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Working Paper

Education, Lack of Complementary Investment and Underemployment In an Open Economy

CESifo Working Paper, No. 9278

Provided in Cooperation with:

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Marjit, Sugata; Ahuja, Rashmi; Pandey, Abhilasha (2021) : Education, Lack of Complementary Investment and Underemployment In an Open Economy, CESifo Working Paper, No. 9278, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:

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Impressum:

CESifo Working Papers

ISSN 2364-1428 (electronic version)

Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH

The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute

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Editor: Clemens Fuest

<https://www.cesifo.org/en/wp>

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Education, Lack of Complementary Investment and Underemployment in an Open Economy

Abstract

In many developing economies rate of unemployment is increasing with skill accumulation and thereby leading to underemployment. Our paper offers to look at skill formation as a demand side problem not as a traditional supply side problem and also how skill formation or education affects unemployment among the remaining uneducated. We have developed a general equilibrium model of a small open developing economy incorporating skill formation, unemployment of unskilled labour in the formal sector and an informal sector which absorbs unemployed workers at a flexible wage rate. In this set up greater education for a group may generate educated unemployment within the group and increase unemployment of the uneducated outside the group leading to underemployment through the expansion of the informal sector. Both effects are due to shortage of complementary investment in production activities. Our theoretical findings are motivated by existing empirical evidence and a fresh empirical exercise undertaken using panel data of 32 countries.

JEL-Codes: J240, J310, E260, E240.

Keywords: skill formation, informal employment, skilled-unskilled wage inequality, underemployment.

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1. Introduction

Skill formation is considered to be very critical to stimulate country's economic growth and enable a country to be competitive in the world economy. Notwithstanding all its advantages for an economy, it is important to understand that the skilled or educated workers need to find a job. The purpose of this paper is to develop a general equilibrium model of a small open developing economy incorporating skill formation, possible unemployment of unskilled labour in the formal sector and an informal sector which absorbs unemployed workers at a flexible wage rate. We explore the consequence of skill accumulation by those who are employed in a formal unskilled sector and also by informal workers employed at a lower wage than the formal sector minimum wage.

One core point of the paper is that, *ceteris paribus*, it is greater education that opens the door for educated unemployment or increase unemployment among those who are not educated. Both drive the unemployed to the informal sector where they remain underemployed with lower income. The model shows it is scarcity of capital or lack of investment in productive activities that nullify good impact of human capital accumulation.

In the first case, with a capital-intensive skilled sector, if already employed unskilled workers get educated, it must lead to greater educated unemployment and those not finding a job would migrate to the informal sector lowering wage of the informal workers and leading to greater underemployment. In the second case, the educated informal workers will get a job in the skilled sector, but that in the process will cut back employment of the minimum wage sector and necessarily increase the size of the informal sector in spite of educated workers leaving that sector, pulling down the informal wage. Both these results point

unambiguously toward the lack of productive investment and the weakness of the supply side argument of skill accumulation. This way of looking at the problem of skill formation in a developing economy is new in the literature and has not been rigorously discussed elsewhere

Skill formation on the supply side is not useful unless and until it is supported by creation of substantial demand for the skilled workers with other types of investment. Also greater use of skill also means extra capital is needed to accommodate extra skill and it can be supplied only at the cost of lay-offs in other sectors if capital is scarce. Thus unemployment cuts through both ways. In such an economy, more education depresses the informal wages as people do not find the right kind of jobs and are forced to choose a low wage occupation. Unfortunately, skill formation is usually looked upon only as a supply side problem such as the role of imperfect credit market in restricting human capital accumulation and encouraging poverty traps by Banerjee and Newman (1994), Galor and Zeira (1993) etc. and more recently by Marjit and Mandal (2017) and Marjit, Mandal and Nakanishi (2020) which argue that scarcity of human capital by raising skilled wage will hurt economic growth in countries like India, which has gained substantially by virtual trade.

Typically, the presumption in the literature is that larger supply of skilled workers will lead to a sufficient rise in demand through a fall in skilled wage. However, the idea that traded goods prices are disciplined by world conditions and only non-traded prices are more volatile have been used extensively in two recent policy papers in completely different contexts by Besley et al. (2021) and Burstein et al (2020). Thus increasing supply of skill may not reduce skilled wage. In our model this happens because return to capital determined by the unemployed unskilled workers and given price of the skilled traded good in the rest of the world does not allow skilled wages to move.

The argument that skilled supply would create its own demand assumes away any

constraint that might operate on the availability of capital for production in the skilled sector. If demand for skill is effectively inelastic because of dearth of capital, unemployment among educated is likely to increase giving rise to underemployment. Educated unemployed is absorbed in the informal sector as there is no open unemployment in the model as people have to work for survival. Lower informal wage signals higher unemployment in the formal sector. Thus, it has implications for rising wage gap, a topic of great interest among trade economists. Readers may look at Feenstra (2003), Feenstra and Hanson (1996,1997), Currie and Harrison (1997), Wood (1994), Marjit and Acharyya (2003), Feenstra and Hanson (2003), Marjit and Kar (2005), Yabucchi and Chaudhuri (2009) etc.

Beladi, Marjit & Broll (2011) introduced hierarchical education and skill formation into the standard Jones specific factor model and showed that due to international capital mobility, the economy gets polarised between the highly educated i.e., skilled workers and the absolutely uneducated i.e., unskilled workers¹.

In this paper we construct a general equilibrium model with realistic features of a developing economy and show that scarcity of capital will push excess supply of educated workers to the informal sector driving down the informal wage and increasing wage gap. While individual worker may not internalize the general equilibrium outcome of the whole system and hence educational capital is fully utilized by aspiring workers, the equilibrium outcome will be greater educated unemployment who would accept a job in the low wage informal sector.

We differentiate between those unskilled workers who are employed in the formal sector at a minimum wage higher than the wage in the informal sector following

¹ Biswas and Chaudhuri (2018) and Gupta and Dutta (2010) both talk about education and wage inequality but the demand for skill issue the way we highlight here is not highlighted in these papers. Also see Mehta and Hasan (2012) and Mukhopadhyay (2021).

the usual practice of modelling voluminous literature on formal-informal labor market such as Carruth and Oswald (1981), Agenor and Montiel (1995), Marjit (1991, 2003) etc.

