ERF Working Papers Series

From Rentier to Digital Capitalism in Lebanon: Effects, Prospects, and Policies

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ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية

Working Paper No. 1485
September 2021

FROM RENTIER TO DIGITAL CAPITALISM IN LEBANON: EFFECTS, PROSPECTS, AND POLICIES[1]

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[1] Prepared as Digital Transformation and Implications for Growth, Employment, Poverty and Inequality in the Arab Region-Lebanon Paper for UNDP-ERF project on "Growth, Employment, Poverty, Inequality, and Digital Transformation in the Arab Region: How Can the Digital Economy Benefit Everyone?" The author would like to acknowledge the contribution of Dr. Ali Fakih to section four of this manuscript.

First published in 2021 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

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Abstract

This paper investigates the role of the new digital technologies in the Lebanese economy. After presenting an overview of the economy especially the postwar business cycle and the rise of a low productivity economy, the paper delineates the different aspects of the new technologies in Lebanon including the current state of startups, Fintech, e-government and e-commerce. Moreover, the paper investigates the potential labor market and inequality effects of the introduction of new technologies. The paper concludes with prospects and policy recommendations.

Keywords: Rentier Capitalism; Digital Technologies; Lebanon

JEL Classification: O14; O25; O33

1. Introduction

The world economy is at a historical juncture. New digital technologies have ushered a "Fourth Industrial Revolution" or a "Second Machine Age" (Brynjolfsson and McAfee, 2014). In this respect, new technologies, which encompass automation, robotics, and artificial intelligence, will have a profound impact on the economies of both advanced countries and developing nations. From applications in areas such as autonomous vehicles to the Internet of Things (IoT), they are promising to change the way in which people work and consume. Currently, data has become a factor of production that is limitless and non-rivalrous, and machine labor has become a natural complement to the data as a factor of production (Brynjolfsson, 1994; Varian, 2019). Furthermore, the new technologies are now entering a new phase where they jump from consumption and entertainment to production and investment in productive and efficiency enhancing technologies (Morgan Stanley, 2019). This is the phase of the revolution that is most impactful for advanced economies as well as for developing countries like Lebanon. These new applications, if transpired, will show that the Second Machine Age will have an effect on productivity and wealth generation in the same way as – or even more intensely than – the earlier phases of the industrial revolution. In effect, this would mean that the new technologies are not just new gadgets or sophisticated consumption items but are key to raising productivity, which in the end determines the long-run standard of living of nations.[2] However, in addition to this effect on productivity and growth, the new technologies pose many challenges, namely their effect on employment and inequality.

In the developing world, the new technologies will impact development paradigms. According to Sachs (2019), for developing countries, the "flying geese" approach – where initially labor-intensive products are exported to finance the import of capital goods that would lead to capital accumulation in new manufacturing sectors, as happened in East Asia – is now closed for other countries because of automation. These "jobs of the past" that provided the first step in the ladder of economic development pathway are no longer available as robots and AI substitute workers in the production of low-skilled commodities in the developed economies. Sachs (2019) also argues for new digital-based development pathways that include new export sectors that depend on the import of new technologies and Foreign Direct Investment (FDI) that offer "markets for the future," especially in sectors that benefit from economies of scale, such as telecom companies, tech companies, healthcare companies, higher education, the export of middle-tech services such as coding and big data management, and investment in e-government that would lead to an enhanced and wide range of public service and private business.

[2] This effect, if transpired, would counter the techno-pessimist argument advanced by Gordon (2012) which states that the new technologies are not as revolutionary and productive as electricity, the internal combustion engine, airlines, and other path breaking technologies of the 19th and 20th century that have had tremendous impact on productivity and growth.

In this paper, we will investigate the role of the new digital technologies in the Lebanese economy. The following section will present an overview of the economy, especially the post-war business cycle and the rise of a low productivity economy. Section three delineates the different aspects of the new technologies in Lebanon, including the current state of start-ups, Fintech, e-government, and e-commerce. Section four presents labor market effects. Section five investigates the potential effects on inequality, including gender inequality. Section six presents prospects and policy recommendations.

2. The state of the economy in Lebanon

According to the IMF, the Lebanese economy is projected to enter a Great-Depression-like crisis as real GDP is expected to plummet by 25 percent in 2020 (IMF, 2020). This has been the result of a three-pronged crisis: a currency crisis that ended almost three decades of exchange rate pegging, a banking crisis that led to a severe and sudden drop in liquidity, and the effect of COVID-19 on the economy. The collapse of the peg and the banking crisis, in addition to their effect on GDP and other macroeconomic variables such as unemployment, inflation, and investment, have declared the end of what we can call the "old post-war economic model."

Business cycles and growth

The post-war economic recovery in Lebanon started after 1992 when the foundations of a new economic model were laid down by the first Hariri government. The government implemented policies that aimed at the stabilization of the Lebanese pound, a reconstruction program and high government expenditures, and a tax reform that reduced income taxes (Azzi, 1998). The stabilization of the Lebanese pound was founded on using the exchange rate as a nominal anchor in a typical Exchange Rate Stabilization Program (ERBS). These policies led to a successively large budget, current account deficits, and the rapid accumulation of public debt.

The interest rate policy conducted in defense of the peg caused a major shock to the real economy as a result of the high level of real interest rates generating – early on in the reconstruction period – a typical ERBS business cycle with a recession interrupting the post-war growth beginning in 1998 (Dibeh, 2008). In the aftermath of the first post-war cycle, the Lebanese economy experienced growth volatility. According to the World Bank (2016), growth was highly volatile with a growth rate of 4.4 percent, on average, from 1993 to 2014, with a large average volatility of 3.2 percent.[3] In this respect, the second business cycle started with the expansion following the Paris II Conference in 2002 and ended with the assassination of Rafic Hariri in 2005 and, subsequently, the Israel-waged war on Lebanon in July 2006. The third cycle started with the

[3]According to the World Bank (2016), volatility is caused by the vulnerability of the Lebanese economy to shocks. The volatility is caused by the dependence of the Lebanese economy on sectors such as tourism and real estate that are vulnerable to security shocks. Moreover, growth was dependent on consumption, which is highly sensitive to confidence and security shocks.

expansion in 2007 with a real estate boom and increased capital inflows and ended in 2011. Since 2011, the Lebanese economy has witnessed a prolonged recession as a result of the unravelling of the causes of the post-2006 recovery; mainly capital inflows and the boom in the construction sector. It also manifests the long-term structural crisis in the economy that is characterized by the rise of low-productivity sectors, anemic job growth, and secular stagnation. We can, hence, divide the business cycle in Lebanon in the post-war period as follows (Table 1).

Table 1. Business cycle in post-war Lebanon

Period	Expansion/Recession	Cause
1992-1998	Expansion	Postwar reconstruction/stabilization of Lebanese Pound
1998-2002	Recession	ERBS Recession: high real interest rates, high real exchange rate
2002-2005	Expansion	Paris II (2002)
2005-2007	Recession	Assassination of PM, July 2006 war
2007-2011	Expansion	Real estate boom, Paris III
2011-2018	Recession/Secular stagnation	Exhaustion of regime of accumulation, real estate slowdown; secular stagnation[4]
2019-	Depression	Currency and banking crisis; COVID-19

Source: Author's compilation.

Structural change towards a low-productivity economy

The volatility and less than optimal economic growth in the post-war period led Lebanon to fail to recover its average income per capita of the pre-war 1970s.[5] In addition to the highly volatile and less than optimal post-war growth, the Lebanese economy underwent long-term structural changes which led to a gradual shift to an economy based on low-productivity activities, as resources shifted away from agriculture and manufacturing towards the less productive services and trade sectors.[6] In this respect, Berthelemy et al. (2007) showed that Lebanon entered a slow growth trap after 1996 partly because of the real appreciation that harmed competitiveness, leading to a move to the production of non-tradables where productivity gains are lower than in the tradable sector. According to the International Labor Organization (ILO) (2015): "After two decades of mediocre growth, average growth in worker productivity turned negative after 2010, suggesting increasing

[4] Some observers have attributed the post-2011 recession to the impact of the Syrian crisis and influx of refugees to Lebanon. However, there is scant evidence beyond the anecdotal on that effect. Although the crisis has affected trade and the tourist sectors (World Bank, 2015; Ianchovichina and Ivanic, 2016), David et al. (2019), using a Computable General Equilibrium (CGE) model, showed that the influx of Syrian refugees had a positive impact on economic growth reinforced by humanitarian aid flows.

[5] In fact, Lebanon's growth rate in the immediate post-war period was not as high as expected from growth in a postwar economy (see Dibeh, 2005).

[6] The high interest rates that dominated the Lebanese economy during the post-war period played a role in such 'deindustrialization.' The experience of other countries like Brazil and South Africa recently also show this detrimental effect of high interest rates on the manufacturing sector (Chang and Andreoni, 2020).

employment in relatively low quality, low-paying jobs in informal activities." Table 2 shows the time evolution of aggregate productivity in the period between 1991 and 2012.

Table 2. Aggregate Productivity Growth in Postwar Lebanon

Year	Output per Worker Index	Total Change (%)	Average Annual Change (%)
1991	95.02	-	
2000	100.0	5.24	0.58
2010	110.09	10.09	1.01
2011	107.84	-2.05%	-2.05%
2012	103.31	-4.21%	-4.21%

Source: ILO (2015).

