



The 2015 Female Entrepreneurship Index

Analyzing the conditions that foster
high-potential female entrepreneurship in 77 countries

Siri Terjesen and Ainsley Lloyd

The Female Entrepreneurship Index (FEI)

An analysis of the conditions that foster high-potential female entrepreneurship

Produced at the

Global Entrepreneurship and Development Institute

By

Siri Terjesen and Ainsley Lloyd

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We thank Abbigail Knowlton Israelsen for the cover art.
The painting is titled: Prayer, 2014
Gouache, acrylic, graphite, ink on wood

Expert Panel Members

David Audretsch - Professor and Director, Institute for Development Studies, Indiana University

Yasmin Bin-Humam - Consultant, Women, Business and the Law, World Bank

Amanda Elam - CEO, Galaxy Diagnostics

Matthew Gamser - Head, SME Finance Forum/Women's Finance hub, IFC

Connie L. McNeely - Professor of Public Policy and Co-Director, Center for Science and Technology Policy, George Mason University

Shelly Porges - Global Entrepreneurship Advocate, previously, Senior Advisor, Global Women's Business Initiative and Global Entrepreneurship Program, US Department of State

Anastasia de Santos - Economist, Microenterprise and Private Enterprise Promotion Office, USAID

Randy Simmons - President and Director of Research, Strata, and Professor, Utah State University

Joni Simpson - Head, ILO's women's entrepreneurship efforts, ILO

Halla Tómasdóttir - Founder, Sisters Capital; Co-Founder, Audur Capital

Friederike Welter - Professor, Female Entrepreneurship Expert, Siegen University & President, IfM Bonn (SME Research Institute)

Rebecca White - Professor and Director, Entrepreneurship Center, University of Tampa

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About the authors: Siri Terjesen is an Assistant Professor at Indiana University's Kelley School of Business and a Visiting Research Fellow at Lund University, Sweden, and Catalyst. She holds a Bachelors from the University of Richmond, Masters from the Norwegian School of Economics, and PhD from Cranfield. She is an Associate Editor of *Academy of Management Learning & Education* and *Small Business Economics*. Ainsley Lloyd is a researcher at GEDI. She holds a Bachelors from the University of Arizona and a Masters from the Yale School of Forestry and Environmental Studies, and co-authored the 2014 Gender-GEDI Index.

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Abbreviations

FEI: Female Entrepreneurship Index

GEDI: Global Entrepreneurship and Development Institute

GEM: Global Entrepreneurship Monitor

GGGI-WEF: Global Gender Gap Index, World Economic Forum

GID-OECD: Gender, Institutions and Development

ILO: International Labor Organization

IMF: International Monetary Fund

OECD: Organization for Economic Co-operation and Development

TEA: Total Entrepreneurship Activity – the percentage of the working age (18-64) population that are either a nascent entrepreneur or owner-manager of a new business (no more than 42 months old) (from GEM)

UNESCO: United Nations Educational, Scientific and Cultural Organization

WB: World Bank

WBL: Women Business and the Law Database, World Bank

WEF: World Economic Forum

WEO-EIU: Women's Economic Opportunity, Economist Intelligence Unit

Highlights

The 2015 Female Entrepreneurship Index (FEI) analyzes 77 countries—an increase from 30 in 2014; and utilizes an established theoretical framework to measure entrepreneurial environment ecosystem and individual aspirations, and score nations from 0 to 100. Key findings from the 2015 Female Entrepreneurship Index including the following:

- The **United States** ranks first in the world again at 82.9, eight points ahead of 2nd-ranked **Australia** (74.8).
- This year, the **UK, Denmark**, and the **Netherlands** climbed into the top five, displacing **Sweden, France**, and **Germany**. All six of these European countries have strong ecosystems for female entrepreneurs, so even small changes can result in year-to-year rank shifts.
- 47 of 77 nations still score below 50 points – an indication that these countries must pursue significant changes in order to reduce barriers for female entrepreneurs.
- **Chile** outperforms the rest of Latin America and ranks #15 - among the top nations in the world for female entrepreneurship.
- Many Latin American countries experienced large declines over last year; **Colombia, Peru, Venezuela**, and **Panama** all dropped by at least 5 ranks.

In 2015, the top ten countries for female entrepreneurs are:

Table 1.1: The top ten countries for female entrepreneurs

Rank	Country	Score
1	United States	82.9
2	Australia	74.8
3	United Kingdom	70.6
4	Denmark	69.7
5	Netherlands	69.3
6	France	68.8
7	Iceland	68.0
8	Sweden	66.7
9	Finland	66.4
10	Norway	66.3

Global trends:

Improvements in technology transfer and business risk: Aggregating all countries, there has been an 18% improvement in “tech transfer” which captures private sector R&D investments, presence of high-quality research institution, active collaboration in research between universities and industry, and intellectual property rights protection. Also, at the macro-level across all 77 countries, business risk has improved an average of 13% in terms of better availability and reliability of corporate financial information, protection of creditors by law, and institutional support of inter-company transactions.

Increase in female business gazelles: Overall, there has been a 7% increase in the percent of female entrepreneurs who intend to grow their business by 50% and employ 10 people within 5 years.

Female entrepreneurs have higher levels of education: The percent of female entrepreneurs who are highly educated – those that have participated in some form of post-secondary education — has increased 9%.

Female entrepreneurs' innovativeness and participation in the technology sector has decreased:

Innovativeness is measured by the percent of entrepreneurs who report that few businesses offer the same product, and is down 13% among female businesses. More disturbingly, the percentage of female businesses that are in the technology sector has decreased 19%. Taken together with the global increase in tech transfer, this suggests that the use and transfer of technology has increased while the number of businesses producing new technology has decreased.

Improvements are still needed: Despite the progress of these countries, 61% of the countries score below 50 out of 100. **Europe** can improve opportunity recognition—that is, women's ability to recognize good opportunities to start a business in the area in which they live. **Latin American** can improve their export focus and pursue customers who come from outside the country. **Sub-Saharan Africa** can improve women's access to bank accounts and financial training programs. **East Asia** can improve women's perceptions of their skills: that is, that women believe that they possess the required knowledge and skills to start a business.

Introduction

The Female Entrepreneurship Index (FEI) seeks to identify which factors enable the flourishing of high potential female entrepreneurs— women who own and operate businesses that are innovative, market expanding, and export-oriented. Through their entrepreneurial activities, high-potential female entrepreneurs improve their own economic welfare, and contribute to the economic and social fabric of society. The FEI's systematic approach enables cross-country comparison and benchmarking of the gender differentiated conditions that often affect high potential female entrepreneurship development.

As the world's first diagnostic tool for comprehensively identifying and analyzing the conditions that foster high potential female entrepreneurship development, the FEI does not simply measure the quantity of female entrepreneurs— rather FEI focuses on identifying a country's strengths and weaknesses in terms of providing favorable conditions that could lead to high potential female entrepreneurship development. The 2015 FEI contains 77 countries— more than doubles country the coverage over last year's 2014 Gender-GEDI.

Chapter 1. The Importance of Female ‘High Potential’ Entrepreneurs

There is growing appreciation that the conditions that support women’s ability to start and grow ventures may be different from those that help men, and therefore there is a need to examine factors that impact women’s enterprise development (OECD, 2004; Bosma and Levie, 2010). The Female Entrepreneurship Index (FEI) results distill the most important issues for policy makers, governmental officials, and other decision makers who are interested in improving the conditions for high potential female entrepreneurship development.

Early approaches to study female entrepreneurship involved comparisons of individual characteristics of male and female entrepreneurs, e.g., demographics of age and education as well as attitudes and perceptions such as risk aversion, growth ambitions, or self-efficacy (e.g., Sexton and Bowman-Upton, 1990, Fagenson, 1993). Although individual characteristics are important, a pure focus on them can result in an ‘individualistic fallacy’—that is, when one assumes that outcomes at the individual level can only be explained by individual-level characteristics rather than other variables such as those found in the environment.

An emerging body of comparative international entrepreneurship research on female entrepreneurs suggests that many environmental institutions must be considered (Terjesen, Hessels, and Li, 2013; e.g., Verheul, van Stel, and Thurik, 2006). For example, family-related institutions such as greater provision of childcare services and family leave are associated with higher levels of female entrepreneurship (Elam, 2008; Terjesen and Elam, 2012) as women tend to start ventures at a later age (ages 35-40) than men, and must manage work-family conflicts (Shelton, 2006). Furthermore, educational training can help women to build confidence in their business skills and ability to identify entrepreneurial opportunities (OECD, 2004). Levels of female entrepreneurship are also influenced by differences across countries in terms of women’s freedom to work and travel due to traditional family and religious norms (Terjesen and Elam, 2012). Other important institutions which impact female entrepreneurship include equal legal rights, access to education, networks, technology, capital, social norms, values, and expectations. Furthermore, the overall business environment in terms of laws, regulations, and business stability will affect businesses’ ability to thrive and grow.

Datasets such as World Bank’s Global Findex and Women, Business and the Law provide gender-specific data on access to basic financial resources (i.e. ‘access to a bank account’) and equal legal rights. Since 1999, the Global Entrepreneurship Monitor (GEM) compiles annual comparative global data on male and female entrepreneurs (See Reynolds et al., 2005 for a discussion of GEM data and Bosma, 2014 for a summary of GEM research outputs).

One of the critical issues is defining ‘female entrepreneurship’ (Ahl, 2006; Jennings and Brush, 2013). Many studies take a broad approach which includes all female entrepreneurs, ranging from informal petty traders and shopkeepers to high-tech start-ups. Although all forms of female entrepreneurship are important, more sophisticated ventures require additional resources, skills, and aspirations.

Only a very small sub-segment of entrepreneurs are interested in starting rapidly growing businesses; For example, Ernst and Young’s 2011 survey of 80,000 adults in 60 countries, found that only 3 of every 1,000 respondents achieve high growth, as measured by growing five or more jobs in five years. These high impact entrepreneurs tend to have a college education and to start internationally-oriented ventures. A recent Kauffman Foundation (2015) report indicates that high-growth firms’ dynamism is decreasing which could lead to lower levels of economic growth.

It is not easy to determine which entrepreneurs will successfully grow their businesses exponentially (Acs and Mueller, 2008). Rather than focusing on ‘gazelle’ firms that have increased their revenues 20% annually for at least four years, starting from a base of US\$1 million, it may be a more productive strategy to promote a healthy entrepreneurial eco-system that supports a diverse array of ‘high potential’ female-owned firms from which gazelles can grow. We define ‘high potential’ female entrepreneurs as those who exhibit characteristics associated with high growth outcomes but which may currently be an aspiration rather than an achievement. Thus, high potential female entrepreneurs are ‘market expanding, export oriented, innovative’ entrepreneurs (Acs, Szerb, and Autio, 2014).

Women entrepreneurs play a substantial role in growing their economies (Terjesen and Amorós, 2010). When a country does not achieve its full potential, the economy suffers. Fewer 'high potential' female entrepreneurs result in fewer ideas being realized, less innovation, less export potential, and fewer jobs created. Through their entrepreneurial activities, high-potential female entrepreneurs increase their own economic welfare, and also improve the economic and social fabric of society through job creation, innovative products, processes, and services, and cross-border trade.

Chapter 2. Female Entrepreneurship Index Theory and Framework

This chapter summarizes the theory and framework behind the Female Entrepreneurship Index. Appendix 2 contains a detailed description of the methodology and data sources.

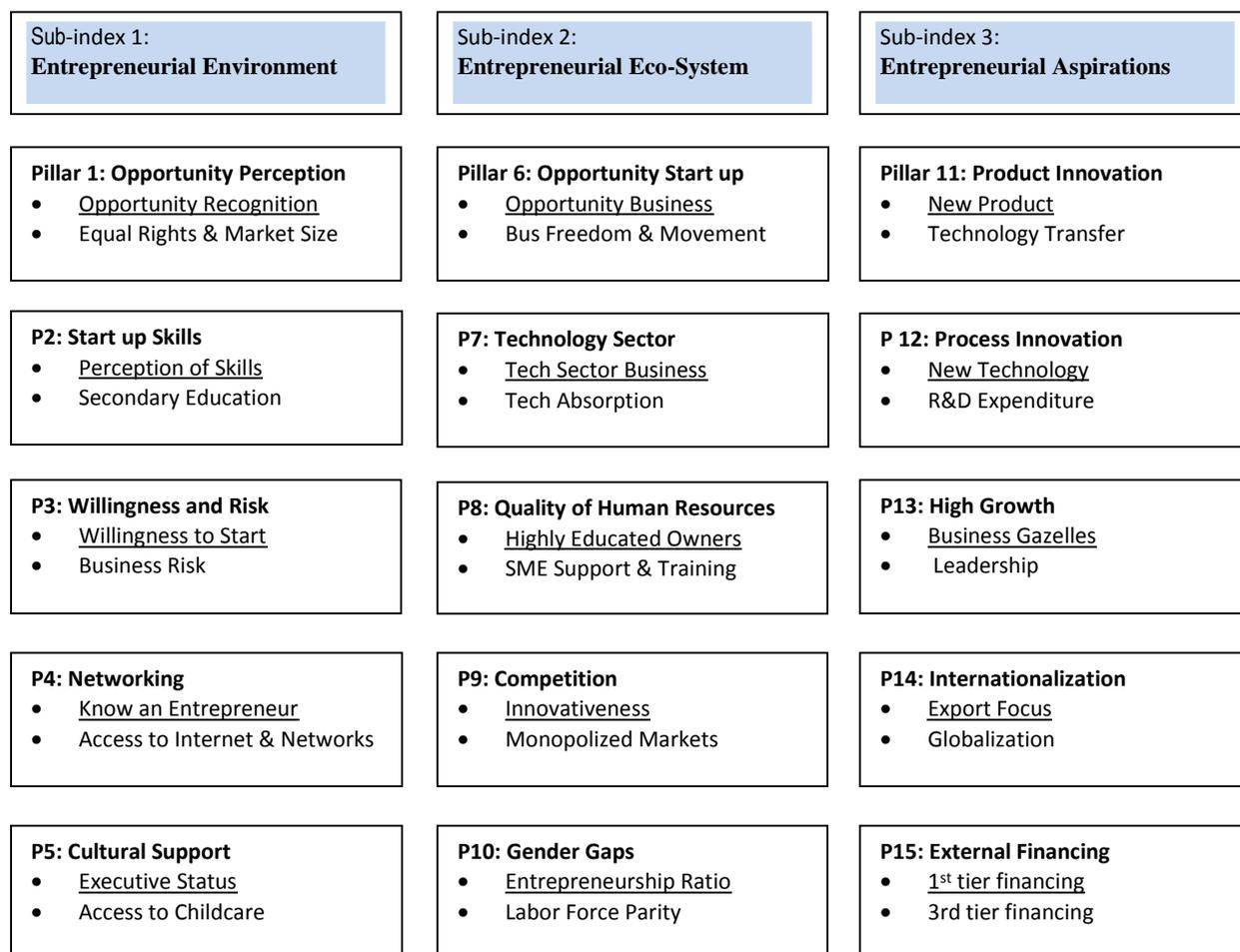
2.1 Theory

The conditions and characteristics that lead to 'high potential' female entrepreneurship occur on multiple levels. Female entrepreneurs, like their male counterparts, are influenced by the general business environment in which they live. There are few incentives for entrepreneurs— male or female— when the general business environment is unstable, and the procedures for starting, running, or exiting a business are highly regulated or bureaucratic. Formal institutions or cultural conditions create additional barriers for women that make it more difficult to start or grow a business enterprise. For example, women may face diminished legal rights (either for all women or with respect to rights that women lose at marriage) or restrictions on their activities outside of the home or on their ability to travel within their communities, outside their communities, or outside the country. In addition, this combination of gendered attitudes, social norms, and beliefs can result in more limited access to resources critical for 'high potential' female entrepreneurship development such as education, skills, and finance.