A unique feature of our model is that it highlights the impossibility of effective skill formation i.e. a match between excess supply and additional demand for skill inherent in such models. An increase in the stock of skilled labour happens in terms of conversion of unskilled workers from the formal sector. Then a critical impossibility result is brought into focus. If the skilled sector is capital intensive, the amount of released capital, as some workers get educated and leave the unskilled sector, cannot be sufficient to create the extra demand for skill and hence the educated workers who do not get job would flock to the informal sector. It will expand depressing the wage there.

If we consider skill accumulation only by the informal workers, educated ones will get a job in the skilled sector, but in the process will draw so much capital from the formal unskilled sector that freshly unemployed people will rush towards the informal sector, again reducing informal wage.

Thus, in both cases greater education is leading to a potential rise in unemployment and an increase in the wage gap. Both cases clearly point out that along with rising supply of skilled workers investment in physical capital could contain both these effects. Somehow the literature as it stands now seldom talk about such a mismatch and do not point towards the weakness of the supply side argument behind skill formation.

The related literature is interested in comparative statics of having greater number of skilled workers either allowing for a decline in skilled wage to boost the demand, or by immigration without disturbing the local unskilled labour supply.

Theoretically, one would expect that extra skilled workers will be employed through adjustment in skilled wage. That will fail to create extra demand. In our

set up fixed minimum wage for the unskilled will peg the rate of return to capital as we are in a small open economy. That in turn will determine skilled wage which is insulated by factor flows as long as both goods are produced. Hence, there is no way that additional educated workers will get employment in the skilled sector through a decline in skilled wage and especially if some physical capital is not relocated to the skilled sector. In the end such relocation may not be sufficient.

Our paper highlights an important issue that only raising skill formation in an economy may not be the way forward for unskilled workers. Increasing skill formation will lead to rise in skilled-unskilled wage inequality as well as informal employment. If all educated and skilled workers do not get employed in the formal sector, it will only lead to more workers crowding the informal sector leading to further depressed informal wages . Hence, it is important to highlight that there is a need for creation of substantial demand for the skilled workers via investment in other types of capital in other sectors along with investment in education sector to tackle the problems of unskilled worker. The key point we highlight is that when those who are already employed in the formal sector get educated and look for a job in the skilled sector leaving their current employment, adequate amount of capital may not be released to accommodate higher skilled supply, thus leading to educated unemployed who are forced to find a job in the informal sector. When only the existing informal workers get educated, all of them might get absorbed as skilled workers, but that would lead to retrenchment of unskilled workers in the formal sector leading to an expansion in the informal sector. In the first case it is excess supply of skilled labour and in the second it is greater retrenchment of unskilled workers from the formal sector. In both cases the culprit is limited amount of capital for production.

Further, it is to be noted that it is the formal sector that leads to this underemployment and it might not be reflected in the official data as people will

do something to survive. Also, opportunity costs will vary among the unemployed, relatively prosperous one can afford to wait for the job and poorer one would be underemployed. Since we do not differentiate among the unemployed and assume that there is no other means to them for survival, we do not have open unemployment. If we consider the case where unskilled workers have varying amount of wealth, exogenously given, we could explain open unemployment and underemployment coexisting. But that is beyond the objective of the paper as lack of investment in production would surely increase underemployment and that is what we focus in this paper.

Empirical Literature

In this section, we briefly review previous empirical literature on educated unemployment which highlight the effects of lack of demand and calls for rapid industrialisation.

A number of developing countries around the world are facing the challenge of “educated unemployment” wherein the rate of unemployment increases with the level of education owing to low absorption of highly educated people. This leads to rise in underemployment where overqualified persons are settling for a low paying, informal employment as a coping mechanism.

This phenomenon is highlighted in a number of papers. Angel-Urdinola & Semlali (2010) studies labor markets and the entry of fresh graduates into workforce in Egypt between 1998 to 2006. There is an overall increase in informality as more and more college graduates join the informal sector owing to sluggish growth in job market. They also point to low investment in private sector, evident from the fact that a majority net employment creation was in informal sector, even for educated job seekers. Moreover, it was found that the formal sector had a net job destruction for low skilled workers. The paper also points to the loss in terms of time and resources invested, both public and private,

in educating the populace. Sam V. (2018) in their study on Unemployment Duration in Cambodia notes that the unemployment risks are high for highly educated people as there is insufficient demand for college graduates in the economy.

Bairagya (2015) examines trends in unemployment and education levels to highlight a lack of demand as unemployment ratio necessarily increases with level of education when there is not enough creation of productive jobs and demand for skill. He contrasts this to observations in developed countries where unemployment rate decreases with increasing level of education. His analysis reveals that even though the rate of unemployment in India is seen to increase with level of education, high-industrialised states (i.e. states with higher per capita private capital) are seen to have lowest unemployment rates for the educated. He posits that a possible reason could be that such states are able to create more jobs for educated people than other states.

Croce & Ghignoni (2012) in their paper suggest that the phenomenon of “overeducation” can only be tackled by an increase in demand for skilled labour. Expansion of skilled labour causes overeducation wherein demand for educated individuals lags far behind the supply.

One of the impacts of the educated unemployment phenomenon is that labour force is unable to benefit from education and settle for low paying jobs. Skill based technological changes have shifted the economy towards highly skilled workers who have seen an increase in real wages in general at the cost of rising unemployment at the entry level. This worsens the wage gap as the unemployed would flock to the informal sector to make ends meet. Skill formation is usually promoted as a solution to this but the problem of capital remains.

Biswas and Chaudhuri (2018) examined the relationship between wage inequality and public expenditure on education. Public funded education would offer an

incentive for the population to get educated but that does not guarantee jobs or productivity. The paper makes a compelling case that the wage gap certainly would not close up on subsidising education.

