Understanding and Alleviating Future Skilled Labor Shortage in Norway

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Abstract

The objective of the study is to conduct an exploratory study of the causes that constitute to skilled labor shortage in Norway. Subsequently, we formulate policy to increase skilled labor supply. We apply system dynamics methodology to model the causal relationship between individuals' motivation to tertiary education participation, from wages and job opportunity perspective. From the simulation, we find that if tertiary education participation persists as it is, skilled labor shortage will increase from 21,000 in 1994 to 228,000 skilled laborers in 2050, which accounts for 11% of the total skilled labor force. With the introduction of voluntary-based internship program into current tertiary curriculum, promotion of online tertiary education, and encouragement of more foreign tertiary students to study in the country, total university students in 2050 will be 1.30% higher, domestic skilled labor force will be lifted 2.5%, and skilled labor shortage will be reduced by 35%.

Keywords: *skilled labor, labor supply, tertiary education, skilled labor shortage*

Introduction

Norway has seen a strong productivity and economic growth at unprecedented rates. From 1948 to 2003, Norway's mainland GDP grew by an average of 3.3% annually (Hagelund, 2009). Since the past two decades, Norwegian labor demand has shifted from unskilled to skilled (Linquist & Skjerpen, 2003). In the coming years, demand for skilled labor[1] in Norway is expected to increase (Norges Bank, 2002). Net job creation rate for the low-skilled labor was -4% from the 1980s to 1990s whereas it was 1% and 5% for the medium- and high-skilled workers respectively. Salvanes & Førre (2003) expect the trend to be continued into the future.

Norway also has a high labor force participation rate[2], 81% in 2009 (OECD StatExtract, 2010a). Due to rapid output growth, unemployment rate had remained low, between the range of 3.5% and 3.2% from 2000 to 2009 (OECD StatExtract, 2010a). On the other hand, real wages for the

[1] Since skill is unobservable, we use education attainment as an indication of skills. In our paper, we refer skilled labor market as a labor market that is made up labors with education attainment of at least ISCED 5.

[2] Labor force participation rate in Norway is defined by the population in the age group of 15-64 in OECD StatsExtracts

tertiary educated also projected an increasing trend from 1993 to 2003. The average annual real wages[3] for a tertiary educated labor was slightly above NOK[4] 300,000 in 1993. In 2007, the number approached NOK500, 000 (Statistics Norway, 2010a). As a consequence of strong output growth, high participation rate, and low unemployment rate, Norway encounters a tight skilled labor market. Lately, much attention was devoted to skilled labor supply in the media and politics. Some were concerned about the development of skilled labor shortage in the future. In a tight skilled labor market, skilled labor immigration is a fast-track solution to ease the tight skilled labor market situation. The inflow of foreign skilled labor has increased from less than 1,500 people per year in 1999 to about 5,000 people per year in 2009 (UDI, 2009). If the development of skilled labor supply and demand continues as it is, skilled labor shortage will possibly surge in the near future.

The persistent dynamic nature of a complex system stems from its causal structure internally rather than external disturbances or random events (Meadows, 1980). Due to the complex and dynamic nature of the skilled labor market, we apply system dynamics methodology to study the endogenous relationship between wages, job opportunity, and skilled labor supply and how the endogenous relationship constitutes to skilled labor shortage. We will discuss the dynamic problem in the following section.

The Dynamic Problem

From indicators such as skilled employment growth, skilled unemployment rate, and skilled wages, the skilled labor market in Norway in the past 17 years is characterized to be tight. As the nation's economy is transforming to be knowledge- and technology- intensive, the demand for skilled labor will continue to rise. If skilled labor demand continues to rise faster than skilled labor supply, shortage will possibly occur. Depending on the growth rate of skilled labor force, the intensity of skilled labor shortage varies (Fig. 1).