Attitudes play a crucial role in forming a country's 'entrepreneurial culture' in terms of how the general population views entrepreneurial endeavors, tolerates risk, and judges business ownership as a viable career option. This cultural environment influences individuals' opportunity recognition and willingness to take the risk to start a new venture.

The institutional foundations including gendered institutions, access to resources, and the entrepreneurship culture form the context from which female start-ups emerge. In focusing on 'high potential' female entrepreneurship, we are specifically interested in female start-ups that exhibit characteristics that are related to 'high impact entrepreneurship' which we define as market expanding, innovative, and exporting businesses. There are three sub-indices to the Female Entrepreneurship Index: Entrepreneurial Environment, Entrepreneurial Eco-System, and Entrepreneurial Aspirations. Broadly speaking, Entrepreneurial Environment focuses on assessing the 'entrepreneurial spirit and culture' of a given society as well as the presence of institutions to support entrepreneurial start-ups. The Entrepreneurial Eco-System contains variables that capture the access to resources and institutions needed for female business development. The final sub-index, Entrepreneurial Aspirations, focuses on the individual entrepreneurial characteristics as well as resource availability needed for 'high potential' female entrepreneurship to prosper and contribute to economic growth. These three sub-indices stand on 15 pillars, each of which contains an individual and an institutional variable that corresponds to the micro- and the macro-level aspects of entrepreneurship. Unlike other indices that incorporate only institutional or individual variables, FEI's pillars include *both* individual and institutional variables. These pillars attempt to capture the open-ended nature of entrepreneurship, and can provide an in-depth view of their countries' strengths and weaknesses. The FEI Framework is shown in Figure 2.1 and the 15 pillars are described in detail in Appendix 2.

Figure 2.1: The 2015 Female Entrepreneurship Index Framework



Note: Each pillar contains an individual level indicator (underlined) and an institutional level indicator.

Chapter 3. Female Entrepreneurship Index Results

3.1 Introduction

An index is an ideal tool for simplifying highly complex relationships and distilling them into a final rank of scores for benchmarking progress. The Female Entrepreneurship Index is a barometer of a country's current situation relative to a group of other countries with respect to the conditions present that will fuel high potential female entrepreneurship development. In this way, the FEI is a powerful tool for policy makers and other decision makers in terms of identifying the areas that need improvement in order to foster high potential female entrepreneurship development. However, an index and overall score cannot substitute for a thorough understanding and analysis of a given country's context. The results section provides country and regional comparisons as well as a more detailed discussion of five additional specific issues: women in leadership positions, women's rights and access to resources, access to capital, entrepreneurship crowding, and professional social media networks.

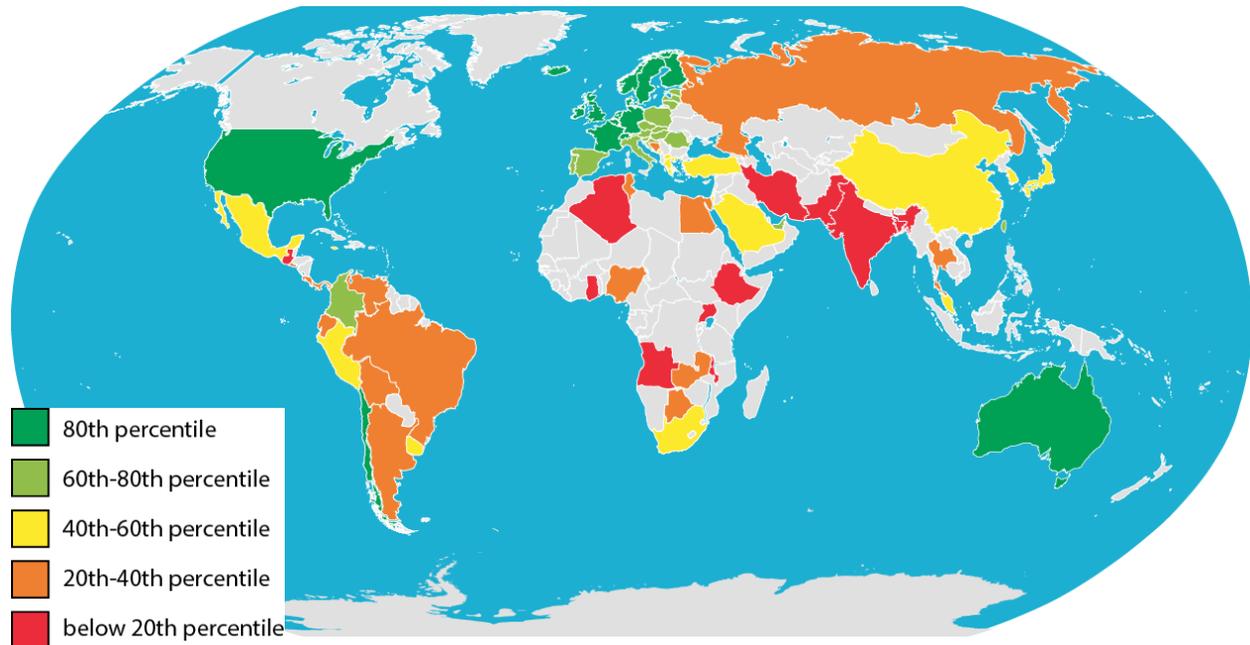
Countries that rank at the top of the FEI still require improvements. Each country is characterized by its unique set of strengths and weaknesses which can be used to chart a course for improvement, for example by using another country's exemplary performance as a starting point for discussion and analysis. Furthermore, a top rank is not a static position, and is subject to the relative performance of other countries. Only countries that actively cultivate gender parity in terms of access to resources and institutions as well as their institutional foundations and entrepreneurial spirit will retain their top positions.

This chapter presents the FEI rankings for the 77-country sample, and then examines two main parts: the 2015 FEI country scores compared to (1) the 2014 Gender-GEDI Index rankings and (2) the Global Entrepreneurship Index rankings. We then present a regional analysis, and conclude with policy implications and future steps.

3.2 The Female Entrepreneurship Index rankings

As shown in Figure 3.1 and Table 3.1, the top ten countries whose institutions support female high-growth entrepreneurs are: (1) United States, (2) Australia, (3) United Kingdom, (4) Denmark, (5) Netherlands, (6) France, (7) Iceland, (8) Sweden, (9) Finland, and (10) Norway.

Figure 3.1: FEI 2015 scores



Key: Color coding ranges from dark green for the highest scoring countries to yellow for middle scoring countries to red for the lowest scoring countries.

Table 3.1: Female Entrepreneurship Index 2015 Ranks and Scores

Rank	Country	Score	Rank	Country	GEI	Rank	Country	GEI
1	United States	82.9	27	United Arab Emirates	52.6	53	Botswana	36.4
2	Australia	74.8	28	Spain	52.5	54	Costa Rica	36.1
3	United Kingdom	70.6	29	Colombia	52.0	55	Argentina	35.7
4	Denmark	69.7	30	Italy	51.4	56	Russia	35.6
5	Netherlands	69.3	31	Croatia	49.9	57	Nigeria	32.8
6	France	68.8	32	Portugal	49.8	58	Ecuador	32.3
7	Iceland	68.0	33	Romania	49.4	59	Bosnia and Herzegovina	31.6
8	Sweden	66.7	34	Israel	47.6	60	Brazil	31.1
9	Finland	66.4	35	Uruguay	44.5	61	Tunisia	30.7
10	Norway	66.3	36	South Africa	44.2	62	El Salvador	29.9
11	Ireland	64.3	37	Montenegro	43.7	63	Bolivia	29.7
12	Switzerland	63.7	38	Peru	43.6	64	Zambia	29.1
13	Belgium	63.6	39	Barbados	43.4	65	Venezuela	29.0
14	Germany	63.6	40	Greece	43.0	66	Egypt	27.7
15	Chile	63.5	41	Mexico	42.8	67	Algeria	27.4
16	Singapore	59.8	42	Macedonia	41.2	68	Angola	26.0
17	Czech Republic	59.1	43	Korea	40.1	69	Ghana	25.8
18	Lithuania	58.5	44	Japan	40.0	70	India	25.3
19	Poland	57.7	45	Turkey	39.3	71	Guatemala	23.2
20	Latvia	56.6	46	Malaysia	39.2	72	Ethiopia	20.9
21	Slovenia	55.9	47	Jamaica	38.6	73	Iran	20.6
22	Estonia	55.4	48	China	38.3	74	Uganda	18.4
23	Austria	54.9	49	Saudi Arabia	37.0	75	Bangladesh	17.9
24	Slovakia	54.8	50	Panama	36.9	76	Malawi	15.5
25	Hungary	53.7	51	Trinidad & Tobago	36.9	77	Pakistan	15.2
26	Taiwan	53.4	52	Thailand	36.6			

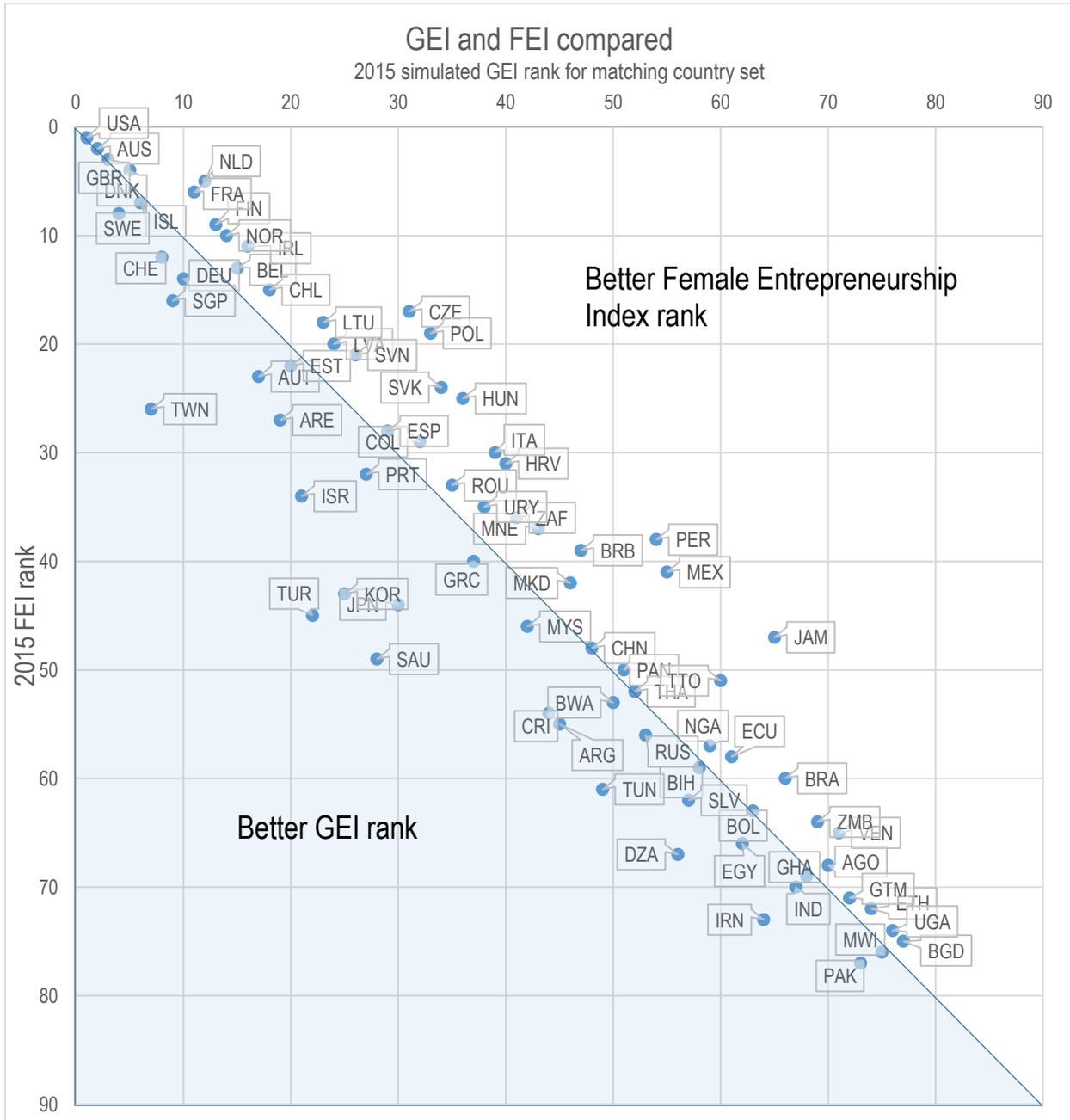
Note: Individual country results at the variable level are in detail in Appendix 1 and 2, and can provide additional country-specific data for each variable.

3.3 Charting the differences: Female Entrepreneurship Index and Global Entrepreneurship Index comparisons

This section compares country ranks of the 2015 FEI ranking and 2015 Global Entrepreneurship Index (GEI) (See Acs, Szerb, and Autio, 2014) ranking in order to gain insights into the possible gendered differences for rankings and scores at the country level. Both the FEI and the GEI are based on the same framework and share some variables; however, the FEI includes 23 gender-specific variables focusing on female entrepreneurs, and the GEI includes only

non-gender specific variables. We simulate GEI and FEI rankings based on our sample of 77 countries in the 2015 FEI. The simulated GEI ranks preserve the order of countries in the full index, eliminating countries that were not included in the FEI to produce a list of how countries would have ranked in the GEI if that index included only the 77 FEI countries.

Figure 3.2: GEI and FEI compared



Source: Female Entrepreneurship Index (2015)

Eastern European nations like the Czech Republic, Poland, Hungary, Slovakia, and Slovenia all have better Female Entrepreneurship Index (FEI) ranks than GEI ranks, indicating that they are particularly strong performers when it

comes to fostering female entrepreneurship. A different pattern emerges among the East Asian nations of Japan, Korea, Taiwan, and Singapore which all have better GEI ranks than FEI ranks, indicating that these nations do better at encouraging entrepreneurship in general than they do at creating the right conditions for entrepreneurship among women.

Some of the biggest entrepreneurship gender inequalities occur in Taiwan, Turkey, and Saudi Arabia, all of which rank approximately 20 places lower on the FEI than they do on the GEI. Jamaica, Peru, and Mexico are all notable for their relatively strong ranking on the FEI compared to the GEI – given the overall conditions in their entrepreneurship ecosystems, these countries do particularly well at creating the right entrepreneurship conditions for female entrepreneurs.

It is also interesting to see if there have been any changes to countries' ranks when comparing the 2014 Gender-GEDI Index and the 2015 Female Entrepreneurship Index.

