

## Article

# The Potential of Absorbing Foreign Agricultural Investment to Improve Food Security in Developing Countries

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**Abstract:** Global food security has been in a severe condition in recent years, especially in developing countries. These countries need sufficient investment to promote their agricultural development. At the same time, the increasing foreign investment in agriculture has aroused widespread concern in the international community. It is controversial whether it is conducive to the host country's agriculture and social development. In order to study whether developing countries can promote food security by absorbing adequate and effective foreign agricultural investment, we use principal component analysis and select 135 countries (regions) as samples to construct an indicator system from three aspects: investment demand, investment environment and investment motivation. We use cross-section data consisting of the values of the most recent year updated for each indicator. The results show that the demand for foreign investment in developing countries is strong, but overall, it does not have much investment appeal and the investment environment is bad. There is a gap between the expectations and realities in societies in each developing country in terms of the introduction of foreign agricultural investment to promote food security. Governance and capacity building should be strengthened to reconcile their investment needs with investors' motives. Meanwhile, more inclusive rules for foreign agricultural investment will help it to play its due role in developing countries.

**Keywords:** foreign agricultural investment; food security; developing countries; comprehensive evaluation

## 1. Introduction

Food security is an important topic of the Sustainable Development Goals agenda [1,2]. It has witnessed remarkable progress during the past several decades [3]. However, due to population growth and climate change, as well as the desire to make high profits, price diktat and monopolization of markets by large corporations and financial funds, the number of undernourished people in developing countries, especially in sub-Saharan Africa, is increasing [4–6]. In these regions, people spend a much higher ratio of their income on food than that of the developed countries [3]. Considering the increasing food needs with limited natural resources, it is a major challenge and also a development priority to promote global food security, especially in developing countries [7].

Agricultural development is meaningful to improving food security, especially for its importance and efficiency to food availability, food accessibility, and food systems stability [8]. However, its role in food security has long been restrained as the share of public spending on agriculture in developing countries has been decreasing [9,10]. For example, Anriquez et al. find that the displacement of government expenditures on public goods by subsidies to private goods hinders farm sector performance in Latin America and large gains are had from a redistribution of rural (and particularly

agricultural) spending [11]. Inadequate investment usually means low productivity and stagnant production [12]. However, the ability of developing countries to fill this gap is limited. The lack of investment has been identified as a key challenge for developing countries to address food crises and ensure food security [12]. In the least developed countries, the large investment gap in infrastructure has led to the inefficiency of agriculture, and lands in these countries are not fully exploited [12]. The CFS (United Nations Committee on World Food Security) requested that the HLPE (High Level Panel of Experts) produce a report on ‘Multi-stakeholder partnerships (MSPs) to Finance and Improve Food Security and Nutrition in the Framework of the 2030 Agenda’ [13]. As a result, many developing countries have begun to introduce foreign agricultural investment in order to increase their agricultural productivity and meet the needs of agricultural development [14].

Therefore, in the past few decades, higher agricultural returns and relatively cheap land have triggered a wave of foreign agricultural investment, and multinational companies have begun to participate in agriculture in developing countries [15]. Nevertheless, it is still controversial in academia whether this kind of investment can really improve food security in developing countries [16]. It is clear that foreign agricultural investment has great potential to support and improve agricultural performance in developing countries [17]. It has promoted technology transfer and increased the yield and quality of agricultural products [18], which, in turn, have enlarged the share of developing countries in global agricultural production and exports [19]. The investment also has created employment opportunities, promoted the growth of farmers’ income [20], met the growing food demand [21], and reduced malnutrition [22]. However, some scholars believe that it is a threat to local small farmers, food security, environmental and socio-economic stability [23–25]. The agricultural investment has led to the marginalization of small farmers, the replacement of local labor, increased food insecurity, and serious environmental pollution problems [14]. In general, agricultural foreign investment involves economic, political, institutional, legal and ethical issues [26]. Its actual effect may be more complicated than reported and needs to be viewed comprehensively [27–29].

In summary, faced with the strong demand for foreign agricultural investment and the controversial investment effect, it is worth studying whether developing countries can absorb sufficient agricultural investment to fill the investment gap, and whether the absorbed foreign agricultural investment can exert positive effects and transform into actual productivity. Based on this, we propose the following research questions: Will foreign agricultural investment flow to developing countries? What are the factors that affect foreign capital inflows? Can the absorbed foreign agricultural investment produce the desired effect? What measures should developing countries take to optimize the effects of foreign agricultural investment and promote investments that are truly beneficial to local people? In addition to the introduction section, we will first review the relevant mainstream foreign direct investment (FDI) theory. In the methodology and data section, we will build an indicator system that illustrates this research issue by comparing developing countries, and globally, in terms of investment environment, investment demand, and investment motivation. In the discussion and implications section, based on the results, we will delve into the dilemma of insufficient agricultural investment in developing countries, illustrate the shortcomings of our research, suggest the direction of research and propose ways to use foreign capital to promote food security. In the conclusion section, we will briefly summarize the conclusions of this paper.

## 2. Theories and Methodology

### 2.1. Theories of FDI

Foreign agricultural investment is a part of FDI. There are a large number of theoretical studies on corporate FDI and its location selection. We quote several influential theories to study the characteristics of international capital flows, as shown in Table 1.

**Table 1.** Theories of foreign direct investment.

Theories	Presenter	The Main Points	Location Selection
Monopolistic Advantage Theory [30]	Hymer (1960)	Monopolistic advantage is the driving force for international direct investment.	Multinational companies choose the host country's location based on competitiveness.
Oligopolistic Reaction Theory [31]	Knickerbocker (1973)	Oligopolistic companies will take any action and other companies will respond.	International direct investment is more likely to flow to markets with different investment environments and countries with developed capital markets and oligopolistic market structures.
International Product Life Cycle Theory [32]	Vernon (1966)	It divides the product life cycle into a new product stage, a maturity stage, and a standardization stage. The latter two stages are suitable for FDI due to the gradual loss of monopolistic advantages.	The source of international direct investment is generally developed countries, and then investment in other developed countries with similar conditions but certain geographical advantages, and then turn to the developing countries.
Comprehensive Advantage Theory [33]	Kojima (1978)	FDI should be judged based on the principle of comparative cost.	FDI should be carried out in turn from industries in which the country is already at or about to be in a disadvantaged position.
Internalization Theory [34,35]	Buckley (1976) and Rugman (1987)	Intermediate products such as technology, knowledge, and management skills are flawed, and enterprises have the driving force to internalize the external market.	International direct investment flows to countries with incomplete markets.
Eclectic Theory of International Production [36]	Dunning (1977)	Companies can engage in FDI only when they have ownership advantages, internalization advantages and location advantages.	Companies are more likely to look for locations that can make full use of intellectual capital to strengthen or complement their core competencies.
Theory of Small-scale Technology [37]	Louis (1983)	The advantages of FDI in developing countries are small-scale manufacturing, local procurement and special products, and close to the market.	Multinational companies in developing countries are suitable to invest in low-income, small-market countries.
Theory of Technological Competence [38]	Cantwell (1989)	In the process of FDI, developing countries have gradually accumulated and improved their technological capabilities, and the investment field has gradually expanded from traditional industries to high-tech industries.	FDI follows the sequence from the surrounding areas to the developing countries to the developed countries.