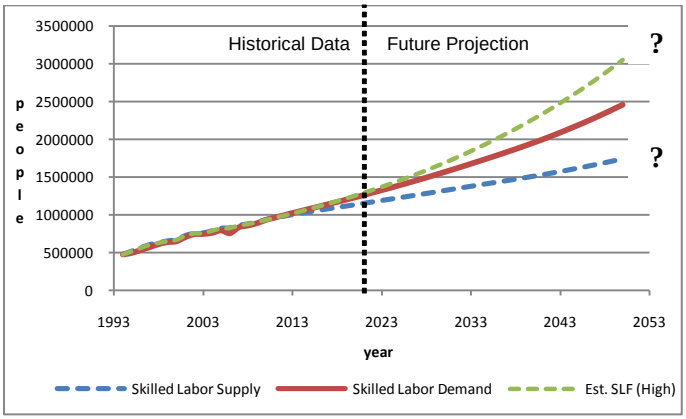

Figure 1 Reference Mode: Historical and Future Projection of Skilled Labor Supply, Skilled Labor Demand and Desired Demand
Source: Statistics Norway

[3] Basic monthly salary.
[4] NOK represents Norwegian krone.

Fig. 1 demonstrates the historical development and future projection of the estimated skilled labor force and skilled labor demand. It is uncertain how the development of skilled labor force will be in the future. If the education attainment rate (34%) (OECD, 2009) and skilled labor force participation rate (81%) remain at the current rate, the gap between skilled labor force supply and demand will be widening from 2013 onwards; if the skilled labor force is projected to be growing at 3% annually (Est. SLF High), skilled labor supply will exceed skilled labor demand from 2020 onwards. In this scenario, skilled labor supply outgrows skilled labor demand and skilled labor surplus will occur.

The two sources of skilled labor are foreign skilled immigrant and local tertiary educated laborers. Foreign skilled immigration is on the rise as domestic skilled labor is insufficient to meet the demand. Thus, tertiary education participation is vital to assure sufficient supply of domestic skilled labor, this leads to the question of what motivates individuals to become skilled labor. This becomes a concern for the policy makers.

Regardless, undersupply or oversupply of skilled labor is not a desirable outcome from the government's perspective. Undersupply of skilled labor will slow down Norway's transformation to a knowledge- and technology intensive economy; whereas oversupply will bring forth skill mismatch or layoffs within industries. This may lead to unemployment and increases welfare expenditure. Therefore, the ideal condition is to be able to have a predictable and steady development of skilled labor supply and demand as pre-requisite and to close the gap as the secondary goal.

The purpose of this paper is to investigate the causes of skilled labor shortage. Thereafter, we formulate feasible policy to mitigate the mismatch of skilled labor supply and demand that will lead to future worsening shortage.

Dynamic Hypothesis

In the past twenty years, the demand for skilled labor in Norway has been increasing. However, due to slower population growth, it is projected by media and politicians that skilled labor supply will lag behind demand. On one hand we hypothesize that the sluggish skilled labor force growth is mainly caused by lower growth rate in tertiary entry rate in conjunction with slower population growth.

Looking into the tertiary education entry patterns in the country, we find different entry rates of various age cohorts. The tertiary education entry rate of age group for 20 to 24 has dropped 50% in 2006 and 2007 compared to 2005; meanwhile, the entry rate for age group 25 to 29 dropped 14% in the same period of time compared to 2005 (Trendle, 2008). This is an alarming signal as it indicates that the fraction of young working age population that opted to pursue tertiary education has reduced significantly in the recent years.

In conjunction with the slower growth in population in the future, lower tertiary education entry rate will lead to slow accumulation of domestically educated skilled labor. Norway is facing the demographic ageing challenge just like other European countries due to declining fertility rate. According to Statistics Norway, the fertility rate, average number of children per woman, has fallen from 2.13 in 1970s to 1.98 in 2009 (OECD StatExtracts, 2010b). On the other hand, life expectancy has improved over the years. The life expectancy of men and women in 1951 was 71.11 and 74.7 respectively (Statistics Norway, 2010b). Albeit the population is expected to

grow, it is estimated that by 2050, almost 25% of the total population will be aged 65 and over as opposed to 14% only in 2000 (Statistics Norway, 2010c).

A nation's population growth is determined by three factors, namely: births, deaths, and net migration. In the recent years, net migration is the third force that contributes to the population growth in Norway. Net migration was insignificant during 1970s and early 1980s, but gradually increased considerably in late 1980s. The increment was more and more drastic since 1986 and continued to grow until 2008. It seems to decrease slightly in 2009. Amidst fewer deaths and staggering births, net migration is the dominating factor for the population growth in the last 10 years.