Figure 3.3: Charting progress: The Gender-GEDI 2014 vs the FEI 2015 rankings compared

2015 matched rank	2014 matched rank	Country	Change in matched rank	2015 matched rank	2014 matched rank	Country	Change in matched rank
1	1	United States	0	36	31	Peru	-5
2	2	Australia	0	37	46	Greece	9
3	5	United Kingdom	2	38	35	Mexico	-3
4	10	Denmark	6	39	40	Macedonia	1
5	6	Netherlands	1	40	41	Korea	1
6	9	France	3	41	45	Japan	4
7	8	Iceland	1	42	44	Turkey	2
8	3	Sweden	-5	43	42	Malaysia	-1
9	12	Finland	3	44	54	Jamaica	10
10	4	Norway	-6	45	39	China	-6
11	16	Ireland	5	46	50	Saudi Arabia	4
12	14	Switzerland	2	47	38	Panama	-9
13	7	Belgium	-6	48	43	Thailand	-5
14	11	Germany	-3	49	48	Costa Rica	-1
15	15	Chile	0	50	49	Argentina	-1
16	13	Singapore	-3	51	47	Russia	-4
17	27	Czech Republic	10	52	53	Nigeria	1
18	21	Lithuania	3	53	56	Ecuador	3
19	20	Poland	1	54	57	Bosnia and Herzegovina	3
20	25	Latvia	5	55	51	Brazil	-4
21	17	Slovenia	-4	56	58	Tunisia	2
22	24	Slovakia	2	57	55	Bolivia	-2
23	23	Hungary	0	58	64	Zambia	6
24	19	Taiwan	-5	59	52	Venezuela	-7
25	26	United Arab Emirates	1	60	62	Egypt	2
26	28	Spain	2	61	59	Algeria	-2
27	22	Colombia	-5	62	63	Angola	1
28	29	Italy	1	63	60	Ghana	-3
29	33	Croatia	4	64	68	India	4
30	37	Portugal	7	65	66	Guatemala	1
31	30	Romania	-1	66	61	Iran	-5
32	18	Israel	-14	67	65	Uganda	-2
33	34	Uruguay	1	68	67	Bangladesh	-1
34	32	South Africa	-2	69	68	Pakistan	-1
35	36	Montenegro	1				

Source: FEI (2015)

The biggest increases over last year occurred in the Czech Republic, Greece, and Jamaica, while Israel and Panama saw the steepest declines. Also, four Latin American countries (Colombia, Peru, Panama, and Venezuela) declined by at least 5 places (while no Latin American countries improved by 5 places).

3.4 Regional Highlights

Next, we examine regional differences in the gender index, including strengths and weaknesses.

Regional ranking			Strongest areas	Weakest areas																																																																																																
<table border="1"> <thead> <tr> <th>East Asia</th> <th>Score</th> <th>Global Rank</th> </tr> </thead> <tbody> <tr> <td>Singapore</td> <td>59.8</td> <td>16</td> </tr> <tr> <td>Taiwan</td> <td>53.4</td> <td>26</td> </tr> <tr> <td>Korea</td> <td>40.1</td> <td>43</td> </tr> <tr> <td>Japan</td> <td>40.0</td> <td>44</td> </tr> <tr> <td>China</td> <td>38.3</td> <td>48</td> </tr> </tbody> </table>			East Asia	Score	Global Rank	Singapore	59.8	16	Taiwan	53.4	26	Korea	40.1	43	Japan	40.0	44	China	38.3	48	<ul style="list-style-type: none"> Market Size Access to Childcare Monopolized Markets R&D Expenditure Business Gazelles 	<ul style="list-style-type: none"> Opportunity Recognition Perception of Skills Willingness to Start 																																																																														
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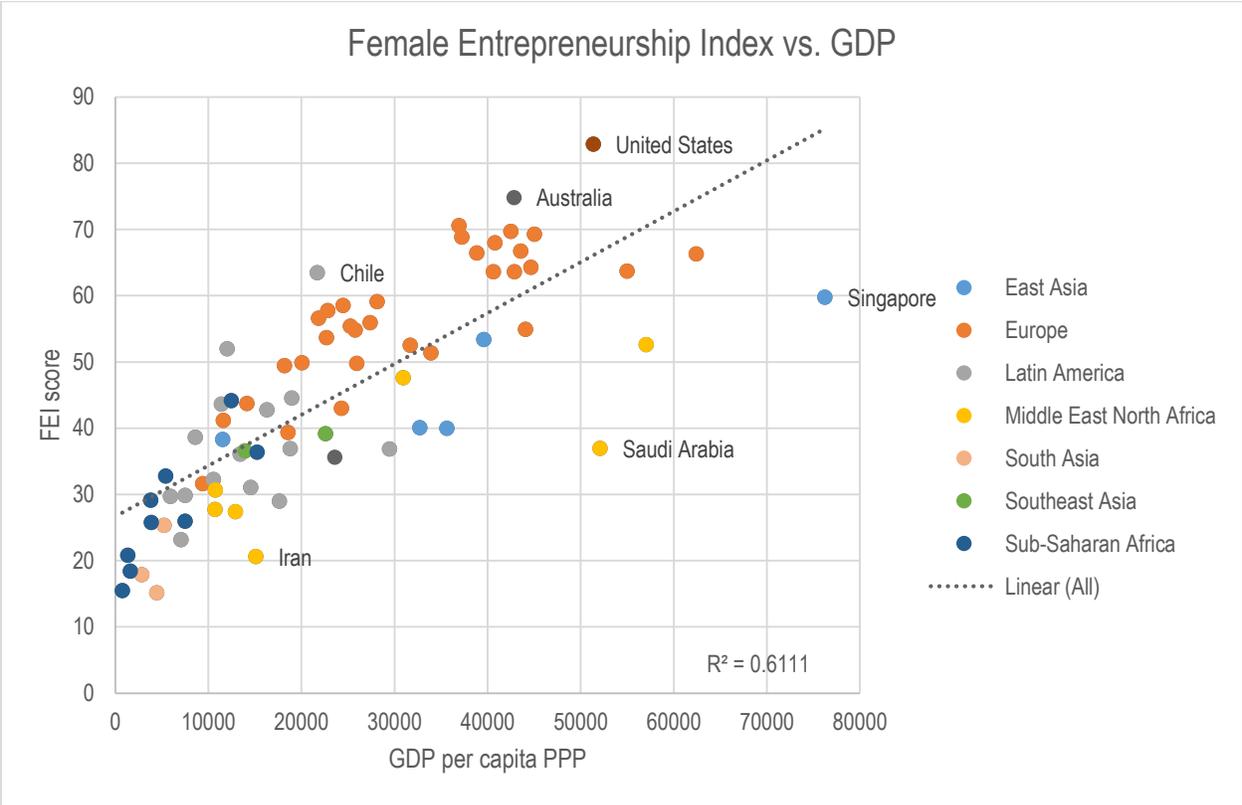
Regional ranking			Strongest areas	Weakest areas
Uruguay	44.5	35	<ul style="list-style-type: none"> Female Leadership 	
Peru	43.6	38		
Barbados	43.4	39		
Mexico	42.8	41		
Jamaica	38.6	47		
Panama	36.9	50		
Trinidad & Tobago	36.9	51		
Costa Rica	36.1	54		
Argentina	35.7	55		
Ecuador	32.3	58		
Brazil	31.1	60		
El Salvador	29.9	62		
Bolivia	29.7	63		
Venezuela	29.0	65		
Guatemala	23.2	71		
MENA	Score	Global Rank	<ul style="list-style-type: none"> Highly Educated Owners New Technology 	<ul style="list-style-type: none"> Executive Status Willingness to Start 1st Tier Finance
United Arab Emirates	52.6	27		
Israel	47.6	34		
Saudi Arabia	37.0	49		
Tunisia	30.7	61		
Egypt	27.7	66		
Algeria	27.4	67		
Iran	20.6	73		
South Asia	Score	Global Rank	<ul style="list-style-type: none"> Innovativeness New Product New Technology 	<ul style="list-style-type: none"> Labor Force Parity 1st Tier Finance
India	25.3	70		
Bangladesh	17.9	75		
Pakistan	15.2	77		
Southeast Asia	Score	Global Rank	<ul style="list-style-type: none"> Opportunity Businesses Technology Transfer 	<ul style="list-style-type: none"> Willingness to Start Tech Sector Businesses
Malaysia	39.2	46		
Thailand	36.6	52		
Sub-Saharan Africa	Score	Global Rank	<ul style="list-style-type: none"> Opportunity Recognition Perception of Skills Know an Entrepreneur 	<ul style="list-style-type: none"> Internet and Networks Tech Sector Businesses R&D Expenditure
South Africa	44.2	36		
Botswana	36.4	53		
Nigeria	32.8	57		
Zambia	29.1	64		
Angola	26.0	68		
Ghana	25.8	69		
Ethiopia	20.9	72		
Uganda	18.4	74		
Malawi	15.5	76		

3.5 Focus Areas: Key issues that affect Female Entrepreneurship Index rankings

At first glance, the FEI results may seem directly linked to a country's economic development and GDP levels. As shown in figure 3.4, the relationship between a country's per capita GDP and the FEI scores is significant, with an R-squared value of 0.61 which means that a variation in GDP per capita explains 61% of the variation in FEI scores.

However, as is evident from the data points both above and below the trend line, a number of countries do not fit this pattern.

Figure 3.4: Higher per capita GDP does not necessarily mean higher FEI 2015 scores



Source: Female Entrepreneurship Index (2015)

Chile, Australia, and the United States stand out as countries that have particularly good conditions for female entrepreneurs relative to their per capita GDP. Singapore, Saudi Arabia, and Iran all show relatively unfavorable conditions for female entrepreneurs, relative to their per capita GDP. European nations tend to have better conditions for entrepreneurship than would be expected from their per capita GDP, while Sub-Saharan Africa and the MENA countries on average score worse on the FEI than would be expected from their per capital GDP.

Chapter 4. Conclusion

The 2015 Female Entrepreneurship Index includes both individual and institutional characteristics that can enable or inhibit high potential female entrepreneurship. The index illustrates that a number of individual and institutional factors impact the ability to start and grow firms, particularly attitudes, norms, values, legal environments that help women to access resources, accept women in leadership positions, and gain work experience in all sectors. These building blocks are absolutely fundamental to women's abilities to start new businesses.

This report analyzes the regional and performance category trends for 77 countries. Top ranking countries are not necessarily the countries with the highest GDP levels, but rather they are countries that are characterized by an enabling environment for female entrepreneurship development.

Appendix 1: FEI Results by Country

Note: The bar charts on the following pages are designed to provide a quick, visual overview of comparative country performance. The bars' scales range from slightly below zero to the highest observed value so that countries that score a zero for a given variable still have a visible bar.

Pillar	Indicator	Pillar	Indicator	Pillar	Indicator	Pillar	Indicator
1	Opportunity Recognition	4	Know an Entrepreneur	8	Highly Educated Owners	12	New Technology
1	Equal Rights	4	Internet and Networks	8	SME support and training	12	R&D Expenditure
1	Market Size	5	Executive Status	9	Innovativeness	13	Business Gazelles
2	Perc. Of Skills	5	Access to Childcare	9	Monopolized Markets	13	Female Leadership
2	Secondary Education	6	Opportunity Business	10	Entrepreneurship Ratio	14	Export Focus
3	Willingness to Start	6	Bus Freedom & Movement	10	Labor Force Parity	14	Globalization
3	Business Risk	7	Tech Sector Business	11	New Product	15	1st tier financing
		7	Tech Absorption	11	Technology Transfer	15	3rd tier financing

Individual level indicators are listed in black; Institutional level indicators are listed in blue

■ Highest score ■ Lowest score



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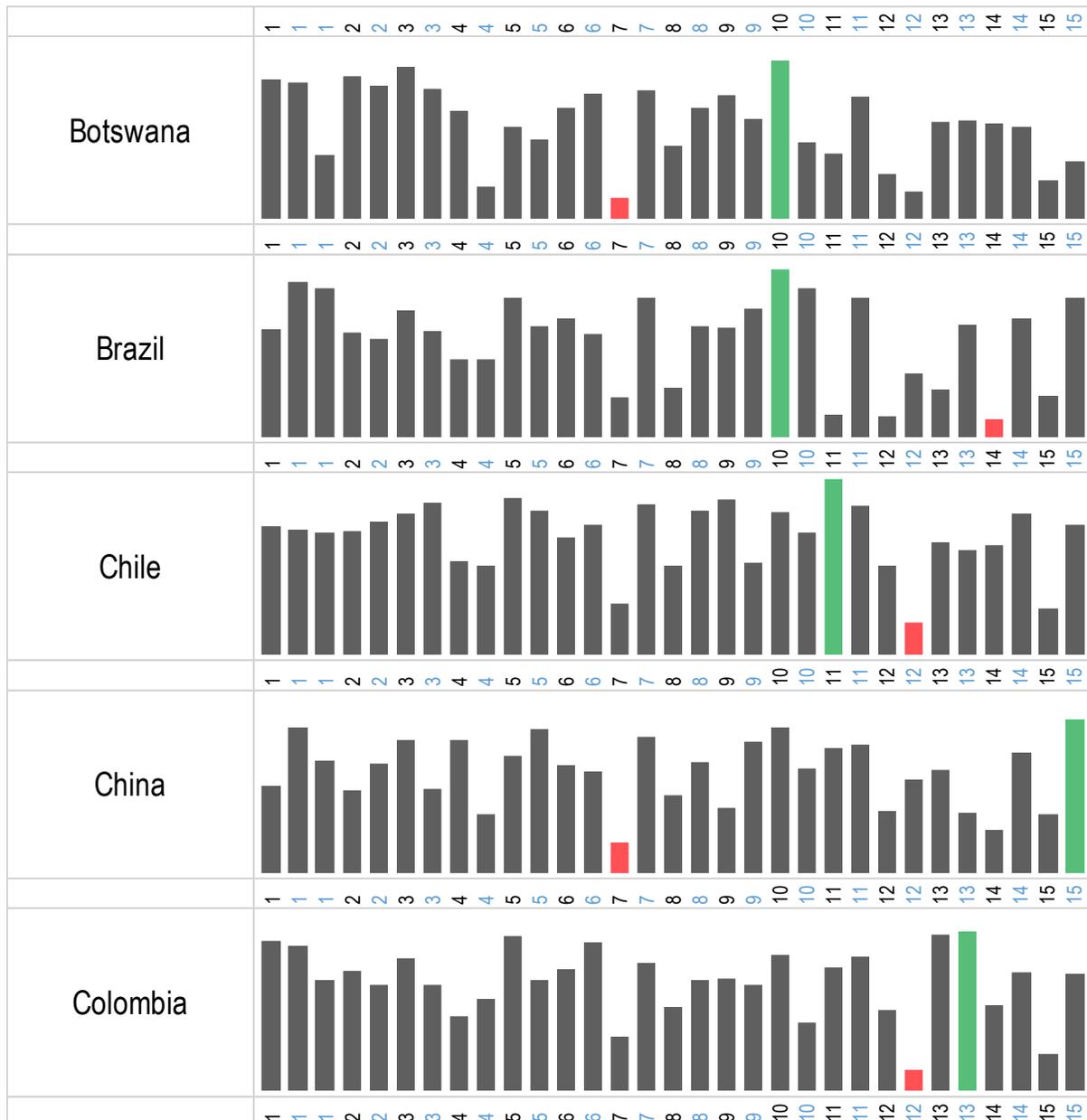


