludes from the "rich" countries the oil rich countries (e.g. the Gulf, Brunei) and of rich industrial countries excludes Singapore. Many non-rich countries will also experience ageing, in particular China, which will "get old before it gets rich."

6 trillion dollars to wages by allowing people to work in high productivity places. Given the differences in labor productivity between the ADRI countries host countries and the sending countries this would add 6 trillion dollars to global wages. While sustaining such massive flows in a safe, regular, orderly, and rights-respecting way is a challenge, it is of similar difficulty to many other challenges modern economies handle routinely.

I) Calculations of 2050 demographic labor force gaps

The basic question is: "how much bigger that it's forecasted level with zero migration would each rich industrial country's labor force in 2050 need to achieve a given ratio of labor force to 65+ population (say, keep it constant at its 2020 level, or prevent it from falling below 2)?"

I.A) Data and formula

The UN Population Division of the Department of Social and Economic Affairs produces estimates and projections of country populations by sex (male, female) and by 21 five-year age brackets (e.g. 0-4, 25-29), with the top-coded category of 100+. There are population forecasts from 2020 at five-year intervals out to 2100. These population estimates are cumulations of estimated births and deaths (the rate of natural increase) and net migration. The UN DESA provide nine scenarios that use different assumptions about the future of fertility, mortality and migration³. I use the Zero Migration scenario, not because "zero migration" is a "forecast" of what will happen (as migration is already happening and will continue at some level) but because future migration is shaped by political choices of host countries and therefore projections of migration are highly contingent. Hence the Zero Migration scenario is a clear, if counterfactual, baseline scenario.

I group the five-year population brackets into "young" (ages 0-14), "labor force aged" (ages 15-64), and "65+".⁴ The change in the relative shares of these populations over time and the medium-run inversion of the demographic pyramid is well documented, widely discussed, and, largely inevitable. While forecasting economic or political or social changes thirty years ahead is largely a mug's game, projections of a countries population over 65 from 2020 to 2050 is quite certain as everyone over 65 in 2050 is already 35 in 2020 and so all that needs forecasting are population wide death rates, which are quite stable. Moreover, the labor force aged population is also predictable as most people who will be labor force aged (15-64) in 2050 are already born by 2020 (all of those 30 plus) and hence even drastic increases in fertility rates (which are highly unlikely (GBD, 2024)⁵) starting in 2020 would only produce a few extra "prime" labor force aged people (those over 25) by 2050.

³ The nine scenarios are: medium variant, high variant, low variant, constant fertility, instant replacement, momentum, zero migration, constant mortality, and no change.

⁴ I call this category "65+" to avoid labels like "aged" or "elderly" which carry unnecessary connotations.

⁵ The Global Burden of Disease 2021 Fertility and Forecasting Collaborators (2024) estimate that the median total fertility rate in these ADRI countries will fall from 1.53 in 2021 to 1.42 in 2050 in their "reference" scenario and estimate that adoption of a package of "pro-natal" policies would increase TFR

However, the demographic pyramid does not estimate the labor force. Not all "labor force aged" are economically active and many "65+" are still in the labor force. To calculate the labor force I use OECD data on economically active population by sex and five-year ages to estimate the labor force in 2020 and, under various assumptions, in 2050.

The difficulty is that the OECD data on economically active population only provides estimates for the five-year cohorts up to age 65 and then only single estimate of the labor force participation rate for those 65+. This is a serious limitation as a major feature of ageing between 2020 and 2050 is extensions in longevity hence a much larger share of the "65+" will be, say, over 80. Assuming that the "65+" labor force participation rate would stay constant would imply implausible shifts in the LFPR of the very old. My fix is to assume the LFPR declines overt age 65 by half over each five-year cohort, e.g. that the LFPR rate of those 70-74 is half that of those 65-69. I then adjust this declining LFPR curve such that the average LFPR for those 65+ with this assumed age structure equals the actual LFPR in 2020.

Figure 1 shows the average LFPR across all ADRI countries displaying the well-known shape that LFPR increases from 15-19 to reach its peak at "prime age" (around 25) and then for males is roughly constant until starting a decline at age 55. For females LFPR declines a bit after 25 and then is roughly constant until starting a decline around 50 and declining more steeply than males to age 65 (beyond age 65 the shape of the decline is just assumed). While the shape for males and females is quite similar, the "prime age" female LFPR is from 10 to 15 percentage points below the male rate.

in these countries by .2 so their 2050 forecast TFR would by 1.62 even with full adoption of pro-natal policies.

Figure 1: The average 2020 labor force participation rate across the 31 rich industrial countries, by age and sex



Source: OECD data (with author's extrapolation for ages 65 and above).

For each country c (for the 31 ADRI countries) and each time period T (2020 and 2050) the labor force aged population is the sum of the male and female (s) populations by age cohorts (a).

$$labor force aged_T^c = \sum_{a=15-19}^{a=60-64} \sum_{s=F}^{s=M} population_T^{c,a,s}$$

The labor force in the labor force aged population 15 to 64 is the population of each sex/age cell times its labor force participation rate.

labor force in LF aged^c_T =
$$\sum_{a=15-19}^{a=60-64} \sum_{s=F}^{s=M} population^{c,a,s}_{T} * LFPR^{c,a,s}_{T}$$

The same calculations can be made for the 65+ population and the labor force in the 65+ population.

Over
$$65_T^c = \sum_{a=65-69}^{a=100+} \sum_{s=F}^{s=M} population_T^{c,a,s}$$

Labor force over
$$65_T^c = \sum_{a=65-69}^{a=100+} \sum_{s=F}^{s=M} population_T^{c,a,s} * LFPR_T^{c,a,s}$$

I divide the labor force into these two age categories to emphasize the difference between the standard demographic reporting strictly by age and my calculations of the actual labor force, which include the labor force participation of those over 65.

I.B) Country estimates of the labor force and 65+ in 2050

I use the c estimates of the population by age category and the labor force from 2020 to 2050 and the assumption that the LFPR in 2050 is the same, cell by cell, as in 2020 to produce an estimate of each country's 2050 Zero Migration LF/65+ ratio.

The demographic labor force gap (DLFG) calculation then asks: "If the LF/65+ ratio in 2050 were to reach a specific value (e.g. the same as in 2020, or 2.11) how many more people in the labor force would there need to be?"

I illustrate these calculations using the graph for Germany (Figure 2), with the same graph for each ADRI countries country in an Appendix. I choose Germany as it is a large country with relatively "typical" demographic shifts.

Figure 2 shows the 2020 labor force in Germany is 43.4 million (42.1 million of whom are labor force aged) and the total 65+ population is 18.3 million. The 2020 LF/65+ ratio therefore is 2.36 (=43.4/18.3).

By 2050 the ZM scenario labor force in Germany will have declined to just 33.1 million (31.6 of which are labor force aged) as the labor force aged population will have declined from 52.2 million to only 39.2 million. As the assumption is that cell-by-cell LFPR remain constant, the aggregate LFPR of the labor force aged has remained relatively stable at 80.6 percent.

In sharp contrast, the population 65+ will have increased by 5.46 million, from 18.3 to 23.8 million. In order for the LF/65+ ratio to have remained constant at 2.36 this increase in 65+ population would require an *increase* in the labor force of about 13 million (5.46*2.36). But the inversion of the demographic pyramid creates a labor force that falls by 10.3 million. The ZM LF/65+ ratio would be just 1.39.

And a very substantial part of the rise in those 65+ will be a rise in those over 80, as longevity is expected to continue to rise. The population 65+ will increase by 5.46 million and of that, 4.61 million or 84 percent, will be an increase those over 80+.

These changes in the age structure of the population is a central and often underappreciated point. The challenge is not that "population is falling." It is hard to argue that "Germany" would be better off or worse off in the long-run (and by what measure?: as a nationstate in a global political system? as an economy? by subjective well-being of its residents? as an natural eco-system?) with an absolute population of 83.3 million (its 2020 level) versus half that or twice that. The big demographic challenge is not whether total population is rising or falling but that over the next 30 years the labor force, which contributes to the economic output that sustains both private consumption and the base for tax revenues to carry out all public purposes, will (at current LFPR) *fall* by 10.3 million and the population 65+ will *rise* by 5.5 million--and those aged 80 and older will rise by 4.6 million.

Figure 2: Illustration of calculations of the demographically driven gap in the future labor force, Germany's labor force, 65+ population and labor force gap in 2050



Source: Author's calculations as described in text.

I.C) Estimating the demographic labor force gap (DLFG)

The first two columns of Figure 2 are arithmetic calculations using existing scenarios and labor force participation rates, requiring only the additional assumption that participation rates are constant in each age/sex cell (I explore alternative assumptions below).

