The Economic Impacts of Brain Drain in Iran

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Abstract

For decades, less developed and developing countries are facing brain drain phenomena. The effects of this human phenomenon on the economy of these countries can be unpleasant and slow economic growth. Iran is facing brain drain from many decades ago, and is one of the countries, which has the highest rate of migration of the elite. This study aimed to identify the impact of brain drain on some economic variables in Iran. To this end, the global trade analysis project modeling approach is used for this purpose. Policy shocks in three different scenarios are simulated. The results show that (1) when production factors are can be substituted for each other, brain drain will increase demand and price of all production factors, thus the demand for all endowments has increased; (2) When production factors are complementary, price and demand for unskilled labor and capital decreases and increases the wage of skilled labor; (3) When production factors are complementary, and investment also decreases with the brain drain, price and demand for unskilled labor has decreased in intensity; and (4) Real GDP and Welfare of Iran reduced in all scenarios, which in the third, the real GDP growth has been more than -5% and the welfare losses for Iran is more than $ US 7 billion.

Key Words: Brain Drain, Endowments, Welfare, Real GDP
Introduction
From the very beginning of creation of societies, emigration of individuals has been a subject for debate. But, the emigration of individuals with technical skills or knowledge is a phenomenon that most developing countries face and it deeply concerns them. These countries are struggling first to identify the reasons and second to find what outcomes it causes for them and their fragile economies. In the new era, Iran is one of these countries facing such phenomenon and concerns that it may last and spread out. To identify the reasons, several studies have been conducted (Mahmoudi, 2004), but there have been much debate on the issue of effects. This research, thus, is aimed at recognizing the economic effects of brain drain in Iran.

Problem Statement
Brain drain means the departure or emigration of educated or wealthy individuals, managers and smart people from less developed or developing countries to developed countries. Iran is one of developing countries has been dealing with and suffering from such problem since the first half of the twentieth century. Iranians concern about the negative economic effects of such phenomenon and search for its reasons and its economic effects.

In Iran, brain drain has started and spread out since 1960s and 1970s. In the first decade of Iranian Revolutionary in 1979, a large number of physicians, engineers, university professors, entrepreneurs, graduated students, musicians, movie producers, poets, authors, and technical labor forces, or about two millions people immigrated to western countries and stayed there (Saljughi, 2000). This continued up to the second and the third decades of Revolutionary and each year many of specialists, professors, and genius students emigrate from their homeland to developed countries, especially Western Europe and Northern America.

The flow of brain drain has worried statesmen and people because it politically represents a country as an unpleasant place and shows sovereignty as a weak one. On the other hand, it slows down the drive motor of economy in which human resource is its main accelerator. This fact has drawn governments’ and people’s attention in two sides. First, they desire to find the reasons and second, they like to know its outcomes. For the first
one, many social, political (Saljughi, 1998) and economic (Mahmoudi, 2004, Shah Abadi and Mahmoudi, 2006) studies have been conducted. And accordingly, it can be understood that there are some socio-political, economic, and cultural factors. Several policies have been also made in this regard. However, the least attention has been paid to the effects. In the notion of brain drain, the effects are though concealed (brain drain is like draining a productive land and turning it into an arid one, and undoubtedly it is not useable any more), the effects of such humanistic phenomenon on economy, in Iran in particular, are virtually uncertain. Shahabadi and Pouran (2009), Tayebi et al. (2011) and Khezri (2001) have done some research, but several aspects of economy such as economic growth have been evaluated by mostly unsuitable methods like econometrics. Identifying this gap, this paper is aimed at studying this subject and the outcomes of brain drain to developed countries by Global Trade Analysis Project (GTAP). This question is then posed that if the brain drain has any negative effect on Iran’s economy and in what dimensions and intensity.