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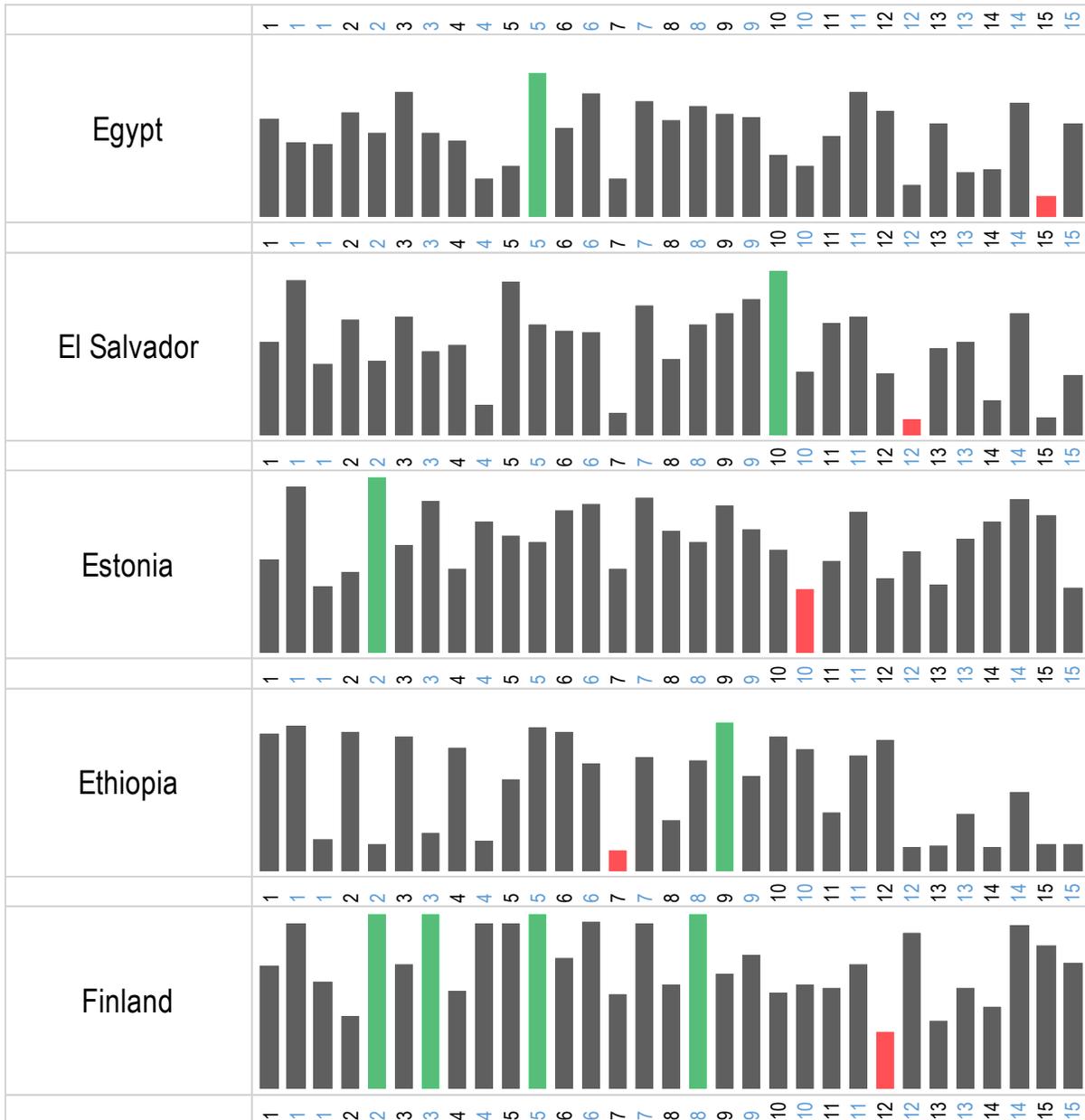


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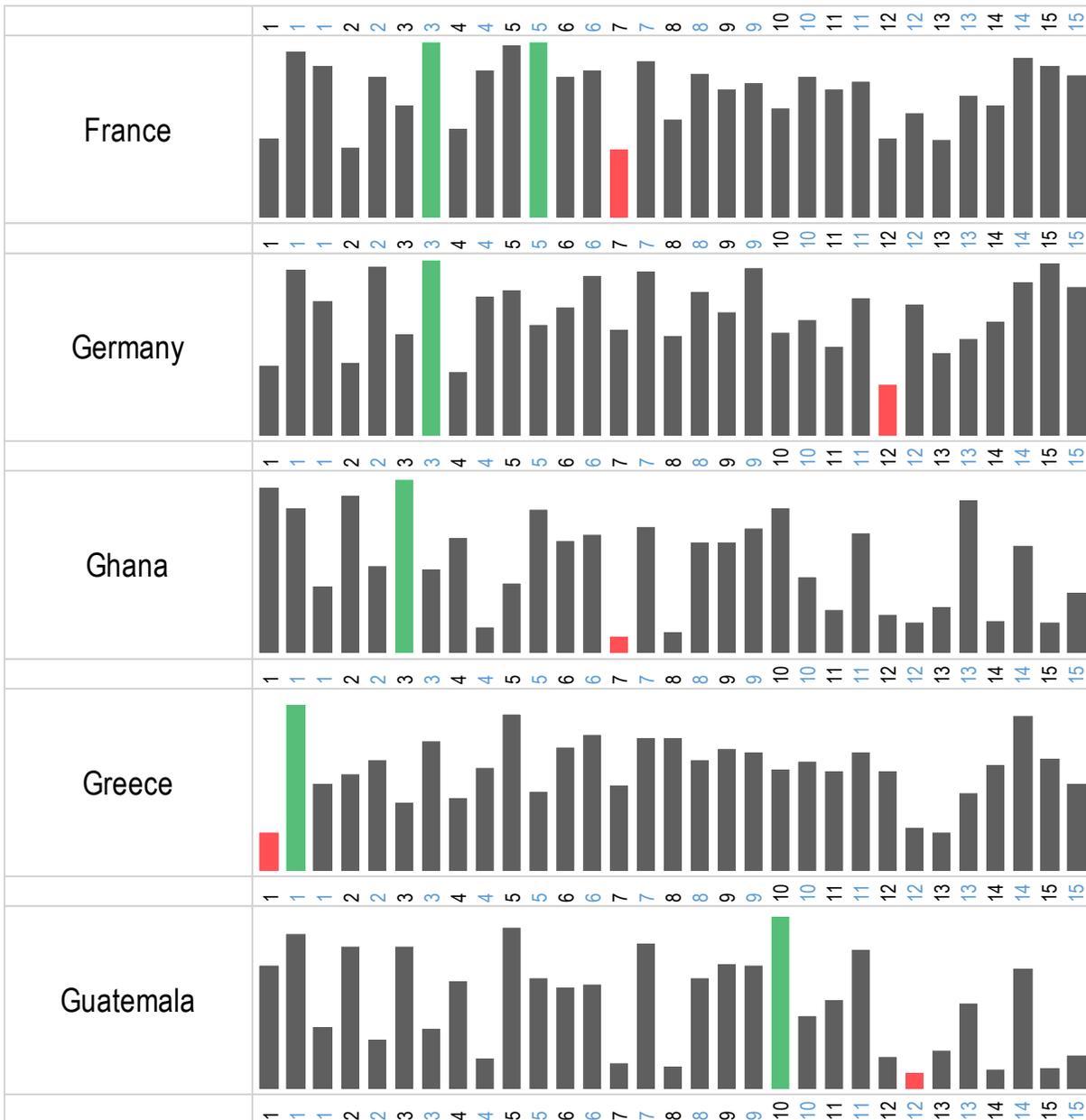


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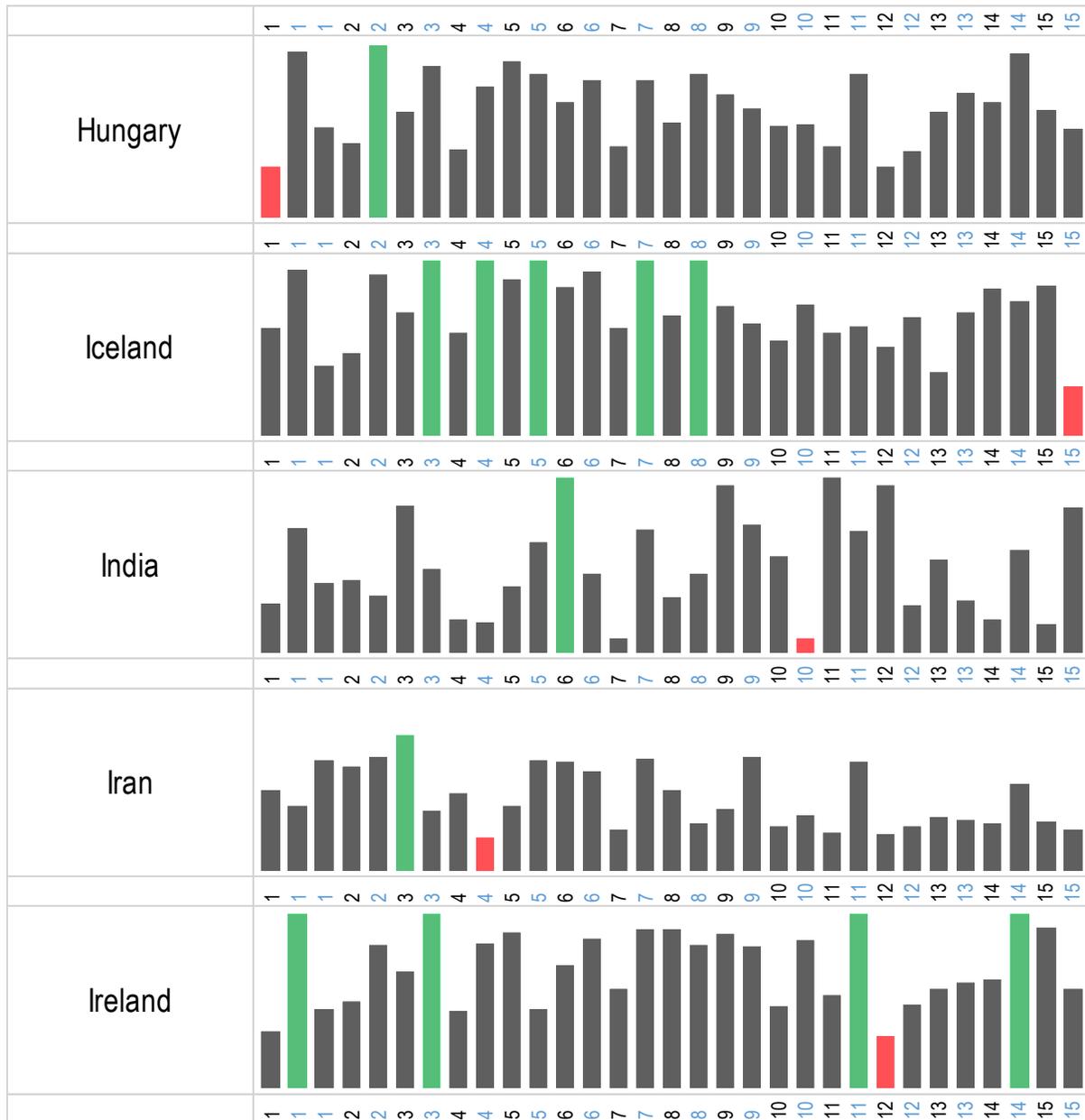


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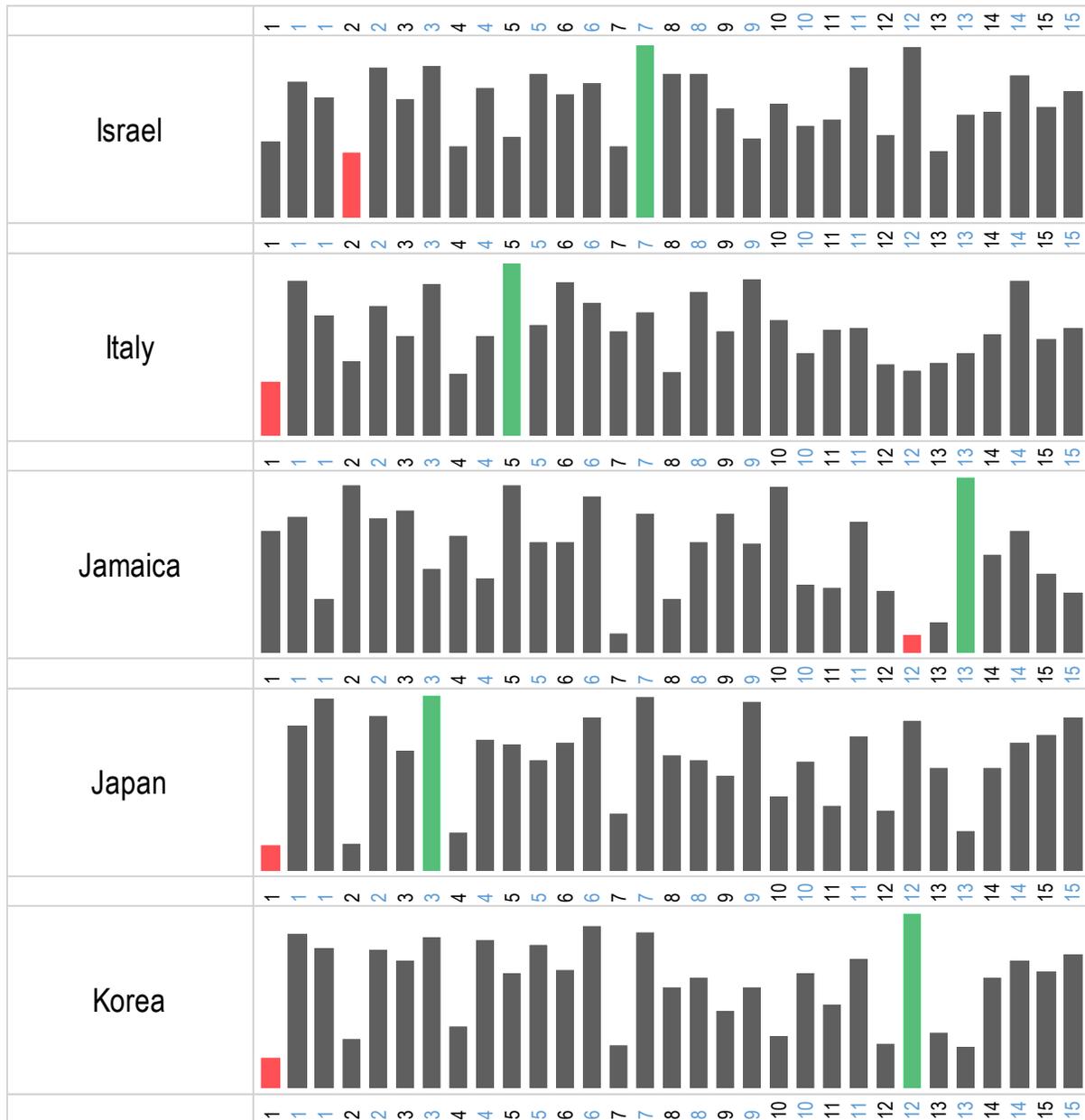