Given the increasing contribution of skill formation to economic growth in developing economies via enhanced employability and improving labour productivity, many developing economies are still struggling to deliver on the promise of skill development. One of the striking features of developing economies is the strikingly large percentage of workers operating outside the line of sight of governments in developing economies i.e. informal sector. According to a World Bank study “The Long Shadow of Informality: Challenges and Policies”, informal sector accounts for more than 70 percent of total employment—and nearly one-third of GDP—in emerging and developing economies. According to an OECD report², Asia and the Pacific has the second-highest level of informality on average (68.2%), ranging from 21.7% in developed countries to 71.4% in developing and emerging countries: below 20.0% in Japan, just above 30.0% in the Republic of Korea and 90.0% and above in Bangladesh, Cambodia, India and Nepal. In the informal sector, huge proportion of people are working in the agriculture sector and it's the level of education that is considered to be one of the key factor affecting the level of informality in an economy. The percentage of labor force that is skilled is low in developing economies as compared to developed economies. To familiarize oneself with some statistics related to it, according to Human development report 2020, only 21.2 percent of labor force is skilled in India, 39.4% of the labor force in Vietnam, 25.8 percent in Bangladesh as compared to 96.5 percent in United States, 99.9 percent in Japan and 84.4 percent in United Kingdom etc. However, it is important to note that having higher share of skilled labor force does not always simply translate into better job outcomes. In this context, Rowchowdhury

² OECD report on “TACKLING VULNERABILITY IN THE INFORMAL ECONOMY” , 2019.

(2021) has shown that although there is excessive emphasis on science and technical education in India but it does not translate into better job market outcomes as finding an employment is itself difficult for people with science majors in India. This again highlights the issue we are addressing in our paper that although it's important to invest in education or skill formation but it needs to be complemented with the demand creation for skilled workers in the economy where these skilled workers could be absorbed.

The paper is laid out as follows. In the next section we provide an empirical background to the problem to indicate the significance of the issue. In the third we spell out our general equilibrium model and its features. Further, In the third we provide the comparative static results. The fourth confirms the robust nature of our theoretical results with various alterations of the model. The last section concludes.

2. Empirical Background

In this section, we present an empirical examination of how an increase in the educated population affects the unemployment of the educated people. Our argument asserts that the rate of educated unemployment would increase with an increase in the number of educated people if the rate of investment lags behind.³ Thus, if the rate of investment is low and stagnant, higher educational attainments would not be reflected in higher employment of educated and might lead to greater informal employment. The official data does not consider this informal employment as people are compelled to do something to survive. Hence, an

³ Hanushek, Schwerdt, Woessmann & Zhang (2017) talks about policies that are aimed at improving school to work transition rates by improving vocational education might fail to retain the initial gain in employment due to technological changes whereas Hanushek, Ruhose, & Woessmann (2017) talks about the importance of improvement in Human capital in studying cross-state income differences or economic development. These are very important works for the US economy, but these do not talk about the Informal labour market or complementary investment which we focus upon in this paper.

increase in the educated population would be reflected as an increase in unemployment of the educated who as per our developed theoretical model would be joining the informal sector at a low wage rate.

We performed a panel data analysis on a sample of total 32 countries to observe how the unemployment rate of the educated gets affected when education increases alone and when education increases along with an increase in rate of Investment. Although, our model focuses on developing economies, for this, we have taken 15 years data for a cluster of countries including both developed and developing countries since sufficient data is not available for developing countries alone. Further, we use an interaction term to capture the effect of increase in both education and rate of investment.

To overcome the problem of non-normality of data, we divided our sample of total 32 countries into two groups (i.e., low investment countries and high investment countries) based on average Rate of Investment, that is, an average of Gross Fixed Capital Formation (% of GDP) over 15 years (Refer Appendix A.3). For classifying the countries, we consider the countries with an average rate of investment less than 21 as low investment countries and the rest as high investment countries.

Once the two clusters of countries are formed, we estimated the following model:

$$\mathbf{Unemprate}_{it} = \beta_0 + \beta_1 \mathbf{Edu}_{it} + \beta_2 \mathbf{FDI}_{it} + \beta_3 \mathbf{Trade}_{it} + \beta_4 \mathbf{GDPpcUSD}_{it} + \beta_5 \mathbf{edu_gfcf}_{it} + \epsilon_{it}$$

where $i = 1 \dots N$, where N is the number of countries, $t = 1 \dots T$, where T is the time period and ϵ_{it} is the error term.

Our dependent variable is the unemployment rate according to their tertiary education level (*Unemprate*). Other variables that might affect both the educated unemployment and educational attainment such as GDP per capita, FDI and Trade Openness have been taken as control variables. A detailed description

of the all the variables along with their sources is presented in Table 1.

Table 1: Variables used in Model and their sources

VARIABLE	DESCRIPTION	SOURCE
Unemployment rate	Unemployment rates of people according to their tertiary education levels. This indicator measures the percentage of unemployed 25–64-year-olds among 25–64-year-olds in the labour force.	OECD Education Statistics
Educated Population	This indicator looks at adult education level as defined by the highest level of education completed by the 25–64-year-old population. The indicator is measured as a percentage of same age population; for tertiary and upper secondary, data.	OECD Education Statistics
FDI	This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors and is divided by GDP.	World Bank national accounts data, and OECD National Accounts data files.
Trade	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Bank national accounts data, and OECD National Accounts data files.

GDP per Capita	GDP per capita is gross domestic product divided by midyear population. Data are in constant 2010 U.S. dollars.	World Bank national accounts data, and OECD National Accounts data files.
GFCF	Gross fixed capital formation (formerly gross domestic fixed investment) as a percentage of GDP. This is our Rate of Investment.	World Bank national accounts data, and OECD National Accounts data files.

Further, Gross Fixed Capital Formation is excluded as an individual control variable to avoid the problem of multicollinearity. However, its effect has been incorporated by dividing our sample of countries based on average value of GFCF. Both the groups pass normality and multicollinearity tests. Since data has been taken across time over 32 countries, there exists a problem of heteroskedasticity which has been overcome with the use of robust standard errors. We estimated both the Fixed Effect and Random Effect models and based on findings of Hausman test, Random Effect Model is chosen to be most appropriate model for both the group of counties.