**Literature Review**

In world economies in which knowledge is an important issue and a factor of economic growth, brain drain incredibly affects economies of origin and destination. This was studied by Shahabadi and Pouran (2009) by endogenous growth model. They believe that educated and skilled labor may have two ascending outcomes relative to scale resulting from entering human capital to production function and the positive effect of knowledge on production and the growth of productivity. Thus, a reduction in educated labor has had an unpleasant effect on Iran economy. This is while by using a neoclassic model to study the immigration of the brains from 79 developing countries to six developed countries, Tayebi et al. (2011) concluded that brain drain only slowed down the economic growth. Montford (1997) believed that in some cases brain drain might result in economic growth of the origin country (if it increases the average human capital).

Here, to study the effects of brain drain from Iran to developed countries, the neoclassic model and general equilibrium theory are employed. In general equilibrium modeling, skilled and unskilled labor composes two principle groups. The combination these two with other primary factors of production brings about an added value. In the function of
added value, two groups can supplement and substitute each other. This is specified by elasticity of substitution and supplementation of production functions.

Equations (1) and (2) explain the added value of the production technology tree. These equations particularly present the price changes of value added (PVA) and conditional demands for endowments (qfe) in any sector. Here, the coefficient of SAV (i, j, r) is the share of endowment i in total cost of value added of section j in area r. Furthermore, in price variables, pfe (i,j,r), these equations include variables controlling the rate of primary factors of production (by adding technical changes, afe (i,j,r). More obviously, such change is in variable AFE (i,j,r). That is AFE (I,j,r) × QFE (I,j,r) is equal to the effective factor of primary factor of i in section j in area r. Thus, afe (i,j,r) > 0 results in a reduction in the effective price of the primary factor i. Accordingly, this is added to the equation as a reductive value from of pfe (i,j,r) and includes the following effects: 1) the right side of the equation (2) encourages the substitution of production factor i for the other primary production factor; 2) the left side of the equation slopes the demand curve for i (in constant effective prices), and 3) equation (1) makes a reduction in combined value added and consequently increases the use of all primary production factors.

Finally, in the next stage or production of final good, demand for value added and intermediate commodities is shaped by a combination of intermediate commodities and value added (3). As it is assumed that value added and intermediate good are not substitutable, the relative price of this conditional demand is eliminated and we will just have extension effect. There are also three types of technical changes. Ava (j,r) and af (i,j,r) are technical changes of combined factors of value added and intermediate respectively. "ao(j,r)" variable is the technical changes of Hick's Neutral. The needed production factors, equally decreases a particular level of the product. Ultimately, the zero profit condition (5) is considered, which help us to determine the price of the good that this production sector produces.

\[
\begin{align*}
1 & \quad pva_{jr} = \sum_{k\in ENDW} SVA_{kjr} \times [pfe_{kjr} - afe_{kjr}] \\
2 & \quad qfe_{ijr} + af_{ijr} = qva_{jr} - sVA_{j} \times [pfe_{ijr} - afe_{ijr} - pva_{jr}] \\
3 & \quad qva_{jr} + ava_{jr} = qo_{jr} - ao_{ji} \\
4 & \quad qf_{ijr} + af_{ijr} = qo_{jr} - ao_{jr} \\
5 & \quad VOA_{jr} * [ps_{jr} + ao_{jr}] = \sum_{i \in ENDW, prod} VFA_{ijr} * [pfe_{ijr} -]
\end{align*}
\]
To sum up, the emigrated labor reduces the national wealth, the productivity capacity of origin country, and if the skilled and unskilled labor are substitute, the demand for unskilled labor will decrease, and finally the wage for both groups of skilled and unskilled labors. On the other hand, when skilled labor leaves his/her homeland, an increase in demand or a reduction in supply will raise wages; substitution of unskilled labors will raise their wages as well. The cross-price effects of the departure of skilled workers will lower the wage of supplementary jobs because demand for products of them decreases.

When firms reduce their capital, demand for labor complementing the capital goes down. In supply and demand curves, a reduction in capital reserve shifts down the demand curve for all types of skills and helps decreasing the wage.

As said before, brain drain has various effects on demand for labor, investment, wage and interest rate. Here, the general equilibrium theory is used to analyze the effects of immigration on wages. Wages of labor of any kind in labor market depend on its correlation with other kinds of labor and particularly on correlation with changes in investment in capital good.