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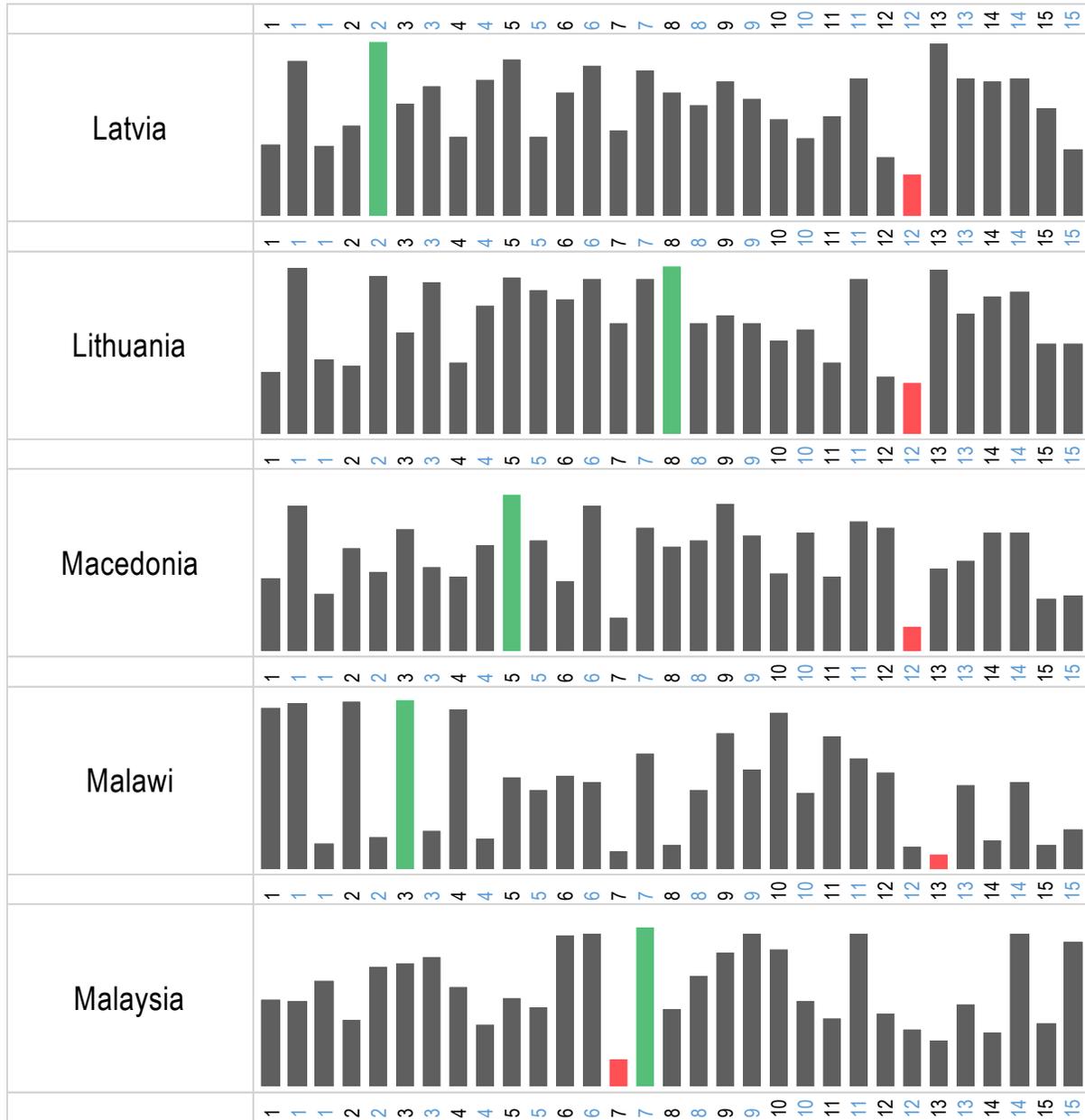


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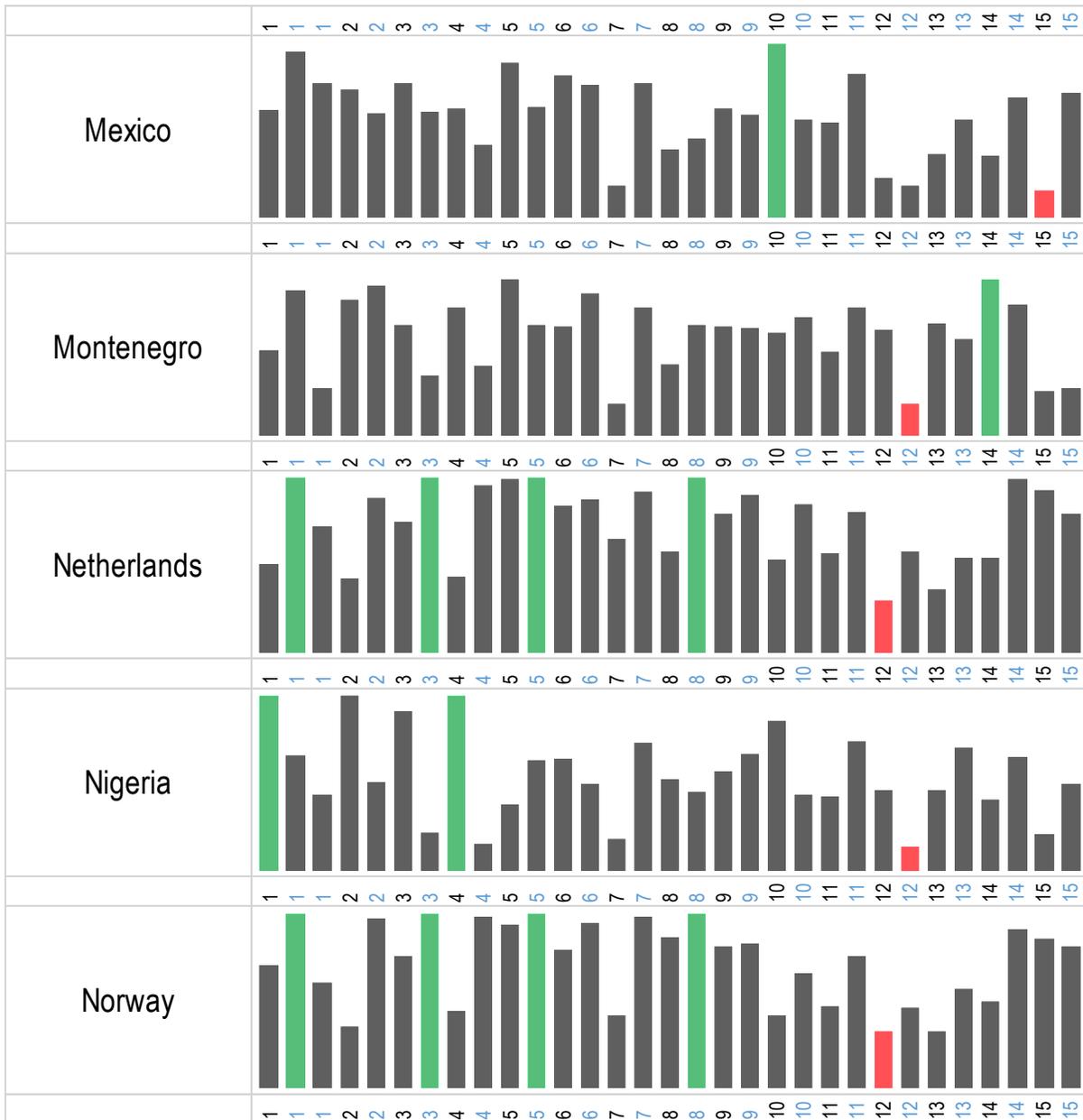


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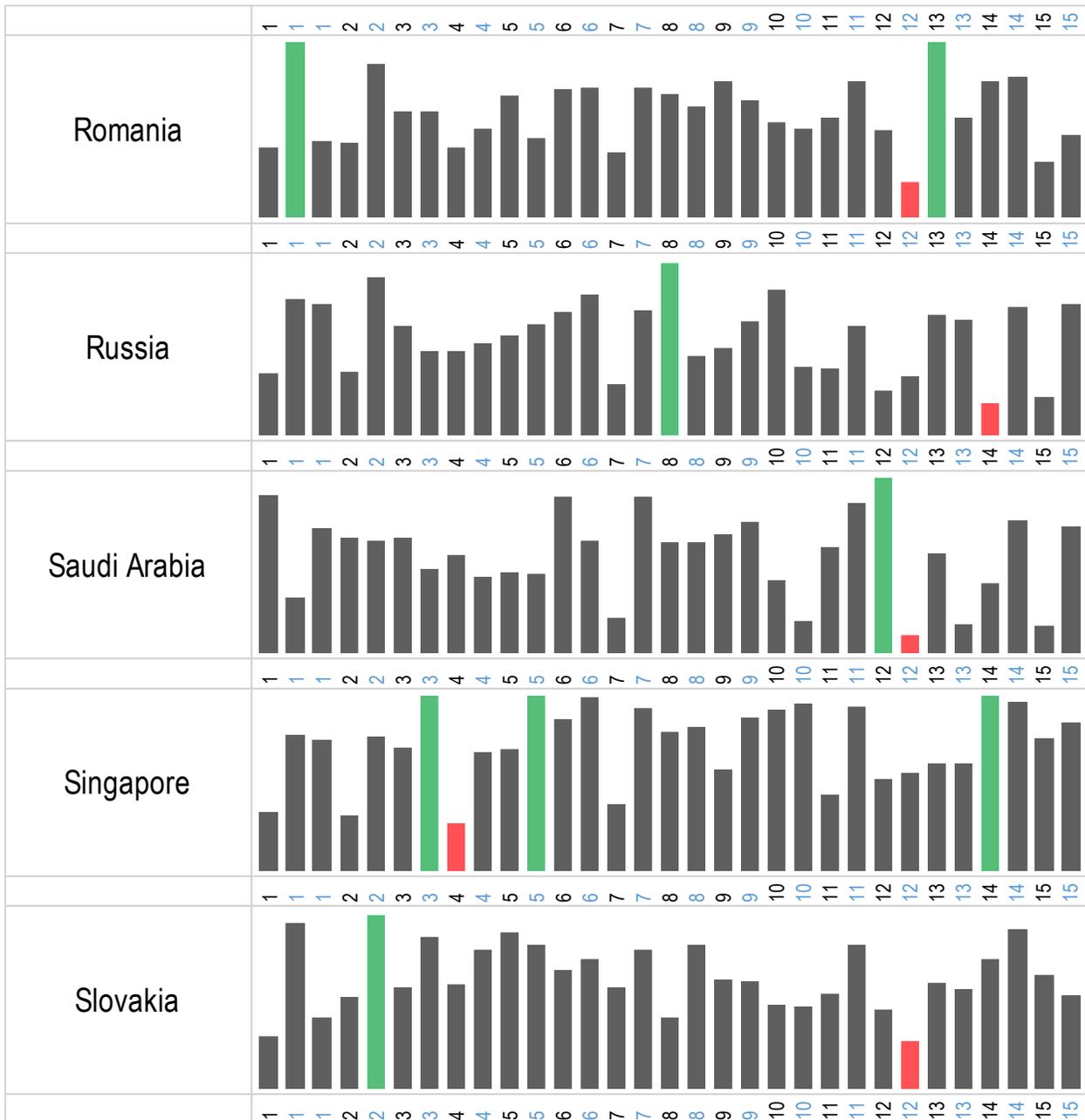


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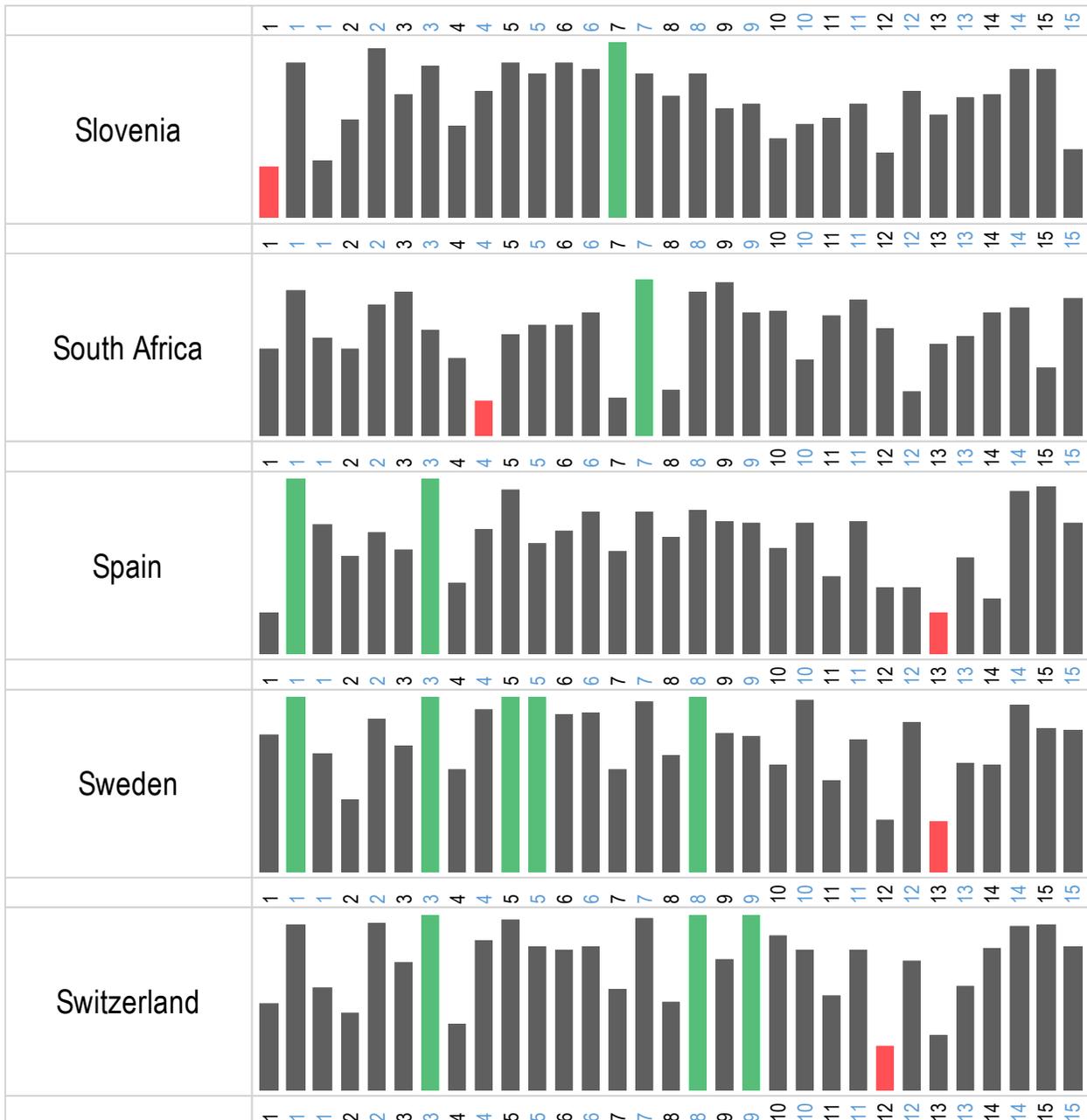