Figure 3 shows a "constant LFPR" estimate of the LF/65+ ratio which assumes that the LFPR cell by cell is the 2020 value. This makes the time series change in the "constant LFPR" labor force a function of demographic shifts only. The ratios for the ADRI countries have fallen dramatically from 1950 to 2020, with the ADRI countries median falling from just under 6 in 1950 to around 4 by the 1980s to 2.62 in 2020.

Figure 3 also shows the ZM scenario LF/65+ ratios for 2050, assuming 2020 LFPR cell by cell, for selected countries. Italy is at .88, Japan at 1.25, Germany 1.39 and the USA at 1.83. There is no historical experience of *any* country *ever* with these low ratios of labor force to elderly. The current levels in 2020 of Japan and Italy of around 1.8 are already the lowest ever observed.

No one knows yet whether even the current ratios of LF/65+ are fiscally sustainable into the future. The existing "social contract" embodied in the programs for old age security and health insurance come into existence and was built out to (near) universal coverage during a historical period where the LF/65+ more than twice as high as 2020 levels.

But whether or not the existing social contract between young and old can be made sustainable at *today's* demographic structure, what is clear is that no country/economy/society has ever experienced anything like the LF/65+ ratios that are inevitable without migration.

In Germany with Zero Migration and 2020 LFPR the LF/65+ ratio would fall to 1.39. In the 1950s and 1960s the ratio was three times as high. The ratio was still above 3.5 during the 1990s, and twice as high (over 2.8) until 2005 and in 2020 was 2.37. In the ZM scenario the fiscal strains caused by the fall in the LF/65+ ratio from 1990 to 2020 from around 3.4 to 2.4, are going to be repeated by 2050 with another unit fall, from around 2.4 to 1.4. There is nothing in Germany's—or any other country's--historical experience to suggest that anything like current configurations of taxes and benefits for pension and health care coverage (and other social programs) are physically or fiscally feasible at ratios of LF/65+ under 2, much less at 1.39.





Source: Author's calculations.

I start with a simple counter-factual calculation: if Germany were to allow enough foreign-born workers in 2050 relative to the Zero Migration scenario to restore the LF/65+ ratio to some value believed to be "feasible" in the sense of maintaining an adequate labor force for a thriving economy, an adequate labor force for care of the elderly, and a labor force that makes the social contact fiscally sustainable how many would that be?

These calculations are arithmetically straight forward and intuitive.

Demographic LF gap = Needed LF to achieve
$$\frac{LF}{over 65} = k$$
 less Zero Migration LF

Suppose Germany were to maintain its current LF/65+ ratio of 2.37 in 2050. Then the calculation (result shown in Figure 2, third bar) is:

German 2050 Demographic Gap = 2050 actual Over $65 * \left(2020 \frac{LF}{cmer.65} \right) - ZM$ labor force

German 2050 *Demographic Gap* = $23.8 \times 2.37 - 33.1 = 56.4 - 33.1 = 23.3$ *million*

This implies that, relative to the ZM scenario labor force Germany would need an additional 23.3 million people in the labor force. This number is intuitive as the population 65+ grew by 5.5

million (from 18.3 to 23.8) and hence to keep the ratio constant each of those would need 2.37 more people in the labor force and hence the incremental labor force needed would be 5.5*2.37=13.1 million more people in the labor force. But the labor force (ZM, 2020 LFPR) will be 10.2 million less (down to 33.1 from 43.4). The "demographic gap" from LF need is the sum of those two: 13.1 million more needed due to the demographics of ageing plus 10.2 less in the labor force due to demographic shrinking for a total incremental labor force need of 23.3 million.

Again, the labor force growth as in "how many more workers would be needed to keep the labor force constant?" only captures a part of the ageing challenge, and in this case, less than half of the demographic gap. The labor force could have remained constant from 2020 to 2050 by adding an additional 10.2 million workers, but a *constant* labor force and *growing* older population obviously implies a shrinking LF/65+ ratio. Even if the labor force were kept constant at its 2020 level of 43.4 million the LF/65+ ratio would decrease from 2.37 to 1.82 (which is the current very low level of Japan and Italy).

Table 1 shows the same demographic gap calculations as illustrated for Germany in Figure 2 for all 31 ADRI countries, grouped into three geographic regions (Europe, North America, Asia and Pacific), then sorted within each region by the absolute size of the DLFG. (Appendix 1 shows a graph identical to Figure 1 for each country).

The bottom line is that if these countries were to maintain their 2020 ratio of LF/65+ they would cumulatively require 356 million more workers than they would have in the Zero Migration, 2020 LFPR scenario. This would imply that the total labor force in 2050 would be 810.4 million, 454.5 million in the Zero Migration, constant LFPR scenario (which is 88.6 million workers *less* than in 2020) plus the 355.9 million additional workers.

If these additional workers were the result of labor movement from other countries, this would imply that 44 percent of the total labor force in 2050 would be workers that were the result of labor mobility⁶.

There are differences across countries in the fraction of labor force from movers, which depend on the speed and magnitude of the inversion of the demographic pyramid, which depends mostly on how recently, how quickly, and how deeply fertility fell. So, for instance, within Europe there is a big difference between Spain where the fraction would be .59 and France where it would be only .38. France's fertility rate has been relatively low for a very long time and has not fallen by much (TFR as 2.09 in 1975 and is 1.83 in 2021) and hence the ageing, while happening, is less dramatic. In contrast, Spain's fertility fell very fast to very low levels quite recently (TFR was 2.77 in 1975 and then fell to 1.13 by 1995 and has stayed at those very low levels and is at 1.19 in 2021) which implies the rise of aged to labor force is large and rapid over the coming years as the LF/>65 ratio falls to just 1 worker per person 65+ by 2050. Similarly, in

⁶ "Result of movement" is more accurate than "migrants" or "foreign born" as movers in 2021 who stayed until 2050 could also have contributed children who could be in the labor force by 2050 as "native born" non-migrants.

Asia and the Pacific the ratio of workers from migration in 2050 is .66 in Korea, as Korea's TFR was 3.43 in 1975, fell to 1.08 by 2005 and then fell further still to .808 in 2021, so the demographic ageing from 2020 to 2050 will be massive.

The differences across the major regions are not very large, .44 in Europe, .42 in North America and .47 in Asia and Pacific. Hence the absolute magnitude of the demographic labor force gap is mainly driven by population size. Of the global figure of a DLFG of 355.9 million, 152.3 would be in Europe, 126.8 in North America (110.7 in the USA), and 76.8 in Asia and Pacific.

Table 1: Changing demographics of population 65+ and labor force imply that the additional labor force over the Zero Migration scenario needed to keep ratios of labor force to 65+ stable is massive, 356 million additional workers, 44 percent of the total labor force in 2050

percent of the tot		1 2030					T	
Country	Actual labor force, 2020	Population 65+, 2020	LF/65+ ratio, 2020	Estimated labor force 2050 (ZM, 2020 LFPR)	Population 65+ 2050 (at ZM)	LF/65+ ratio, (ZM, 2020 LFPR, scenario)	Demographic gap in labor force in 2020 (to keep country's 2050 LF/over65 ratio at its 2020 level)	Ratio of gap to total labor force, 2050
Columni	т	II	III	IV/	V	VI	VII	VIII
Column:	I		111	IV	v	VI	(sorted within regions)	VIII
Spain	22.8	9.3	2.45	16.1	16.1	1.00	23.3	0.59
Germany	43.4	18.3	2.37	33.1	23.8	1.39	23.3	0.41
United Kingdom	34.5	12.6	2.75	31.2	18.4	1.69	19.5	0.38
Italy	25.0	13.9	1.80	17.0	19.3	0.88	17.7	0.51
Poland	18.5	7.1	2.62	13.7	10.3	1.33	13.3	0.49
France	28.7	13.5	2.12	25.9	18.4	1.41	13.1	0.34
Netherlands	9.5	3.4	2.76	8.2	4.8	1.71	5.1	0.38
Switzerland	5.0	1.6	3.09	4.0	2.8	1.45	4.5	0.53
Austria	4.6	1.7	2.70	3.5	2.7	1.30	3.7	0.52
Eight moderate sized countries	35.7	14.6	2.44	28.9	20.7	1.40	22.1	0.43
Eight smaller countries	13.1	5.1	2.56	11.0	6.8	1.62	6.7	0.38
Europe	240.9	101.2	2.38	192.7	144.1	1.34	152.3	0.44
USA	169.2	54.5	3.10	158.8	86.8	1.83	110.7	0.41
Canada	20.4	6.8	2.99	17.4	11.2	1.56	16.1	0.48
North America	189.6	61.3	3.05	176.3	98.0	1.69	126.8	0.42
S. Korea	28.4	8.2	3.46	21.0	18.0	1.17	41.2	0.66
Japan	67.8	37.1	1.83	48.6	38.7	1.25	22.3	0.31
Australia	13.6	4.2	3.27	13.2	7.4	1.78	11.0	0.46
New Zealand	2.9	0.8	3.63	2.9	1.4	2.04	2.3	0.44
Asia and Pacific	112.7	50.2	3.05	85.6	65.5	1.56	76.8	0.47
Total of 31 Rich Industrial countries	543.1	212.8	2.55	454.5	307.6	1.48	355.9	0.44

Source: Authors calculations with UN World Population Prospects Zero Migration scenario data on demographics and OECD data on Economically Active Population.