The changes in demography indicate that the working age population will grow at a decreasing rate while the elderly population will grow linearly. Without immigration, the population net growth will become negative eventually. Therefore, the development of the population will have direct impact on the inflows and outflows of the labor force stocks.

Motivation to University is a dimensionless variable ranges from 0 to 2. It encompasses four factors; these are perceived wage premium, expected foregone earnings, ease of finding job, and expected lifetime earnings. Individuals weigh expected foregone earnings more than other factors during the decision-making process in tertiary education participation (Tannen, 1978). On the other hand, we hypothesize that "supply begets demand". Industries take advantage of skills available in the market. Therefore, firms invest in capital to boost labor productivity. Thus, more skilled labor is needed to utilize better and newer technology.

Demand for skilled labor increases moderately within the past 15 years. This has prompted moderate growth of indicated skilled labor needed. As a consequence, skilled labor gap widens and skilled job density increases and thus skilled labor market is tighten. On one hand, the tighten labor market will lead to higher wages for skilled labor as firms compete for talents. On the other hand, from the neo-classical economic perspective, higher wages will also encourage firms to increase capital investment to reduce human input and to boost labor productivity. As wages is expected to reflect labor productivity, wage growth enhances the attractiveness of skilled jobs. Hence, more individuals take up tertiary education.

Analysis

The model starts at year 1994 until 2009 to determine the fitness of the simulated behavior to the reference mode. There are two reference modes: skilled labor supply and skilled labor demand. The model is able to reproduce a behavior similar to the reference mode—linear increment (Fig. 2). Through statistical significance testing, mean absolute percent error (MAPE[5]) is used to determine the fitness of the simulated behavior to the reference mode. The MAPE for Skilled Labor Supply is 4.21% and 3.53% for Skilled Labor Demand (Fig. 3). As the percentage error is less than 5%, the confidence level of the simulated behavior to the reference mode is more than 95%. The model has passed the behavior reproduction test.

[5] $\text{MAPE} = 1/n \sum_{k=1}^{n} |(\text{X} - \text{Y})|/\text{Y} * 100$

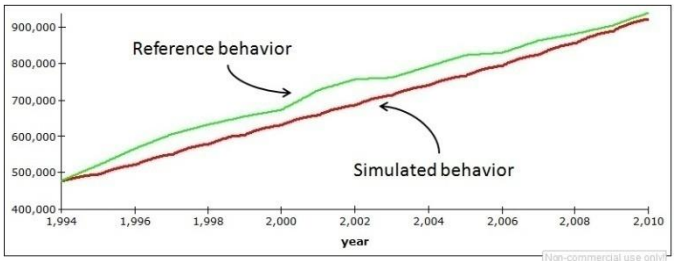

Figure 2 Behavior Reproduction Test: Comparison of Skilled Labor Supply reference and simulated behavior, 1994 - 2009

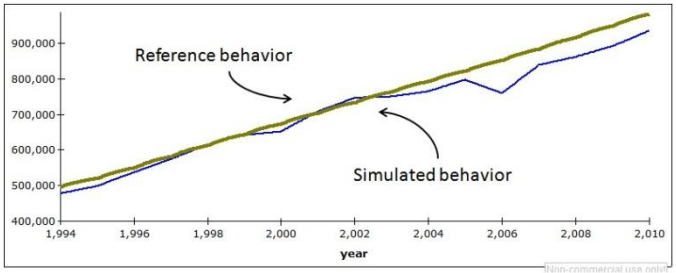

Figure 3 Behavior Reproduction Test: Comparison of Skilled Labor Demand reference and simulated behavior, 1994 – 2009

Since the model has passed the behavior reproduction test, we present the following base run for Skilled Labor Supply and Skilled Labor Demand. The base run demonstrates the simulated behavior from 1994 to 2050 (Fig. 4).