Note: The content of the table was compiled by the authors based on References [30–38].

In general, multinational companies in developed countries are more inclined to invest in other developed countries. The investment strategies of companies in developing countries are more inclined to invest in neighboring developing countries first, and then gradually transfer to developed countries with enough experience obtained. As for the influencing factors, capital, market, management, and technology are the main factors affecting the selection of investment location. It is worth noting that these theories mainly focus on the non-agricultural sectors. Agricultural investment has the characteristics of high risks, long cycle and high scale economic threshold, thus it is worthwhile to study whether the location selection has different rules.

## 2.2. Methodology and Data

We introduce the push-pull perspective into the analysis of the process of agricultural foreign investment. Whether agricultural foreign investment actually takes place, on the one hand, depends on the “thrust”, that is, the investment motive of the enterprise. In other words, can the company make a profit if it invests in this region? The motivation for companies to invest in host countries generally includes resources, labor, markets, and technology [39]. On the other hand, it depends on the “pull”, that is, the demand for foreign capital in the host country, including promotion of food production, technology transfer and employment [40]. The demand can also be interpreted as the inherent needs of agricultural development in developing countries. In addition, whether an investment occurs depends on the “intermediate factor”, namely, the investment environment of the host country [41]. Before investing, enterprises will consider the impact of investment environment factors. Therefore, we construct an indicator system from three aspects: investment demand, investment motivation and investment environment.

### 2.2.1. Indicators for Measuring Investment Demand

The most important need for developing countries to introduce foreign agricultural investment is to guarantee national food security. From the perspective of factors affecting food security, food security can be roughly divided into four dimensions, namely food supply, food accessibility, food availability and food systems stability. We select the following variables to measure the investment needs of countries (Table 2).

(1) Food supply. Food supply plays a decisive role in food security and is a necessary condition to ensure that people have access to adequate food [42]. One of the basic reasons for a country, especially developing countries, to introduce foreign agricultural investment is to meet its food needs and increase food production and food supply. In general, the less abundant a country’s food supply is, the stronger the country’s need to introduce foreign agricultural investment. We use the indicator of Food Supply-Crops Primary Equivalent to measure the food supply of countries.

(2) Agricultural productivity. Food accessibility is one of the sufficient conditions for food security [43]. Producing food is an important way to obtain food. In general, the lower the food productivity of a country, the less secure food supply, and the greater the need to introduce foreign agricultural investment. We use the indicator of agriculture value added per worker to measure agricultural productivity in countries.

(3) Per capita capital stock. Another way to access food is to buy food through market transactions, which depends on people’s purchasing power [44]. Per capita capital stock is an important indicator of purchasing power. Generally speaking, the lower the per capita capital stock of a country, the weaker the ability to obtain food, the less secure food security, and the stronger the demand for foreign investment in agriculture. We use GDP per capita to measure the per capita capital stock of each country.

(4) The level of economic and social development. Food availability and food systems stability are also important dimensions of food security [45], and it is related to the level of development of a country. If a country’s economic development level is low, the food produced and obtained will not be fully utilized. If its level of social development is low, the impact of instability on food security is increased. The inability to fully utilize food and the instability of food security will increase the demand for foreign investment in a country. We use the Human Development Index to comprehensively examine the level of economic and social development in each country.

### 2.2.2. Indicators for Measuring Investment Motivation

Dunning divided the FDI motives into different types such as resource seeking, market seeking, efficiency seeking and strategic asset seeking [39]. Therefore, we will measure the investment motives of the company from the following aspects (Table 2).

(1) Agricultural resources. Rich natural resources are an important material basis and favorable conditions for industrial development. In the process of foreign agricultural investment, cultivated land is an important resource that enterprises value [46]. We use the indicator of arable land (hectares per person) to measure the resource endowments of countries.

(2) Market. Many companies invest in agriculture abroad because of the motivation to circumvent trade barriers and increased market share. Knickerbocker's Oligopolistic Reaction Theory argues that FDI tends to flow to countries with developed capital markets [31]. Countries with larger market sizes are more attractive to corporate investment. We use the indicator of market size to measure the market of countries.

(3) Efficiency. Enterprises engaged in agricultural foreign investment need to hire local labor [47], and the effective matching of labor supply and demand is an important condition for the low-cost expansion of efficiency-seeking enterprises [48]. We use the indicator of labor market efficiency to measure the labor costs of investment.

(4) Agricultural technology. Some enterprises choose developed countries to invest in order to track international advanced technology and improve the technical content of agricultural products [49]. We use the indicator of cereal yield (kg per hectare) to measure the level of agricultural technology in each country.

### 2.2.3. Indicators for Measuring Investment Environment

We select the following variables to comprehensively examine the economic, political, social and legal environment of countries (Table 2).

(1) Stability of the economic environment. FDI enterprises hope to obtain stable economic returns, and the stability of the host country's economic environment is an important factor to consider [50]. We use inflation (GDP deflator) to measure the economic fluctuations of the host country. Generally speaking, the lower the inflation rate of a country, the more favorable the investment environment.

(2) Political and legal environment. Countries with stable political conditions, high-functioning government, and sound legal systems have a better investment environment and will reduce political, legal and social risks in the process of corporate investment [51]. We use The Worldwide Governance Indicators to measure the political and legal environment of countries, including Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Control of Corruption, Regulatory Quality, Rule of Law, Voice and Accountability. In order to facilitate the subsequent calculations, we take the average of these indicators as a general indicator to measure the investment environment of countries.