Notes: The eight moderate contribution to demographic gap European countries are: Portugal, Czech Republic, Belgium, Greece, Ireland, Sweden, Slovakia, Hungary. The eight small contribution to demographic gap countries are: Norway, Denmark, Finland, Slovenia, Lithuania, Luxemburg, Estonia, Latvia.

I.D) Robustness of demographic labor force gap

The estimates of the demographic labor force gap in Table 1 make two strong, if defensible, assumptions. One assumption is that the labor force participation rates in each sex/age cell remain constant from 2020 to 2050. A second assumption is about the level of the ratio of labor force to aged that is "sustainable." I address the robustness of the estimates to each of these assumptions these in turn.

I.D.a) Labor force participation rate

The demographic labor force gap estimates in Table 1 assume that the labor force participation rates in 2050 are the same as in 2020 in each age/sex cell. The change in the labor force in 2050 versus 2020 is driven the changing age structure of the population⁷.

Some suggest that at least some part of the growing labor scarcity could be addressed by increased labor force participation by prime age women and increased labor force participation at higher ages. Figure 4 expands on the average labor force participation rates shown in Figure 1 by showing both the median labor force participation by age and sex across the 31 ADRI countries, but adds a graph of the average LFPR of the highest three countries for each age/sex cell and the average of the lowest three countries for each age/sex cell. For instance, the highest three countries in their LFPR of males aged 65-69 are Korea (82.7), Japan (76.51), and New Zealand (57.6) and the average of 72.3. The lowest three countries in male 65-69 LFPR are Luxembourg (8.1), Slovenia (8.0) and Spain (7.7) with the average of 7.9.

Figure 4 shows that the biggest differences for male LFPR are among the young (less than 25) and older than 50 as retirement starts much earlier in some countries than others. For females there are much larger cross-national differences in LFPR, even in prime labor ages. Hence in reporting the potential gains in the labor force I report the fraction of the gain from increased LFPR by four categories: Young (under 25) both sexes, Prime age (25-64) female, Prime age (25-64) male, and 65 and over both sexes.

Table 2 shows the results of the demographic labor force gap under the assumptions that the LFPR in 2050 in each country either descends to be as low as the average of the lowest 3 countries (cell by cell) or, alternatively, rises to be as high as the average of the highest 3. These are extreme robustness checks rather than actual alternative possibilities, as it is hard to predict the secular trend in LFPR over the next 30 years.

Column IV of Table 2 shows that if the LFPR by age/sex in each country were to fall to the lower levels (average LFPR of the lowest three countries in each cell—the green/dotted line in Figure 4) then, naturally, the demographic labor force gap would be much larger than in Table 1 as the ZM labor force would fall to just 209 million. The gap would be just over 100 million workers higher, rising from 356 million to 461 million.

Column VI of Table 2 shows the alternative if LFPR in each country rose to the higher observed levels (the blue/dashed line in Figure 4) for every country. This would substantially

⁷ There might be some changes in the sex structure but these are minor compared to age shifts.

raise the ZM projected labor force to 562 million, slightly larger than its 2020 value as the demographic shift would be outweighed by increased LFPR. This reduces the demographic labor force from 355 to only 233 million.





Source: Author's calculations as described in text.

Table 2: Scenarios for the demographic labor force gap with lower and higher labor force participation rates													
Country/region	Labor force 2050	DLF gap (col VII of Table 1)	Labor force 2050	DLF gap, LFPR	Labor force 2050 (high LFPR)	DLF gap, high	Gain in LF from higher	Percent of gain in higher LF from: Percentage point incr Female age 65-69 LF 2020 to high scenario			oint increase in 5-69 LFPR, scenario		
	(2020 LFPR)		(low LFPR)	low		LFPR	LFPR	Young	Prime female	Prime Male	Old	Female	Male
Col:	Ι	II	III	IV	V	VI	VII	VIII	IX	Х	XI	XII	XIII
Spain	16.1	23.3	13.83	25.6	22.8	16.65	6.7	18.4%	19.4%	12.9%	49.4%	43.8%	64.6%
Germany	33.1	23.3	24.95	31.5	40.5	15.91	7.4	15.1%	19.6%	13.1%	52.3%	36.6%	51.3%
United Kingdom	31.2	19.5	23.52	27.2	37.3	13.35	6.1	12.3%	27.9%	15.9%	43.9%	30.2%	43.7%
Italy	17.0	17.7	15.98	18.7	26.3	8.44	9.2	18.4%	31.1%	14.3%	36.2%	41.9%	56.1%
Poland	13.7	13.3	11.79	15.2	19.4	7.61	5.7	19.0%	27.3%	12.9%	40.8%	41.8%	57.2%
France	25.9	13.1	21.82	17.2	34.7	4.28	8.8	24.9%	19.3%	15.1%	40.6%	42.4%	62.7%
Netherlands	8.2	5.1	5.95	7.3	9.5	3.77	1.3	-1.6%	28.5%	14.1%	59.0%	37.1%	46.8%
Switzerland	4.0	4.5	2.78	5.8	4.6	3.99	0.6	3.9%	19.5%	5.8%	70.8%	31.7%	41.1%
Austria	3.5	3.7	2.79	4.4	4.6	2.66	1.1	8.9%	24.1%	18.1%	48.9%	42.4%	59.0%
8 moderate size	28.9	22.1	1.31	27.5	37.9	0.73	9.0	24.5%	21.7%	12.0%	41.7%	37.0%	49.9%
8 small size	11.0	6.7	1.65	9.3	13.4	0.69	2.4	20.8%	15.3%	17.6%	46.3%	34.9%	50.8%
Europe	192.7	152.3	126.4	189.8	251.0	78.1	58.3						
USA	158.8	110.7	123.32	146.2	194.6	74.96	35.8	15.5%	38.6%	23.1%	22.8%	18.2%	28.8%
Canada	17.4	16.1	12.94	20.6	20.8	12.69	3.4	6.2%	29.7%	21.3%	42.8%	28.8%	37.2%
North America	176.3	126.8	68.13	166.8	215.4	87.65	39.1						
S. Korea	21.0	41.2	14.73	47.5	24.4	37.82	3.4	37.0%	66.2%	19.6%	-22.8%	-12.2%	-10.5%
Japan	48.6	22.3	31.63	39.2	52.2	18.60	3.7	43.4%	63.0%	-4.2%	-2.3%	2.8%	-4.2%
Australia	13.2	11.0	9.77	14.4	15.6	8.58	2.4	2.0%	36.7%	21.6%	39.7%	26.8%	37.0%
New Zealand	2.9	2.3	1.99	3.2	3.1	2.00	0.2	11.2%	45.2%	16.2%	27.4%	9.5%	14.7%
Asia and Pacific	85.6	76.8	14.53	104.2	95.3	67.01	9.8						
Totals	151 5	355.0	200.0	160.8	561.7	2327	107.2	16 50/	31.40/	14 704	37.50/	20.0%	40.4%
Source: Author's a	alculations	described in to	209.0	400.0	501.7	434.1	107.2	10.3%	51.470	14./70	57.570	27.070	40.470
Source: Autor s calculations, described in text.													

The results in Table 2 are the arithmetic of various assumptions not "predictions" or even "policy options" and it is worth making three points.

First, in Europe especially the plurality of the gains (over 40 percent in most countries) come from increased LFPR of those 65 and over and the magnitudes depend on extremely large gains in the LFPR rate of the older population. The scenario would require that the LFPR of those aged 65-69 in Germany (as one example) increase by 51 percentage points, from the current value of 21 percent (four out of five people in this age group *not* in the labor force) to the "highest three country average" of 72 percent (almost three out of four *in* the labor force). These changes seem implausible. While obviously some people could choose to voluntarily extend their careers if they have a rewarding and interesting job and are in good health, this is unlikely to be true of 40 to 50 percent of the (male) population.