One important aspect of structural change in the economy is its effect on the labor market. In Lebanon, as in other countries and regions, there has been a shift in the allocation of labor from the production of tangible goods (manufacturing and agriculture) to the production of goods (manufacturing and agriculture) to the production of services.[7] Table 3 shows the GDP composition by sector change between 2000 and 2018. The distribution of workers according to sectors shows a shift in weight as GDP per capita increases. The economy witnessed a decrease in participation in the goods market from around 48 percent to 36 percent and an increase in participation in the services market from around 52 percent to 64 percent as the GDP per capita increased from approximately USD 1,600 to USD 7,700 from 1991 to 2019 (See Figures 1 and 2).

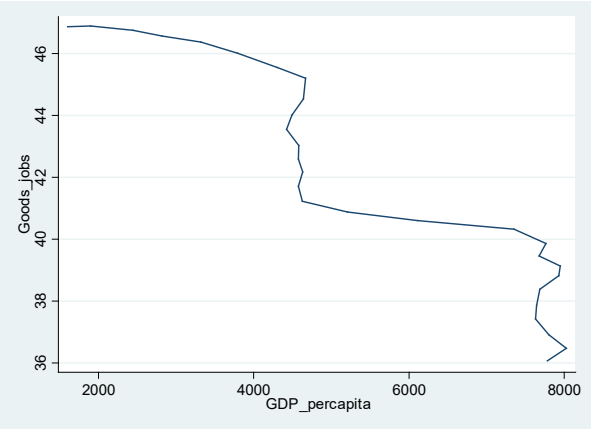
Table 3: The GDP composition by sector change between 2000 and 2018

Sector	Composition by sector in 2000	Composition by sector in 2010	Composition by sector in 2018
Agriculture	6.24 %	3.86%	3.24%
Manufacturing	11.41%	7.72%	7.62%
Industry	19.97 %	13.81%	14.23%
Services	61.52%	71.86%	76.67%
GDP	**100%**	**100.0%**	**100%**

Source: World Bank national accounts data, and OECD National Accounts data files[8].

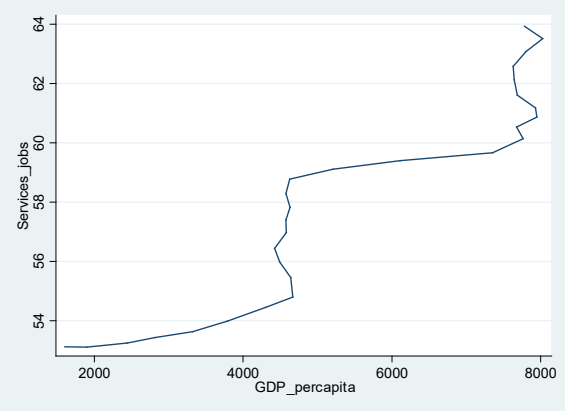
[7] According to the World Bank (2020a), a similar trend is happening in Latin America and would have significant implications with regard to the effect of automation on labor markets and the future of work.
[8] See https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=LB

Figure 1: The evolution of labor in the goods market with respect to the increase in the GDP per capita (1991-2019)



Source: World Bank database. International Labour Organization, ILOSTAT database.

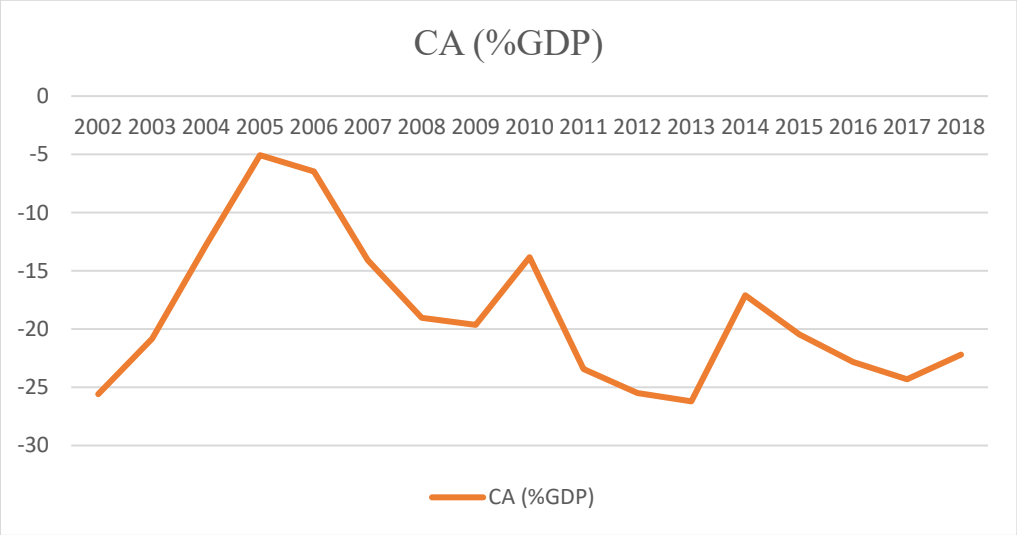
Figure 2: The evolution of labor in the services market with respect to the increase in the GDP per capita (1991-2019)



Source: World Bank database. International Labour Organization, ILOSTAT database.

The economy in the post-war period exhibited chronic current account deficits that proved detrimental, especially in the post-2011 period when capital inflows decelerated. Figure 3 shows these persistent current account deficits that reached more than 20 percent of GDP.

Figure 3. Current account deficits (% of GDP) between 2002 and 2019



Source: World Development Indicators.

Economic costs of political arrangements

One of the political-economic characteristics of the post-war period in Lebanon is the rise of a political system of sectarian distribution and redistribution among different sects in Lebanon. The Taif Accords that ended the civil war designed a redistribution of political power between sects that created the "Mohasasa" system in which the governing sectarian parties divided not only political power amongst them, but also "economic rents," and became the "the dominant system for structuring socioeconomic relations" (World Bank, 2016, p.57). Such a political-economic arrangement generated economic costs. In the broad sense, it created Olson-type growth-impeding coalitions (Olson, 1982) between the governing parties that paralyzed the implementation of optimal economic policies and created economic waste. The World Bank (2016) reports that the yearly cost of sectarianism, which it dubbed as "elite capture hidden behind the veil of confessionalism," to be nine percent of the GDP, according to Chaaban (2014). In addition to these broad political-economic and -macroeconomic effects of sectarianism, Diwan and Haidar (2016) show that politically-connected firms (PCFs) serve the constituencies of those in political power in a clientelistic manner which creates discrimination in labor markets. In addition, the existence of such firms leads to economic inefficiency; reducing job creation in sectors dominated by PCFs and stifling job creation at the sectoral-level in non-PCFs. Moreover, the public allocation process of government contracts also suffers from lack of competition, thereby allowing few companies to benefit from infrastructure funding in the post-war period (Atallah et al., 2020)

3. Assessment of digital technological readiness of Lebanon

As shown in section two, the Lebanese economy became dominated by low-productivity sectors.[9] In addition to the diminution of the share of agriculture and manufacturing in employment and output, the service sector is also dominated by low-productivity activities. According to the World Bank (2012), 35.4 percent of wage employees and 61 percent of the self-employed work in low-productivity service sectors such as retail and wholesale trade compared to only 14.3 percent of wage employees and three percent of the self-employed working in high-productivity service sectors such as information and communication, financial and insurance activities, and professional, scientific, and technical activities, while only 11.3 percent and eight percent respectively work in manufacturing. These structural changes were produced by a rentier economy that allocated resources to low-productivity activities while there was a latent scientific and technological readiness in the economy that would form a "skilled resource" base for the transformation of the economy. In this respect, the educational system produces highly-skilled graduates, however, firms lack the demand for such a skilled work force (Kawar and Tzannatos, 2012).[10] To investigate this potential, we look at various measures of the technological readiness of Lebanon.

The tech start-up ecosystem in Beirut

Lebanon ranked fourth worldwide in Total Early Stage Entrepreneurial Activity, according to the Global Entrepreneurship Monitor 2017/2018 Global Report (ESCWA, 2019a). Hence, it is important to look at the state of tech startups as they represent the ecosystem which will "incubate" the technologies of the Fourth Industrial Revolution. A study done by the World Bank (2017) showed that the tech startup ecosystem in Beirut is past its nascent phase but far from maturity; i.e. occupying a middle-stage ecosystem with a compound annual growth rate of 24 percent.[11] The study found that founders were highly skilled, with 90 percent holding university degrees and 50 percent holding graduate degrees. In Beirut, start-ups attended ten accelerator programs, three of which were international. However, although the presence of accelerators has increased funding

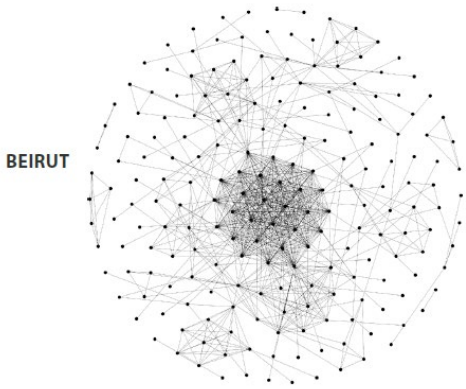
[9] The World Bank (2012) report or the MILES report was instrumental in analyzing the structural changes that occurred in the Lebanese economy during the reconstruction period.

[10] Hence, the job creation problem in Lebanon is a demand-side problem where the Lebanese firms and productive structure in general do not demand highly skilled labor force, or the labor mismatch is demand-constrained rather than supply-constrained.