Any changes in supply and demand of labor will change the wage, consumption, and Iranian well-being. All these are shown by the general equilibrium model. Here, the effects of brain drain on Iran’s economy are simulated in a general equilibrium model. As CGE has two types of skilled and unskilled labors, the analysis is fairly limited. Furthermore, the model is focused on simplified hypotheses in which immigration is considered just for skilled labor while both groups emigrate to West.

Research Methodology

In this research general equilibrium project of global trade analyses is used. Here, an aggregation of $3 \times 10$ (three regions and ten industries) is created with a version having skilled and unskilled labor and capital. In this data aggregation, all world countries are divided into three groups: Iran, developed countries which are the destination for immigrants (20 countries which are mostly the destination of Iranian immigrants) and all
countries of region 3 which are not placed in regions 1 and 2. In aggregation of economic sections, 57 goods and services groups are categorized into 10 predefined categories. In aggregation of $qfe$, all five production factors are put into three new classes of skilled labor, unskilled labor and capital, including land, natural resources. Now with the new version, policy simulation of brain drain is carried out with two scenarios of decreasing Iran’s skilled labor (with states by which substitution elasticity is changed) and the third scenario in which there is supplementary factors of production and decreases along with supply of skilled labor:

These three experiences are as follows:

- Simulation of 5% reduction in supplying skilled labor in Iran with this assumption that production factors are substitutable
- Simulation of 5% reduction in supplying skillful labor in Iran with this assumption that production factors are complement of each other
- Simulation of 5% reduction in supplying skillful labor and 6% reduction in supplying capital with this assumption that production factors are complement of each other

In all above scenarios, supply goes up by 0.00741% in destined countries and the same percent goes down in supply of skilled labor in origin country, Iran. Additionally, emigrated skilled labor is regarded as unskilled in destination and because of being smaller in number comparing with the destined countries’ labors does not have a significant effect on the economy. In all three scenarios, GRAG’s multi-stage method is employed. Data are of the version of GTAPAgg 8.02.

1. In the first scenario, when substitution elasticity of production factors is assumed to change into 12 (ESUBVA), production factors in all industries can easily substitute for each other (elasticity changes in all section excluding CGDS).
2. In the second and the third scenario, a new parameter file was defined and when substitution elasticity decreases, these two versions explain that production factors are complement of each other (elasticity was defined at 0.2).

**Results**

Brain drain in Iran has raised the wage of skilled labor in all three scenarios. In the case in which skilled labor complements other factors, brain drain lowers the wage of unskilled labor and the interest rate of capital. However, in the case in which skilled labor complements unskilled labor and the brain drain decreases investment, both significantly lower the wage of skilled labor (see table 1).
Table 1: The brain drain impacts on price of production factors in 3 different scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>pfe</th>
<th>Labor</th>
<th>Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Unskilled</td>
<td>Skilled</td>
</tr>
<tr>
<td>Complementarily</td>
<td>-2.25</td>
<td>23.54</td>
<td>-0.23</td>
</tr>
<tr>
<td>Substitution</td>
<td>0.07</td>
<td>0.53</td>
<td>0.05</td>
</tr>
<tr>
<td>Capital</td>
<td>-15.96</td>
<td>0.36</td>
<td>1.37</td>
</tr>
</tbody>
</table>

Source: Research findings

Brain drain highly influences demand for labor by various economic sectors and their amount of production. In the scenario of production factors being complement of each other without changing the volume of investment, in six economic industries, mostly agriculture and services, demand for skilled labor has risen and in all economic sectors, demand for unskilled labor has sharply fallen (see columns 2 and 3 in table 2). In a case in which production factors substitute for each other, policy shock lowers demand for skilled and unskilled labor in most industries and consequently production decreases as well (see the substitution columns). In another case in which production factors are complement of each other and this is accompanied by brain drain, investment decreases (see capital columns). This is also true for skilled labor demand in most sectors, demand for unskilled labor in all sectors excluding two sectors and production in 8 economic sectors (see table 2).