There could be policy steps to force/encourage later retirement and OECD (2023) *Pensions at a Glance* documents that many countries are taking action to extend working lives by raising pension eligibility ages so that for workers starting work today (and hence retiring after 2050) the retirement age will be, on average, 66.3 years for men and 65.3 for women But even those efforts would not reach have 72 percent LFPR for the age range 65-69. The significant political protests against French President Emanuel Macron's efforts to raise the pension eligibility age from 62 to 64, forcing him to invoke special constitutional provisions to enact the reform without a parliamentary vote—and even in May 2023 his approval rating was in the low 30s--were a vivid illustration of the risks in "decreasing benefits" by raising minimum pension eligibility ages as a way of addressing demographic pressures.

Second, a significant fraction, typically between 15 and 25 percent, of the gain in LFPR would come from increases for youth less than 25 and a significant fraction of that from gains in the LFPR of the 15-19 age range—as some ADRI countries have relatively high youth employment. This seems neither plausible as a forecast nor desirable and the general expansion of schooling, higher education, and training for the 15 plus population is seen by most countries as an integral part of their strategy for creating a highly skilled labor force.

Third, the gains from increased prime aged female labor force participation are quite mixed by region. In Europe only about 20 to 30 percent of the total increase in LFPR comes from increased participation by prime age females—because participation rates are already quite high. In the USA the fraction is much higher. And in Korea and Japan, where female LFPR rates are low, it is the most important component of LFPR increases (as LFPR for men, both prime age and older) are already quite high.

There is general consensus among economists (and others) that policies that eliminate discrimination against women and hence increase their opportunities, wages, and labor market choices are win-win. That said, the idea that large increases in female LFPR is a mechanism for coping with labor scarcity due to shrinking labor force aged populations ignores the reality that a large, if not primary, reason that women are often out of the labor force is gendered roles for care-giving of both children and the elderly. Hence a realistic plan for increasing female LFPR

has to address the creation of viable options for child and elder care—which itself requires more workers.

Even under extreme assumptions about the growth of LFPR in each age and sex cell by 2050 (changes that are in my view both unlikely and not obviously welfare improving), the estimates of the demographic labor force gap are still 234 million.

I.D.b) Level of 2050 LF/65+ ratio

The results in Table 1 estimate the DLFG to keep each country at its current (2020) LF/65+ ratio. While this ratio has been trending downward across all countries. it currently has a pretty substantial range (from Italy at 1.8 to New Zealand at 3.6). In this sub-section I explore two alternative scenarios for the 2050 ratio for each country:

(a) All countries converge to the current average ratio of 2.66.

(b) that all countries converge to the 10^{th} percentile of the current distribution of LF/65+ across the 31 ADRC, which is 2.11, the current level in France.

In the "all converge to the current average" the global totals are nearly the same (not surprisingly), 356 million versus 366 million. The main difference is across countries as the gap for countries with currently high ratios are smaller as their ratio falls substantially. For example, the gap in the USA falls from 111 million to 73 million as its 2020 ratio is 3.4 and hence maintaining that high level creates a bigger gap that falling to 2.66. In contrast, those countries currently below the average have much larger gaps. In Italy the gap roughly doubles, increasing from 17.7 to 34.4 million as its 2020 ratio is only 1.8 so moving to the average would require a much higher labor force in 2050.

The open and likely undecidable question is "how low can this ratio be and still sustain the economy, the elderly population, and manageable fiscal balances?" As we saw above the "business as usual" outcomes without migration lead to ratios never before seen in human history and so there can be no persuasive argument that these can be sustained. The lowest current ratios (Italy, Spain, Japan) do not seem "sustainable" as currently policymakers in those countries are acting with urgency to address their labor scarcity. As mentioned above, France recognizes that even their relatively slowly declining ratio of 2.11 is not sustainable at current configurations of taxes and benefits and hence their leadership had to, was willing to, absorb enormous political pressure to make changes in retirement ages (and these were strongly resisted as they were seen as not the final change but a harbinger of more to come). Hence as a guess of a lower-bound 2.11 is likely not far off (it might be somewhat higher, cannot be much lower).

Assuming every rich industrial converges to this lower bound of 2.11 produces an estimate of the demographic labor force gap of 196 million, much lower than the 356 million needed to sustain each country's current level.

Table 3: Scenarios for the size of the demographic labor force gap at various "target" levels of the LF/65+ ratio in 2050

Country	LF/65+	LF/65+	"Target" ratios of LF/65+ in 2050				
	ratio in	2050	8				
	2020	(ZM,	Country's	All country	10 th percentile		
		2020	own 2020	2020	of 2020 ratios		
		LFPR)	level	average	(=2.11)		
			(col VII of	(=2.66)			
			Table 1)				
Col:	I	II	III	IV	V		
Spain	2.5	1.0	23.33	26.82	17.95		
Germany	2.4	1.4	23.32	30.33	17.23		
United Kingdom	2.8	1.7	19.50	17.98	7.82		
Italy	1.8	0.9	17.68	34.45	23.82		
Poland	2.6	1.3	13.31	13.78	8.10		
France	2.1	1.4	13.12	23.28	13.12		
Netherlands	2.8	1.7	5.07	4.62	1.98		
Switzerland	3.1	1.4	4.55	3.39	1.86		
Austria	2.7	1.3	3.73	3.65	2.17		
8 moderate sized	2.6	1.4	22.06	26.28	14.88		
8 smaller sized	2.7	1.6	6.69	7.18	3.42		
Europe	2.4	1.4	152.35	191.74	112.36		
USA	3.1	1.8	110.72	72.87	25.02		
Canada	3.0	1.6	16.06	12.43	6.26		
North America	3.0	1.7	126.77	85.29	31.28		
S. Korea	3.5	1.2	41.23	26.99	17.08		
Japan	1.8	1.3	22.27	54.76	33.42		
Australia	3.3	1.8	11.02	6.54	2.47		
New Zealand	3.6	2.0	2.25	0.88	0.10		
Asia and Pacific	3.0	1.6	76.77	89.17	53.08		
Total (average)	2.67	1.48	355.9	366.2	196.7		
Source: Author's calcula	tions.						

II) How big can "rotational" labor mobility be?

There are wide variety of reasons that countries allow citizens of other countries to be in their country: tourism, transit, visit friends or relatives, students, attend an academic conference. Many provisions for legal presence do not allow those visitors to work. There are also a variety of visas (or other permits) that allow people to perform various economic activities or work of various kinds. The United States, for instance, has a visa category (actually six categories) to allow athletes and performers to be in the USA for specific performances or tournaments (along with their support personnel). There are temporary visas for specific occupations or jobs, such as the H-2A for agricultural workers, the H1-B for specialty occupations (including fashion models). There are "exchange visitor" visas that allow students from foreign countries to work during their summer in the USA. Each of these visa categories has specific terms and conditions about qualifications, length of stay, whether family members are allowed to accompany the work authorized person (often on a separate visa category that may not allow work). The word "migration" is too vague to describe the variety of legal pathways for people to cross international borders to engage in work.

Talking about "migration" or "migrant" is often misleading as it has the connotation (if not actual denotation) of moving for extended periods with the intent (or possibility) of changing one's long-term residence and perhaps legal citizenship. I was born in the USA and have lived extended periods in another country on five occasions: Argentina (1978-80), Indonesia (1998-200), India (2004-2007), India (2012-13), UK (2018-2022), on various visas--in India 2012-2013 I was a "trailing spouse" without authorization to work.

Collapsing all of the granularity, I am going to group legal pathways to work opportunities in rich industrial countries into three groups based on the legal status in the host country and expectations with which people move.

Path to citizenship. These are legal pathways to work that are built on the expectation (even if not always realized) that: (a) the person is moving for an extended period (say, longer than 3 years), (b) is expected/allowed to bring their immediate family, (c) the legal authorization has a 'natural' pathway to extension and eventually (if not rapidly, and through filters and criteria) leading to becoming a citizen of the host country. This pathway is often with intergenerational expectations of the mover that the their children will be raised and remain in the host country (as citizens).

Rotational. These are legal pathways to work that are built on the expectation that: (a) the period of legal authorization is time-limited, which could be from months (seasonal or for specific tasks) to a year or three years (and these could be renewable or extended, (b) family members are not (always) allowed to accompany the mover, (c) while there could be some long-term path to citizenship (e.g. a rotational scheme for, say, 3 year work authorization could allow a person to accumulate "points" for compliance within a points based system allocating longer-term, 'path to citizenship' visas) permanence is not legally authorized nor the current expectation of mover, host country, or employer.