[11] In 4 August, 2020, a huge blast at the Beirut port led to damage to economic activities in Beirut. The UNDP survey on businesses affected showed that out of 349 firms in the knowledge sector, only 13 percent did not sustain damage as a result of the explosion, with 27 percent sustaining structural damage and seven percent completely destroyed. See https://www.lb.undp.org/content/lebanon/en/home/library/impact-of-beirut-explosion-on-economic-activities-located-in-the.html.

to start-ups, they have not led to an increase in the quality of start-ups.[12] As start-ups form a community where knowledge and resources flow, the Beirut community network is still sparse with low density and a limited number of clusters; with one main cluster formed by the Central Bank of Lebanon (BdL) accelerate (Figure 4).[13]

Figure 4. Beirut community start-up network



Source: World Bank (2017).

AI-related start-ups and participation in GVCs

ESCWA (2019a) surveyed established companies that have been set up in various areas of the Fourth Industrial Revolution, from AI to block chain technology. Table 4 shows the different companies established in Lebanon in the various areas of digital technologies. In this respect, it is important to note that Lebanon has a vibrant assembling generators and transformers industry as part of the electrical machinery industry, which constitutes 9.7 percent of the manufacturing sector. According to ESCWA (2019a), this electronics sector "would be an impactful sector to grow as part of 4IR technology development, particularly in robotics, automation and instrumentation." (p. 36). However, according to the World Bank (2020b), Lebanon has participated only in the limited manufacturing part of the Global Value Chains (GVCs).[14] The report lists the top ten technology rising stars in Lebanon. Out of the ten "rising stars," only one type (spark-ignition engines for

[12] The quality of start-ups is measured according to World Bank (2017), by "the ratio of quality, as represented by the acceleration multiplier of investment (0.95) to quantity, as represented by the acceleration multiplier for funding probability (2), which results in a ratio of 0.48. This is consistent with the quality to quantity ratio from other middle stage ecosystems, such as Cairo, which also has a ratio of less than one, while mature ecosystems such as New York City will have a ratio of more than one," (p. 14). The acceleration multiplier of investment is measured by the ratio of accelerated start-ups receiving average investments to unaccelerated start-ups' average investments. The multiplier for funding opportunity is the likelihood of start-ups supported by accelerators to receive funding as those that do not.

[13] BdL accelerate is the result of the BdL circular 331, which started in 2013 to provide funding for start-ups in Lebanon in the order of USD 650 million.

[14] According to the World Bank (2020b), countries and regions participating in GVCs are classified into four types of exporters, from low complexity to high complexity: commodities, limited manufacturing, advanced manufacturing and services and innovative activities.

aircrafts) is in a sector most amenable to GVCs. In comparison, countries such as Tunisia had three types, while Morocco and Jordan had four and two, respectively.

Table 4. Lebanese companies in various areas of the fourth industrial revolution

Type	Companies
Artificial Intelligence	Seez (car sales), Cherpa (education), Giftlivery (e-commerce), Neotic (fintech), Augmental (education), Lexium (legal), Tapklik (media), and NAR (inspection)
Augmented Reality and VR	Sfearia (medical), Proximie (medical)
Robotics and Automation	Instabeat, the first waterproof heads-up swimming wearable; the Little Engineer; Lamba Lab
Internet of Things	Scriptr (software platform), Verboze (hotel automation)
Biotechnology	Algorithm, Azm Centre for Research in biotechnology and its applications
3D Printing	Buildink (a concrete 3D printer) – Inkript
Blockchain	Central Bank of Lebanon

Source: ESCWA (2019a).

Network readiness

The overall ability of Lebanon to participate in the Fourth Industrial Revolution depends on many dimensions and factors. The Network Readiness Index (NRI) measures such readiness of countries based on four pillars: technology, people, governance, and impact (Dutta and Lanvin, 2020). Lebanon's overall rank was 90 out of 134 countries. Tables 5 and 6 show Lebanon's score and rank in the various pillars.

Table 5. Lebanon's rank and score in the NRI Index

Pillar	Rank	Score
Technology	61	41.55
People	67	47.91
Governance	123	34.82
Impact	100	40.94

Source: Dutta and Lanvin, 2020.

Broadly, Lebanon does better in the areas of technology and people ranking in the 60s than in the areas of governance and impact ranking in the 100s.[15] Table 6 presents rank for selected sub-pillars of the main pillars that Lebanon is deficient in; defined as rank above 67.[16] We can conclude that Lebanon, in addition to being "weakly ready" in the areas of governance and impact, **has five areas where significant improvement is needed**. First, in the speed, pricing, and subscriptions

[15] The impact dimension measures the impact on economy, quality of life and SDG contribution.
[16] Except for sub-pillar on government which is presented in section on e-government.

to broadband; second, in future technologies, specifically the adoption of emergent technologies and computer software spending; third, in the regulation of the digital sector and ease of doing business in general; fourth, in the area of inclusion of e-participation and socio-economic exclusion; and finally, in the advancement of the high-tech sector in the economy.

Table 6. Selected NRI indicators for Lebanon

Technology (access)	Rank
Mobile tariffs	95
International Internet bandwidth	89
Technology (future technologies)	
Adoption of emerging technologies	79
Computer software spending	102
People (individuals)	
Active mobile-broad **band subscriptions**	105
People (businesses)	
Ease of doing business	115
Governance (trust)	
Cybersecurity	117
Governance (regulation)	
ICT regulatory environment	131
E-commerce legislation	77
Governance (inclusion)	
E-participation	119
Socioeconomic gap in use of digital payments	121
Impact (economy)	
Medium and high-tech industry	79
High tech exports	100

Source: Dutta and Lanvin, 2020.

The "fiscal burden" on the telecommunication sector in Lebanon

The telecommunication sector can be considered as the basic infrastructure for the process of digitalization of the economy. In Table 5, we see that the sector has not given a high ranking for Lebanon in terms of mobile tariffs, international internet bandwidth, and active mobile broadband subscriptions. However, the sector has made recent strides as a fiber optics network is being implemented, along with the introduction of 5G services in 2019. The telecommunication sector in Lebanon is publicly-owned and is divided into three corporations: one for fixed line services and two for mobile services. In this respect, there have been plans for the privatization of the sector since 2002. However, the sector's lagging status arises not from the ownership or market structure, but from what we can call a "fiscal burden" on the sector. The first element in this burden is that the sector is considered a source for revenue for the government, even when the mobile sector was private (pre-2002). The government revenue from the sector in 2019 was USD 1.5 billion or around nine percent of total revenues. The second element in the burden is the dearth of public investments in the sector. In 2015, the Ministry of Telecommunications launched the "Lebanon 2020 Digital Telecom Vision" entailing a total expenditure investment of USD 600 million, which amounted

only to around seven percent of the telecommunication sector's revenue. Moreover, it is not clear if the plan was fully implemented.[17]

Fintech and new digital finance

The current banking system crisis in Lebanon manifested itself in the total collapse of credit in the economy. This event exacerbated the already difficult credit situation for financing innovation and start-ups in the areas relevant to the Fourth Industrial Revolution. Even before the crisis, credit provision was already weak. With respect to the financing of tech start-ups, the World Bank (2017) has noted that "contrast with West Bank & Gaza's ecosystem is particularly striking: in Beirut, it takes twice as long for a start-up to obtain credit and almost four times as long to receive funding." In addition, using a sample of eight MENA economies (Djibouti, Egypt, Jordan, Lebanon, Morocco, Palestine, Tunisia, and Yemen), Betz and Ravasan (2016) showed that the existence of credit constraints, in the form of a stringent collateral regime, has led to suboptimal job growth. In this respect, fintech may provide the solution for both the dearth of credit to tech start-ups, and to the banking crisis. It can form part of the restructuring of the banking system that was geared towards financing the state at high interest rates, which led to the rise of what we can call an "ultra-bank" where the commercial banks deposits with BdL exceeded USD 120 billion or two thirds of their assets.

In contrast, the attributes of fintech hold significant relevance in the Lebanese context today as they will relax financial constraints and form a new medium of capital intermediation outside the traditional banking system. However, the current fintech landscape is weak. Most fintech solutions have been a "digital" complement to existing traditional banks, which is not the type of fintech that would fully exploit the potential for the financing of innovation. One of the main obstacles is the lack of a legal and regulatory environment that governs the establishment of such fintech lenders outside the commercial banking system.[18] Interestingly, the BdL announced in November 2020 plans to issue a digital currency that will be traded locally and used as means of payment, stating that it would stimulate financial technologies and provide a savings vehicle to the consumer. In this respect, this issuance could also make a dent in the dominant but now defunct commercial banking system. Several effects are expected from the introduction of a central bank digital currency; from consumers wanting to hold central bank digital currency rather than deposits with banks, to reordering the chain of funding and transforming banks to be funded by equity rather than deposits (The Economist, 2020). All these potential effects can be part of an overall restructuring of the crisis-ridden banking system in Lebanon.

[17] The Ministry of Telecommunications has removed the link to the plan on its website.

[18] An interesting new cooperative enterprise was recently established called Shreek, which offers individuals and firms alternative savings and finance services. According to its website, "Shreek is an innovative Lebanese institution that works to enhance its members' socio-economic conditions, by providing sustainable alternatives for saving and credit and money management." See https://shreek.org/about/.