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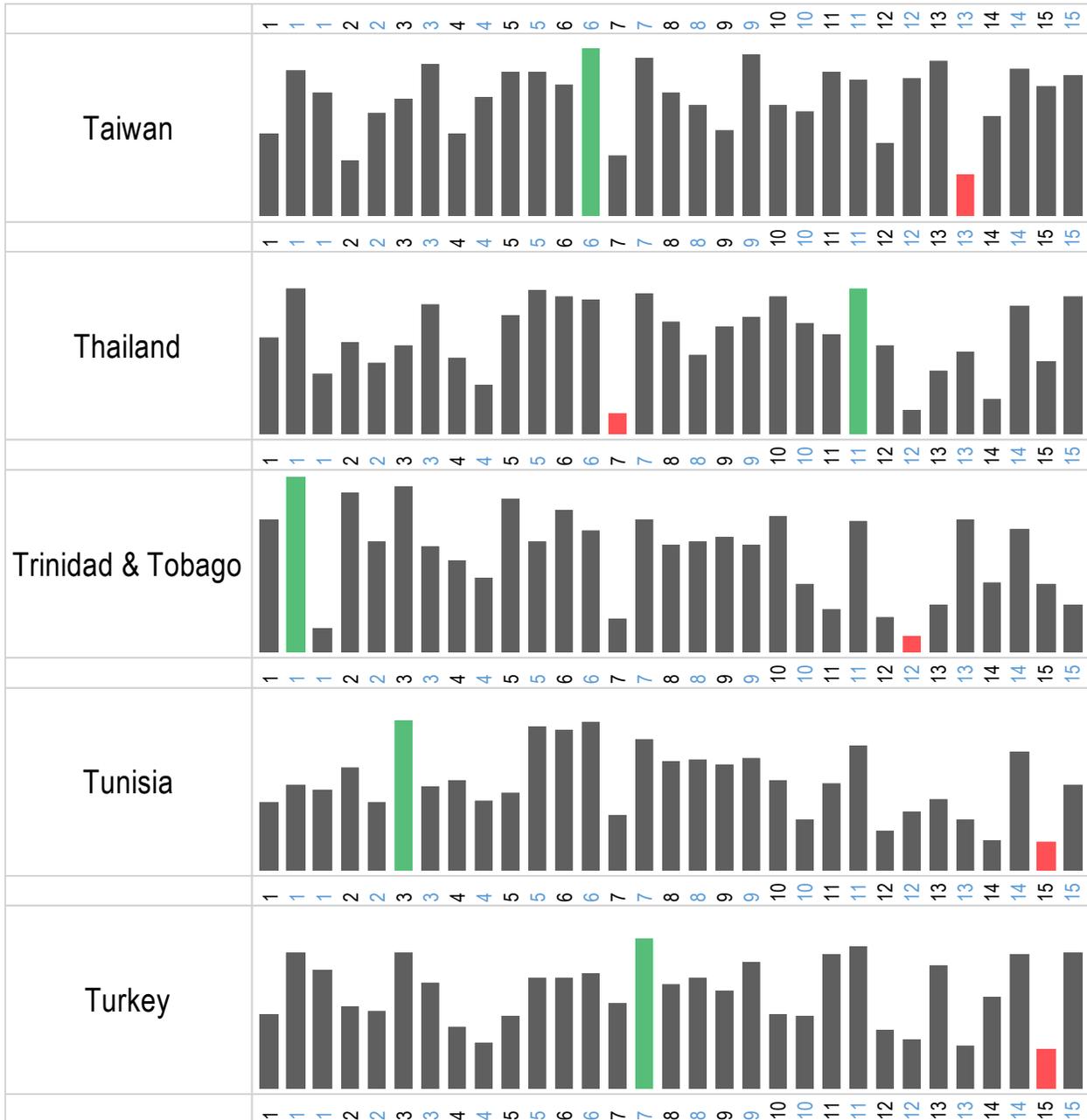


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3	Business Risk	7	Tech Sector Business	11	New Product	15	1st tier financing
		7	Tech Absorption	11	Technology Transfer	15	3rd tier financing

Individual level indicators are listed in black; Institutional level indicators are listed in blue

Highest score
 Lowest score

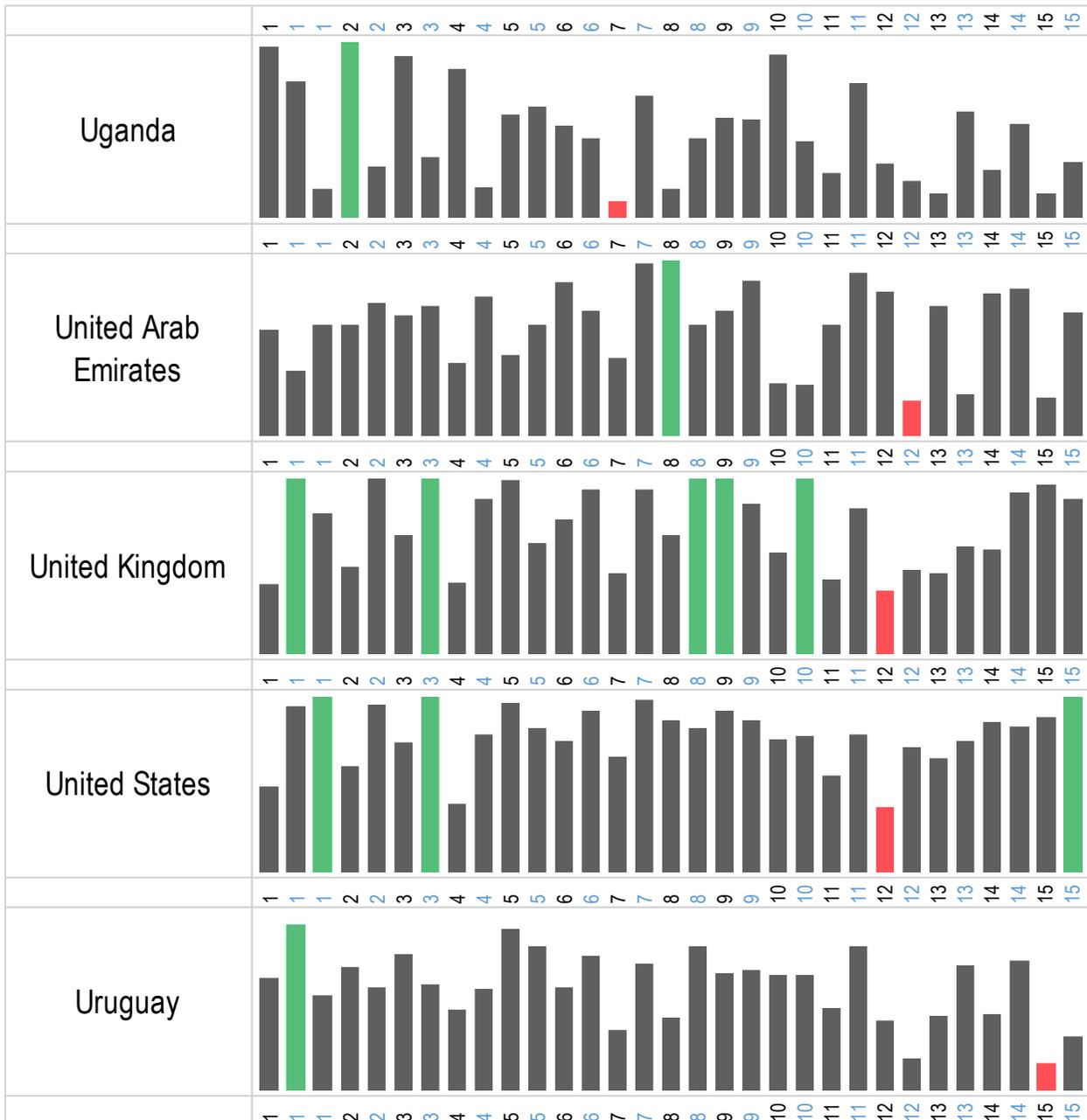


FEI Results by Country

Pillar	Indicator	Pillar	Indicator	Pillar	Indicator	Pillar	Indicator
1	Opportunity Recognition	4	Know an Entrepreneur	8	Highly Educated Owners	12	New Technology
1	Equal Rights	4	Internet and Networks	8	SME support and training	12	R&D Expenditure
1	Market Size	5	Executive Status	9	Innovativeness	13	Business Gazelles
2	Perc. Of Skills	5	Access to Childcare	9	Monopolized Markets	13	Female Leadership
2	Secondary Education	6	Opportunity Business	10	Entrepreneurship Ratio	14	Export Focus
3	Willingness to Start	6	Bus Freedom & Movement	10	Labor Force Parity	14	Globalization
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■ Highest score ■ Lowest score

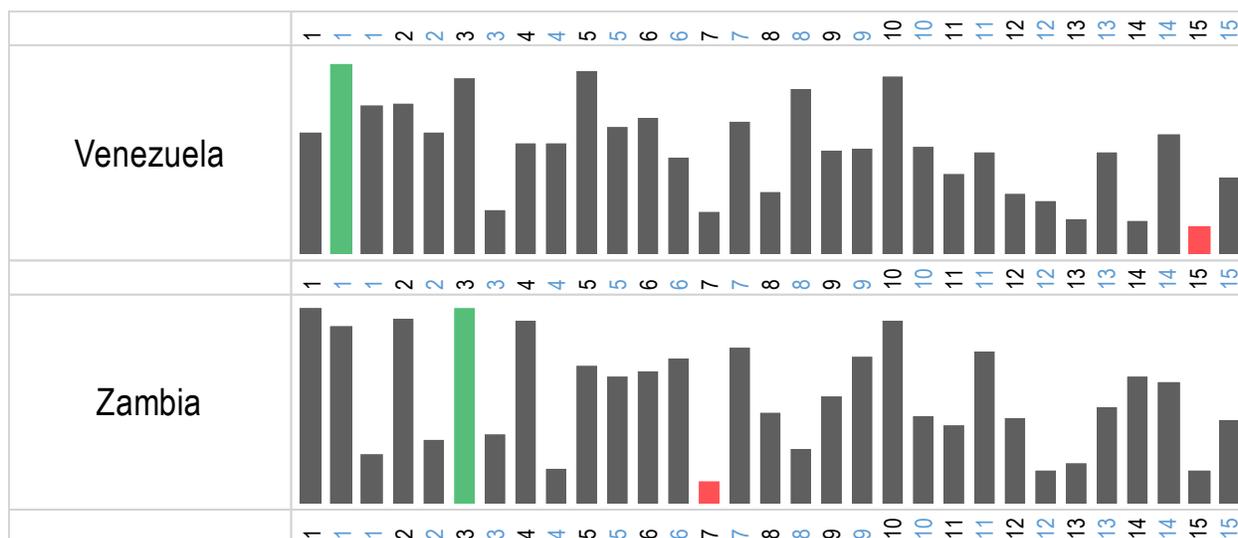


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Appendix 2. Methodology

2.1 Introduction

This appendix presents the methodology and data used to construct the FEI Index. Section 2.2 introduces the FEI model and framework. Section 2.3 describes the Penalty for Bottleneck Methodology which we use for the FEI to highlight the lowest index values or pillar ‘bottleneck’ for each individual country in our sample. Section 2.4 discusses the construction of the index. Section 2.5 describes the data selection process. The final section 2.6 describes the variables in the FEI Index.

2.2 Methodology and Data

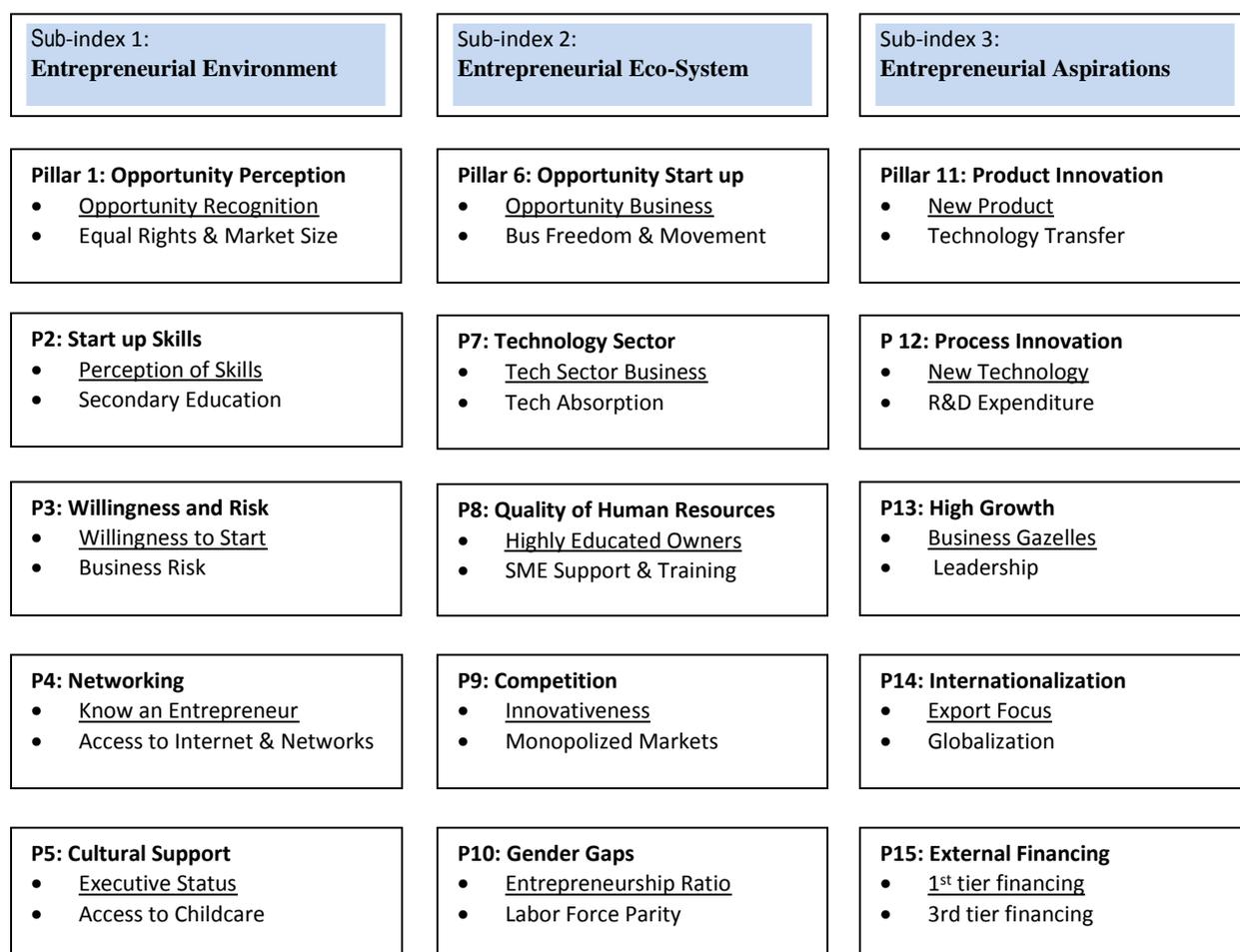
The conditions and characteristics that lead to ‘high potential’ female entrepreneurship occur at multiple levels. Female entrepreneurs, like their male counterparts, are influenced by the general business environment in which they live. Both male and female would-be entrepreneurs are dis-incentivized by an unstable general business environment, highly regulated or otherwise bureaucratic procedures for starting, running, or exiting a business. Some formal institutions or cultural conditions create additional barriers for women that make it more difficult to start or grow a business enterprise, such as diminished legal rights (either for all women or with respect to rights that women may give up at marriage) or restrictions on women’s activities outside of the home or their ability to travel within their communities, outside their communities, or outside the country. In addition, this combination of gendered attitudes, social norms, and beliefs can result in more limited access to resources critical for ‘high potential’ female entrepreneurship development such as education, skills, and finance.