Movers of distress. Nearly all countries have mechanisms for allowing people to enter and stay in their country (with or without work authorization) based on conditions that create "distress" for the potential movers in their home country. There is an international convention on refugees that most countries are signatories to. Many countries have mechanisms for asylum based on whether the specific mover is at risk in their home country. There are people that move due to natural disasters (e.g. floods, famine). There is increasing concern that climate change will require greater movements of people as the physical and/or economic viability of regions shifts (e.g. islands may disappear, rainfall patterns shift, temperatures too hot for traditional agriculture).

The medium term (next 30 years) challenge facing every rich industrial country is how to cope with the inevitable and historically unprecedented demographics of ageing. One way of filling the labor force gap is by allowing foreigners to live in work in your country.

As we discuss in section III below the "supply side" of this is feasible, in two regards.

One, was we show below (section III.A) although fertility has been falling in nearly every country of the world there are still regions of the world, particularly South Asia and Africa, in which the young labor force is growing and these regions could easily meet both their own labor force needs and those of the ADRI countries. In fact, the main challenge facing countries in South Asia and Africa is finding adequate employment opportunities for their youth so labor mobility is increasingly seen as an attractive "safety valve" for youth employment.

Two, the deep reason the rich industrial countries are rich is that they have created economies in which all factors—capital, labor, human capital, resources—are highly productive. Employers in ADRI countries could pay movers (roughly) the existing wages earned by native born workers because the movers would, once in these countries, be sufficiently productive to justify those wages. And these wages would be multiples of their home country wage and hence would be sufficient to attract whatever number of people the ADRI countries wish to attract.

In the domain of labor mobility most of the purely economic questions are pretty well worked out and all of the hard questions are political, administrative, and social. The hard questions are: "What are the magnitudes of movers to fill the demographic labor force gap in each of the three broad categories of movers (pathway, rotational, and distress) that will be politically and administratively feasible?"

II.A) Pathway movers to meet demographic labor force gaps

The main challenge to meeting the DLFG exclusively with pathway movers is that the gaps are widely perceived to be much, much, too large for that pathway alone to be politically feasible. This because there are two important implications for host countries of allowing pathway movers.

First, pathway movers (by my definition above) are permitted to bring families and dependents along with them. The sentiment it widely shared that family unification is important and that allowing people to live and work for extended periods (10 years, 20 years) in a country while not allowing their families to join them is unfair. The implication of this is that to fill a labor force gap of X with pathway movers requires a multiple of X in total population gain. In Table 4 I assume this ratio is 2: this could be a worker plus a spouse, or two workers plus two dependents, etc. This is about what the 2020 population to labor force is ADRI countries (it is lower than LF/65+ as it includes youth and non-LF labor force aged).

Column II of Table 4 shows that if Spain in 2050 were meeting its labor force gap of 23.3 million with pathway workers this would imply the total population movement would be 46.6 million people. Column III shows the percent of the population that would be "pathway movers" in 2050 if the all of the DLFG were filled by pathway movers. The average across the ADRI countries is 43.7 percent. This is only below 30 percent for France (as its fertility has been low for a very long time and hence ageing will be more gradual) and, among the large countries listed, this ratio would be above 50 percent for Spain, Switzerland and Korea.

These numbers are so big they create a reaction that "these levels of movement are impossible to migration cannot be the solution."

These ratios are huge relative to any historical experience in any of these countries including those with populations currently formed historically from immigration. The historical peak ratio of foreign born in the USA was 14.7 percent in 1910, in Canada the historical peak was 22.3 percent in 1921, in Australia the percent foreign born was 17 percent in 1911, in Argentina the foreign-born ratio in 1914 was 30 percent. So having a ratio of foreign born to population of 43 percent would be outside of the range of nearly all historical experience with movement.

And, while movement of people is already seen as a major social and political issue, the current (2020) overall ratios of foreign born to population are, on average, only 16 percent. Moreover, much of the current movement is of people within Europe, or from US to Canada (or vice versa), or otherwise from ADRI countries to other ADRI countries.

Column V using the UN DESA estimates of international migrant stock by origin and destination countries estimate the ratio of foreign born in these countries from six other UN defined regions (Sub-Saharan Africa, North Africa and West Asia, Central and South Asia, Eastern and Southeastern Asia, Latin America and Caribbean, and Oceania)—which excludes Europe and Northern America and I take out Japan and Korea from the Asia total and Australia and New Zealand from the Oceania total.

I think the calculation of the current non-ADRI countries country migrants are interesting for two reasons. One, the political and social implications of movers from countries that are "close" in both distance and social characteristics is less fraught perhaps that from places that are "far." So Germany, for instance, has a very high migrant to population ratio (18.9 percent) but most of that is movement from other European countries and only 7.5 percent is from non-ADRI countries. In contrast, the USA (on these figures) has a lower migrant to population ratio than Germany (15.1 percent versus 18.9) but a much higher non-ADRI countries migrant to population ratio (11.8 percent to 7.5 percent). The second reason is that since all these countries are experiencing quite similar demographic shifts there is no scenario in which, on net, movement within these countries plays a large gap in filling the labor force gap. If Germany brings in more workers from Poland, for instance, this just makes Poland's labor force gap larger and hence their need for movers increases.

Column III is just the *additional* foreign workers to meet the growing labor force gaps from 2020 to 2050 but does not take into account that the Zero Migration 2050 scenario already

takes into account the existing 2020 migrants (and their fertility). Column VI just adds the 2020 to 2050 increment to population via movers and the non-ADRI countries foreign born in 2020.

The average is over 50 percent in 2050, with Spain, Switzerland, Austria, USA, Canada, Korea, Australia and New Zealand (of the large countries listed) above 50 percent. Only two countries, France and Japan are below 40 percent, France because, as mentioned the ageing is gradual and Japan because the existing migration is so low (only 1.5 percent) and that much of the ageing has already happened so the incremental need to keep LF ratio constant is therefore smaller (again, begging the question of whether Japan's 2020 ratio of 1.82 is sustainable).

According to the UN data, the current non-ADRI countries foreign born in Europe is 31.4 million people. If the 2050 DLFG were met by pathway movers and hence host countries allowed two movers for each person in the LF this would imply that these European countries would have 305 million additional movers, about 10 times the current non-ADRI countries stock. Similarly, Asia and Pacific (Japan, Korea, Australia and New Zealand) have 8.3 million non-ADRI countries foreign born and would need 153 million. Even the relatively high non-ADRI countries foreign born North America currently has 44 million and would need an additional 253 million.

Table 4: The demographic labor force gap is so big that if the gap were filled entirely by 'pathway' migration then over half the population would be migrants by 2050. If pathway migration is politically capped at an upper threshold then between 2/3 and 3⁄4 of movers would need to been rotational

Country	DLFG 20250 (at ZM, 2020 LFPR)	Total pathway movers if all DLFG met from	Percent of population that would be pathway movers in 2050 is	Migrant (foreign born) as a percent of population, 2020		Pathway movers in 2050 (col III) plus non-	If total migrants (LF plus others) are capped as a percent of the total population at an upper bound, how much of the		
	(=col VII of	movers	DLFG met			countries	met through	rotational	
	Table 1)	(=col	by all		T	foreign	labor mobility		
		I*2.1)	pathway movement	novement Total Non- ADRI countrie		born 2020 (col V)	25 percent	35 percent	
	Ι	II	III	IV	V	VI	VII	VIII	
Spain	23.3	46.7	52.2%	14.4%	9.2%	61.4%	85.5%	76.4%	
Germany	23.3	46.6	38.9%	18.9%	7.5%	46.4%	72.5%	56.8%	
United Kingdom	19.5	39.0	37.2%	14.0%	7.5%	44.7%	70.5%	53.6%	
Italy	17.7	35.4	41.3%	10.7%	5.0%	46.4%	71.7%	57.5%	
Poland	13.3	26.6	44.1%	2.1%	0.1%	44.2%	68.4%	55.7%	
France	13.1	26.2	29.2%	13.2%	9.0%	38.2%	61.2%	36.9%	
Netherlands	5.1	10.1	37.6%	13.5%	8.0%	45.6%	71.8%	55.3%	
Switzerland	4.5	9.1	52.3%	28.8%	7.4%	59.7%	83.9%	74.8%	
Austria	3.7	7.5	47.6%	19.5%	5.4%	53.0%	78.4%	67.4%	
8 moderate size	22.1	44.1	40.2%	11.4%	4.3%	44.5%	68.8%	53.3%	
8 small size	6.7	13.4	37.3%	16.0%	3.2%	40.5%	58.7%	40.1%	
Europe	152.3	304.7	41.6%	14.8%	6.1%	47.7%	71.9%	57.1%	
		1	1	1	1		1		
USA	110.7	221.4	39.5%	15.1%	11.8%	51.4%	79.83%	64.54%	
Canada	16.1	32.1	46.6%	21.2%	14.1%	60.7%	87.49%	76.04%	
North America	126.8	253.5	43.1%	18.2%	12.9%	56.0%	83.7%	70.3%	
~ ~~		1	Ι	1			Γ		
S. Korea	41.2	82.5	64.8%	3.3%	3.0%	67.8%	88.0%	82.6%	
Japan	22.3	44.5	30.8%	2.2%	1.5%	32.3%	47.1%	24.6%	
Australia	11.0	22.0	44.8%	29.9%	16.0%	60.8%	88.9%	76.6%	
New Zealand	2.3	4.5	45.1%	27.3%	14.7%	59.8%	87.5%	75.3%	
Asia and Pacific	76.8	153.5	46.4%	15.7%	8.8%	55.2%	77.9%	64.8%	
Ageing, Democratic, Rich Industrial Countries	355.89	711.78	43.7%	16.2%	9.3%	53.0%	77.8%	64.1%	
Source: Author's calculations, as described in text.									