E-Commerce

E-commerce is the most developed digital technology in Lebanon, with hundreds of sites that are offering online shopping and transactions services and many e-commerce developers. This is expected as the Lebanese economy is service- and trade-oriented. According to the 2019 UNCTAD B2 E-Commerce index, Lebanon ranked 68 (out of 152) in the world and ranked ninth in Western Asia. Table 7 shows the components of the B2C e-commerce index for Lebanon and selected regions. The table shows that in internet usage and postal service reliability, Lebanon scores above the world average and above the score for Western Asia.[19] In contrast and surprisingly, Lebanon lags behind the world and Western Asia in individuals' holding of financial accounts and in secure internet servers.[20] Lebanon stands relatively well-positioned to enter a new phase of e-commerce expansion, especially in the light of anecdotal evidence that, with the advent of the COVID-19 crisis, the online shopping market has experienced a significant boom. It is to be noted that this new wave of online shopping services is spearheaded by small and medium businesses which comprise around 97 percent of all Lebanese enterprises (IFC, 2014) despite the existence of monopolies that can exploit e-commerce to the advantage of large firms that can dominate the online market environment.[21]

Table 7. Lebanon and regional values for the UNCTAD B2C e-commerce index, 2019

Country/Region	Share of individuals using the Internet (2018 or latest)	Share of individuals with an account (15+, 2018 or latest)	Secure Internet servers (normalized) (2018)	UPU postal reliability score (2018 or latest)	2019 Index value
Lebanon	78	45	48	67	59.4
Western Asia	75	48	49	52	59
Developed	86	93	87	82	87
World	57	60	55	49	55

Source: UNCTAD (2019)

E-Government

Although the successive governments in Lebanon since the end of the civil war have publicized the project of administrative reform with e-government being at its heart, only slight progress has been made in this area. Table 7 shows the development of the UN E-government Development

[19] Reliability does not include cost of service, which in Lebanon is considered high – at least before the currency depreciation.

[20] It is to be noted here that most online shopping sites do provide payment in cash service, which mitigates the negative effects of lower financial accounts holdings. In addition, with the current banking crisis, it is expected that this low value will even deteriorate as a result of the de-banking of a large section of the population.

[21] In this respect, the informal economy can play a major role in the expansion of e-commerce. The informal sector in Lebanon is prevalent in many sectors such as agriculture (92 percent), commerce (58 percent) and transport, post and telecommunication (71 percent) (ILO, 2015). It is worth mentioning that a new phenomenon of "informal" Instagram accounts selling items online has been detected in Lebanon.

Index (EGDI) since 2003. It is clear that there is a deterioration in the rank of Lebanon in the world with respect to this index although the large drop in 2020 was, according to UN-DESA (2020), more of a result of the methodological change in the calculation of the index than in country performance. In addition, Table 9 shows the UN-DESA E-participation Index, which measures various aspects of the citizenry participation in e-governance, namely the use of online services to facilitate the provision of information by governments to citizens ("e-information sharing"), interaction with stakeholders ("e-consultation"), and engagement in decision-making processes ("e-decision making").

Table 8. EGDI for Lebanon (2003-2020)

EGDI	2020	2018	2016	2014	2012	2010	2008	2005	2004	2003
Lebanon (Rank)	127	99	73	89	87	93	74	71	74	69
Lebanon (Value)	0.4955	0.553	0.5646	0.49823	0.51388	0.43875	0.484	0.456	0.41634	0.42361

Source: UN-DESA (2020)

Table 9. E-participation Index for Lebanon (2003-2020)

EPART	2020	2018	2016	2014	2012	2010	2008	2005	2004	2003
Lebanon (Rank)	148	122	91	110	48	45	28	69	69	72
Lebanon (Value)	0.3333	0.4438	0.4913	0.2941	0.3158	0.2712	0.4099	0.1111	0.0816	0.0862

Source: UN-DESA (2020).

It is also clear that Lebanon's rank has deteriorated in this vital index since 2003, as presented in Table 8. To further quantitatively assess the state of e-government in Lebanon, Table 10 provides selected e-government-related indicators from the Network Readiness Index (NRI) (Dutta and Lanvin, 2020), which shows Lebanon's low world ranking in these indicators.

Table 10. Government-related indicators from the NRI

Category	Rank
Government online services	114
Publication and use of open data	100
Government promotion of investment in emerging technologies	93

Source: Dutta and Lanvin (2020).

4. Digitalization and labor markets

The new technologies of the Fourth Industrial Revolution impact labor markets, and the future of work is considered one of the most important transformations that will happen as a result of the introduction of such technologies – both in the advanced and developing economies. In addition, the impact of such technologies on inequality is assumed to be pervasive, as demand for skilled and capital-labor substitution alter the returns to different factors of production. In addition, automation raises the specter of massive job losses (Frey and Osborne, 2013).

Types of jobs and threats of automation in Lebanon

According to Frey and Osborne (2013), who assessed the degree of vulnerability of 702 occupations as automation takes place in the United States, administrative workers and office clerks, among others, are highly at risk of losing their jobs. According to ESCWA (2019a), only around 20 percent of jobs in Lebanon are at risk of being automated in agriculture and industry, the sectors deemed susceptible to automation. This job loss would be heavily skewed towards low-skilled workers. Lebanon's labor force with low-skilled activities, such as clerical support workers and other workers with low skills, occupy around 20 percent of the total force (see Table 11). Moreover, the Lebanese economy is extremely reliant on the banking industry that accounts for a large part of the already dominant services sector. This will further magnify the effect of automation because of the wide change that will occur as banks heavily shift towards automation according to Cusano and Starrs (2017).[22]

Table 11: Distribution of employed (aged 15 years and above) according to occupation in current work and gender, Lebanon, 2018 (in thousands)

Occupations	Gender		
	Female	Male	Total
Legislators, senior officials, and managers	23	86	109
Professionals	145	106	251
Technicians and associated professionals	33	46	79
Clerical support workers	32	37	69
Service and sales workers	91	231	322
Skilled agricultural, forestry, and fishery workers	5	33	38
Craft and related trades workers	15	248	264
Plant and machine operators, and assemblers	3	138	141
Elementary occupations	133	109	242
Armed forces occupations	4	69	73
No response	0	2	2
Total	**485**	**1,105**	**1,590**

Source: Labour Force and Household Conditions Survey 2018-2019 published by Lebanon's Central Administration for Statistics (CAS) and the International Labor Organization (ILO)[23].

We can further investigate the structure of the labor market in Lebanon by looking at the skilled/unskilled labor mix in production in order to assess the potential effect of automation. For instance, as seen in Table 12, **37 percent of Lebanon's labor force in production is classified as unskilled labor which will be vulnerable to automation**.

[22] The World Economic Forum (2016) predicts that there will be a large shift in the skills needed in the banking sector where the transformation will be biased towards skills that are more abstract due to the fact that new technologies are becoming more and more capable of handling different types of tasks.

[23] See: http://www.cas.gov.lb/index.php/component/content/article/79-english/221-labour-force-and-household-conditions-survey-lfhlcs-2018-2019-microdata-files

Table 12: Proportion of skilled and unskilled labor out of all production workers in percent

	2013	2019	Average 2013 and 2019
Proportion of skilled workers	48.0	73.7	63.0
Proportion of unskilled workers	52.0	26.3	37.0

Source: The World Bank Enterprise Survey (WBES). These variables are calculated only for manufacturing firms in the WBES.

Furthermore, such job losses of unskilled workers will augment the informal labor force. In this regard, Bhattacharjee and Chowdhury (2020) investigated the effect of automation in the Singaporean manufacturing sector. They concluded that higher degrees of automation will enhance the position of highly-skilled workers in the formal sector. On the other hand, low-skilled workers in the formal sector will be forced to lose their jobs and hence will relocate to jobs in the informal sector. In this respect, Table 13 shows that around 55 percent of workers were employed in the informal sector. As such, an increase in automation would further amplify the numbers of informal Lebanese workers.

Table 13: Distribution of employed (aged 15 years and above) according to formality-informality of employment and sex, Lebanon, 2018 (in thousands)

Employment	Gender		
	Women	Men	Women and Men
Informal	269	605	**874**
Formal	216	500	**717**
Total	**485**	**1,105**	**1,590**

Source: Labour Force and Household Conditions Survey 2018-2019 published by Lebanon's Central Administration for Statistics (CAS) and the International Labor Organization (ILO).

However, in the Lebanese context, where 95 percent of firms are micro to medium firms, the effects of automation on employment will be mitigated as small firms are less likely to adopt automation of jobs. In this respect, there is ample evidence of a positive relationship between firm size and the degree of automation within the firm. For example, Cainarca et al. (1990) analyzes the effect of firm size on the adoption of automation in the Italian metalworking industry and arrives at a positive correlation between the former and the latter. Similarly, Swamidass and Kotha (1998), using data on 160 manufacturing firms in the United States, concluded that as firm size increases in a logarithmic manner, the rate of AMT adoption increases linearly.