(3) Institutional conditions. Companies will also take into consideration the institutional conditions of the host country [52]. If the host country protects investors, it will greatly reduce the operational risks of enterprises and attract enterprises to invest. We use the investor protection to measure the institutional conditions of a country's investment.

(4) Infrastructure. The quality of the infrastructure is an important aspect of assessing the host country's investment environment [53], especially the transport infrastructure. If a country's infrastructure is too poor, it will significantly restrict the  $p$  of investment projects. We use the transport infrastructure to measure the quality of infrastructure.

Taking into account the comprehensiveness and accessibility of the data, we hope to choose the value of the most recent year of the indicators as the research period. We use cross-section data consisting of the values of the most recent year updated for each indicator from 135 countries. Since the data year of each indicator is different, some indicator data are only updated to 2013, such as Food Supply-Crops Primary Equivalent, and some indicator data are updated to 2018. The indicators and data sources we selected are shown in Table 2.

**Table 2.** Indicators selection and data sources.

Levels	Variables	Indicators	Data Sources	Year of Data
Host country's investment demand	Food supply	Food Supply-Crops Primary Equivalent	FAO	2013
	Agricultural productivity	Agriculture value added per worker	World Bank	2018
	Per capita capital stock	GDP per capita	World Bank	2018
	Economic and social development level	Human Development Index	UNDP Human Development Report	2018
Corporate investment motivation	Agricultural resources	Arable land (hectares per person)	World Bank	2016
	Market	Market size	The Global Competitiveness Report	2018
	Effectiveness	Labor market efficiency	The Global Competitiveness Report	2018
	Technology	Cereal yield (kg per hectare)	FAO	2018
Host country's investment environment	Economic stability	Inflation, GDP deflator	World Bank	2018
	Political and legal environment	The Worldwide Governance Indicators	World Bank	2018
	Institutional condition	Investor protection	The Global Competitiveness Report	2018
	Infrastructure	Transport infrastructure	The Global Competitiveness Report	2018

## 2.2.4. Methodology

We use SPSS22.0 software for principal component analysis to assess the investment demand, investment environment and investment motivation of countries.

### Principal Component Analysis

Principal component analysis can reduce the dimensionality of the data set while maintaining the feature of the largest variance contribution [54], which is often used for comprehensive evaluation. The analysis uses the data to obtain the weight of each index in the comprehensive score, reflecting the objectivity and fairness of the comprehensive evaluation. Since the indicators have different influence directions on the evaluation results, we use the method of standard deviation to convert the negative indicators into positive indicators before the analysis and then we started the principal component analysis. The steps are as follows.

The first step is the standardized processing of raw data. We use the formula (1) to standardize the evaluation indicators.

$$zx_{ij} = (x_{ij}^* - \bar{x}_j) / S_j \quad (1)$$

where  $zx_{ij}$  represents the value of the raw data of the  $j$ th indicator in the  $i$ th sample after normalization,  $x_{ij}^*$  is the raw value of the  $j$ th indicator in the  $i$ th sample,  $\bar{x}_j$  is the mean of the raw values of the  $j$ th indicator,  $S_j$  is the standard deviation of the raw value of the  $j$ th indicator.

The second step is to determine the number of principal components. When the cumulative contribution ratio of variance is greater than 80%, the number of principal components  $p$  is determined, and the cumulative contribution ratio of variance is determined by Equation (2).

$$\alpha = \sum_{i=1}^p \alpha_i / \sum_{i=1}^m \alpha_i \quad (2)$$

In the formula,  $\alpha$  is the variance cumulative contribution rate,  $p$  is the number of the principal components,  $m$  is the total number of indicators, and  $\alpha_i$  is the variance contribution rate of the  $i$ th indicator.

In the third step, the principal component score is calculated. First, the eigenvector of the principal component is determined using Equation (3)



$$e_{ij} = \frac{a_{ij}}{\sqrt{\lambda_i}} \quad (3)$$

where  $a_{ij}$  represents the load coefficient of the  $i$ th principal component of the  $j$ th indicator in the principal component load matrix before rotation,  $\lambda_i$  represents the eigenvalue of the  $i$ th principal component, and  $e_{ij}$  represents the value corresponding to the normalized orthogonal vector. From this, an expression for each principal component score can be derived, as in Equation (4).

$$F_i = \sum_{j=1}^m e_{ij} z x_{ij} \quad (4)$$

In the formula,  $F_i$  is the  $i$ th principal component score,  $e_{ij}$  represents the value corresponding to the normalized orthogonal vector, and  $z x_{ij}$  represents the value of the raw data of the  $j$ th indicator in the  $i$ th sample after normalization processing, and  $m$  is the number of indicators.

In the fourth step, the weights of the principal components are calculated. The calculation formula is as shown in Equation (5).

$$\omega_i = \frac{\lambda_i}{\sum_{i=1}^p \lambda_i} \quad (5)$$

In the formula,  $\lambda_i$  represents the eigenvalue of the  $i$ th principal component,  $\omega_i$  represents the weight of the  $i$ th principal component, and  $p$  is the number of the principal components.

In the fifth step, the principal component comprehensive score is calculated. The formula for calculating the principal component comprehensive score is Equation (6).

$$F = \sum_{i=1}^p \omega_i F_i \quad (6)$$

where  $F$  is the comprehensive score,  $\omega_i$  is the weight of the  $i$ th principal component,  $F_i$  is the  $i$ th principal component score, and  $p$  is the number of the principal components.

### Spearman Correlation Analysis

Spearman correlation coefficient, also known as rank correlation coefficient, is a linear correlation analysis using the rank of two variables. It does not require the distribution of the original variables and has a wider scope than other correlation analysis and can effectively reveal the correlation between variables [55]. After conducting the principal component analysis, we use Spearman correlation analysis to obtain the correlation and regularity between the investment demand score, investment attractiveness score, and investment environment score, and then form the results and inspiration.

## 3. Results

### 3.1. Single Dimension Feature

#### 3.1.1. Investment Demand

In terms of the demand for foreign agricultural investment, we comprehensively examined the needs of countries in ensuring food security, and listed the 20 countries with the strongest demand for introducing foreign agricultural investment, as shown in Table 3.