Table 2 : Regression Results for two group of countries

Dependent Variable: Unemprate		
Variables	Low Investment Countries	High Investment Countries
Edu	.3402551 *** (0.000)	.2310595 *** (0.000)
FDI	.0036588 * (.076)	.0017449 (.791)
Trade	.0079741 (0.514)	-.014399 * (.094)
GDPpercapitaUSD	-.0001023 ** (.044)	-.0000953 *** (0.000)
edu_gfcf	-.020554 *** (0.000)	-.0068489 *** (0.001)
Constant	9.483318 *** (0.000)	6.970276 *** (0.000)
R-squared	0.304	0.310

*Notes: p-value is stated in brackets where *** $p < .01$, ** $p < .05$, * $p < .1$*

Our findings (refer Table 2) show that as the level of the educated population rises, the Unemployment rate of the educated also increases. Education has a stronger positive effect in the case of low investment countries. On the contrary, when education and rate of Investment increase together, Unemployment rate falls. This again has a stronger influence on the unemployment rate in the case of low investment countries. We see that for countries with low GFCF, FDI plays a significant role but does not affect unemployment to a great extent. Overall, none of the other variables affects the unemployment rate considerably. These have anyway not been removed from the analysis to avoid any kind of bias. Thus, although the data set is limited to 15 years which is relatively less to present any

clear picture, we get an idea that when education and rate of investment move together, the unemployment rate in the formal sector falls which is our key argument in the paper.

3. Model & Analysis

We consider a three sectors economy i.e. X (Skilled Service sector), Y (Unskilled manufacturing sector) and Z (low skilled informal sector). This is a small open economy with commodity prices given from the rest of the world. Typically the informal sector can be a non-traded good. We shall discuss the consequence of a variation in its price later. The three goods are produced in these sectors in a neoclassical framework i.e. with CRS and diminishing marginal productivity and with four factors such as unskilled labor(L), Skilled labor(S) and two types of capital (K and T) i.e. X and Y are produced by the formal or organized segment of the labor market whereas goods in sector Z are produced with informal unskilled workers and capital T. Capital K is perfectly mobile across X and Y whereas T is specific to the sector Z. The unionized bargaining determines the level of fixed wage \bar{w} for the unskilled workers in the formal sector. However, it is important to note here that once can easily endogenize the fixed wage by invoking a utility maximizing union without any appreciable change in the direction of the results⁴. Therefore, exogeneity of fixed unskilled wage \bar{w} in the formal sector is not a crucial assumption and could be relaxed. The informal wage w is market determined and is less than the fixed formal wage \bar{w} . It is further assumed that the unskilled workers which do not get absorbed in the formal sector Y will find a job in a low skilled sector Z.

The symbol and basic equations are in consistence with Jones(1965). To build the system of equations, we use the following notations:

P_i = Price of the i^{th} Good, where $i = X, Y, Z$;

⁴ See Appendix A.2 for the detailed discussion.

\bar{w} = Formal wage offered by the sector Y;

w = wage offered in the agriculture sector Z;

r = return to capital K;

R = return to capital T;

a_{ij} = Technological co-efficient;

K = Total supply of capital K;

L = total supply of unskilled labor L;

T = total supply of Capital T;

S = total supply of Skilled labor.

Competitive commodity market guarantees the following equalities:

$$a_{SX}w_s + a_{KX}r = \bar{P}_X \quad (1)$$

$$a_{LY}\bar{w} + a_{KY}r = \bar{P}_Y \quad (2)$$

$$a_{LZ}w + a_{TZ}R = \bar{P}_Z \quad (3)$$

Note that $\bar{w} > w$.

Full employment conditions ensure the following.

$$a_{SX}X = S \quad (4)$$

$$a_{LY}Y + a_{LZ}Z = L \quad (5)$$

$$a_{TZ}Z = T \quad (6)$$

$$a_{KX}X + a_{KY}Y = K \quad (7)$$

We now briefly describe the approach followed by us in the paper further. To start with, we constructed our basic model. So, Equations (1)-(7) constitutes our anchor model. In this model, these seven equations determine seven unknown

variables i.e. w_s , w , r , R , X , Y and Z . Note that, given \bar{P}_X , \bar{P}_Y and \bar{w} , we solve for r from equation (2) and then w_s from (1). Given the Initial exogenous level of skilled labor supply (i.e. S) and Capital T , X and Z could be determined from equation (4) and (6) respectively. Further, Y could be determined from the (5). All a_{ij} 's is determined via CRS assumptions. Then, we solve for w and R from equation (3), (5) and (7). Thus, this gives us our initial general equilibrium (GE) solution how resources are allocated and factor prices are solved.

Now, in the second step, we introduced educational Stock of capital (i.e. H) into our basic model and discuss how education or skill formation takes place among unskilled workers divided into two groups, those who are employed in the formal sector i.e. Sector Y and those employed in the informal sector (i.e. Sector Z).

We define that H amount of investment or stock of educational capital is required for educating and training L number of unskilled workers into skilled workers as given by the following equation:

$$H = h L \quad (8)$$

Further, it is assumed that in every period, unskilled workers of the past period are fired and rehired. Therefore, any unskilled labor needs to make a decision about whether he/she should work or would go for education. The unskilled labor is not aware whether he/she will be a part of sector Y or Sector Z . Alternative scenario is that already hired L_y won't be fired and they can continue to work. Hence, there are two markets for education i.e., unskilled workers employed in the formal sector (L_y) and unskilled workers employed in the informal sector (L_z).

Our model clearly shows that those employed in the informal sector will remain unemployed if there was no informal sector. If informal sector statistics are not recorded properly as generally is the case since it is one of the major characterizations of the informal sector globally, those workers will give us a measure of unemployment in the economy. The allocation of educational stock

of capital(H) to train two these unskilled labour groups happens given the values of the variables solved in our initial GE anchor model.

Lastly, once the education takes place, we have a larger supply of skilled workers. So, the issue is to examine whether they will find a job in the skilled sector. This leads to change in the basic GE solutions of variables and depends on who is educated -unskilled workers in the formal sector or unskilled workers in the informal sectors. Our analysis ends here. Allocation of H can be affected by subsequent changes in w and w_s . But that affects the allocation of H in the next period which we do not analyse. An alternative assumption is that H fully depreciates and hence cannot be reallocated.

We now detailed out our procedure and the analysis further. The total stock of educational capital, H is getting allocated to the two sectors Y and Z, which implies that,

$$H = H_Y + H_Z \quad (9)$$

Where, H_Y is the stock of educational capital going into Sector Y and H_Z is the stock of educational capital going into Sector Z for skill formation of unskilled workers employed in informal sector. We now explain the process of allocation of educational stock of capital(H) to train two these groups of unskilled workers in sector Y and Sector Z. For this purpose, R_i is defined as the return to H from i^{th} sector skill formation.