Attitudes also play a crucial role in forming a country’s ‘entrepreneurial culture,’ meaning how the general population views entrepreneurial endeavors, tolerates risk, and judges business ownership as a viable career option. This cultural environment influences individual opportunity recognition and willingness to take the risk to start a new venture.

The institutional foundations including gendered institutions, access to resources, and the entrepreneurship culture form the context from which female start-ups emerge. In focusing on ‘high potential’ female entrepreneurship, we are specifically interested in female start-ups that exhibit characteristics that are related to ‘high impact entrepreneurship’ which we define as market expanding, innovative, and exporting businesses.

In order to build the Female Entrepreneurship Index, we use the three sub-index framework of the Global Entrepreneurship Index. These three sub-indices are: Entrepreneurial Environment, Entrepreneurial Eco-System and Entrepreneurial Aspirations. Broadly speaking, Entrepreneurial Environment focuses on assessing the ‘entrepreneurial spirit and culture’ of a given society as well as the presence of institutions to support entrepreneurial start-ups. The Entrepreneurial Eco-System contains variables that capture the access to resources and institutions needed for female business development. The final sub-index, Entrepreneurial Aspirations, focuses on the individual entrepreneurial characteristics as well as resource availability needed for ‘high potential’ female entrepreneurship to prosper and contribute to economic growth. These three sub-indices stand on 15 pillars, each of which contains an individual and an institutional variable that corresponds to the micro- and the macro-level aspects of entrepreneurship. Unlike other indices that incorporate only institutional or individual variables, the pillars of the FEI include *both* individual and institutional variables. These pillars attempt to capture the open-ended nature of entrepreneurship; analyzing them can provide an in-depth view of the strengths and weaknesses of those listed in the index. The FEI Framework is shown in Figure A-2.1 and the 15 pillars are described in detail below.

Figure A-2.1: The 2015 FEI Framework



Note: Each pillar contains an individual level indicator (underlined) and an institutional level indicator.

The five pillars of the Entrepreneurial Environment sub-index described

Pillar 1: OPPORTUNITY PERCEPTION. This pillar captures two aspects of opportunity: (1) awareness of opportunity and (2) the ability to act on opportunity. Research indicates that a population's opportunity perception is an essential ingredient of entrepreneurial start-ups (Sorensen and Sorenson, 2003). But if women are socialized differently than men are, they will perceive opportunities in a different way (DeTienne and Chandler, 2007). This pillar includes an individual variable that measures the percentage of the female population that can identify good opportunities to start a business in the area where they live. However, for some women, the desire to act on these opportunities for some women is constrained legally, as a number of countries worldwide women do not share the same legal rights as men. The 'Equal Legal Rights' variable measures the parity of laws for women and men in 17 key areas including capacity, property rights, and employment. Opportunity is also affected by a country's market size. The Market Size variable captures both a country's urbanization and the domestic market size which both contribute to creating conditions for business development. For this pillar, we combine 'Equal Legal Rights' with 'Market Size' to form the institutional level variable.

Pillar 2: START-UP SKILLS. Launching a successful venture requires the potential entrepreneur to have the necessary start-up skills (Papagiannidis and Li, 2005). The individual variable, 'Perception of Skills' measures the

percentage of the female population who believe they have adequate start-up skills to start a business. The results of the Global Entrepreneurship and Development Index (GEDI) have shown that higher percentages of both men and women in developing countries believe they have the necessary skills to start a business, but in reality, they often lack a more complex level of skills needed to grow a business to the next level of size and sophistication. Hence, education plays a vital role in teaching and developing entrepreneurial skills and building networks. We use the percentage of the female population who have completed secondary education as the institutional variable since it better reflects women's overall access to education. Studies have shown that once women get access to basic levels of education, there is a high likelihood that they seek higher levels of education. Therefore, women's initial access to basic levels of education is essential.

Pillar 3: WILLINGNESS AND RISK. Of the personal entrepreneurial traits, fear of failure is one of the most important obstacles to the start-up process (Caliendo et al., 2009). Women are often viewed as more 'risk averse' than men but more recent research indicates that the main difference lies in the way in which men and women perceive themselves and their environments (Langowitz and Minniti, 2007). This pillar includes the variable 'Willingness to Start' which measures the percentage of the female population who do not believe that fear of failure would prevent them from starting a business. For a more macro view, we combine 'Willingness to Start' with the institutional variable 'Business Risk', which reflects the availability and reliability of corporate financial information, the protection of creditors by law, and the institutional support of inter-company transactions.

Pillar 4: NETWORKING. Networking is critical for entrepreneurs, particularly female entrepreneurs (Klyver and Terjesen, 2007). Entrepreneurs who have better networks are more successful, can identify more viable opportunities, and access more and better resources (Shane and Cable, 2003). The Networking pillar combines two strong indicators for networking: (1) an individual-level indicator 'Know an Entrepreneur' shows the percentage of the female population who personally know an entrepreneur who started a business within the last two years, and (2) an institutional-level indicator measures the percentage of female Internet users together with the percentage of women with LinkedIn profiles. The Internet opens up new opportunities for entrepreneurial networking that eliminate temporal, geographic, and gendered social constraints that have in many cases limited women's access to information and resources. The percentage of women with LinkedIn profiles provides us with insights into women's use of professional social networking platforms. There is no obvious impediment to the use of professional social networking platforms such as LinkedIn since it is free of charge and widely available. We are aware that in some countries, other professional social networking platforms are as popular as, or even more popular than LinkedIn. For example, Xing is a LinkedIn competitor used in many German-speaking countries. However, there is no indication that the gender composition of individual profiles would be any different on competitor platforms.

Pillar 5: CULTURAL SUPPORT. This pillar combines the female population's attitudes towards women in executive roles with an indicator measuring access to childcare. Entrepreneurship is a socially constructed phenomenon (Welter, 2011) and the views toward entrepreneurship vary and are socially embedded (Davidsson, 2003, 2005; Steyaert and Katz, 2004). In other words, without strong cultural support, the best and brightest may not decide to apply their skills towards entrepreneurship (Baumol, 1990). For the individual level variable, we use the World Values Survey data which measures the percent of women that respond with 'disagree' or 'strongly disagree' to the question 'Do Men Make Better Business Executives than Women?' The responses provide an indication of women's attitudes towards women in leadership and decision-making positions such as those held by successful female entrepreneurs. The associated institutional variable measures access to childcare that is both affordable and of high-quality. It also includes the role of the extended family in providing childcare. Social norms as well as personal 'internalized' gendered beliefs worldwide result in women being the primary care-takers for their children. Access to affordable and high-quality childcare expands mothers' opportunities to pursue entrepreneurial activities.

The five pillars of the Entrepreneurial Eco-System sub-index described

Pillar 6: OPPORTUNITY START-UP. This pillar combines the level of female opportunity-motivated start-up activity with regulatory constraints as well as gendered constraints to participate fully in business activities. An entrepreneur's motivation for starting a business is an important signal of quality. Opportunity entrepreneurs are believed to be better prepared, to have superior skills, and to earn more than what we call necessity entrepreneurs. The individual level variable 'Opportunity Business' provides the percentage of female Total Entrepreneurial Activity (TEA: percentage of 18-64-year-old population who are either nascent entrepreneurs or baby business owners) businesses started to exploit a good opportunity, to increase income, or to fulfill personal aims; in contrast to businesses started by women because they had no other options for work. The institutional variable combines both an overall measure of the business environment with a specific gendered measure that affects business activity. 'Business Freedom' captures overall burden of regulation, as well as the regulatory efficiency of the government in influencing start-ups and operating businesses. This is combined with 'Freedom of Movement', a gendered institutional variable that measures legal restrictions or discriminatory practices affecting women's access to public space, which impacts a women's ability to start and or expand a business.

Pillar 7: TECHNOLOGY SECTOR. Technology-based businesses play a critical role in innovation, economic development, and growth. The individual level variable 'Tech Sector Business' measures the percentage of female TEA businesses that are active in the medium or high technology sectors. The institutional variable combines 'Female ICT Role Models' with 'Tech Absorption'. The Female ICT Role Models indicator measures perceptions of whether there are many prominent women in senior positions in IT-sector firms, as well as women in senior government positions that have an impact on or govern the sciences or information technology. Also it captures whether female voices are prominent across the IT sector landscape. The Tech Absorption variable measures the firm-level technology absorption capability in a country.

Pillar 8: QUALITY OF HUMAN RESOURCES. The prevalence of high-quality human capital is vitally important for ventures that are highly innovative and require an educated, experienced, and healthy workforce to continue to grow. A critical feature of a start-up with high growth potential is the entrepreneur's level of education (Bates, 1990). The 'Highly Educated Owners' variable captures the quality of entrepreneurs' academic preparation; it is widely held that entrepreneurs with higher education degrees are more capable and willing to start and manage high-growth businesses. The quality of employees also impacts business development, innovation, and growth potential. In addition, female entrepreneurs having a higher degree may not be the only advantage in education as graduate school may open up access to key networks and networking channels that help female entrepreneurs in their businesses (Morris, 2012). The institutional variable 'SME Support and Training' measures another important aspect for business skill development through SME support and training. It considers the availability (including geographic availability), accessibility and affordability of the programs, as well as additional gendered factors such as the length of the program (taking into account women's time burdens) and if the program is culturally appropriate for women to participate in.

Pillar 9: COMPETITION. Competition measures the level of a business' product or market uniqueness, combined with the market power of existing businesses and business groups. 'Innovativeness' is defined as the percentage of female businesses who have only a few competitors that offer the same product or service. However, market entry can also be prevented or made more difficult if there are powerful business groups dominating the market. The extent of market dominance by a few business groups is measured by the institutional level variable 'Monopolized Markets'. Lower degrees of monopolized markets should facilitate new business entry.

Pillar 10: GENDER GAPS. This pillar measures two important aspects of gender parity in terms of women's ability to actively participate in economic activities in entrepreneurship and in the labor force. The first variable 'Entrepreneurship Ratio' measures the ratio of female to male TEA. This percentage includes both opportunity and necessity-driven entrepreneurs and does not distinguish between formal or informal entrepreneurial activity. It therefore measures the total engagement of women and men in start-up and early stage entrepreneurial activity. The

second variable 'Labor Force Parity' measures the ratio of female to male labor force participation in a country's main sectors of employment. Female labor force parity provides a good indication of a country's ability to exploit its innovative and entrepreneurial potential. Research shows that business start-ups follow gendered employment patterns. Balanced representation of men and women in the labor force in a country can cultivate a pool of male and female entrepreneurs that can transform previously non-dynamic sectors.

The five pillars of the Entrepreneurial Aspirations sub-index described

Pillar 11: PRODUCT INNOVATION. New product innovation is crucial for 'high potential' female entrepreneurs' success. The individual variable 'New Product' is a measure of female TEA entrepreneurs who are offering new products to their customers or adopting existing products. The corresponding institutional variable 'Technology Transfer' combines important aspects of technology transfer such as investment in R&D by the private sector; the presence of high-quality research institutions; active collaboration in research between universities and industry and intellectual property rights protection.

Pillar 12: PROCESS INNOVATION. This pillar highlights the important role played by applying and/or creating new technology for high potential female entrepreneurs by including micro and macro dimensions supporting innovation. The individual variable 'New Technology' is defined as the percentage of TEA female businesses whose principal underlying technology is less than five years old. The institutional variable relates to research and development (R&D) on a macro scale. R&D Expenditure is the R&D percentage of Gross Domestic Product (GDP) as reported by OECD. While R&D alone does not guarantee successful growth, it is clear that without systematic research activity, new product development—and therefore future growth—will be inhibited (Stam and Wennberg, 2009).

Pillar 13: HIGH GROWTH. This pillar combines the percentage of high-growth TEA female businesses who intend to employ at least ten people and plan to grow more than 50 percent in five years (Business Gazelles) with a variable measuring the percentage of female managers (Female Leadership). Although the 'Business Gazelle' variable measures expected growth and not actual growth, there is evidence that attitudes towards growth are good indications of future entrepreneurial activity. We include the percentage of female managers as the institutional variable, since higher rates of female managers are important for 'high potential' female entrepreneurs for a number of reasons. Most importantly, female managers often embody the education, skills, and experience needed for successful 'high potential' female entrepreneurship and as such form a pool of potential candidates. Also the percentage of female managers provides a good indication of a country's overall acceptance of women in positions of leadership and decision-making.

Pillar 14: INTERNATIONALIZATION. A widely applied proxy for internationalization and growth is exporting, since exporting demands capabilities beyond those needed by businesses that produce only for domestic markets. An individual variable measuring the percentage of female TEA businesses exporting (Export Focus) is included as a defining characteristic of high potential female entrepreneurs. The institutional variable used is Globalization, which captures the degree to which a country's entrepreneurs are internationalized, as measured by businesses' exporting potential, controlling for the extent to which the country is economically globalized.

Pillar 15: EXTERNAL FINANCING. The availability of external financing, particularly equity rather than debt, is an essential precondition for fulfilling entrepreneurial aspirations that are beyond an individual entrepreneur's personal financial resources (Gompers and Lerner, 2004). In general, women-owned businesses start with both lower levels of overall capitalization and lower ratios of debt financing than men-owned businesses (Carter and Allen, 1997; Coleman, 2000). Anecdotal evidence suggests that sex discrimination may be an influence, which leads researchers to state the need to accumulate more knowledge in this area (Brush et al., 2004). In this pillar, we capture the 1st and 3rd financing tiers. The 1st tier financing relates to debt capital and financial literacy and includes the combined percentage of women with a bank account at a formal institution, the percentage of women with a bank account for business purposes and women's access to finance programs. The 3rd tier of financing measures the 'Depth of Capital Markets'. It measures access to equity capital for high growth entrepreneurs. Countries with better developed equity markets provide risk capital, an exit strategy for investors and provide financial rewards for successful entrepreneurs

that do not exist in countries that have bank-centered capital markets owner-manager of a new business (no more than 42 months old) which tend to be much more conservative. 2nd tier financing data measuring access to credit is unfortunately not available.

The GEDI Penalty for Bottleneck methodology is applied to the pillar scores so that the 'bottleneck' (i.e., the pillar with the lowest score) penalizes the final country ranking. This allows for the inter-related nature of the pillars to affect the final scores. This approach encourages countries to address their weakest areas first, since that improvement will have the greatest effect on their final score. Without this procedure, countries could put additional resources in areas of relative strength in order to improve their final score, yet this would not lead improvement for 'high potential female entrepreneurs'. Since the variables are related to one another, their balance is important. For example, increasing your score in education will not lead to further increases in weak areas such as the availability of informal finance. There is an analogy to baking: if you don't have enough eggs, adding more flour or sugar will not solve the problem of missing eggs. A more detailed description of the Penalty for Bottleneck Methodology is given in Section 2.3 below.

2.3 Penalty for Bottleneck Methodology

In the 'Penalty for Bottleneck (PFB) Methodology', a bottleneck is defined as the worst performing link or a binding constraint in the system. With respect to entrepreneurship and the FEI, a bottleneck indicates a shortage or the lowest level of a particular entrepreneurial pillar, relative to other pillars. This notion of a bottleneck is important for policy purposes. The PFB suggests that pillars interact; if they are out of balance, 'high potential' female entrepreneurship is inhibited. The pillar values should thus be adjusted in a way that takes into account this notion of balance.