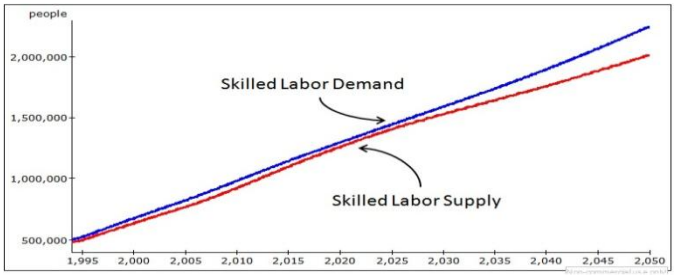

Figure 4 Base Run: Skilled Labor Supply and Skilled Labor Demand, 1994 – 2050

From 1994 to 2025, skilled labor supply is growing parallel to the demand. Although the gap between the two trends starts widening slightly after 2005, the gap grows narrower from 2020 to 2025. However, after 2025, skilled labor supply starts deviating from demand and the gap grows bigger since then. In such case, skilled labor shortage starts intensifying.

In the next stage of testing, we run the behavior sensitivity test by cutting some loops to determine the sensitivity of certain variables on skilled labor supply and demand. We eliminate three loops, they are (1) effect of Expected Foregone Earnings on Motivation to University; (2) effect of foreign skilled labor; (3) effect of constant skilled aggregate demand fraction.

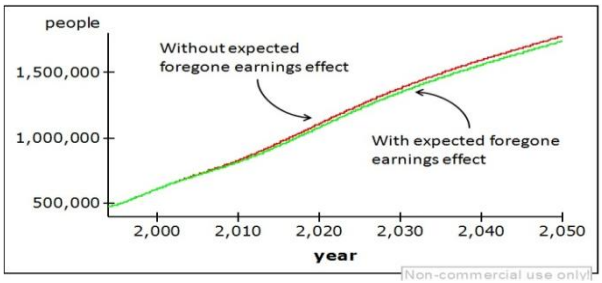

Figure 5 Domestic Skilled Labor Force Stock: with and without expected foregone earnings effect

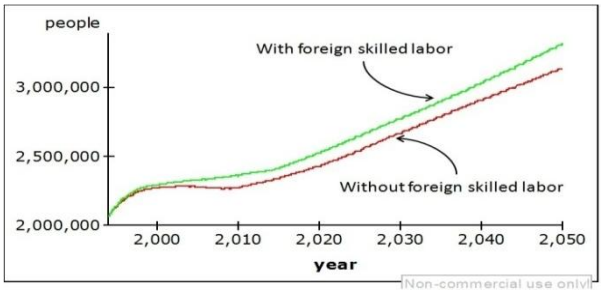

Figure 6 Skilled Labor Supply: with and without foreign skilled labor

After Expected Foregone Earnings loop is removed, individuals will be more motivated to pursue tertiary education. This factor weighs the most among the four factors that make up Motivation to University. This test implies that if expected foregone earnings is not individuals' concern, Motivation to University will increase 15% by 2050. Thus, the larger fraction of working age population participate in tertiary education will lead to more tertiary graudates. After graduation, they will become domestic skilled labor should they seek or obtain employment. So, domestic skilled labor force will be about 10,000 people higher than in the base run (Fig. 5). Thus, the Expected Foregone Earnigns loop has an suppresing effect on domestic skilled labor force stock.

In the second test, the inflow of foreign skilled labor is eliminated. Fig. 6 shows the comparison of the behavior of Skilled Labor Supply with and without foreign skilled labor. Without foreign skilled labor, the total skilled labor supply will be about 200,000 lower than in the base run. However, domestic skilled labor force stock only increase insignificantly as Motivation to University only increases about 10%. This test implies that after 2005, skilled labor supply relies on foreign skilled labor heavily. Foreign skilled labor contributes to the growth of skilled labor supply.

Finally, we test the effect of skilled aggregate demand fraction on skilled labor supply and demand. In this test, we eliminate the feedback loop of skilled labor force growth on the growth of skilled aggregate demand fraction. Thus, the fraction remains at 26%, the estimated fraction in 1994[6], throughout the simulation.

[6] It is estimated from the education attainment in working age population and labor participation rate.