Now, competitive condition implies that

$$R_i H_i = w_s S_i - w_i S_i \quad (10)$$

Where, S_i is the number of workers educated in the i^{th} sector and $i = Y, Z$.

$$S_i = S_i(H_i) \quad S'_i > 0, S''_i < 0 \quad (11)$$

$$R_i = (w_s - w_i) \frac{S_i(H_i)}{H_i}$$

Where, $w_Y = \bar{w}$ and $w_Z = w$.

Further, we assume that when any unskilled worker wishes to get educated, he/she expects to get w_s . One could easily substitute w_s by expected w_s i.e. Ew_s but that has to be the same for everyone.

Now, $R_y = R_z = R$

We assume that $\frac{S_i(H_i)}{H_i}$ declines as H_i increases.

The allocation of educational stock of capital into two sectors based on the returns in two sectors could be seen from the figure 1.

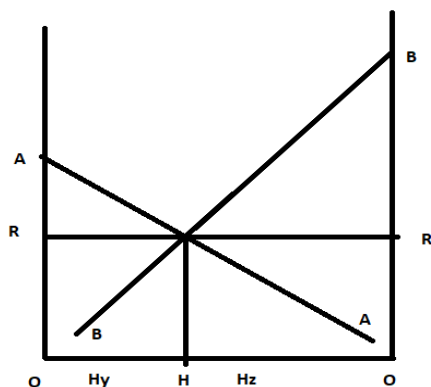


Figure 1: Allocation of Educational stock of capital in sector Y and Sector Z

In the figure1, AA will be represented by

$$R_y = (w_s - \bar{w}) \frac{S_y(H_y)}{H_y} \quad (12)$$

and BB will be represented by

$$R_z = (w_s - w) \frac{S_z(H - H_y)}{H - H_y} \quad (13)$$

It is clear that $OA < OB$ as $\bar{w} > w$. Further, we can also assume initial increasing returns so that $\frac{S_i(H_i)}{H_i}$ increases and then falls as it does not matter.

Based on which group of unskilled workers is getting education, we consider two cases for analysis in our next section.

3.1 Basic Results

In this section, we trace the effect of increase in skill formation on the unskilled workers and unskilled-skilled wage inequality in an economy as modelled in our model. We consider two cases in this. The first case is when only unskilled workers from formal sector gets educated and the second case is when only unskilled workers from informal sectors gets educated.

Case 1 : When only L_y is getting educated

In this case, when $\hat{S} = \frac{S_y}{S} \widehat{S}_y$, we have,

$$\widehat{L}_z = \frac{\lambda_{LY}}{\lambda_{KY} \lambda_{LZ}} (\lambda_{KX} - \frac{S}{L} \frac{\lambda_{KY}}{\lambda_{LY}}) \frac{S_y}{S} e_y \widehat{H}_y$$

With $\widehat{H}_y > 0$ and skilled sector being capital intensive i.e. $\frac{a_{KX}}{a_{SX}} > \frac{a_{KY}}{a_{LY}}$,

$$\widehat{L}_z > 0$$

Also, from Appendix equations [A.1.3] and [A.1.6], we have, $\widehat{L}_y < 0$ and $\widehat{w} < 0$. This gives us our first proposition.

Proposition 1: An increase in educational stock of capital (H_y) designed to encourage skill formation of unskilled workers in formal sector raises the skilled-unskilled wage inequality as well as informal employment.

Proof: - The above proposition can be intuitively explained as follows: -

We are considering the case when only unskilled workers from formal sector (Y) gets educated. This means that all the educational stock of capital is getting into sector Y. With increase in this stock of capital (H_y), extra amount of unskilled worker from sector Y is getting educated and skilled. Due to increased supply of skilled labor, the sector X expands but not all the skilled labor could be absorbed

into the sector X. This is due to the fact that the other factor i.e. capital is limited and per unit requirement of capital for sector X is very large. Although, there is excess supply of skilled labor but it does not lead to reduction in w_s as evident from equation (1) due to small economy assumption and return on capital getting pegged from the assumption of fixed minimum unskilled wage(\bar{w}). This means that all the skilled workers could not be absorbed into the sector X without some reallocation of physical capital and even such reallocation is not sufficient to absorb everyone. Hence, those educated unemployed unskilled workers will be looking for a job into the informal sector(Z) leading to expansion of informal sector Z and rise in informal employment i.e. (L_z). This in turn will depress the informal wage(w) as evident from the equation (3). From the equation (1) and (2), we have $\widehat{w}_s = 0$. With $\widehat{w} < 0$, we have $\widehat{w}_s - \widehat{w} > 0$ i.e., the skilled-unskilled wage inequality increases.

Next, we consider the case when only unskilled workers from informal sector (L_z) are getting educated. This means that all the total educational stock of capital is going into the Sector Z.

Case 2: When only L_z is getting educated

In this case, when $\hat{S} = \frac{S_z}{S} \hat{S}_z$, we have,

$$\widehat{L}_z = \frac{\lambda_{LY}}{\lambda_{KY} \lambda_{LZ}} (\lambda_{KX} - \frac{S}{L} \frac{\lambda_{KY}}{\lambda_{LY}}) \frac{S_z}{S} e_z \widehat{H}_z$$

With $\widehat{H}_z > 0$ and skilled sector being capital intensive i.e. $\frac{a_{KX}}{a_{SX}} > \frac{a_{KY}}{a_{LY}}$,

$$\widehat{L}_z > 0$$

Also, from Appendix equations A[1.8] and A[1.11], we have, $\widehat{L}_y < 0$ and $\widehat{w} < 0$. This gives us our second proposition.

Proposition 2: An increase in educational stock of capital (H_Z) designed to encourage skill formation of unskilled workers in informal sector also raises the skilled-unskilled wage inequality and informal employment.

Proof:- The above proposition can be intuitively explained as follows: -

In this case, we consider only unskilled workers from the informal sector are getting educated. This means that all the educational stock of capital is getting into the informal sector (Z). With increase in this stock of capital (H_Z), extra amount of unskilled labor from sector Z is getting educated and skilled. Due to increased supply of skilled labor, the sector X expands and again capital is reallocated from formal sector Y to formal sector X to absorb the skilled labor. It is important to note that excess supply of skilled labor won't cause reduction in skilled wages due to return on physical capital getting pegged from the assumption of fixed minimum unskilled wage in small open economy. Due to the release of physical capital from formal sector Y to skilled sector X, formal sector contracts ($\hat{Y} < 0$) leading to cutback in the unskilled workers employed in formal sector (i.e. $\widehat{L}_Y < 0$). Hence, these unskilled workers compelled to earn a living would find a job in the informal sector leading to expansion of informal sector (Z) and further depressing the informal wages (w) leading to increase in skilled-unskilled wage inequality.