5. Digitalization's impact on inequality

Inequality of wealth and income in Lebanon

One of the consequences of the post-war economic model in Lebanon is the rise of income and wealth inequality. In a seminal paper aptly titled "The Lebanese economic miracle: The extreme concentration of income and wealth in Lebanon: 2005-2014," using, for the first time, personal income tax records with data from household surveys, Assouad (2017) shows that income is highly concentrated, with the richest ten percent and one percent of adults accounting for respectively 56 percent and 23 percent of total national income on average between 2005 and 2014. In contrast, the bottom 50 percent are left with approximately half of what is accruing to the top one percent.[24] In addition, wealth is, on average, extremely concentrated with the top one percent and ten percent acquiring almost 45 percent and 70 percent of total wealth respectively. In addition, it is found that there is a global impoverishment of the Lebanese population after 2011, where the bottom 90 percent of the adult population experienced a negative growth, far below the average, while the top ten percent enjoyed very large growth rates.[25]

The prevalence and rise of such high inequality in income and wealth in Lebanon is highly tied with Lebanon's post-war model. First, early on in the post-war period there was suppression of the labor movement and unions in an attempt to protect the stabilization of the Lebanese pound from any wage-price spirals. The minimum wage freeze that lasted from 1996 to 2008 played an important part in reducing the labor share of income.[26] Such anti-labor measures were also seen as a form of "socialization of parts of the reconstruction costs" (Perthes, 1997). In 1997, the government engineered a split in the General Federation of Labor and, since then, independent labor unions have been marginalized and new politically-affiliated unions were established.[27] Second, the rise of low-productivity and informal sectors led to further pressure on the wages and incomes of the poor. In such an environment, the labor share of income reached 40 percent. Third, the rentier system in which high interest rates on public debt, subscribed to by the wealthy and commercial banks, led to income and wealth accumulation in the hands of the few. The high return

[24] According to Assouad (2017) "the top 0.1 percent of the adult population, that is approximately 3,000 individuals, receives approximately the same amount of national income as the bottom 50, that is 1.5 million individuals."

[25] Assouad (2017) uses a 'fiscal correction" to the survey data that is available in Lebanon, which significantly underestimate income inequality. This "correction" is in line with those advanced and observed by Abu-Ismail and Sarangi (2015), which estimate the extent of the presence of the "missing wealthy" in the Arab region, which derive from new sources of income in profits, rents, and external income generated by the oil boom and economic liberalization. However, such incomes usually do not appear in household surveys, as rich households tend to underreport their incomes. By comparing the difference in growth rates between final consumption expenditures per capita from national accounts data and the growth recorded in consumption in household survey data, estimation was carried out for six countries: Egypt, Jordan, Oman, Syria, Tunisia, and Yemen, but unfortunately not in Lebanon. However, the Assouad calculations and the prevalence of such rent and external incomes in Lebanon shows the importance of such incomes in driving up income and wealth inequality.

[26] There were wage increase in 2012 in the private sector and a significant increase in public sector wages in 2017 that can be seen as a result of pent up pressure in labor markets that experienced wage freeze for a long time.

[27] The split came after "a government-orchestrated defeat of labor leader Ilyas Abu Rizq in the General Confederation of Labor (CGTL) elections of 24 April 1997" (Baroudi, 1998). According to Atkinson (2015), structures of power in the economy can have a significant effect on inequality. in particular, the prevalence of monopolies, and the weakness of labor unions and collective bargaining, can lead to higher inequality, caused by "the fact that the balance of power is weighted against consumers and workers."

on “capital” assets given low growth rates of the economy followed what Piketty (2014) calls "the fundamental contradiction of capitalism,” which is determined by the relationship between the rate of return on capital (r) and the rate of growth of the economy (g). If r > g then the income accruing to owners of capital grows faster than the rate of growth of national income, and hence inequality between capital income and labor income rises. In Lebanon, this fundamental contradiction can be conjectured to have had a significant impact on inequality, given the low growth rates since the 1990s, and the higher rates of return on capital (profits, interest, rents, dividends…etc.) over time. The World Bank (2016) estimated this effect for Lebanon during the period 1993-2013 and found that the average yearly r-g was 2.5 percent. The cumulative effect of this positive divergence has hence been increasing inequality between the owners of capital and workers.

Table 14. Measures of income and wealth inequality in Lebanon

Type of Inequality	Description
Labor Share	40% of GDP
Top 1% Income	23%
Top 10% Income	56%
Wealth of few as % of GDP	30%
Top 1% wealth	45%
Top 10% Wealth	70%
Wealth Gini	81.9
r-g	2.5%

Source: Labor share, Guerriero (2012). Wealth Gini. Credit Suisse (2019); Top income and wealth, Asouad (2017). Rate of return minus growth, World Bank (2016).

Poverty in Lebanon

As we have seen, the Lebanese economic model was not successful at regaining peak pre-war income per capita. In addition, except for the top ten percent of income earners, the vast majority of the population has been experiencing a drop in income as shown by Assouad (2017). In addition, an interesting aspect of the Lebanese economic model is the persistence of poverty since the 1990s. Although many of the developing countries have experienced a significant drop in their poverty rates in the past thirty years, Lebanon has maintained a persistent poverty rate of around 30 percent since the first post-war measure of poverty rates in 1996. In the first measure of post-war poverty, Haddad (1996) estimated that 28 percent of the population lived under the poverty line. In 2008, a UNDP study published as Laithy et al. (2008) measured poverty levels and found that 28.6 percent of the population lived under the poverty line. CAS-WB (2015) showed that 27 percent of the population were poor based on the 2011/2012 household consumption survey. Furthermore, it is interesting to note that the latter study showed that poverty rates amongst productive sector workers (agriculture and manufacturing) was higher than in the service sectors and that poverty incidence is higher for informal workers (daily and weekly paid); reaching higher rates than the national average. Finally, in the aftermath of the economic crisis and COVID-19 shock, Abu-Ismail (2020) estimated that poverty rose to 55.3 percent in May 2020.

Horizontal inequality and poverty

According to Stewart (2000), horizontal inequalities among different groups in culturally diverse societies has been largely neglected in the development literature. In Lebanon, this type of inequality takes the form of inequality between sects and regions. Table 15 shows the poverty levels in different regions according to CAS-WB (2015).[28] The data shows that the regions that have the highest poverty rates are the North and Bekaa.

Table 15. Poverty headcount by region in Lebanon

Region	Poverty Rate (%)
Beirut	16
Mount Lebanon	22
North Lebanon	36
Bekaa	38
South	31
Nabatieh	25

Source: CAS-WB (2015).

Skill-driven inequality

One of the major effects of new digital technologies is inequality in labor incomes between skilled and unskilled workers as this type of technological change exhibits skill-based technological change characteristics. A positive technological shock causes an increase in productivity and demand for skilled labor and a decrease in demand for unskilled labor, which causes earnings inequality between the two types of labor (Katz and Murphy, 1992). In this respect, we can predict that, in addition to being threatened with unemployment, the unskilled labor force in Lebanon will be worse off in terms of incomes relative to skilled workers as a result of the introduction of digital technologies. To assess the extent of the potential effect on labor income inequality, we look at the current wage inequality. According to Saliba et al. (2017), there is significant labor income inequality in Lebanon, with private sector earnings disproportionately distributed between income groups with the top two percent capturing a share of income almost as high as that of the bottom 60 percent with a correspondingly high Gini of 0.5. The study does not empirically determine the factors that led to such labor-labor inequality, but it is expected that automation and digital technologies – by favoring higher skilled workers – will only worsen the current labor distribution of income.[29]

[28] There is no available official data on poverty or inequality between different sects. Cammett (2011) provides a snapshot of socio-economic status of different sects from a survey sample in 2008 that includes household income, an index of ownership of basic household items, and an index of measures of financial hardship. Cammett (2011) concludes that "the variation in the sample corresponds with general expectations about the population: Christian respondents generally have higher socioeconomic status than Shi'a, Sunnis, and Druze."

[29] In Lebanon, inequality in access to education will exacerbate such skill-biased technological change effects on inequality. According to UNDP HDI, Lebanon's HDI (0.744) while the HDI education index value adjusted for inequality in distribution of years of schooling is 0.567 which signifies a high degree of inequality in access to education in Lebanon. (see http://hdr.undp.org/en/countries/profiles/LBN).

In this respect, Lebanon has a substantial skilled migrant workforce that works in the Gulf Cooperation Council (GCC), Europe and the United States. In 2014, there were an estimated 885,000 migrants with 41 percent in GCC, 23 percent in North America, and 21 percent in Europe (De Bel-Air, 2017). The proportion of skilled workers in the GCC countries is unknown.[30] However, De Bel-Air (2017) reports that in Europe and North America, the majority of Lebanese migrants were highly-skilled professionals. In the aftermath of the current crisis, anecdotal and journalistic evidence lend support for an increase in the emigration of skilled labor that is expected to continue unabated in the coming years. Notwithstanding the old numbers (stock of skilled migrants) and the new numbers (outflow of new skilled migrants), this skilled labor migration is a major generator of current skill-based inequality between the migrants and all forms of local labor, whether skilled or unskilled. The migration of labor can be seen as leading to a "dual economy": the traditional local economy with low wages and the modern external economy with high wages. In this respect, the adoption of new technologies in Lebanon will have a mitigating effect on "income differentials" between local skilled labor and migrant skilled labor, as wages of local skilled labor increase with increased demand for skilled labor resulting from the growth of high-tech sectors.