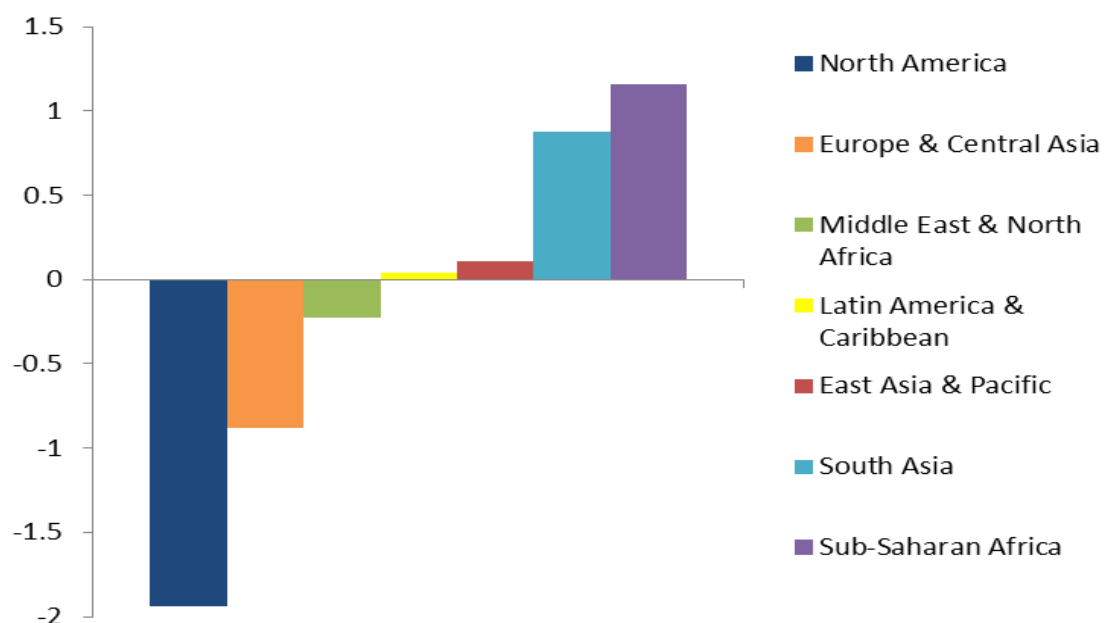
It can be seen that among the top 20 countries which are in great need of introducing foreign agricultural investment, most are African countries. Agricultural investment demand is the strongest, especially in countries such as Chad, Liberia, Ethiopia, Madagascar, Mozambique, etc. This is closely related to the current food insecurity and malnutrition in Africa. According to the recent Food Security and Nutrition Status 2019 Report released by FAO, in 2018, the number of undernourished people is estimated to have increased to 822 million [2]. The situation in most regions of Africa is deteriorating. African countries are in urgent need to introduce foreign agricultural investment to improve the level

of agricultural technology, cope with the problems caused by extreme weather and climate change, and alleviate the current situation of malnutrition.

**Table 3.** Rankings and scores of investment demand.

Rankings	Countries	Scores	Rankings	Countries	Scores
1	Chad	1.92	11	Malawi	1.46
2	Ethiopia	1.71	12	Zimbabwe	1.44
3	Liberia	1.66	13	Rwanda	1.43
4	Madagascar	1.64	14	Guinea	1.33
5	Mozambique	1.64	15	Burkina Faso	1.28
6	Yemen	1.64	16	Senegal	1.28
7	Sierra Leone	1.56	17	Swaziland	1.28
8	Uganda	1.55	18	Gambia	1.27
9	Zambia	1.53	19	Timor-Leste	1.25
10	Tanzania	1.47	20	Congo	1.23

In order to investigate the needs of foreign agricultural investment in various regions, we classified the 135 countries by region (according to the World Bank's regional classification criteria) and obtained the average investment demand scores, as shown in Figure 1.



**Figure 1.** Average scores of investment demand by region.

As can be seen from Figure 1, the demand for the introduction of foreign agricultural investment is related to the level of economic development. It is more difficult for sub-Saharan Africa and South Asia to guarantee food security from food supply, food accessibility, food availability and food systems stability. Decision-makers in these regions hope to expand agricultural production and promote the transfer of agricultural technology through the introduction of foreign capital, and the demand for introducing foreign agricultural investment is significantly higher than in other regions. The performance of agricultural development in Europe and Central Asia, and North America is good, the national food security is guaranteed, and the demand for introducing foreign agricultural investment is relatively low.



### 3.1.2. Investment Environment

Taking into account the economic, political, social and legal environment of countries, the top 20 countries with the most favorable investment environment are displayed in Table 4, and the countries with the worst investment environment are shown in Table 5.

**Table 4.** Rankings and scores of countries with the best investment environment.

Rankings	Countries	Scores	Rankings	Countries	Scores
1	New Zealand	1.78	11	Ireland	1.34
2	Canada	1.7	12	United States of America	1.33
3	United Kingdom	1.6	13	Switzerland	1.28
4	Denmark	1.57	14	Norway	1.26
5	Sweden	1.47	15	Spain	1.23
6	Japan	1.45	16	Finland	1.23
7	Malaysia	1.44	17	Austria	1.21
8	Netherlands	1.42	18	Australia	1.15
9	France	1.39	19	United Arab Emirates	1.12
10	Germany	1.34	20	Slovenia	1

**Table 5.** Rankings and scores of countries with the worst investment environment.

Rankings	Countries	Scores	Rankings	Countries	Scores
1	Yemen	−4.04	11	Algeria	−1.07
2	Venezuela	−3.73	12	Sierra Leone	−1.02
3	Congo	−2.44	13	Malawi	−1
4	Zimbabwe	−2.19	14	Gabon	−0.99
5	Argentina	−2.17	15	Ukraine	−0.96
6	Suriname	−1.54	16	Lebanon	−0.89
7	Egypt	−1.44	17	Madagascar	−0.85
8	Ethiopia	−1.42	18	Nigeria	−0.78
9	Iran	−1.3	19	Cameroon	−0.73
10	Chad	−1.23	20	Laos	−0.72

Overall, the investment environment of developed countries is significantly better than that of developing countries. The top 20 countries with the best investment environment are concentrated in Europe, such as United Kingdom, Denmark, Sweden, etc., and North America, such as Canada and United States of America. In addition, a few developed countries in East Asia and Pacific also have good investment environment, such as Japan, New Zealand, and Australia. The countries with the worst investment environment are concentrated in Latin America, such as Venezuela, Argentina, Suriname; Middle East and North Africa, such as Yemen, Egypt, Iran; and Sub-Saharan Africa, such as Congo, Zimbabwe, Ethiopia, etc. It is obvious that the political and economic macroeconomic environment of developed countries is stable, the policies are transparent, the legal system and infrastructure is sound, the political, economic and legal risks of investing in the region are limited, which is conducive to long-term and stable investment returns.