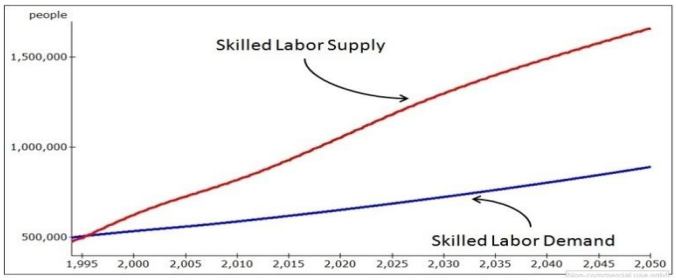

Figure 7 Skilled Labor Supply and Demand: with constant skilled aggregate demand fraction

Fig. 7 shows that skilled labor demand only reaches about 0.8 million people by 2050 as compared to 2.5 million people in the base run; skilled aggregate demand only grows proportionally to the growth of total aggregate demand annually. As a result, no foreign skilled labor is introduced to the country. Due to surplus of skilled labor, skilled wages will grow at a slower pace. Combined with low skilled job density, individuals find skilled jobs unattractive. Thus, motivation to tertiary education is lower and domestic skilled labor accumlation grows at a decreasing rate. This will lead to 500,000 skilled labor supply fewer than in the base run. Even so, the country will have a considerable surplus of skilled labor throughout the simulation. This test implies that skilled labor supply and demand has an reinforcing relationship. The supply and demand contributes to each others' growth.

Policy

After running the behavior sensitivity tests, we formulate policies to close the gap between skilled labor supply and demand. Our policies will aim at boosting domestic skilled labor production and to encourage inflow of foreign skilled labor.

Policy 1-Paid Internship

In the absence of expected foregone earnings, Motivation to University will increase 15% by 2050. Thus, this is a leverage point for policy formulation. In order to boost motivation for tertiary education participation domestically, fostering facilities that promote internship as part of students' curriculum will provide financial returns to students during their study period. Besides, it also helps students gain real working experience and increase the possibility of landing a job faster and easier after graduation. The purpose of this policy is threefold: (1) to reduce students' expected foregone earnings; (2) to reduce skilled working hiring adjustment time; and (3) as an marketing effort to lure foreign students to study in Norway.

Internship is an opportunity for students to integrate real working experience as part of the tertiary education. The program is carried out with planned and supervised work related to students' studies. The compensation from internship participation is one of the benefits to students, but the most important advantages obtained from internship participation stem from clearer career directions and expectations, job preparedness, marketability, interpersonal and leadership skills, and social or professional networking opportunities. A survey shows that 94% of respondents in the United States indicated the experiential advantage from internship compliment their first permanent job search and attainment (OECD, 2004). 90% of colleges in the United States offer students some type of for-credit internship or work-related learning

experience (Coco, 2003). In contrast to the United States, internship arrangement in Norwegian tertiary education system is almost obtained through individual efforts from job fair or individual internship search from private organization websites, school announcements, or governmental-related organizations. In addition, there are other private or not-for-profit organizations that serve as a portal for paid-internship programs[7]. There are only a few programs indicated the inclusion of internship in their curriculum.

This policy targets on tertiary students between age 19 and 29 because students in this age group is more likely lack of professional work experience. We do not encourage the compulsory inclusion of internship into tertiary education because this will incurr substantial amount of time and governmental spending to ensure every students get placement; rather, it is going to be voluntary-based. We propose to broaden the responsibilities of current career planning units within educational institutions by hiring more staff. The tasks of the new staff include student counseling, placement, workforce preparation seminars, marketing internship programs to potential employers, setting up internship placement, and follow-ups.

Policy 2-Online Tertiary Education

Statistics shows that students who entered tertiary education immediately after upper secondary education did not increase much from 1992 to 2002. However, the age of students who enter tertiary education had been increasing. This implies that individuals tend to participate in unskilled labor force after secondary education for a number of years before they continue to tertiary education.

As foregone earnings are one of the most important factors that influence individuals' decision to tertiary education, we propose a policy to encourage tertiary education participation in age group of 30 to 35 through long distance or online tertiary education. This policy will enable employed individuals to obtain undergraduate level tertiary education.

Norwegian government believes that the dividing line between work life and educational system must be reduced. So, the Norwegian University Network for Lifelong Training (Norgesuniversitet) was established in 2000. It provides a database or search engine on several thousand trainings and courses, ranging from short seminars to Master's degree programs, module-based add-on courses and Internet-based instructions. Study shows that not only those who live far away from educational institution would take up online or distance education, often people who are employed or have family with children would opt for this non-traditional learning method (Divine et. al, 2007). As online or distance learning puts more responsibility for learning on the students and on the interaction of students and information-technological based learning material in the absence of direct supervision, this type of learning is more suitable for mature students.