This raises the second issue with the addressing the DLFG exclusively with pathway movers. Pathway movers (by my definition) are prospective citizens and hence on a trajectory to full political participation and also therefore hopefully to full and equal engagement in the wide range of social institutions and to social integration (if not "assimilation").

Most of the arguments against migration are no longer about the economic consequences of migration as the evidence that movers have mostly positive effects on the host economies is widely accepted. And nearly everyone sees that movers are coming to countries because there are job opportunities both for the very high skilled but also because there is a wide array of jobs that cannot (or will not) be filled by native workers. It is also widely accepted that this "pull" factor of domestic employers needing movers to fill jobs is on the increase and that that the demographics of ageing is going to make labor scarcities an increasingly larger issue for ADRI countries societies.

Most of the arguments about are either about (a) the political and social consequences of mass migration for the existing populations and their future generations or (b) about the chaos and lack of order caused by movements of people that are not legally authorized (or are happening through channels not intended to be for movements of people to work, like asylum claims).

One set of arguments is about the impact of a large number of movers on the economic institutions that support high productivity in ADRI countries. Authors like Borjas () and Collier (2013) have argued that large numbers of migrants would lead to a deterioration of the economic institutions in the host countries. However, these arguments were completely ad hoc and unsupported by either theory or evidence. Clemens and Pritchett (2019) build an epidemiological model that allows for non-linear feedback loops on economic institutions and then parameterize this model using empirical evidence and find no indication that migration at anything like current rates of flow or stocks would lead to lower productivity via a deterioration of economic institutions. Similar results emerge from Nowrasteh and Powell (2021) and Nowrasteh, Howard, and Forrester (2022).

While the economic arguments that movers would reduce the wellbeing of existing natives are mostly false or, at worst, addressable, the political consequences that would arrive from very large levels of pathway movers are a real concern of existing voters. Existing voters control the electorate of the future through control of legal pathways to citizenship and voting rights.

It is easy to make a powerful case for open borders, on a variety of grounds from ethical (Carens 2013) to economic (Caplan and Weinersmith 2019), but so far it has not been possible to make a persuasive case. While Benedict Anderson (1991) famously refers to national identities as *Imagined Communities*, that that the sense of shared identity and commonality called "nationalism" is "imagined" does not imply it not a real, and powerful, political force.

Any proposal to current voters of the type: "in order to cope with economic challenges (like ageing) you need to support/vote for actions that will cause a future loss of control over your national identity" is, in my view, a political non-starter⁸.

II.B) The occupational composition of new jobs

The second big issue with meeting the challenge of ageing exclusively with pathway migration is that, by and large, the politics of migration is amenable to allowing migrants that are highly education and bring immediate and obvious economic benefits. However, where the labor scarcities of the future are going to be the largest are going to be in occupations that require little formal education and which make lower wages than other jobs in the economy. This is for the simple reason that the native-born work force is going to shrink, while at the same time the schooling levels of youth continue to improve and hence the schooling levels of new work force entrants on average exceed those of full-age retirees (a person retiring at 65 in 2030 was born in 1965 whereas a person reaching "prime work force age" of 25 in 2030 was born in 2005). In contrast in nearly every ADRI countries economy the structure of employment across occupations has, over the last 40 years, been "U-shaped" such that employment growth has been larger for highest wage and lowest wage occupations and employment growth has been weakest for occupations in the middle range of wages (20th to 80th) (Author 2015).

Table 5 reports an analysis of the US Bureau of Labor Statistics forecasts of employment changes between 2021 and 2031 for over 800 five-digit occupations. I focused on those occupations for which the median wage was US\$35,000 or less (which is below the first quartile of median wage across all occupations) and for which the "typical education needed for entry" was less than a bachelor's degree. The BLS outlook was that in 2031 the US economy would have over 50 million such jobs and that between 2021 and 2031, while some occupations would contract and others expand, the net employment growth in these jobs would be 3.22 million. This 3.22 million would be 39 percent of the net job growth over this period.

Table 5 lists the two-digit occupations and some of the detailed (five-digit) low relative wage, low formal education jobs with the largest absolute employment growth (all those fivedigit occupations expected to grow by more than 50,000 jobs). There will an additional 1.2 million jobs in "food preparation and serving" including 460,000 cooks for restaurants. There is a forecast 924,000 additional employment for "home health and personal care aides." There will a more than 50,000 net increase in employment for drivers/sales workers, child care workers, hairdressers, hair stylists and cosmetologists, nursing assistants, janitors and cleaners, landscaping and groundskeepers, and animal care workers.

⁸ I lived as a rotational worker in the UK during the run-up and aftermath of the Brexit vote. When the IMF released a study arguing that the long-term cost to Brexit would be 2 percent of GDP I assumed this would encourage a "Yes" vote. After all, what kind of heartless cretin, if given the choice between the loss of control over your national identity and autonomy and 2 percent lower income would not choose to preserve control over their "way of life."

Table 5: The projected growth in employment by occupation in the USA from 2021-2031 shows strong growth in occupations with low requirements of formal education (less than a bachelor's degree) and for which median wages are in the bottom quartile, while at the same time the labor force aged population will be shrinking (especially the young)

Two-digit occupation code and name 35: Food preparatio	five digit	name ng related occupations	Forecasted gain in employment 2021 to 2031 1,220.4	Total Employment 2031 10,902.7
Of which, five-digit	35-2014	Cooks, restaurant	459.9	1,715.6
occupations with	35-3023	Fast food and counter workers	243.2	3,438.8
gain >50K	35-3031	Waiters and waitresses	197.0	2,101.4
	35-3011	92.0	606.0	
	35-9011	59.9	415.1	
	35-9031	Hosts and hostesses, restaurant, lounge, and coffee shop	52.6	400.3
31: Healthcare supp	port occupat	tions	1,019.6	6,238.6
Of which, five-digit	31-1120	Home health and personal care aides	924.0	4,560.9
occupations with gain >50K	31-1131	Nursing assistants	62.7	1,406.4
53: Transportation	486.2	7,191.6		
Of which, five-digit occupations with	53-7062	Laborers and freight, stock, and material movers, hand	168.4	2,974.8
gain >50K	53-7065	Stockers and order fillers	157.9	2,630.6
	53-3031	Driver/sales workers	63.5	594.5
39: Personal care an	nd service o	ccupations	427.0	3,551.2
Of which, five-digit	39-2021	Animal caretakers	86.9	377.6
occupations with	39-9011	Childcare workers	61.6	1,010.6
gain >50K	39-5012	Hairdressers, hairstylists, and cosmetologists	60.8	619.5
37: Building and gr	rounds clear	ning and maintenance operations	259.4	5,005.9
	37-2012	Maids and housekeeping cleaners	116.4	1,353.8
	27 2011	Janitors and cleaners, except maids and	95.5	2 282 0
	27 2011		56.0	2,363.9
	37-3011	Landscaping and groundskeeping workers	Net gain in employment	Total
Tota for all five digit entry education" less	occupations than bachel	s with 2021 wages<\$35,000 and "typical or's degree	3,235.9	50,101.6
Total, economy wide	8,317.8	166453.1		
Percent of total			38.9%	30.1%
UN ZM population c	hange, 2020	-2030, ages 20-65	-4,570	
UN ZM change in po	pulation, 20	20-2030, aged 20-40	-3.230	
Sources: Author's ca	lculations w	ith <u>BLS Occupational Outlook</u> data.		

The challenge is that during (roughly) this same period the UN forecast is that, in the absence of additional migration, the total labor force aged population would fall by 4.5 million people and the young labor force aged, those 20-40 would be the demographic falling fastest and would fall by 3.2 million. And there are expected to be roughly 5 million new jobs in occupations with median wages over \$35,000, including 1.1 million net new jobs in occupations making over \$35,000 and which do not require a college degree.