The PFB is applied as follows: after normalizing the scores of all the pillars, the value of each pillar of a country is penalized by an amount proportional to the deficit of the weakest performing pillar in that country. This simulates the notion of a bottleneck; if the weakest pillar were improved, ultimately the whole GEDI would show a significant improvement. Moreover, the penalty should be higher if imbalance is greater. The application of this adjustment implies that stable and efficient configurations (sets of pillar scores) are those that are balanced (have about the same level) in all pillars.

Equation (1) describes the PFB methodology:

$$h_{(i),j} = \min y_{(i),j} + (1 - e^{-(y_{(i),j} - \min y_{(i),j})}) \quad (1)$$

where $h_{i,j}$ is the modified, post-penalty value of pillar j in country i

$y_{i,j}$ is the normalized value of index component j in country i

y_{min} is the lowest value of $y_{i,j}$ for country i.

$i = 1, 2, \dots, n$ = the number of countries

$j = 1, 2, \dots, 15$ = the number of pillars

For each pillar, the bottleneck is calculated by adding one, plus an expression that depends on the difference between that pillar's country value and the value for that country's weakest pillar. *Thus, improving the score of the weakest pillar will have a greater effect on the index than improving the score of stronger pillars.* For example, assume the normalized score of a particular pillar in a country is 0.60 and the lowest pillar value is 0.19. The difference is 0.41. The natural logarithm of 1.41 is 0.34. Therefore the final adjusted value of the pillar is $0.19 + 0.34 = 0.53$ instead of 0.60. The largest potential difference between two pillars can be 1, when a particular country has

the highest value in one pillar and the lowest value in another. In this case the maximum penalty is 0.368, and the final adjusted value is $1-0.368= 0.632$ instead of 1.

We suggest that this dynamic index construction is particularly useful for enhancing female entrepreneurship since it facilitates pinpointing the specific area or areas that need improvement. Dynamic index construction highlights the importance of more balanced pillar scores since the penalty for bottleneck will have the least effect on the overall country ranking when the difference between the pillar scores is negligible.

In general, a country should focus its policy on the lowest ranking pillar in order to improve its overall ranking. However, if a country is characterized by the extremes: a combination of both very low and very high pillar scores, then focusing simply on the lowest scoring pillar may not lead to noticeable improvement in a country's overall score since another weak pillar score will form the next bottleneck. In this instance, it is useful for a country to focus its efforts on several weakly performing pillars at once. Thus the policy message is to address the weakest performing pillar (or pillars) first, since it exerts a negative effect on all the other pillars.

2.4 Index Construction

The construction of the FEI Index is an eight step process:

1. The selection of variables: We chose variables that we could access from original, internationally recognized data sources. Altogether we use 15 individual and 15 institutional variables. Wherever possible, we used data from the most recent year, and individual data are calculated based on a 2010-2012 pooled data set, except in India where we rely on 2008 individual data.

2. The construction of the pillars: The pillars are calculated using the interaction variable method, that is, by multiplying the individual variable with the corresponding institutional variable.

3. Normalization: The next step in constructing the FEI Index is to normalize the pillar values to range from 0 to 1. This form of normalization is compatible with the PFB method (shown below)

$$x_{i,j} = \frac{z_{i,j}}{\max z_{i,j}} \quad (1)$$

for all $j= 1 \dots k$, the number of pillars

where $x_{i,j}$ is the normalized score value for country i and pillar j

$z_{i,j}$ is the original pillar value for country i and pillar j

$\max z_{i,j}$ is the maximum value for pillar j

4. Capping: Since extreme values or outliers could distort the normalized scores, we selected the 95th percentile score adjustment, meaning that any observed values higher than the 95th percentile were lowered to the 95th percentile. The rationale for this approach is to ensure reasonable benchmarks for all the other countries. The selected benchmark should not be the result of extraordinary effort or conditions but rather an attainable benchmark for all other countries.

5. Average pillar adjustment: The different averages of the normalized values of the pillars imply that reaching the same indicator values requires different effort and resources. Since we want to apply the FEI for public policy purposes, the additional resources for the same marginal improvement of the indicator values should be the same for

all indicators. Therefore, we need a transformation to equate the average values of the components. Equation 2 shows the calculation of the average value of a pillar \bar{x}

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n} . \quad (2)$$

We want to transform the $x_{i,j}$ values such that the potential minimum value is 0 and the maximum value is 1:

$$y_{i,j} = x_{i,j}^k \quad (3)$$

where k is the “strength of adjustment”, the k -th moment of X_j is exactly the needed average, \bar{y}_j . We have to find the root of the following equation for k

$$\sum_{i=1}^n x_{i,j}^k - n\bar{y}_j = 0 \quad (4)$$

It is easy to see based on previous conditions and derivatives that the function is decreasing and convex which means it can be quickly solved using the well-known Newton-Raphson method with an initial guess of 0. After obtaining k , the computations are straightforward. Note that if

$$\begin{aligned} \bar{x}_j < \bar{y}_j & \quad k < 1 \\ \bar{x}_j = \bar{y}_j & \quad k = 1 \\ \bar{x}_j > \bar{y}_j & \quad k > 1 \end{aligned}$$

that is k be thought of as the strength (and direction) of adjustment

6. Penalizing: After these transformations, the Penalty for Bottleneck (PFB) methodology is used to create indicator-adjusted PFB values. We define our penalty function as follows:

$$h_{(i),j} = \min y_{(i),j} + (1 - e^{-(y_{(i),j} - \min y_{(i),j})}) \quad (5)$$

where $h_{i,j}$ is the modified, post-penalty value of pillar j in country i

$y_{i,j}$ is the normalized value of index component j in country i

y_{min} is the lowest value of $y_{i,j}$ for country i .

$i = 1, 2, \dots, n$ = the number of countries

$j = 1, 2, \dots, m$ = the number of pillars

7. Sub-index values: The pillars are the basic building blocks of the sub-indices for entrepreneurial environment, entrepreneurial eco-system, and entrepreneurial aspiration. The value of a sub-index for any country is the arithmetic average of its PFB-adjusted pillars for that sub-index multiplied by a 100. The maximum value of the

sub-indices is 100 and the potential minimum is 0, both of which reflect the relative position of a country in a particular sub-index.

$$ATT_i = 100 \sum_{j=1}^5 h_j \quad (6a)$$

$$ABT_i = 100 \sum_{j=6}^{10} h_j \quad (6b)$$

$$ASP_i = 100 \sum_{j=11}^{15} h_j \quad (6c)$$

where $h_{i,j}$ is the modified, post-penalty value of pillar j in country i

$i = 1, 2, \dots, n$ = the number of countries

$j = 1, 2, \dots, 14$ = the number of pillars

8. FEI point calculation: Finally, the FEI index is calculated as the simple arithmetic average of the three sub-indices. Since 100 represents the theoretically available limit for total number of FEI points possible, it can also be interpreted as a measure of entrepreneurship resource efficiency for high potential female entrepreneurship development.

$$GEDI_i = \frac{1}{3}(ATT_i + ABT_i + ASP_i) \quad (7)$$

2.5 Data Selection and sources

The data used for the FEI index is comprised of both individual and institutional level data. The individual level data is compiled from the Global Entrepreneurship Monitor dataset. We specifically use pooled data from the 2010-2012 Adult Population Survey.

All five individual-level variables that comprise the Entrepreneurial Environment sub-index are based on attitudes and perceptions that focus on responses from the adult female population (aged 18-64). These responses make up the entrepreneurship culture level of the FEI model and are presented in Section 2.6 below. The other nine individual variables that make up the Entrepreneurial Environment and Entrepreneurial Aspirations sub-indices are based on the responses of female entrepreneurs engaged in what GEM terms 'Total Entrepreneurship Activity' which is defined as individuals involved in the start-up process whose businesses are not older than 42 months and/or those that have not paid a salary for longer than three months. These variables make up the innermost level of the FEI model called 'Female Entrepreneurship Individual Characteristics'.

One of the novelties of the GEDI index framework, adopted by the FEI, is the matching of an individual-level variable with an institutional-level variable at the pillar level in order to capture the interplay between both of these factors that affect outcomes.

For our index, we selected institutional level variables that represent the three additional levels of our FEI model. The first is comprised of the institutional foundations that affect all entrepreneurs, regardless of whether they are male or female. These include the Business Freedom (compiled by the Heritage Foundation and based on the World Bank's 'Ease of Doing Business Index'), Business Risk (Coface), Market Monopolization and Market Size (World Economic Forum – WEF), Technology Transfer and Technology Absorption (WEF), R&D Expenditure (UNESCO), and Globalization (KOF Swiss Economic Institute).

The second level of analysis is comprised of gendered institutions, which captures the areas where women do not share the same rights as men. We include two indicators: Equal Legal Rights which is a composite indicator we

compiled based on 17 separate measures from the Women, Business and the Law database (World Bank). The second indicator is 'Freedom of Movement' from the Gender, Institutions and Development Database (OECD). In most countries in our sample there are no restrictions on women's access to public spaces, yet we found it important to highlight the cases where these restrictions (legal or discriminatory practices) exist since it affects a woman's ability to independently start and grow her business. Since 'Freedom of Movement' is only relevant in a limited number of cases, we merged this variable with the more general measure 'Business Freedom' in order to create the 'Business Freedom and Movement' variable.

The third level includes variables that identify areas where women's access to resources may be more limited than men's. These include access to education as measured by percentage of women with secondary education (GII, UNDP); the percentage of female internet users was sourced from the International Telecommunication Union (ITU); Access to SME support and training programs for women, access and availability of childcare are based on data from the Economist Intelligence Unit's (EIU) Women and Economic Opportunity Index (WEO-EIU). In order to capture the gendered crowding of the labor force, we created the Labor Market Parity variable based on data from the International Labor Organization (ILO). For most countries, the percentage of female managers is obtained from the Global Gender Gap Index (World Economic Forum) and supplemented by data from the UN World's Women database. For 1st tier financial access, we combined three measures: The percentage of women with a bank account in a formal institution and the percentage of women with a bank account for business purposes using data from the Financial Inclusion database (Findex, World Bank) and Women's Access to Finance Programs compiled by the EIU for the Women's Economic Opportunity Index.

A potential criticism of our index might be the arbitrary selection of institutional variables and the neglect of other important factors. We aimed to collect the best possible indicators informed by current research on female entrepreneurship. However, our variable choices are often constrained by the limited availability of comparative and representative data for the 77 countries included in study. The lack of adequate comparative data on female entrepreneurship in general and the factors that influence its development plagues the field of female entrepreneurship research and severely constrains the ability to conduct robust quantitative analysis. A second potential criticism is that we do not explicitly include social entrepreneurship—an area that is increasingly popular among women (Ingram et al., 2012), however not usually high-growth oriented (Lepoutre et al., 2012).

2.5.1 Missing data and estimations

When working with large data sets, it is not always possible to find data for all indicators for the countries represented in the sample. There are many different techniques for estimating data, ranging from statistical methods such as the expectation maximization algorithm or the hot-deck method. For the FEI index, we carefully choose the most appropriate method for each estimation variety of methods based on similar country values or regional averages.

2.6 Data Sources

Pillar	Individual/ Institutional	Indicator	Source
1 - Opportunity Perception	Individual	Opportunity Recognition	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
1 - Opportunity Perception	Institutional	Equal Rights	World Bank's Women Business and the Law Database, 2013 data Source: http://wbl.worldbank.org/data
1 - Opportunity Perception	Institutional	Urbanization	United Nations Population Division, 2011 estimate. http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS/countries

1 - Opportunity Perception	Institutional	Domestic Market Size	World Economic Forum - The Global Competitiveness Report 2012-2013
2 - Start-up Skills	Individual	Perception of Skills	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
2 - Start-up Skills	Institutional	Secondary education	UNDP Gender Inequality Index Data from most recent year 2005 – 2012 http://hdr.undp.org/en/statistics/gii
3 - Willingness and Risk	Individual	Willingness to start	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
3 - Willingness and Risk	Institutional	Business Risk	http://www.coface.com/
4 - Networking	Individual	Know an Entrepreneur	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
4 - Networking	Institutional	Internet Users	International Telecommunications Union, http://www.itu.int/ITU-D/ict/statistics/IndividualsUsingInternet_00-10.xls
4 - Networking	Institutional	Linkedin Profiles	Linkedin Database
5 - Cultural Support	Individual	Executive Status	World Values Survey, 6th wave (2010-2014), http://www.worldvaluessurvey.org
5 - Cultural Support	Institutional	Access to Childcare	Women's Economic Opportunity Report, EIU, 2010 data http://graphics.eiu.com/upload/WEO_June_2010_final.xls
6 - Opportunity Start-up	Individual	Opportunity Businesses	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
6 - Opportunity Start-up	Institutional	Business Freedom	Heritage Foundation, 2012 data http://www.heritage.org/index/explore
6 - Opportunity Start-up	Institutional	Freedom of Movement	OECD Gender, Institutions and Development Index, 2012 data http://stats.oecd.org/Index.aspx?DatasetCode=GID2
7 - Technology Sector	Individual	Tech Sector Businesses	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
7 - Technology Sector	Institutional	Tech Absorption	World Economic Forum - The Global Competitiveness Report 2012-2013
8 - Quality of Human Resources	Individual	Highly Educated Owners	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
8 - Quality of Human Resources	Institutional	SME Support and Training	Women's Economic Opportunity Report (Economist Intelligence Unit) 2010 data http://graphics.eiu.com/upload/WEO_June_2010_final.xls
9 - Competition	Individual	Innovativeness	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
9 - Competition	Institutional	Monopolized Markets	World Economic Forum - The Global Competitiveness Report 2012-2013
10 - Gender Gaps	Individual	Entrepreneurship Ratio	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org

10 - Gender Gaps	Institutional	Labor Force Parity	GEDI team calculation from International Labor Organization (ILO), Most recent data year available for 2005-2012, www.ilo.org
11 - Product Innovation	Individual	New Product	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
11 - Product Innovation	Institutional	Technology Transfer	World Economic Forum - The Global Competitiveness Report 2012-2013
12 - Process Innovation	Individual	New Technology	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
12 - Process Innovation	Institutional	R&D Expenditure	UNESCO, 2012 data, http://stats.uis.unesco.org/unesco/
13 - High Growth	Individual	Business Gazelles	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
13 - High Growth	Institutional	Leadership	Global Gender Gap Index -World Economic Forum, 2012 data, http://reports.weforum.org/global-gender-gap-report-2012/ ; International Labor Organization, ILOStat online database, 2010 or latest data available; United Nations Development Program, Human Development Report 2009, the most recent year available between 1999 and 2009.
14 - Internationalization	Individual	Export Focus	GEM, 2010 – 2012 pooled data, weighted average. Based on recalculated GEM data by the FEI team. http://www.gemconsortium.org
14 - Internationalization	Institutional	Globalization	KOF, 2010 data, http://globalization.kof.ethz.ch/globalization_2011b_long.xls
15 - External Financing	Individual	1st tier Financing - Access to banks	World Bank's Findex Data, 2011 data http://datatopics.worldbank.org/financialinclusion/
15 - External Financing	Individual	1st tier Financing - Access to finance programs	Women's Economic Opportunity Report, Economist Intelligence Unit, 2010 data http://graphics.eiu.com/upload/WEO_June_2010_final.xls
15 - External Financing	Institutional	3rd tier Financing: Depth of Capital Markets	Groh, A, H. Liechtenstein and K. Lieser. (2012). The Global Venture Capital and Private Equity Country Attractiveness Index 2012, 2012 data, http://blog.iese.edu/vcpeindex/about/

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