Since the infrastructure for the online and long distance education has been built, the government can take the opportunity to utilize the facility to a fuller extent in order to accommodate individuals' needs while trying to boost the production of skilled labor.

Policy 3-Foreign Tertiary Students

[7] These organizations required participation fees from students in order to place them. Some of the internship program is paid, and some is non-paid. Examples of this type of organization are: AIESEC , Internship.NO, IAESTE, etc.

OECD countries are increasingly seeking ways to attract foreign students (OECD, 2000). Among these countries, the United States attracts the most foreign students, about one-third of all foreign students studying in OECD countries. Statistics shows that many of these students remain in the host country upon graduation. For example, 47% of the foreign-born PhD graduates remain in the United States (OECD, 2000). There are many benefits to retaining foreign students as potential skilled labor force. These students have adapted to the culture and society during their stay. The hesitation of migrating and adapting to a new environment and to master a new language will be less of a concern to foreign students.

In 2008, 8100 study permits were issued (OECD, 2000). The largest increase of student group was from EEA countries, particularly from Germany, France, and Spain. Most of these students participate in undergraduate courses or the Erasmus program. They only stay on a temporary basis. The largest groups of foreign tertiary students outside of EEA were from China and Russia. These students usually take the entire degree program and stay for several years (OECD, 2000). In 2010, UDI launched a specialist or skilled labor job-seeking scheme to attract the recently tertiary graduates from Norwegian education institutions to remain in the country for up to six months to search for jobs.

In order to facilitate the job-seeking process for foreign students, the career planning units within tertiary education institutions need to function at a broader level. Meanwhile, most career planning units provide seminars and trainings on how to write CV and application, how to search jobs from job databases, but mostly in Norwegian (OECD, 2002). Some of the careers planning units serve as a meeting place between graduates and potential employers. In a way, the units become a platform solely for Norwegian-speaking students and employers. To a broader extent, career planning units can foster communication between foreign students and potential employers by organizing events not only for Norwegian-speaking students, but also for non-Norwegian students. There are few career services outside tertiary education institutions. The proposed internship policy in the previous section will also serve as a strong attraction to the foreign students. By making the internship program as a competitive advantage of the tertiary education system in Norway, foreign students will not only be able to receive wages during internship to offset the high living costs, but will also gain invaluable working experience. The relevant working experience will provide support and enhance foreign students' learning process as well as groom them to be experienced job seekers after graduation.

Policy Analysis

We use three measures to assess the changes from the implementation of three proposed policies. These measures are performance analysis, absolute number change, and cost-effectiveness analysis.

Fig. 8 shows that the proposed policies will increase university enrollments of age group 19 to 29 by 1.33% in 2050 as compared to the base run. With online tertiary education participation of age group 30 to 35, domestic skilled labor force will also be lifted 2.48% in 2050.

By 2050, domestic skilled labor will be 158,000 higher than in the base run. The three policies will also help fill an additional 225,000 skilled job vacancies. It will cost the government NOK 299,000 for each domestic skilled labor produced and NOK 209,000 per skilled job vacancy filled.

Fig. 9 shows the development of skilled labor supply and demand after the implementation of the three recommended policies. The gap stops widening and is reduced by 35% in 2050.

	Performance Analysis (MAPE)
Total University Students_19 to 29	1.33%
Domestic Skilled LF	2.48%
Skilled Labor Shortage	34.51%

	Changes in Absolute Numbers (people)
Domestic Skilled LF	158000
Skilled Labor Shortage	225000

	Cost-Effectiveness Analysis (CEA) (NOK/people)
Domestic Skilled LF	299000
Skilled Labor Shortage	209000

Figure 8 List of changes from recommended policy implementation with different measures

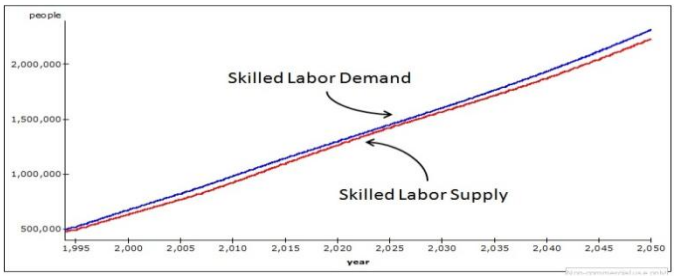

Figure 9 Skilled Labor Supply and Demand: after the implementation of proposed policies

Implementation

These new policy implementations will likely bring forth resistance. It requires consensus of policy makers on objectives setting, budget allocation, and alignment of new policies to political ideology. Support from public is also essential as they need to understand the dynamic of the problem, the need to invest the time and money to solve the problem, and their attitude in reception of foreigners into the country. Finally, both policy makers and public need to under stand the delays involved before the effect of the new policies shows.