We classified 135 countries by region and obtained the average investment environment scores, as shown in Figure 2. Whether at the national or regional level, the conclusions drawn are basically the same, that is, the investment environment in developed countries and regions is better. The investment environment scores in North America and Europe are much higher than in other regions, while Sub-Saharan Africa, Latin America and Caribbean, and Middle East and North Africa have poor governance and infrastructure, lagging development, and more unstable factors. For example, in the Middle East, due to historical reasons, cultural differences, and internal contradictions, it has been in a state of war for a long time [56], and it is difficult for enterprises to continue to operate if they invest in this region.

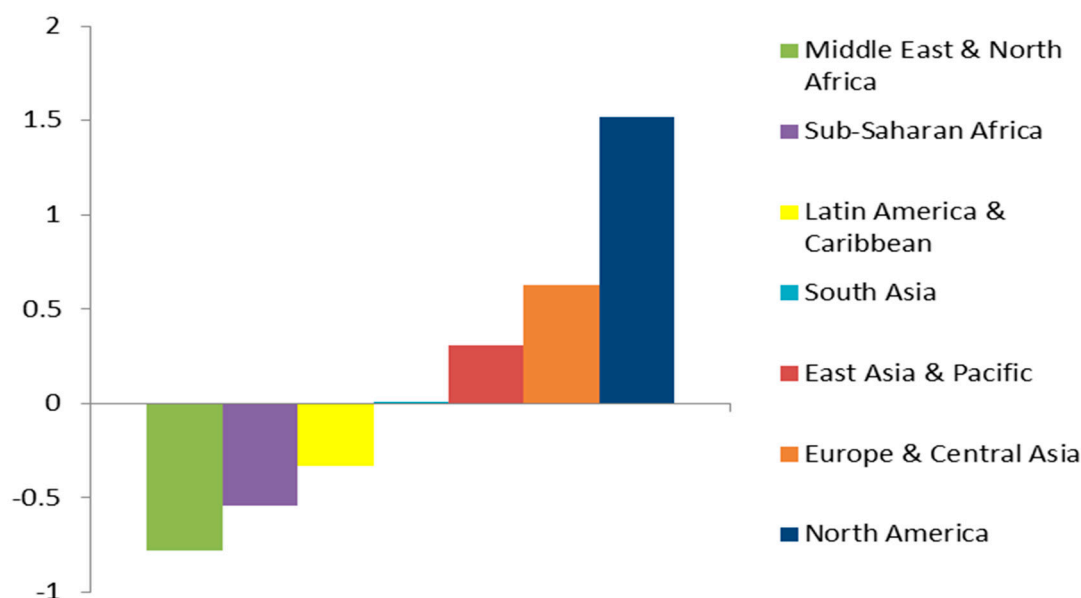


Figure 2. Average scores of investment environment by region.

### 3.1.3. Investment Attractiveness

Countries and regions that can meet corporate investment motives have attractiveness in terms of agricultural resources, labor costs, markets, and technology. Here, we list 20 countries most attractive for investment, as shown in Table 6. The countries with the least investment attractiveness are shown in Table 7.

Table 6. Rankings and scores of countries with investment attractiveness.

Rankings	Countries	Scores	Rankings	Countries	Scores
1	Canada	2.27	11	Russian Federation	1.02
2	Australia	2.24	12	Netherlands	0.94
3	United States of America	2.13	13	Estonia	0.82
4	United Arab Emirates	1.81	14	China	0.74
5	Kazakhstan	1.76	15	Japan	0.73
6	Switzerland	1.49	16	Norway	0.71
7	United Kingdom	1.31	17	Sweden	0.71
8	New Zealand	1.15	18	Finland	0.68
9	Denmark	1.13	19	Ireland	0.67
10	Germany	1.05	20	Azerbaijan	0.63

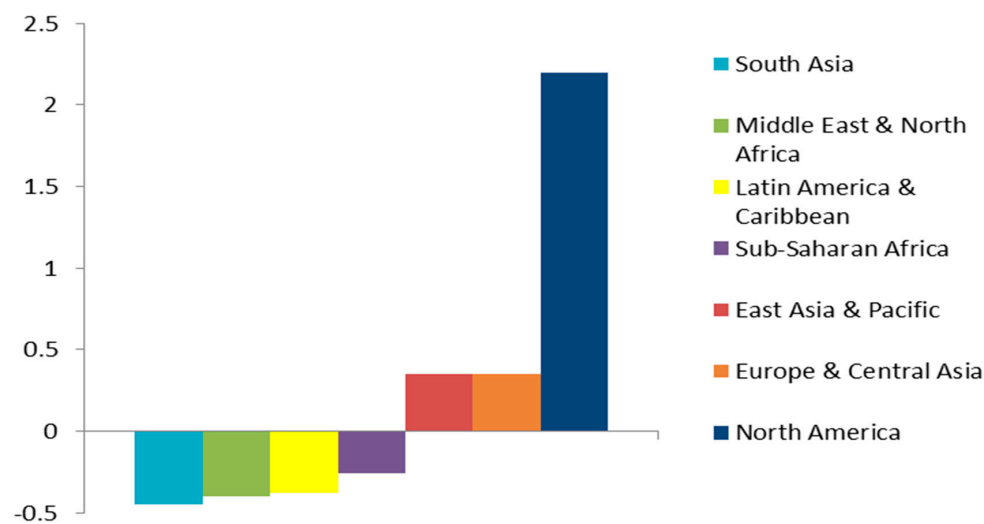
Table 7. Rankings and scores of countries that do not have investment attractiveness.