The other migration

In addition to the emigration of labor, Lebanon is characterized by immigration of especially low-skilled labor from Syria and other countries. The flow of Syrian labor has increased since 2011 with the onset of the crisis and war in Syria. This pool of low-skilled labor joining an already large pool of low-skilled Lebanese workforce can have two potential (conflicting) effects with respect to automation. First, the widening of the inequality generated by skill-biased technological change as unskilled foreign labor push low-skilled wages down.[31] Second, the wide availability of low wage unskilled labor may hinder the process of adoption of new technologies in manufacturing and agriculture, the sectors most susceptible to automation, as relative prices of capital and labor may not induce firms to substitute capital for labor. This latter process will be exacerbated by the currency depreciation; making imported technologies more expensive relative to cheap local and foreign low-skilled labor.

Capital-labor inequality

[30] De Bel-Air (2017) refers to a survey of respondents living in the GCC states (108 men and 36 women) that showed that a higher rate of managerial and professional positions. Maher (2015) says that, of approximately 42,000 Lebanese migrants in Kuwait, over 60 percent are considered to be highly-skilled migrants. For Lebanese youth, Dibeh et al. (2018) has shown that having a university education is a determinant of willingness to emigrate.

[31] According to ILO (2014), there is evidence for downward pressure on wages as a result of the Syrian refugee influx. In the model of David et al. (2019) the labor income suffers a drop of 8.6 percent due to shock to exports and an additional 5.9 percent due to the influx of refugees between 2011 and 2018. In terms of differences in skills, the low and medium skilled workers see their incomes drop by eight percent and five percent respectively while the high skilled workers experience a slight increase in incomes by 0.25 percent. In Ianchovichina and Ivanic (2016), both skilled and unskilled labor suffer a reduction in wages of around 11 percent and 12 percent respectively.

Technology is also changing the way by which national income is divided between the owners of capital and labor. Technology such as robots, automated voice-response systems, and computers can substitute for labor. In this respect, the distributional impact of such technological change via increase of the use of capital depends on the elasticity of substitution between capital and labor, σ. If $\sigma > 1$, which means that labor is easily substitutable with capital, the share of wages in output goes down and the share of profits goes up. Piketty (2014) has shown that this "capital deepening" was one of the main reasons for the rise of capital share in recent times in many advanced capitalist economies.[32] Many other studies have corroborated this profit share increasing impact of new technologies (Korinek and Stiglitz, 2019; Moll et al., 2021). In particular, Moll et al (2021) show that automation leads to higher return on capital, generalizing Piketty's *r-g* relationship explaining, in part, the recent trends in income and wealth inequality in the US. Hence, we conclude that, in congruence with international trends, the introduction of new technologies will likely lead to increased inequality between capital and labor incomes; increasing the share of capital income in Lebanon.

Gender inequality

The gender digital divide is pervasive around the world (OECD, 2018). Some of the salient elements of this digital divide from data on G20 countries include: lower proportions of women graduates in engineering, manufacturing and construction, or ICTs; with women representing only 24 percent of graduates in engineering and manufacturing and construction and just 25 percent in ICTs. In addition, software is a male-dominated world, especially in companies. In the open source R software, only 15 percent of software authors are females. Moreover, the gender gap in entrepreneurship is wide and persistent. According to the report: "Men are nearly twice as likely as women to be self-employed; they are three times more likely than women to own a business with employees across OECD countries; and 90 percent of innovative start-ups seeking VC investments have been founded by men. Women-owned start-ups receive 23 percent less funding and are 30 percent less likely to have a positive exit – i.e. be acquired or to issue an initial public offering – compared to men-owned businesses" (p. 15).

In Lebanon, no comprehensive data exist on the gender digital divide, but some insights can be concluded from the World Economic Forum Global Gender Gap Report (WEF, 2020) and other sources of data on the gender divide in the labor market. In Lebanon, a gender wage gap exists.[33] In this regard, and even after controlling for characteristics such as education and experience, Dah

[32]We used the World Bank Enterprise Survey (WBES) covering data for Lebanon for two years (2006, 2009), to estimate capital-labor elasticity of substitution. We found that the elasticity of substitution is 6.93, which is much larger than one (see appendix A.1 for details on estimation). The estimation is only indicative as it relies only on the two available data points in the WES for the years 2004 and 2009. Unfortunately, the WES series did not produce usable data in 2016.

[33] Moreover, gender discrimination is also prevalent among the youth in the MENA region. Based on a recent survey of the youth in Algeria, Egypt, Lebanon, and Tunisia, a study by Benhaddad et al. (2017) reveals that women's income in these four countries is 54 percent less than that of men with equal levels of education and experience.

and Fakih (2016) found that a significant part of the income gap between men and women in the Lebanese banking sector could not be attributed to visible factors. As such, data from the Labor Force and Household Conditions Survey 2018-2019 (Table 16) show that males benefit from better employment status and higher income, albeit slightly (see Appendix A.2 for the construction of these variables). However, the main gender divide in this respect is the low rate of female labor participation rate, which stands at 26 percent.

Table 16: The gender gap in the Lebanese labor market

	Male	Female
Proportion of employed	0.90	0.85
Mean Income	2.81	2.78

Source: Labor Force and Household Conditions Survey 2018-2019 published by Lebanon's Central Administration for Statistics (CAS) and the International Labor Organization (ILO).

In terms of the Global Gender Gap Index, Lebanon's rank is very low at 145 out of 153 countries. Table 17 shows selected indicators that have significance in terms of their relevance or interaction with the digital divide. In many labor market characteristics, the gender divide is large, which – if not surmounted by the digital revolution – will not bode well for the female labor force. First, labor market participation for females is very low at 26 percent, a rate that has not changed much since the start of post-war reconstruction. In addition, firms with females as top managers or majority female ownership are a rarity. On the positive side, there is almost a gender parity in assuming professional and technical work. In the area of access to credit and to non-land assets, female access is good, which allows females to have the resources needed to start tech businesses. However, females are discriminated against in terms of inheritance and access to land assets which, given the importance of inheritance and land assets in providing resources across generations, gives males a clear advantage in access to resources in Lebanon. Finally, in terms of educational attainment with relevance to digital technologies, females significantly lag behind males in STEM attainment (~0.5) and in information and communications attainment (~0.3) which allows males to have a larger supply of skilled labor in the new digital sectors. On the other hand, females are at an advantage with respect to males in science and mathematics education (1.7), which bodes well as these areas will be demanded in the new sectors.

Table 17. Selected indicators of gender gap in Lebanon

Indictor	Female	Male	Score	Rank
Labor force participation rate	26.3	76.3	0.34	142
Wage equality for similar work			0.619	90
Estimated earned income, int'l $ 1,000	4.6	18.5	0.25	140
Professional and technical workers, %	48.3	51.7	0.933	86
Advancement of women to leadership roles, 1-7 (best)			4.13	
Gender parity in tech roles, 1-7 (best)			3.71	
Firms with female top managers (%)	4.40	95.60	0.05	
Firms with female majority ownership (%)	5.30	94.70	0.06	
Right to hold a bank account & get credit, 0-1 (worst)			0.25	
Inheritance rights for daughters, 0-1 (worst)			0.75	
Women's access to land use, control & ownership, 0-1 (worst)			0.50	
Women's access to non-land assets use, control & ownership, 0-1 (worst)			0.25	
STEMS, attainment %	18.03	30.34	0.59	
Information & Comm. Technologies, attainment %	1.12	3.25	0.34	
Natural Sci., Mathematics & Statistics, attainment %	10.92	6.41	1.70	

Source: Global Gender Gap Index, WEF (2020)

Will the new digital technologies bridge the gender divide in Lebanon? By looking at anecdotal evidence from the current state of tech startups, we can see that women are actually leading men in many areas of the nascent tech sector. According to Lee (2017), at the Beirut Digital District, which is the premier hub that provides space for approximately 70 tech startups and companies with 1,300 employees, the gender ratio is 1.22 in favor of women. However, at the executive level, the ratio is 80 percent men to 20 percent women (Rowley, 2017). In sum, Lebanon suffers from a massive gender gap in many areas in the economy and society (ranking 145 out of 153 countries). With respect to various indicators relevant to digital technologies, Lebanon has a mixed standing at best, with many indicators such as labor market participation, pay parity, ownership, and access to resources playing against women in this area. However, education and recent evidence on the participation of women in the existing tech sector shows that the development of the digital sector in Lebanon will help in bridging the gender divide.

6. Prospects on digitization and policy recommendations

From rentier capitalism to digital capitalism

The deep crisis that has beset the economy since 2019 and the uprising of 17 October, 2019 pronounced the end of the post-war economic model.[34] The rentier economy is currently in shambles; experiencing high inflation and the destruction of financial wealth (Abu-Ismail, 2020). These developments have made rents generated through public debt, the main pillar of the old

[34] Across the hemisphere, another simultaneous revolt that started on 18 October, 2019 declared the end of another economic model, the Chilean neoliberal model implemented in the aftermath of the military coup against the government of Salvador Allende in 1973 (Edwards, 2019).

model, obsolete. Hence, the challenge for the Lebanese economy, in addition to addressing the severe depression and the financial crisis, is to build a new economic model or a new regime of accumulation. In this respect, the new economic model has to reverse the current prevailing trends (predominance of rents, growth-impeding coalitions, dominance of low productivity sectors…etc.), and create an innovative dynamic economy where the technologies of the Fourth Industrial Revolution will play a crucial role. In effect, the Lebanese economy must make the leap from rentier capitalism to digital capitalism. Lebanon, like most developing countries, missed out on the first phase of the Fourth Industrial Revolution as it was mainly centered in areas where winner-takes-all markets dominate, such as apps, communication, software, and other purely digital forms. Now, with the new phase where such technologies will be paired with industry and material production, Lebanon has the chance to "upgrade" its productive structures through such technologies.