The idea that these jobs "low wage" jobs could be filled, if only wages were higher, ignores the increasing overall scarcity of non-migrant labor due to the large demographic shifts. While yes, in principle, one could fill the increase in the number of available hairdresser jobs if wages for hairdressers were higher, but only by either (a) attracting workers from other jobs, which requires the *relative* wage to be higher and this fills one occupational job by attracting a worker from another occupation or (b) drawing workers into the labor force, and, as we saw, employment of prime age labor force is already quite high and there just isn't enough feasible scope for labor force participation rates to offset the demographic shifts. Already even relatively high wage occupations, like "Heavy and tractor-trailer drivers" (53-3032) with a median 2021 wage of \$48,310 are facing difficulty recruiting sufficient numbers of new drivers.

I call these low wage, low formal education occupations "core skill" jobs as they do rely on a large number of skills that human being already possess that are actually quite difficult to replicate with machines. That is, many of these jobs, like home health care, are quintessentially about human-to-human interaction which requires concern, care, kindness, empathy, communication which are important socio-emotional skills that human beings normally possess. Moreover, as Author (2015) points out those jobs which consist of tasks which are "routine" either manually (e.g. tasks in factory assembly line work) or mentally (e.g. filing, sorting)—have mostly already been replaced by automation and the remaining jobs may be manual but are nonroutine and require human judgment to respond to the huge variety of unique physical circumstances. Calling these jobs "low skill" implies that the only relevant skills are a narrow range of cognitive skills—these are important skills but not the only skills.

The challenge for the ADRI countries is who, and under what terms and conditions, should people be allowed into their countries to perform essential, core skill jobs? Neither of the two traditional options of pathway to citizenship nor movers of distress are well adapted to meet the growing need for people to carry out these jobs that the demographics will create.

There are three big issues.

First, high immigration economies like Canada and Australia and New Zealand (see Table 4 above, columns IV and V for their ratios of foreign born, particularly from non-ADRI countries are more than twice that of Europe or Asia (Japan or Korea)) have adopted "points based" systems to choose who will be eligible for pathway mobility. Points based systems can address political concerns about the contribution of migrants by granting points for skills and education levels or resources to invest and concerns about the integration of migrants based on points for speaking the language. As they are seen as attracting "high quality" migrants and part of the country's edge in the "global war for talent" they have been able to generate high levels of

mobility with reasonably high political consensus. However, "points based" approaches can only be a rationing mechanism for the opportunity to work in a country if the points are awarded based on characteristics that are relatively scarce among potential applicants, and which could therefore be raised to match points to allowed migrants. But, as detailed more below, given the massive wage differentials (in consumption units) for core skill jobs a points-based system cannot ration the opportunity to work as a truck driver or hairdresser or home health care worker.

Second, using mobility to supply people to do essential core skill jobs puts the economic logic of *mobility* of people across borders to perform valued work and the political logic of *migration* as a political and social process of constructing "the future of us" in their starkest tension. For societies whose sense of national identity is deeply entangled with place and with histories (and perhaps more importantly, narratives of history) that go back thousands of years, the idea that "the future of us" is to be determined by the economic need for core skill workers has, so far, proven a political non-starter.

A discussion of mobility of persons across national borders is not well served by the assumption that every concern about the political, social, and cultural impact of movers is motivated by racism or xenophobia.

Third, the more narrowly economic objection is that one reason why a society would accept workers is because they would be a benefit to the fiscal situation. The net fiscal contribution is an inverse-U in which people use more than contribute when young and old and the difference is made up by paying more when labor force aged. This raises the very difficult question of whether those allowed to live and work in a country are also allowed to bring dependents, particularly children, who are entitled to the same benefits as citizens (or long-term residents). Clearly pathway migrants—who are expected to be "permanent" residents and to "integrate" socially and politically—are entitled to bring dependents. But in this case most economic studies suggest that core skill pathway migrants are, at best, a fiscal wash and that only over the very long term.

II.C) Rotational labor mobility as the feasible legal pathway

An important and quite general principle of economics is matching "instruments to targets." If an economy has multiple goals then it needs to have multiple policy levers as attempting to hit multiple targets using only a single policy instrument will inevitably lead to trade-offs and tensions between the targets. By having multiple legal pathways for people to live and work one can more easily meet both the important targets of meeting political and social goals of control of "the future of us" and, at the same time, maintain a thriving economy that provides the foundation to meet the social contract with the ageing.

If I assume that there is just a political upper bound to the magnitude of cumulative non-ADRI countries pathway mobility by 2050 then I can work backwards and answer the question: "If the demographic labor force gap is met by movers but pathway movement is politically capped, how much of the total mobility would have to be rotational?" Column VII of Table 4 shows that if non-ADRI countries pathway movers are capped at 25 percent of the population, then, on average, 78 percent of the labor movement needed to fill the labor force gaps in ADRI countries would need to be rotational.

Alternatively, if the share of pathway movers plus existing non-ADRI countries foreign born in 2050 is politically capped at 35 percent (which, as shown above, is higher than *any* ADRI countries country at *any* stage of their modern history) then the fraction of movement would be, on average, 64.1 percent of all movement.

Figure 5 shows the consequences for the magnitude of rotational labor mobility of various combinations of (a) the LF/65+ ratio to be maintained in 2050, the fraction of total additional LF from mobility that is rotational, and (c) the evolution of labor force participation.

The first column is my "base case" which I intend to be not an estimate of the biggest rotational could be, but as a moderate case. In the case that (a) each country maintains its 2020 ratio, (b) the labor force participation rate cell by cell is the same in 2050 as 2020 and (c) that 66 percent (which is a nice 'focal' number of two-thirds) of all mobility to fill the resulting demographic labor force gap is rotational then by 2050 there would be 237 million people living and working in ADRI countries on this legal pathway to residence and work.

Figure 5: Estimates of the total potential for rotational labor mobility to fill the labor force gaps in the ADRI countries by 2050 under various assumptions about 2050 LF/65+ ratios, fraction of labor force gap from rotational and 2050 labor force participation rates



Source: Authors calculations. Preliminary draft for comments only

III) Potential gains from rotational labor mobility

This last section estimates the magnitude of the economic gains to the magnitudes of rotational labor mobility that the demographics of ADRI countries ageing make possible.

III.A) While ADRI countries have a birth dearth, some regions have a youth bulge

While native born, labor force aged, people will be increasingly scarce in rich countries, and the demographic transition from high fertility to low fertility is a globally a widespread phenomena (), there are regions of the world, particularly South Asia and Sub-Saharan Africa, where the demographic transition has happened later or is happening slower, and hence over the years to 2050 there will be very substantial growth in the labor force aged population.

These different demographic destinies over the coming decades are important for three reasons.

One, throughout history exchange (both voluntary and expropriative) between countries and regions has been driven by differences. During the period of modern economic growth (since roughly 1870) the demographic transition in which death rates fell before and faster and further than birth rates meant that nearly all countries had growing populations overall and similarly shaped "thick based" demographic pyramids. As Figure 3 illustrates, the labor force to aged ratio was over 5 in rich countries as recently as 1950. Hence, while wage differences and differential capital and land availability between Europe and the "areas of recent settlement" drove very substantial population mobility in the "first globalization" era between 1870 and 1920 (onset of World War I), migration and mobility fell very substantially, interrupted by the two wars and a global depression, and by a rapidly shifting politics in the main immigration recipients (e.g. USA, Argentina, Brazil) (Williamson).

The coming massive potential for "age arbitrage" and labor mobility driven by radically different demographic pyramids is hence a historically new phenomena.

Two, the labor flows driven by demographic differences is going to be different and this is important to recognize because it means that we should expect the emerging rules, regulations, laws, policies, institutions and organizations to handle this new type of labor mobility to differ massively from both the historical era of "open borders" (only between of course select countries) or the current era of "migration." There need to be safe, orderly, and regular legal pathways for the new types of labor mobility.

Three, "the world" is not facing a uniform birth dearth or labor scarcity or rapid ageing of societies, but this is the medium-term future of the richest and most powerful and most educated, scientifically and technologically advanced nations. The risk this creates is that these nations attempt a technology driven "go it alone" strategy that attempts to deal with labor scarcity by inventing machines that displace labor. Relative to a "people first" strategy this is bad for both ADRI countries and youth bulge regions of the world (Pritchett 2023).