From both the scenario's, it can be clearly observed that no matter whether it's unskilled workers from the formal sector or unskilled workers from the informal sector who gets skilled, both skill formation is leading to rise in skilled-unskilled wage inequality as well as increase in informal employment. Both these results point unambiguously toward the lack of productive investment and the weakness of the supply side argument of skill accumulation. In the first case, it is due to the increased supply of skilled labour and in the second case, it is due to the cutback of unskilled workers in the formal sector. The main problem is the lack of physical capital in the skilled formal sector to absorb all the skilled workers.

This highlight our key idea that alone skill formation would not help unless it is complemented with an increase in investment in other sectors that could lead to increase in demand for skilled workers. It could be substantiated as follows: -

We have ,

$$(w_s - \bar{w}) \frac{S_y(H_y)}{H_y} = (w_s - w) \frac{S_z(H - H_y)}{H - H_y}$$

$$\frac{\frac{S_y(H_y)}{H_y}}{\frac{S_z(H - H_y)}{H - H_y}} = \frac{(w_s - w)}{(w_s - \bar{w})}$$

$$f(H_y, H) = \frac{(w_s - w)}{(w_s - \bar{w})} \quad (14)$$

Where, $\frac{\partial f}{\partial H_y} < 0$ and $\frac{\partial f}{\partial H} > 0$

With \bar{w} , w_s being constant and LHS of equation (14) is not depending on capital K , it's only the unskilled wage i.e. w that is affected by L_z and in turn by both physical capital of type K and educational stock of Capital , H.

Since,

$$(\lambda_{KX} - \frac{S}{L} \frac{\lambda_{KY}}{\lambda_{LY}}) \hat{S} - \frac{\lambda_{KY}}{\lambda_{LY}} \widehat{L_Z} \lambda_{LZ} = \widehat{K} \quad \text{and} \quad \widehat{L_y} = \frac{1}{\lambda_{KY}} \widehat{K}$$

Given S, it could be clearly seen that with $\widehat{K} > 0$, $\widehat{L_Z} < 0$ and $\widehat{L_y} > 0$. This means that increase in physical capital, K definitely increases formal employment i.e. L_y and reduces informal employment i.e. L_z thereby reducing the skilled-unskilled wage gap and unemployment. So, it is important to note that physical capital K should increase along with increase in educational Capital H in order to realize the benefits of skill formation in the economy.

4. Robustness Check

In this section, we discuss the case of a large open economy i.e. when prices are endogenous and show that our results still hold. We assume that entire X is exported whereas Y and Z are consumed, so we can talk about a two-dimension utility function or demand function.

With Homothetic demand function, we have,

$$\frac{\widehat{Y_d} - \widehat{Z_d}}{\widehat{P_y} - \widehat{P_z}} = -\sigma \quad \text{or} \quad (\widehat{Y_d} - \widehat{Z_d}) = -\sigma(\widehat{P_y} - \widehat{P_z})$$

Where, $\frac{\widehat{Y_d} - \widehat{Z_d}}{\widehat{P_y} - \widehat{P_z}}$ is the relative demand change and σ is the elasticity of substitution in demand.

Now first we look at the case when some L_y is getting educated. From the supply side, we have,

$$\frac{\widehat{Y} - \widehat{Z}}{\widehat{P_y} - \widehat{P_z}} = \mu$$

With rise in P_y and \bar{w} being fixed, this implies that r rises and w_s falls, contracting X and expanding Y. Further, Z could expand or contract depending on the unskilled labour movement. Now, to guarantee relative supply(Y/Z) function to be upward rising so that we have a stable system for comparative statics we assume that even if Z rises Y rises more when P_y rises. This is the price effect before educational capital H is spent on training the unskilled workers in sector y (L_y). Now once educational capital is spent to transform some L_y into skilled labor (S), there will also be an endowment effect in addition to the price effect. From our results derived earlier, we already know that this may increase educated unemployment who will now go to Z and sector Y will contract. So, this implies lowered Y/Z ratio and further implies that the relative supply curve at a given $\frac{P_y}{P_z}$, will reduce the supply Y/Z ratio. This will lead to rise in P_y given relative demand. Aggregate income can go either way as educated unemployed has to

earn lower wage now, though educated ones will have higher income. If P_y rises, then there will be a contraction of sector X and expansion of sector Y. But, there would still be lower production of Y. This will partly reduce educated unemployment, but cannot over power the initial shock of higher educated unemployment.

Now, consider the case when L_z is getting educated. In that case, sector X will expand and Y will contract. Here, Z can contract as well and Y/Z may go up. P_y will fall and Y can contract further and Z will expand. There will be no educated unemployment but unemployment will rise.

In a nutshell, whatever be the effect of higher educational stock of capital on sector Y and Z, Given the prices, endogenous prices could restrict the bad effect of a higher H but cannot eliminate or reverse it. Also, it is important to note that if the elasticity of substitution in demand is very high then price of Y won't be changing much and all our results with exogenous prices will hold.

5. Conclusion

Skill development plays an important role in the structural transformation and economic growth of any economy. It is considered one of the necessary factors for productivity growth and hence it needs to be an integral part of the development policies. Investment in education and training helps the developing economies to rapidly move to the high growth sectors and break the low wage, low skill development syndrome. However, skill formation is usually seen as a supply side problem in the literature. But it is important to note that skill formation would not be beneficial unless it is supported by productive investment in other sectors. The argument that skilled supply would create its own demand assumes away any constraint that might operate on the availability of capital for production in the skilled sector. Our paper looks at the problem of skill formation

in a new way where it highlights the problem of lack of productivity investment and point out the weakness of supply side argument of skill accumulation.

An empirical exercise was undertaken by considering a sample of total 32 countries using panel data analysis to indicate the significance of the issue raised in the paper. Our empirical findings suggested that in both low and high investment countries when education and investment move together then they help in reducing the unemployment rather than increasing the education alone.

Further, we developed a general equilibrium model of a small open developing economy with skill formation and possible unemployment of unskilled labor in both formal and an informal sector. We examined the consequences of skill formation by two groups of unskilled workers – one employed in the formal sector at fixed minimum wage rate and other one employed in an informal sector at a lower flexible wage rate.