Table 2: The brain drain impacts on demand for production factors and sectoral production in 3 different scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Complementarily</th>
<th>Substitution</th>
<th>Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factors Sectors</td>
<td>Labor (qfe)</td>
<td>Labor (qfe)</td>
<td>Labor (qfe)</td>
</tr>
<tr>
<td></td>
<td>UnSkil</td>
<td>Skil</td>
<td>UnSkil</td>
</tr>
<tr>
<td>GrainsCrops</td>
<td>0.49</td>
<td>-4.1</td>
<td>0.27</td>
</tr>
<tr>
<td>MeatLstk</td>
<td>0.35</td>
<td>-4.24</td>
<td>0.12</td>
</tr>
<tr>
<td>Extraction</td>
<td>1.17</td>
<td>-3.46</td>
<td>0.75</td>
</tr>
<tr>
<td>ProcFood</td>
<td>0.48</td>
<td>-4.11</td>
<td>0.01</td>
</tr>
<tr>
<td>TextWapp</td>
<td>-0.38</td>
<td>-4.94</td>
<td>-0.91</td>
</tr>
<tr>
<td>LightMnfc</td>
<td>-0.23</td>
<td>-4.79</td>
<td>-0.72</td>
</tr>
<tr>
<td>HeavyMnfc</td>
<td>-0.05</td>
<td>-4.62</td>
<td>-0.55</td>
</tr>
<tr>
<td>Util_Cons</td>
<td>0.06</td>
<td>-4.51</td>
<td>-0.6</td>
</tr>
<tr>
<td>TransComm</td>
<td>0.14</td>
<td>-4.44</td>
<td>-0.32</td>
</tr>
<tr>
<td>OthServices</td>
<td>-0.63</td>
<td>-5.17</td>
<td>-1.86</td>
</tr>
</tbody>
</table>

Source: Research findings

Brain drain has considerable negative effects on macroeconomics variables such as real GDP and welfare. Loss of GDP and welfare in the worst conditions is when production factors complement each other and as a result of a reduction in skilled labor, investment
goes down as well. Such policy shock has significant effects and reduces more than 5% of GDP and welfare (more than $ US million). When production factors substitute for each other, the loss of production and welfare is at the minimum (Table 3).

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>% Changes in real GDP (qgdp)</th>
<th>Changes in EV ($ US million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complementarily</td>
<td>-0.35</td>
<td>-596</td>
</tr>
<tr>
<td>Substitution</td>
<td>-0.3</td>
<td>-460</td>
</tr>
<tr>
<td>Capital</td>
<td>-5.18</td>
<td>-7099</td>
</tr>
</tbody>
</table>

* Equivalent Variation (Welfare)

Source: Research findings

**Conclusion**

A reduction in supply of skilled labor will raise the wage. In such situation, Iranian firms have to substitute unskilled labors for skilled ones. Demand for unskilled labor and the wages will then go up.

When the substitution elasticity of production factors is fairly high, shows that a one-percent change in the price of a production factor, a larger change would be formed in the amount of inversely using that factor. When it is assumed that technologies allow to simply substitute production factors for each other, a reduction in supply of skilled labor will raise the demand for and the price of two other production factors (it is observed in 5 of 10 available industries).

In the second and third cases, as the factors are complement of each other and supply and demand of skilled labor have decreased, firms have to recruit unskilled labors and spend less capital. Thus, demand for unskilled labor and the capital are reduced and consequently there would be a reduction in wage and the interest rate of capital.

While production factors complement each other, a decrease in capital reserve will reduce demand for skilled and unskilled labor and demand curve for both groups of labor will be transferred internally. Comparing with the previous scenario, wage for both groups will be reduced more. In any case, a change in wages is consistent with the theoretical model.

As production resources suffer from a loss, the real GDP is also lowered. When production technology is more flexible, GDP falls less and producers can substitute a
low-priced endowment for another endowment. When these endowments complement each other, real GDP will sharply fall.

References