Flipping g and r?

We have seen in the section on inequality that one of the main drivers of inequality in Lebanon is the relationship between economic growth and the return on capital, or, according to Piketty (2014), the fundamental contraction of capitalism. The World Bank (2016) has estimated that, on average, the rate of return of capital has been larger than economic growth during the period 1993-2013 by 2.5 percent on a yearly basis. As we move from a rentier economy to a more productive economy, and if digital technologies were to play a leading role in this transformation to ensure that the relationship between g and r will flip as the return of capital will go down and the growth of the economy will go up, a series of conditions need to be met. The establishment of a new economic model will, in turn, depend on many factors and institutional arrangements.

Towards new industrial policies

Hence, the challenge is to transform the economy from the accumulation of financial wealth into the adoption of new technologies in production processes and high-productivity services that would raise the standards of living of a growing and young population. The transformation from rentier capitalism to digital capitalism will necessitate deep structural changes and policy reforms, in effect realizing a technological "big push." The policies that are needed are therefore comprehensive and should not be limited in scope and scale in order to pave the way for new digital-based development pathways (Sachs, 2019).[35] There is a need for new broad and specific policies, in effect launching a "technological" big push in the areas of digital technologies through new industrial policies that lead to the development of new modern economic activities (Aiginger and Rodrik, 2020) and promote competitiveness and innovation.[36] This new industrial policy

[35] The devaluation of the Lebanese pound and the de facto abandonment of the exchange rate peg will also contribute to increasing the competitiveness of the Lebanese economy in the future along this development path.

[36]According to UNIDO (2020), Lebanon ranked 94 with a competitive industrial performance index (CIP) of 0.016. The share of medium- and high-tech manufactured exports in total manufactured exports was 37 percent while the medium- and high-tech manufacturing value added share in in total manufacturing value added was around 16 percent.

should include a national strategy for AI, similar to that implemented in the UAE[37] that aims to and includes:

I. Create synergies between technology and economy

Given Lebanon's weak performance in future technologies and the impact of new technologies on the economy as a result of a lack of a medium- and high-tech sector, a synergy needs to be created between the new technologies and the economy. In this respect, the new technologies are not just new gadgets, sophisticated consumption items, or isolated apps and start-ups; they are key to raising productivity, which in the end determines the long-run standard of living of nations. In their transformation to general purpose technologies (GPTs), digital technologies – like electricity before them – can greatly enhance productivity as they spread throughout the economy (Brynjolfsson and McAfee, 2014). Hence, an integration of digital technologies into the economy by transforming firms digitally through their infrastructure and physical capital must occur for technology not to remain at the level of scattered small investments in tech start-ups isolated from the rest of the economy. In particular, new technologies must avoid being an "insular" part of the economy (Unger, 2019). Currently, the nascent digital technology activities in Lebanon are at that stage. The adoption of digital technologies, especially automation and artificial intelligence, in synergy with manufacturing is a pivotal element in the rise of a new productive economy as the manufacturing and the "materiality of production" will still matter in a digitalized economy (Chang and Andreoni, 2020). However, given the predominance of unskilled (local and foreign) labor and the corresponding low wages discussed earlier, the prospects for adoption of new technologies in manufacturing and agriculture are weak at this point. A more promising sector is the export services sector in which ICT services exports currently amount to 23 percent of total services exports (around 80 percent of total goods exports). In this sector, synergy would be more efficient,

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In addition, the World Competitiveness Report (WEF, 2019) classified Lebanon as one of the least competitive economies, where Lebanon ranked tenth among 14 Arab countries and ranked 88th globally out of 141 countries. In ICT adoption, it ranked 95, in entrepreneurial culture it ranked 74, and in innovation capability it ranked 66. According to Dutta et al (2020), Lebanon's level of innovation performance is in line with its level of development being an upper middle-income country. In the Global Innovation Index (GII), Lebanon ranked 86 in the world. In this respect, Lebanon is weak in credit availability, ICT in private and public sectors, and imports of high tech. In contrast, Lebanon has strength, significantly in relation to the world and not only to the upper middle-income group, in per GDP venture capital deals, mobile app creation, and cultural and creative exports as percentage of trade. With respect to ICT, the GII provides the percentage of ICT services exports of total trade, which is 2.5 percent, however, ESCWA (2019b) provides data as percentage of services exports (~ USD 16 billion) which amounts to a significant 23.2 percent while ICT goods exports are at one percent of goods exports (~ USD four billion in 2015). Hence, the picture with respect to the state of the ICT in Lebanon is mixed at best. On the other hand, Lebanon has achieved a respectable ranking in the Economic Complexity Index (ECI) published by Harvard Growth Lab Atlas of Economic Complexity which measures the complexity of a country's exports. It ranked 45 in 2018 with an economic complexity index of 0.35. In comparison, Lebanon is ahead of countries like Cyprus, Costa Rica, South Africa, Greece, and Chile. This ranking bodes well for Lebanon in relation to its ability to build and sustain a set of complex exports which correspond to a range of sophisticated and specialized capabilities and hence for any strategy to adopt digital technologies into the economy.

[37] The Ministry of Industry published a Strategic Plan for Industrial Sector Development that includes elements of industrial policy and the need to develop a high-tech sector. `However, no information is available on its implementation. (see industry.gov.lb/استراتيجية-وزارة-الصناعة).

building on an already existing industry, and could play the role traditionally played by manufacturing in economic development, especially under a state of deindustrialization such as Lebanon.[38] Finally, Lebanon should avoid what Acemoglu and Restrepo (2019) called so-so technologies that do not add to productivity. This will also mitigate against the creation of a dual economy where the modern sector, comprising highly-productive capital and technology-intensive firms, exists side by side with the traditional sector comprising labor absorbing low-productivity firms.[39]

II. From rentier to entrepreneurial state

- Before the crisis, the BdL initiated a financial support program for the knowledge economy. The BdL circular 331, issued in 2013, provided credit and funding support for venture funds, start-ups, and accelerators through an incentive system for the commercial banking system. The funds available amounted to a substantial USD 650 million. However, there are no available reliable data on the actual usage of funds and the overall impact of the program on start-up creation or employment.[40] In this respect, the role of the state or the public sector in general should go beyond supply-side "financial solutions" such as the provision of incentives for commercial banks. The role of the state should be pivotal and comprehensive in the transition from a rentier economy to a digital one. In the same vein that the state was instrumental in propping up the rentier economy (through public debt), the state should play a role in the formation of a digital economy. Hence, the challenge now is to establish an "Entrepreneurial State" (Mazzucato, 2018) that would play the role of "capital" and divert resources in the economy towards the financing of research and development, investment in high-risk areas, and determining the direction and pace of technological change. In addition, the state can play a role in establishing networks and encouraging capitalism that depends on collective entrepreneurship based on the combined contributions of scientific infrastructure and cooperation between companies (Chang, 2011). We have seen in section three that the "network" for Lebanese start-ups is still in its infancy. In this respect, creating "cooperative networks" will raise the productivity of scientific and technological workers and provide an

[38] In this respect, the World Bank (2020) has shown that the COVID-19 pandemic will have an impact on how Latin American labor markets evolve in terms of accelerated transformation of jobs. The region has already entered a new era characterized by premature deindustrialization, plateauing of formal work, and the rise of independent work. The report argues that the services sector can contribute to raising productivity and have "pro-development characteristics that were once thought of as the unique domain of manufacturing" (p. 44). In this respect, the report says: "Specifically, there is evidence that service industries that are intensive in knowledge, ICT, and trade, such as telecommunications, finance, and logistics, have higher rates of productivity growth than manufacturing" (p. 44).

[39] Diao et al (2020) provide evidence on Africa's manufacturing puzzle where there exists a dichotomy between large firms that are highly productive and capital intensive and firms that are small that generate employment with no productivity growth.

[40] ISRS (2019) studied the job creation impact of circular 331 through a case study of the UK Lebanon Tech Hub, a joint venture between BdL and the UK, to function as an accelerator and mentor for start-ups. The study included 49 companies. It is noteworthy that the report found that "of 78 percent that were eligible for Circular 331 funding, two thirds have yet to receive funding from the programme thus far. Out of a total of USD 48.8 million of capital raised by surveyed companies, only USD 9.7 million was attributable to Circular 331."

incentive for local talent to remain in the country rather than emigrating. This will be crucial for providing the infrastructure to what physicist Michio Kaku called "intellectual capitalism" as a necessary condition for prosperity in a post-commodity economy, which the digital revolution is engendering.[41] In this respect, the "entrepreneurial state" can be decentralized to "entrepreneurial local governments" through a regional development strategy in which communities, such as aggregations of municipalities, develop networks of innovation that can harness entrepreneurship locally and regionally. In this respect, the strategy can build on flexible specialization technologies (Piore and Sabel, 1984) of small, atomized, and geographically agglomerated production units. This system would be characterized by networks and communities of digital technology firms that share information, infrastructure, and skilled labor that optimize resource usage, create complementarities, and foster cooperation between firms.