Rankings	Countries	Scores	Rankings	Countries	Scores
1	Yemen	-1.42	11	Sierra Leone	-0.77
2	Venezuela	-1.29	12	Lesotho	-0.77
3	Mauritania	-1.16	13	Algeria	-0.75
4	Cape Verde	-1.09	14	Suriname	-0.71
5	Tunisia	-0.98	15	Zimbabwe	-0.68
6	El Salvador	-0.9	16	Egypt	-0.66
7	Honduras	-0.9	17	Dominican Republic	-0.66
8	Sri Lanka	-0.85	18	Lebanon	-0.65
9	Ecuador	-0.8	19	Liberia	-0.64
10	Guyana	-0.79	20	Iran	-0.63

Overall, developed countries clearly hold more appeal for foreign agricultural investment. The top 20 countries most attractive for investment are mainly in Europe, such as Switzerland, Russian Federation, United Kingdom, etc., and North America, such as Canada and United States of America.

In addition, a few developed countries in East Asia and Pacific, such as New Zealand and Australia, also have investment attractiveness. The least attractive countries are concentrated in Latin America, such as Venezuela, Honduras, El Salvador, etc.; Middle East and North Africa, such as Yemen and Tunisia; and Sub-Saharan Africa, such as Mauritania, Cape Verde, Sierra Leone. It is clear that developed countries have more advantages in land resources and technology, where the level of economic development is higher, the market scale is larger, and the labor market is more efficient, which can meet the main investment motives of enterprises.

We classified 135 countries and obtained the average score of investment attractiveness, as shown in Figure 3. Similar to the conclusion of the investment environment, developed countries and regions are more attractive for foreign agricultural investment, both at the national and regional levels. The investment attraction score in North America is much higher than in other regions, and the average investment attraction score in Europe and Central Asia, and East Asia and Pacific is also greater than zero. However, Sub-Saharan Africa, Latin America and Caribbean, Middle East and North Africa, and South Asia seem to have less investment attractiveness.



**Figure 3.** Average scores for each region to meet investment motivation.

### 3.2. Correlation Analysis

#### 3.2.1. Investment Demand and Investment Environment

According to the results of Spearman correlation analysis, the investment demand and investment environment are negatively correlated (two-tailed) at a significant level of 0.01, and the correlation coefficient is  $-0.678$ . As shown in Figure 4, at the regional level, countries and regions with investment demand scores greater than zero are concentrated in Sub-Saharan Africa, South Asia, and Latin America, while countries with an investment environment score greater than zero are concentrated in North America, Europe and Central Asia, and East Asia and Pacific. At the national level, Table 3 is compared with Tables 4 and 5 respectively. Among the top 20 countries that are in urgent need to introduce foreign agricultural investment, 8 countries have poor investment environment, including Chad, Congo, Ethiopia, Madagascar, Malawi, Sierra Leone, Yemen, and Zambia, and there is no intersection with the top 20 countries with the best investment environment. The investment environment of countries with strong demand for foreign investment in agriculture is generally worse. Therefore, in terms of investment demand and investment environment, the overall situation presented by developing countries is that the higher investment demand corresponds to a poor investment environment.

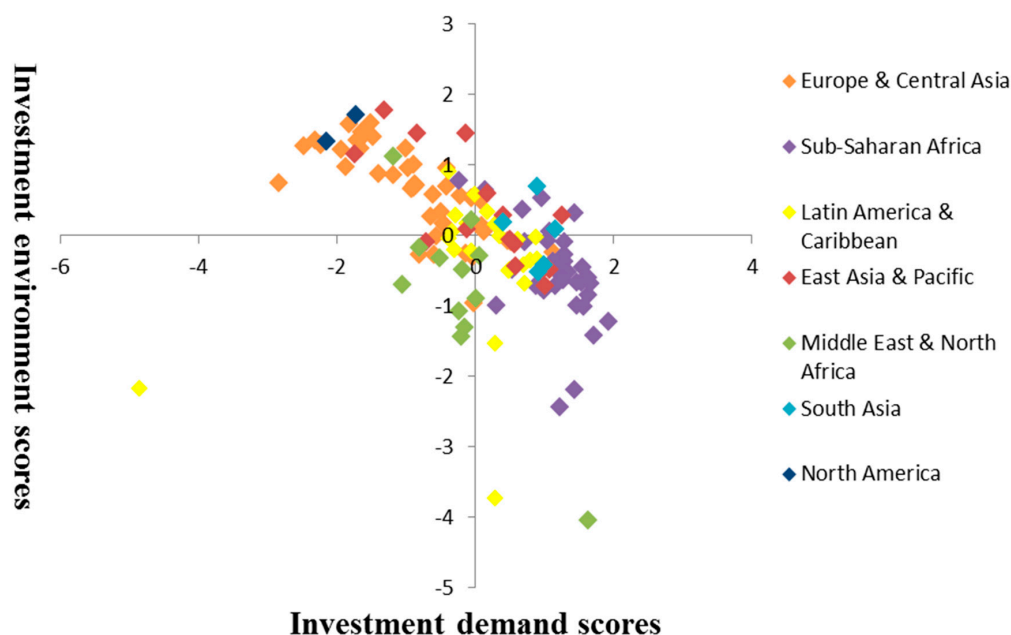


Figure 4. Relationship between investment demand and investment environment.

### 3.2.2. Investment Demand and Investment Attractiveness

According to the results of Spearman correlation analysis, the investment demand and investment attractiveness are negatively correlated (two-tailed) at a significant level of 0.01, and the correlation coefficient is  $-0.515$ . As shown in Figure 5, at the regional level, countries and regions with investment demand scores greater than zero are concentrated in Sub-Saharan Africa, South Asia, and Latin America, while countries with an investment attraction score greater than zero are concentrated in North America, Europe and Central Asia, and East Asia and Pacific. At the national level, Table 3 is compared with Tables 6 and 7. Among the top 20 countries that urgently need to introduce foreign agricultural investment, Sierra Leone, Yemen, Zimbabwe and Liberia are found difficult to meet the investment motives of enterprises in terms of resources, market, labor and technology. At the same time, these 20 countries have no crossover with the top 20 countries with the best investment environment. Therefore, the countries that have strong demand for foreign investment in agriculture do not have investment attractiveness as a whole. It is apparent that in terms of investment demand and investment attractiveness, the overall situation presented by developing countries is that the higher investment demand corresponds to weaker investment attractiveness.