Table 5 and Figure 6 shows the growth in overall population and by age groups of the "developing countries" overall (less China), Africa (both Sub-Saharan and North), and South

Asia. Overall, while the ADRI countries will lose labor force aged population between 2020 and 2050, there will be 1,356 million additional people of labor force age in the developed world. Nearly all of that growth, 86 percent (=1165/1356) will be in Africa, with Sub-Saharan Africa alone with 53 percent of all the gain, and South Asia and over half of the total will be in SSA.

This is in part because the demographic transition is further along in other developing country regions, like Latin America or Southeast Asia and hence over the 30 years their total percent increase in the labor force will be modest (12 percent for LAC, 15 percent for South-Eastern Asia). And in part because other regions with rapid labor force growth are just smaller, so while North Africa grows by 57 percent that is "only" 86 million people, versus the 357 million people gain South Asia from the lower percentage growth of only 26 percent.

Table 6: Gains in labor force aged population from 2020 to 2050 by region								
Region/country		Labor	64)	Ratio LF				
				aged/65+				
	2020	2050	Absolute	Percentage	Percent of	2020	2050	
			Change	change	total LF			
					aged			
					increase			
					(less			
					China)			
Sub-Saharan Africa	601	1,323	722	120.1%	52.9%	18.3	13.0	
South Asia	1,288	1,645	357	27.7%	26.2%	10.8	5.2	
North Africa	152	238	86	57.1%	6.3%	10.7	5.7	
Central and West								
Asia	232	311	78	33.7%	5.7%	11.4	4.5	
South-Eastern Asia	453	520	67	14.8%	4.9%	9.5	3.9	
LAC	439	493	54	12.3%	4.0%	7.5	3.4	
Total (less China)	3,165	4,530	1,365		100%			
China	1,012	848	-164	-16.2%		5.9	2.3	
Source: UN Zero Migration Scenario								

Another reason for focusing on Africa (both SSA and North Africa) and South Asia as potential suppliers of both pathway and rotational movers to ADRI countries is the possible impact of China. In the Zero Migration scenario China will lose 164 million labor force aged by 2050. In just 30 years is ratio of labor force aged to 65+ will fall from 5.87 to 2.31. This combined with the demographics of Japan and Korea implies that the Asia region is not a "net" labor force aged surplus region.

Figure 6: There will be growth in the labor force aged of 1.3 billion people by 2050 in the developing regions (less China), mostly from Sub-Saharan Africa (808 million) and South Asia (357 million)



Source: Author's calculations with UN ZM scenario.

III.B) Productivity differentials between hosts and senders imply huge potential gains

The second way in which rotational labor mobility has massive potential is that the ADRI countries are "rich and industrial" because they have high productivity. This high productivity is a feature of the place and is "in the air" and hence affects all factors, including labor and affects all labor, including "core skill" labor engaged in occupations and tasks that require few formal academic qualifications. Clemens, Montenegro and Pritchett (2019) demonstrate that there is a "place premium" and that workers with identical intrinsic productivity (the same personal "human capital")—and correcting for the "selection" effects of being migrants--make much higher wages working in the USA than in their home countries.

While differences in personal human capital (the skills and capabilities individuals have which raise their wages over "raw" labor) do account for some of the wage differentials, Pritchett and Hani (2020) review differences in PPP wages of people with the same human capital—comparing individuals with same education levels, in the same skill category, in the same occupations, and the wage gains of movers (correcting for selectivity) and find robustly large differences. This is central to any discussion of the gains from mobility as the evidence is consistent with the view that when the same individual moves from a less productive/lower wage to a more productive/higher wage country they make higher wages because they create more value in the higher wage locale.

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	Skill	Skill level	ISCO-08,	ISCO-08
Region/Country	level 1	2	Group 5:	Group 9:
			Services and	Elementary
			Sales	occupations
Sub-Saharan Africa	\$3,034	\$4,727	\$4,146	\$3,011
South Asia	\$4,803	\$6,726	\$6,554	\$5,968
Average of two sending regions	\$3,918	\$5,727	\$5,350	\$4,490
Europe	\$25,259	\$35,538	\$28,732	\$25,365
USA	\$33,577	\$40,010	\$33,463	\$33,577
Australia	\$24,157	\$32,373	\$24,521	\$29,196
All ADRI countries	\$25,259	\$35,538	\$30,565	\$26,401
Difference median all ADRI	\$21,341	\$29,811	\$25,214	\$21,911
countries to average of SSA and				
South Asia				

Table 7: The wage differentials (in PPP) in "core skill" skill levels and occupations between ADRI countries and potential sending regions are between P\$20,000 and P\$30,00 per year

Table 7 shows the data from the International Labor Organization (ILO) data on wages in 2017 PPP units, for the two lowest skill levels and for two single digit occupations.

The ILO (2012) defines skill levels 1 and 2:

Occupations at Skill Level 1 typically involve the performance of simple and routine physical or manual tasks....For some jobs basic skills in literacy and numeracy may be required...[but] would not be a major part of the work....completion of primary education or first state of basic education may be required....Occupations classified at Skill Level1 include office cleaners, freight handlers, garden laborers, and kitchen assistants. (pg 12)

Occupations at Skill Level 2 typically involve the performance of tasks such as operating machinery and electronic equipment; driving vehicles, maintenance and repair of electrical and mechanical equipment... The knowledge and skills required for competent performance in occupations at Skill Level 2 are typically acquired through completion of the first stage of secondary education...Occupations at Skill Level 2 include butchers, bus drivers, secretaries, account clerks, sewing machinists, shop sales assistants, police officers, hairdressers, building electricians, and motor vehicle mechanics

The median wage across South Asian countries is generally higher than SSA with the average of the two regions for Skill Level 1 is around P\$4,000. In the ADRI countries the average wages for Skill Level 1 are around P\$25,000. The difference between potential senders and hosts for Skill Level 1 (which is less than high school completion) education is around P\$21,000 per year. For Skill Level 2, roughly high school completion, the wage differential is roughly P\$6,000 versus P\$36,000 for a differential of roughly P\$30,000.

Similar results emerge if we use occupational wages rather than skill level aggregates. For Elementary Occupations the wage differential is around P\$22,000. The wage differential in Category 5 Service and Sales Workers (which includes, for instance, Health Care Assistants, Home Base Personal Care Workers, Child Care and Security Guards) is P\$25,000 (P\$30,000 in ADRI countries versus P\$5,000 in potential senders).

The fact that the exact same worker moving from a low productivity place to a high productivity place, even when the moving worker has low formal schooling and only core skills and works in a simple occupation in the host country, creates P\$20,000 to P\$30,000 more value implies that mobility can be win-win-win. Win for the moving worker whose earnings increase by around a factor of five. Win for the sending country as, particularly for rotational mobility, a large fraction of that will be used and spent in the sending country (either as remittances or savings or both). Win for the host country both because (a) needed services are done for which native-born workers are just not available and (b) the host country can arrange its tax and benefits such that these workers are a net contribution to the fisc, as a payment from the worker for the "rent" of working in a high productivity country.

III.C) The total potential economic gains from rotational labor mobility

Like everything else in this paper, working out the total potential gains from host country policies that allowed for rotational labor mobility to meet their demographic labor force needs in core skill occupations is just arithmetic.

A "base case" estimate of the annual gains takes the estimates of total movement of people in 2050 from Figure 5 and multiplies that by the 2017 PPP wage differentials. In the scenario in which countries maintain their 2020 LF/65+ ratios, labor force participation is at 2020 levels and 2/3 of movers are rotational and the average wage gain is the average of the Skill Level 1 and Skill level 2 wage differentials of roughly P\$25,000 gain per worker then the incremental wages due to rotational labor mobility in 2050 would be 6 trillion (2017 PPP) dollars (=237.3 million rotational workers*P\$25,000 per worker).

These gains are huge. The fifth largest economy in the world was Japan with GDP of 5.2 trillion. These gains are bigger than each of the four big EU economies (Germany, France, Italy and Spain) bigger than the next 10 largest European economies (Poland, Netherlands, Switzerland, Belgium, Sweden, Portugal, Norway, Denmark, Greece and Finland) combined.

These large gains in 2050 are far into the future. The net present value of the stream of benefits from 2020 to 2050 (relative to ZM) can be calculated assuming that the annual number of migrants grows additively from 2020 to the assumed total in 2050. At a five percent discount rate the NPV of rotational labor mobility reaching 237.2 million in 2050 at a wage gain of P\$25,000 per migrant is P\$34.6 trillion (2017 PPP dollars).

Nothing else compares. In 2022 development assistance flows were \$210.7 billion dollars. Even assuming these flows produce dollar for dollar benefits in the recipient countries the NPV of that flow from 2020 to 2050 would be 3.24 trillion dollars, one tenth as much.



Conclusion

{to be written}

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