- **The state's role is also crucial in setting the legal and regulatory environment that improves the doing business environment (for example, the insolvency law, secured lending, the start-up law, and the private equity law) that are needed to foster the development of a start-up ecosystem that also includes the pricing of the basic infrastructure of the digital economy, namely broadband services** and the removal of the "fiscal burden" on the telecom sector. In addition, regulations affecting the nascent areas of fintech and e-commerce must be implemented. In the case of fintech, a reform of the Money and Credit Code (MCC) that regulates the banking system is needed to provide a basis for fintech platforms and digital currencies. In the case of e-commerce, crucial competition and anti-trust laws must be enacted to ensure a competitive environment for e-businesses, in addition to enacting the implementing decree for the e-transaction law issued in 2018 that would allow important enablers of e-commerce, such as e-signatures and e-payments. In this respect, it is widely held that the Lebanese market is dominated by monopolies and oligopolies. However, there is no comprehensive study of the degree of concentration of Lebanese markets except a relatively old study on manufacturing (CRI, 2003). Moreover, the Lebanese body politic has systematically opposed the enactment of competition laws. In 2007, the parliament rejected a law proposed by the Ministry of Economy and Trade and is currently considering a draft law which was rejected by a technical committee in June 2020 (Wood et al, 2020). An active dismantling of monopolies in various sectors and ensuring that monopolies do not arise in the new sectors must be a priority.

[41] Smith (2021) cites a recent paper that showed that scientific immigrants to the US are six times more productive than when they stay home or emigrate to other countries due to the presence of synergies in the US between universities, tech companies, and government labs. In this respect and in the aftermath of the current economic crisis in Lebanon, there has a been a huge drive for emigration by young talented workers and university graduates which would be detrimental for any plans for the digitization of the economy. Moreover, not only individuals are emigrating; the recent move of the headquarters of the highly successful digital company *Anghami* from Lebanon to the UAE, where it will establish its research and development center, attests to that challenge facing Lebanon.

III. Prioritize investment in e-government

We have seen that the level of development of e-government in Lebanon is very weak and even regressing despite various plans drafted since 2002.[42] In this respect, the acceleration of the establishment of e-government should be a priority, as e-government is a pivotal element in the digitization of the economy. Moreover, according to Tse et al. (2019), the role of tech in government is pivotal to improve competitiveness and bridge the digital divide. With relevance to Lebanon, Tse et al. (2019) give the example of Estonia's e-government model, which attracted foreign e-residents who registered more than six thousand companies, as a model where a small country can compete with larger, wealthier ones and where the adoption of tech by the government has led to a feedback mechanism with the private sector; where the IT sector has come to account for seven percent of the GDP. They said: "this is the importance of digitalization and how smaller countries can compete with larger and wealthier ones. Countries need to understand how this impacts their competitive positions on a global scale. Countries that have a blank canvas can theoretically leapfrog from zero to a hundred if they have the right leadership and the right investments" (p. 178). In addition to the impact of e-government on the overall digital development of the economy, e-government can produce rich data on communities, regions, and sectors that would be beneficial for the government to design anti-poverty measures, public service delivery, and other public interventions that would contribute to economic development. The latter is a crucial function in the case of Lebanon, where the dearth of economic and social data has prevented the proper design and delivery of economic and social plans and programs.[43]

IV. Prioritize investment in the services sector

In Lebanon, the World Bank (2012) estimated that only 14.3 percent of wage employees and three percent of the self-employed work in high-productivity services sectors such as information and communication, financial and insurance activities, and professional, scientific and technical activities. At the same time, the services sector comprises around 68 percent of the GDP. The task is to invest more in the high-productivity services sector by upgrading it with the technologies of the Fourth Industrial Revolution. In addition, high-productivity services should be geared towards exports to the MENA region, including AI consulting services, as businesses in the region move to integrate AI into their processes. The prioritization of investment in the high-productivity services sector should also include investment in data generation with regard to the sector as this is crucial to the success of this policy initiative.[44]

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[42] The latest plan is available at https://www.omsar.gov.lb/Digital-Transformation/Strategies/Lebanon-Digital-Transformation-Strategy.

[43] For the importance of the "data revolution" in development contexts, see the UN report "A World that Counts: Mobilizing the data revolution for sustainable development." https://www.undatarevolution.org/report/.

[44] The World Bank (2020a) says: "Policy makers should give priority to investing in data gathering and analysis of services sector firms in view of the lack of data for the sector. Understanding the specific issues of the sector regarding firm size distribution, dynamics, barriers to entry, lack of competition, and restrictions to trade is key to formulating policies that can unleash productivity growth in this sector."

V. Education for a new economy

Currently, the labor mismatch in Lebanon is mainly a demand side issue where skilled labor, produced by the educational system, lack demand for it in the economy (Kawar and Tzannatos, 2012). However, the Fourth Industrial Revolution requires new skills that need to be developed. In this respect, the educational system in Lebanon needs to be reformed to avert the labor mismatch problem from becoming a supply-side one. Education in Lebanon comprises two systems: a regimented school system and a university-level education that is delivered by one public university and dozens of private universities that are, in effect, replicas of each other. In this respect, there is a need for an overhaul of the system of education that goes beyond the production of a specialized minority of digitally-skilled workers towards the engendering of a society-wide digital literacy. First, Lebanon should follow the Finnish model that aims at instructing citizens with the basics of AI, as a way to get ahead in the field of AI in a world dominated by economic giants such as the US and China.[45] In a similar vein to mimicking the experience of Estonia in the realm of e-government, Lebanon as a small country can implement such a program to hasten its accession to the digital economy. Second, Lebanon should enter the area of online education, not as a means to expand the customer base of existing universities offering existing traditional programs, but in order to train the population, at various stages of their careers, with the new skills required in the new economy. Strusani and Houngbonon (2019) give examples of such online educational platforms in developing countries that contribute to the upgrading of human capital. Finally, overhaul the pre-university education system to move away from what Tse et al. (2019) call the "industrial education model" to a system that teaches skills that are relevant to the digital age such as creativity, coding, communication, and confidence, which are all currently missing in the regimented standardized Lebanese curriculum.

VI. Implement social policies

The effect of new technologies on inequality would add to an already highly unequal society in Lebanon. This necessitates that the government play a role in mitigating such adverse effects. The design of a tax system can entail a differential system that favors labor over capital, taxes the excess profits of superstar firms, and gives tax credits or wage and hiring subsidies that would increase demand for low-skilled labor (ILO, 2018).[46] This attention to the rise of inequality as a result of the introduction of new technologies can also have a positive impact on innovation itself. Contrary to conventional wisdom, Hopkin et al. (2014) have shown that although the "cutthroat capitalism" of the US is innovative, other countries with more egalitarian features and welfare states are also high performers in innovation, while countries with high inequality perform poorly. Finally, although anecdotal evidence shows that women are leading men in many areas of the

[45] The course is *Elements of AI* and is available freely all over the world. https://www.elementsofai.com/.

[46] The policy could entail also a comprehensive two-legged strategy to ensure growth of demand for local low-skilled labor, in addition to skills-upgrading, in the nontradable sectors as the new sectors develop in order to dampen the inequality effects of skill-biased technological change.

nascent tech sector in Lebanon, policies that would bridge the gender gap in the labor market must be implemented so that the gender digital divide does not spill over to the digital sector as digitization is generalized in the economy. There is a need to establish a national strategy to identify emergent areas of the gender digital divide and consequently conduct policies and initiatives to bridge it. In the case of Lebanon, the most important policy initiative is to increase the female labor market participation rate as the currently low participation rate would hinder women's participation in the digital economy. In this respect, the digital economy may form an opportunity for such an increase in participation rates as it provides female workers with the opportunities to join the labor market with flexible schedules and place of work (OECD, 2018). Finally, policies to address horizontal inequalities as manifested by significant differential poverty rates would be crucial for any inclusive digital transformation of the economy as poverty is highly correlated with lower educational levels, access to health services, and ownership of household items (CAS-WB, 2015). The persistence of such significant poverty basins in the North and Bekaa as well as other areas will translate into a higher divide generated by the inequality-generating skill bias and capital-ownership bias of digital technologies.

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Appendix

A.1. Elasticity Computation

To compute the elasticity of substitution defined in the following equation:

$$\sigma = \frac{\%\,\Delta\ capital\ labor\ ratio}{\%\,\Delta\ in\ MRTS_{LK}}$$

We use two years (2006, 2009) to compute the elasticity of substitution. First, we use the summation of two variables (one representing the net book value of machinery and equipment at the end of the year and the other representing the net book value of land, buildings, and leasehold improvements at the end of the year) to extract the capital K. Second, we also use the summation of two other variables (one representing the average number of permanent workers and the other representing the average number of temporary workers). This is to reflect the level of labor L. We use these variables to measure the change in the ratio of capital to labor ratio across 2006 and 2009. Third, we use the total cost of labor, including wages, salaries, and bonuses to extract the price of labor w. Fourth, we use the establishment amount of rent on machinery, equipment, and vehicles to reflect the total capital rent r. These variables allow us to calculate the ratio of total labor wage over total capital rent between the two years 2006 and 2009 as the denominator component.

A.2. Description of the variables in Table 15

Proportion of employed: After eliminating the observations that were outside of the labor force, we generated a dummy variable called "emp" taking the value of 1 if the individual is employed, and 0 otherwise. We then sorted the variable between males and females to get the proportion of the individuals employed in each category.

Mean income: We acquired the mean of a categorical variable that ranges from 1 to 8, reflecting income categories, where a person in category 1 earns less than LBP 600,000 per month, and a person in category 8 earns more than LBP 4,500,000 per month. We then sorted the variable between males and females to get the average across genders.