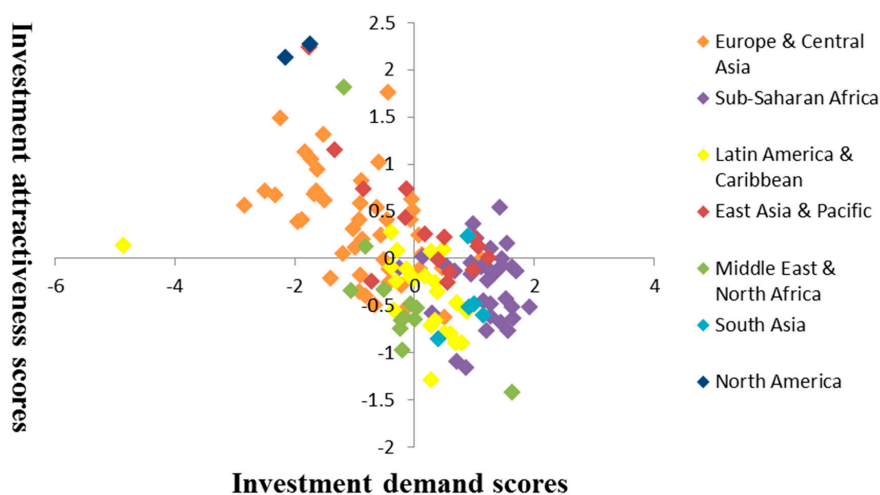


Figure 5. Relationship between investment demand and investment attractiveness.

### 3.2.3. Investment Environment and Investment Attractiveness

According to the results of Spearman correlation analysis, the investment environment and investment attractiveness are positively correlated (two-tailed) at a significant level of 0.01, and the correlation coefficient is 0.631. As shown in Figure 6, at the regional level, countries with investment environment scores and investment attractiveness scores greater than zero are concentrated in North America, Europe and Central Asia, and East Asia and Pacific. At the national level, comparing Table 4 with Table 6, among the top 20 countries with the best investment environment, there are 15 countries with investment attractiveness, including Australia, Canada, Denmark, Finland, Germany, Ireland, Japan, Netherlands, New Zealand, Norway, Sweden, Switzerland, United Arab Emirates, United Kingdom, and United States of America. Comparing Table 5 with Table 7, among the top 20 countries with the worst investment environment, there are 9 countries that do not have investment attractiveness, including Algeria, Egypt, Iran, Lebanon, Sierra Leone, Suriname, Venezuela, Yemen, and Zimbabwe. Therefore, the investment environment in areas that do not have investment attractiveness is generally poor. The overall situation presented by developing countries is that the poor investment environment corresponds to weak investment attractiveness.

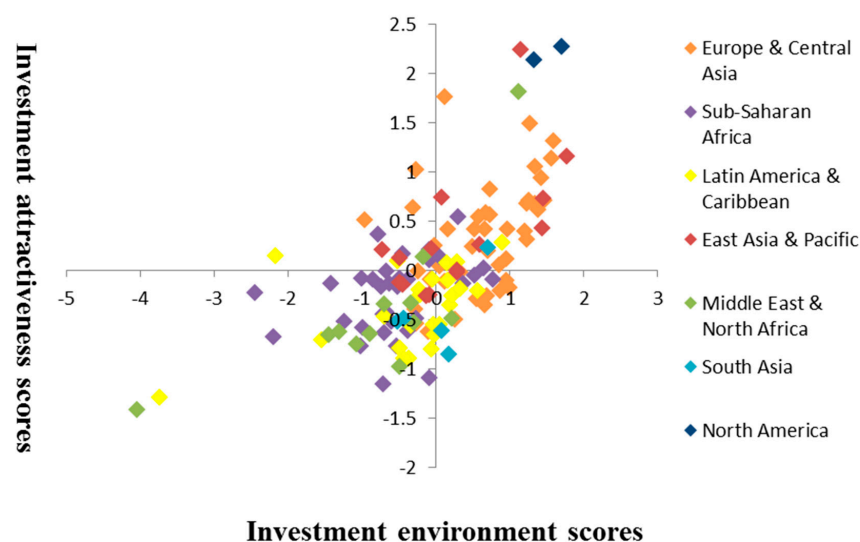


Figure 6. Relationship between investment environment and investment attractiveness.

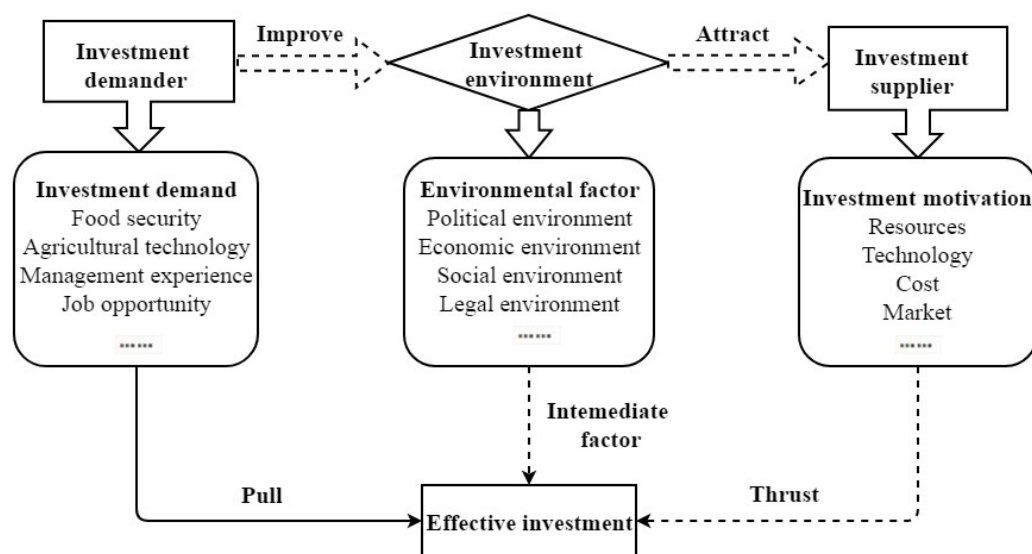
## 4. Discussion and Policy Implications

### 4.1. Discussion

By constructing an indicator system, we have studied whether developing countries can attract enough and effective foreign agricultural investment. In summary, there is still a gap between the ideals of developing countries to promote food security through the absorption of foreign agricultural investment and the actual investment status. As shown in Figure 7, developing countries have strong investment needs. Furthermore, foreign agricultural investment in developing countries has increased compared to the past due to its role in promoting the agricultural growth, employment, and improving the level of agricultural technology [57–59], which creates a “pull” for investors. However, developing countries that have few advantages on market and technology cannot meet the needs of investors. The unfavorable political, economic and legal environment, and other “intermediate environmental barriers” in developing countries have led to deviations in the “thrust” of investors’ motivations, which have hindered the inflow of foreign agricultural investment [60].