Our findings from both the cases highlight the problem of lack of physical capital in the skilled sector due to which not all skilled workers get absorbed in that sector. In the first case, it is the excess supply of skilled labour and in the second case it is the greater retrenchment of unskilled workers in the formal sector leading to expansion of informal sector with further depressed unskilled wages. It is the formal sector that leads to underemployment and it will not be captured in the official database as people would end up getting absorbed in informal sectors for earning something. Also, it could be opportunity costs will vary among the unemployed as relatively prosperous one can afford to wait to get a job and poorer one would be underemployed but since our model does not differentiate between unemployed, we do not have open unemployment. But it does implies that the more prosperous of the nations would show greater open unemployment and less underemployment, since more people can afford to remain unemployed. Hence, it is important that skill formation should go hand in hand with investment

in other sectors to derive the maximum benefits from the skill formation in developing economies.

APPENDIX

A1. Expression for change in L_y , L_z and w

From (4), $X = \frac{S}{a_{SX}}$ and

From (6), $Z = \frac{T}{a_{TZ}}$

Substituting value of Z into (5), we have

$$Y = \frac{1}{a_{LY}} (L - a_{LZ}Z) = \frac{1}{a_{LY}} \left(L - \frac{a_{LZ}}{a_{TZ}}T \right)$$

Further from (7), we have

$$\frac{a_{KX}}{a_{SX}} + \frac{a_{KY}}{a_{LY}} \left(L - \frac{a_{LZ}}{a_{TZ}}T \right) = K$$

Differentiating the above equation and using cap notation, we have

$$\lambda_{KX} \hat{S} + \frac{\lambda_{KY}}{\lambda_{LY}} \left[\hat{L} - \widehat{L_Z} \lambda_{LZ} \right] = \hat{K}$$

$$\lambda_{KX} \hat{S} + \frac{\lambda_{KY}}{\lambda_{LY}} \hat{L} - \frac{\lambda_{KY}}{\lambda_{LY}} \widehat{L_Z} \lambda_{LZ} = \hat{K}$$

Since, $dS + dL = 0$, or $\hat{S} = -\frac{L}{S} \hat{L}$.

$$\lambda_{KX} \hat{S} - \frac{S \lambda_{KY}}{L \lambda_{LY}} \hat{S} - \frac{\lambda_{KY}}{\lambda_{LY}} \widehat{L_Z} \lambda_{LZ} = \hat{K}$$

Since K is given, we have $\hat{K} = 0$.

$$\left(\lambda_{KX} - \frac{S \lambda_{KY}}{L \lambda_{LY}} \right) \hat{S} - \frac{\lambda_{KY}}{\lambda_{LY}} \widehat{L_Z} \lambda_{LZ} = 0 \quad [\text{A.1.1}]$$

From the equation (11), we have,

$$S_y = S_y(H_y)$$

This implies that,

$$\widehat{S}_y = e_y \widehat{H}_y \quad \text{Where, } e_y = \frac{\partial S_y / S_y}{\partial H_y / H_y} \text{ is the elasticity of skill formation in sector Y.}$$

Similarly, we have

$$S_z = S_z(H_z)$$

This implies that,

$$\widehat{S}_z = e_z \widehat{H}_z \quad \text{where } e_z = \frac{\partial S_z / S_z}{\partial H_z / H_z} \text{ is the elasticity of skill formation in sector Z.}$$

We also have, $S = S_y + S_z$ which further implies that

$$\widehat{S} = \frac{S_y}{S} \widehat{S}_y + \frac{S_z}{S} \widehat{S}_z$$

Now we consider the two different cases,

Case 1 : When only L_y is getting educated

$$\text{It means, } S_z = 0, \widehat{S} = \frac{S_y}{S} \widehat{S}_y$$

Using (A.1.1), we have,

$$\widehat{L}_z = \frac{\lambda_{LY}}{\lambda_{KY} \lambda_{LZ}} \left(\lambda_{KX} - \frac{S}{L} \frac{\lambda_{KY}}{\lambda_{LY}} \right) \frac{S_y}{S} \widehat{S}_y$$

$$\widehat{L}_z = \frac{\lambda_{LY}}{\lambda_{KY} \lambda_{LZ}} \left(\lambda_{KX} - \frac{S}{L} \frac{\lambda_{KY}}{\lambda_{LY}} \right) \frac{S_y}{S} e_y \widehat{H}_y \quad [\text{A.1.2}]$$

With e_y being positive and skilled sector being capital intensive than sector Y (

$$\frac{a_{KX}}{a_{SX}} > \frac{a_{KY}}{a_{LY}}),$$

When $\widehat{H}_y > 0$ then $\widehat{L}_z > 0$

$$\text{Also, } \widehat{L}_y = \frac{1}{\lambda_{LY}} (\widehat{L} - \lambda_{LZ} \widehat{L}_z)$$

$$\widehat{L}_y = -\frac{\lambda_{KX}}{\lambda_{KY}} \frac{S_y}{S} e_y \widehat{H}_y \quad [\text{A.1.3}]$$

Similarly, when $\widehat{H}_y > 0$, $\widehat{L}_y < 0$.

$$\text{Also, } \widehat{L}_z = -\sigma_z (\widehat{w} - \widehat{R}) \quad [\text{A.1.4}]$$

From [A.1.2] and [A.1.4], we have,

$$w/R = f(H_y), \quad f' < 0 \quad [\text{A.1.5}]$$

From equation (3), (A.1.5) and envelope condition, we have,

$$a_{LZ} \frac{dw}{dH_y} + a_{TZ} \left(\frac{\frac{dw}{dH_y} f(H_y) - f'w}{f^2} \right) = 0$$

$$\frac{dw}{dH_y} \left(a_{LZ} + \frac{a_{TZ}}{f(H_y)} \right) - w \frac{a_{TZ} f'}{f^2} = 0 \quad [\text{A.1.6}]$$

Hence, $\frac{dw}{dH_y} < 0$ or $\frac{d(\frac{w}{S})}{dH_y} > 0$ i.e skilled-unskilled wage inequality going up with increase in educational capital into sector Y.