References

Donella, Meadows, "The Unavoidable A Priori," in *Elements of the System Dynamics Method, ed.* Jørgen Randers (Waltham, MA: Pegagus Communications, 1980), 488

K.G. Salvanes and S.E. Førre, "Effects on Employment of Trade and Technical Change: Evidence from Norway," *Economica* 70(2003): 293-329, accessed on 09-07-2010 from http://www.jstor.org/stable/3548849

K. Linquist & T. Skjerpen, "Exploring the Change in Skill Structure of Labour Demand in Norwegian Manufacturing," (Norway: Statistics Norway, 2003).
Kåre Hagelund, "Productivity growth in Norway 1948 – 2008," (Norges Bank,2009).
Malcom Coco, "Internship: A Try Before you Buy Arrangement", *S.A.M. Advance Management Journal 65* (2003): 41-45.
Michael B Tannen, "The Investment Motive for Attending College," *Industrial and Labor Relations Review, 31*(United States: Cornell University, 1978), 489-497.
OECD, Thematic Review on Adult Learning: Norway, (Organization for Economic Co-operation & Development, 2000).
OECD, International Mobility of the Highly-Skilled-Policy Brief, (Organization for Economic Co-operation & Development, 2002).
OECD, Ageing and Employment Policies: Norway, (Organization for Economic Co-operation & Development, 2004).
OECD, Thematic Review of Tertiary Education: Country Background Report for Norway, (Organization for Economic Co-operation & Development, 2005).
OECD, OECD Education at a Glance: 2009, (Organization for Economic Co-operation & Development, 2009).
OECD, Unemployment Rate, *Organization for Economic Co-operation & Development*, OECD StatExtracts (2010a), accessed on 16-11-2010, http://stats.oecd.org/BrandedView.aspx?oecd_bv_id=lfs-data-en&doi=data-00288-en.
OECD, *Organization for Economic Co-operation & Development*, OECD StatExtracts (2010b), accessed on 16-11-2010. http://www.oecd-ilibrary.org/content/table/20755120-table3
R. Bjørnstad et al., "Past and Future Changes in the Structure of Wages and Skills," cited in *OECD* (2004), (2002): 9.
R. Divine et al., "Required Internship Programs in Marketing: Benefits, Challenges and Determinants of Fit," *Marketing Education Review* 17 (2007).
Statistics Norway, "Wages and Labour Costs," (2010a), accessed on 16-11-2010, http://statbank.ssb.no/statistikkbanken/Default_FR.asp?PXSid=0&nvl=true&PLanguage=1&tilside=selecttable/MenuSelS.asp&SubjectCode=06.
Statistics Norway, "Total Women Fertility Rate," (2010b), accessed on 16-11-2010, http://statbank.ssb.no/statistikkbanken/Default_FR.asp?PXSid=0&nvl=true&PLanguage=1&tilside=selecttable/MenuSelS.asp&SubjectCode=02.
Statistics Norway, "Life Expectancy for Males and Females," (2010c), accessed on 16-11-2010, http://www.ssb.no/english/subjects/02/02/10/dode_en/fig-2010-04-15-01-en.gif.
Trendle, Bernard, "Skilled Labour Shortages-definition, cause and implications," Working Paper No. 54, (Australia: Queensland Government, Labour Market Research Unit-Department of Education, 2008), accessed on 03-06-2010 from http://www.training.qld.gov.au/resources/employers/pdf/wp54-skill-labour-shortages.pdf(2008).
UDI, "Facts and figures 2008", (The Norwegian Directorate of Immigration) , accessed on 20-05-2009 from http://www.udi.no/upload/Pub/Aasrapport/2008/UDI%20Tall%20og%20fakta_eng_web.pdf