Some land in developing countries is in an unutilized state [61], which is still attractive to resource-seeking companies. However, this kind of land resource-oriented agricultural investment is not sustainable and more likely to bring risks [28]. It may bring problems such as the marginalization

of small farmers, people's displacement, environmental pollution, breaking the structure of the local labor market, and vicious competition with local enterprises [23,24,27]. These are also the main reasons of criticism for international agricultural investment [27,29]. Therefore, for developing countries that urgently need to introduce foreign agricultural investment, it is crucial to improve the investment environment and strengthen their own capacity building to increase their attractiveness to investors. This coincides with the recommendation of the CFS to focus on capacity building to promote food security [13]. In addition, how to optimize the current effect of such resource-oriented agricultural investment is an important issue. The 2030 Agenda proposes to encourage multi-stakeholder collaboration, promote the sharing of knowledge, experience, technology and funding to promote the achievement of Sustainable Development Goals in all countries, especially developing countries [13]. Therefore, reconciling the needs of developing countries with the purpose of investors to achieve a win-win situation should be the goal of the effort.



**Figure 7.** Status of introducing foreign agricultural investment in developing countries.

We acknowledge that we are somewhat subjective in the selection of indicators. Some indicators, such as bilateral relations, are also factors influencing the selection of investment location, but these indicators are hard to be quantified, so we have not been able to add them to the indicator system. However, the 12 indicators we selected basically cover most aspects of investment demand, investment environment and investment motivation. In the sample selection, because some countries' data are difficult to obtain, we selected 135 countries as samples, including the world's major regions, and the conclusions obtained are basically consistent with the actual situation, and have certain value and reference.

The analysis in this paper is conducted in a macro way. Due to the particularity of countries in terms of national conditions and policies, future research directions should be concentrated on the case analysis of typical foreign agricultural investment projects. At the same time, the scale, nature and impact of these projects need to be monitored to assess the suitability of policies and legislation at the national or international level.

#### 4.2. Policy Implications

In the long run, it is necessary for developing countries to reconcile their investment needs with investors' investment objectives by improving the investment environment and strengthening capacity building. First, the involvement of the host government to guide investment is necessary. The host country needs to develop a holistic policy framework that aligns foreign agricultural investment with national agricultural development strategies, enabling foreign agricultural investment to flow



to key areas that contribute to food security and poverty alleviation in the host country. Second, developing countries need to improve their regulatory level, enhance policy transparency, improve laws and regulations, and develop a multi-stakeholder participation mechanism for open dialogue with multinational corporations [13]. Third, establish a unified, open, competitive and orderly market system to rationally allocate resources. At the same time, increase the degree of openness to the outside world, provide relevant information on investment needs, and try to avoid information asymmetry between the host country and investors. Finally, the host government should establish and improve infrastructure such as farmland water conservancy, transportation, communication, and energy, while strengthening technical exchanges, encouraging personnel training, and promoting scientific and technological research and development to enhance regional competitiveness.

In the short run, the formulation of international rules for foreign agricultural investment should be more comprehensive. Restrictions can be appropriately liberalized to encourage capital flows to developing countries in order to play its role in improving agricultural productivity and food security. Since developing countries do not have a favorable investment environment, their attractiveness to investors mainly comes from land resources. This highly sensitive land investment model will inevitably attract the attention and criticism of the international community. On the one hand, this investment method that takes over land ownership may cause marginalization of small farmers and displacement of local people [24,27]. On the other hand, the inflow of foreign agricultural investment may cause vicious competition with local enterprises and even form a monopoly, which will increase the dependence of poor countries on transnational corporations [62,63]. Some scholars believe that if the adverse effect is alleviated, global land acquisition will become an unparalleled development opportunity for land-renting countries because foreign agricultural investment brings not only capital, but also technical, management and organizational knowledge [64]. Strengthening FDI inflows is beneficial to the development of agricultural and food industries as well as to economic growth and the maintenance of international competitive positions in developing countries [17]. If the formulation of international investment rules is too strict, it will restrict the inflow of agricultural investment, and the development bottlenecks, such as insufficient production capacity and backward infrastructure, and agricultural technology in developing countries, cannot be effectively solved. For foreign agricultural investment with positive effects greater than negative impacts, an encouraging attitude should be adopted and the focus should be on governance and cooperation.

Under the conditions of poor investment environment in developing countries, it is more important to exert the positive externalities of foreign agricultural investment and improve investment efficiency. On the one hand, the host government needs to guide investment. Some scholars believe that poor land governance and weak institutional capacity in developing countries make many investment projects economically, socially or environmentally unsustainable [65,66]. Therefore, optimizing investment effect requires strengthening land management and institutional development, and increasing public investment to increase smallholder productivity [67]. On the other hand, enterprises should try to avoid large-scale land occupation and give priority to more inclusive investment models, such as joint ventures in the main links of the value chain, contract farming, and technical cooperation, as well as fully considering the local labor force, social status and environmental standards, and paying more attention to the distribution of food and profits. What we hope to see is that the company's investment objectives can be achieved, the investment needs of developing countries are met, and ultimately a win-win result.

## 5. Conclusions

From the overall situation, areas that urgently need to introduce foreign investment in agriculture do not match the areas with investment attractiveness. The regions that need to introduce foreign agricultural investment are mainly in developing countries. The situation of food security in developing countries is severe and foreign agricultural investment is needed. This is consistent with previous research conclusions [68,69]. Some people believe that developing countries are rich in resources and

therefore attractive to investment but question the nature of foreign agricultural investment [70,71]. However, our research shows that developed countries are more attractive to enterprises and more capable of meeting investors' investment motives. The attractiveness of resources from developing countries will be limited by market and technology conditions. In addition, the poor investment environment makes it difficult to attract enough foreign agricultural investment. It is because foreign agricultural investment is important for food security, and on the other hand, it is difficult for developing countries to attract sufficient foreign investment. Therefore, we encourage a more inclusive and open attitude towards foreign agricultural investment in developing countries. At the same time, we also suggest that developing countries should strengthen governance and improve the investment environment to enhance investment attractiveness, so that foreign agricultural investment is truly beneficial to food security and social livelihoods in developing countries.

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