Case 2: When only L_z is getting educated

It means, $S_y = 0$, $\widehat{S} = \frac{S_z}{S} \widehat{S}_z$

Using Equation (A.1.1), we have,

$$\begin{aligned} \widehat{L}_z &= \frac{\lambda_{LY}}{\lambda_{KY} \lambda_{LZ}} \left(\lambda_{KX} - \frac{S}{L} \frac{\lambda_{KY}}{\lambda_{LY}} \right) \frac{S_z}{S} \widehat{S}_z \\ \widehat{L}_z &= \frac{\lambda_{LY}}{\lambda_{KY} \lambda_{LZ}} \left(\lambda_{KX} - \frac{S}{L} \frac{\lambda_{KY}}{\lambda_{LY}} \right) \frac{S_z}{S} e_z \widehat{H}_z \quad [\text{A.1.7}] \end{aligned}$$

With $e_z > 0$ and skilled sector being capital intensive than sector Y i.e. $\frac{a_{KX}}{a_{SX}} > \frac{a_{KY}}{a_{LY}}$,

When $\widehat{H}_z > 0$, then $\widehat{L}_z > 0$.

Also, we have,

$$\begin{aligned}\widehat{L}_y &= \widehat{L} - \lambda_{LZ} \widehat{L}_z \\ \widehat{L}_y &= -\frac{\lambda_{KX}}{\lambda_{KY}} \frac{s_z}{s} e_z \widehat{H}_z\end{aligned}\quad [\text{A.1.8}]$$

Similarly, when $\widehat{H}_z > 0$ then $\widehat{L}_y < 0$.

$$\text{Also, } \widehat{L}_z = -\sigma_z (\widehat{w} - \widehat{R}) \quad [\text{A.1.9}]$$

From [A.1.7] and [A.1.9], we have,

$$w/R = f(H_z), \quad f' < 0 \quad [\text{A.1.10}]$$

From equation (3), (A.1.10) and envelope condition, we have,

$$a_{LZ} \frac{dw}{dH_z} + a_{TZ} \left(\frac{\frac{dw}{dH_z} f(H_z) - f'w}{f^2} \right) = 0$$

$$\frac{dw}{dH_z} \left(a_{LZ} + \frac{a_{TZ}}{f(H_z)} \right) - w \frac{a_{TZ} f'}{f^2} = 0 \quad [\text{A.1.11}]$$

Hence, $\frac{dw}{dH_z} < 0$ or $\frac{d(\frac{w}{w_s})}{dH_z} > 0$ i.e skilled-unskilled wage inequality going up with increase in educational capital into sector Z.

A2. Determining the value of \bar{w} optimally.

We assume that trade unions maximise collective utility which could be defined as a positive function of formal wage \bar{w} and negative function of unskilled workers employed in the sector Y (i.e. L_y).

$$u = u(\bar{w}, L_y(\bar{w})) \quad [\text{A.2.1}]$$

where $u_1 > 0$ and $u_2 > 0$, $u_{11} < 0$; $u_{12} = u_{21} = 0$; $u_{22} < 0$.

Now, $u(\bar{w}, L_y(\bar{w})) \geq u(w(L), L)$ where $w(L)$ is the informal wage.

We define the reservation utility to be u_0 i.e. when all the unskilled labor (L) have to go to Z and they earn $w(L)$.

Assume the trade union makes an offer and firms accept else goods in Sector Y are not produced.

So, Trade Union, maximize V ,

$$V(\bar{w}) = [u(\bar{w}, L_y(\bar{w})) - u_0] \quad [\text{A.2.2}]$$

$$\frac{dV}{d\bar{w}} = 0$$

$$u_1 + u_2 L_y'(\bar{w}) = 0 \quad [\text{A.2.3}]$$

Note that from firm's profit maximization condition

$$\pi_y = P_y f(L_y) - \bar{w} L_y \quad \text{when } L_y \text{ is optimally chosen at some } \bar{w}.$$

$$P_y f'(L_y) = \bar{w}$$

$$P_y f''(L_y) \cdot \frac{dL_y}{d\bar{w}} = -1$$

$$\text{Or } L_y'(\bar{w}) = \frac{1}{P_y f''(L_y)} < 0 \quad [\text{A.2.4}]$$

From (A.2.3)

$$-L_y'(\bar{w}) = \frac{1}{-P_y f''(L_y)} = \frac{u_1}{u_2} \quad [\text{A.2.5}]$$

So, \bar{w} will be determined from (A.2.5).

Note that $\frac{u_1}{u_2}(\bar{w})$ is declining in \bar{w} as \bar{w} increases, u_1 falls as $u_{11} < 0$ and u_2 increases as $u_{22} < 0$.

As \bar{w} increases, L_y decreases.

Also, $\frac{u_1}{u_2} > -L_y'(w)$ hence $\bar{w} > w$

If P_y increases, $-L_y'(\bar{w})$ decreases. So unions set a higher \bar{w} for a more profitable industry.

If firms call the shot then they set up $u = u_0$ as decreases in \bar{w} is always profitable.

So, one could simply formulate a bargaining problem over \bar{w}^* derived from

$$\frac{u_1}{u_2} = -L_y'(\bar{w}^*)$$

and $w = w(L)$

With bargaining actual \bar{w} , \bar{w} must lie between the informal wage and \bar{w}^* i.e.

$$\bar{w} \in (w(L), \bar{w}^*) \quad \text{[A.2.6]}$$

For our model to derive \bar{w} endogenously, [A.2.5] or [A.2.6] anyone should serve the purpose.

A3. List of countries with their average investment rate

COUNTRY	AVG. INVESTMENT RATE	COUNTRY	AVG. INVESTMENT RATE
GRC	16.21985609	HUN	22.32302876
GBR	16.71000842	FRA	22.41911601
LUX	18.60234767	SVK	22.43525246
PRT	18.68999853	FIN	22.9452732
ITA	19.02420551	AUT	22.98428377
CRI	19.62173143	BEL	23.01160516
POL	19.88067444	NOR	23.11742772
DEU	20.14988194	CAN	23.22275034
NLD	20.42541299	SWE	23.56096205
USA	20.5453737	CHE	23.84680487
DNK	20.69446586	LVA	24.91572909
LTU	20.91754673	AUS	26.44673898
ISL	21.22424467	CZE	26.91806602
MEX	21.89745921	TUR	27.48197751
SVN	21.90558306	EST	27.53759989
ESP	21.95418134	KOR	30.10377431

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