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Industrial Policy in the Development of the Iron and Steel Industry in Several Countries

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Abstract

Iron and steel making is one of the most important industrial sectors for economic development since they have high forward and backward linkages. Iron and steel production provides inputs and creates jobs in many other industries. Particularly, steel plays a prominent role in our daily lives. Experiences of many countries reveal that industrial policy plays a key role to achieve the best results for economic development. Because industrial policy can be used to prioritize the use of a country's limited resources to facilitate industrial upgrading. This study addresses the question of whether industrial policy is the main driver for economic development by focusing on the iron and steel industry. In this context, the leading countries in the iron and steel industry are examined from a historical perspective. It is emphasized that China and Japan, which are prominent countries in the iron and steel industry today, have achieved their status as global powers through selective industrial policy.

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Industrial policy, economic development, steel industry, forward and backward linkages

JEL Codes
L52, L61, O25

1. Introduction

Steel is deeply engrained in our society since it is an indispensable material in modern life (IEA, 2020). When viewed in general, iron and steel (hereafter I&S) production appears to be one of the sectors that has a much greater impact on the development of national economies than commonly believed (Mousa et al., 2016). This is because, it is a strategic industry for economic development since I&S industry provides inputs for many sectors, such as automotive, consumer durables, railways, and aircraft construction. Also, the products of the I&S industry are crucial in buildings and infrastructure. Therefore, the development of the I&S industry means the development of other industries.

The I&S industry has long played a crucial role in economic development since it is one of the most essential materials supporting industrialization. In other words, the development of the I&S industry means the development of other industries.

Throughout history, the leading countries in I&S production have continuously changed. It appears that this change is very much related to the application of industrial policy (IP) in the related countries. As Chang (2003: 26) documented, several countries such as Sweden, Germany, and Japan actively used non-tariff measures to promote their I&S industries during the late 19th and early 20th centuries. In this article, we will follow the traces of IPs in the I&S industry.

In line with this perspective, the first section of the article examines the historical changes in iron and steel production and the current state of the industry. Subsequently, emphasis is placed on the significance of the iron and steel industry for national economies. Finally, the discussion revolves around the critical role that industrial policy plays in achieving rapid economic development through structural changes.

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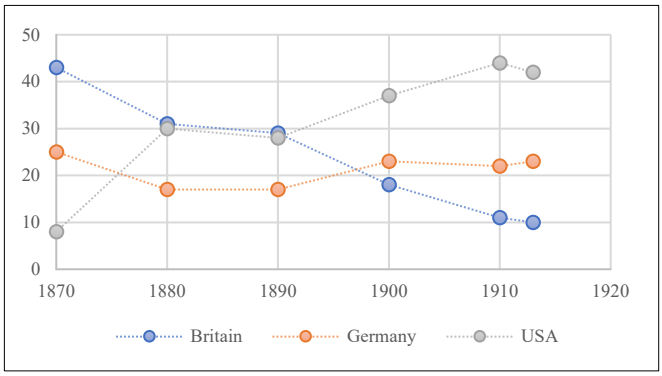
2. Historical Overview of the Iron and Steel Industry

In the 1700s, Sweden was a leader in world steel production. Between 1800 and 1900, there were two prominent countries in the I&S industry in the world. These were the UK and the United States (US), respectively. At the beginning of the 20th century, the Soviets began to carry out considerable production. Meanwhile, England left the leadership to the US. China and Japan did not have a significant share in the I&S industry at that time. After the Second World War, while Russia, Japan, and China gradually increased their production, the percentage of steel production of the US and the UK decreased. Today, China is the clear leader in the I&S industry (Pei et al., 2020: 3).

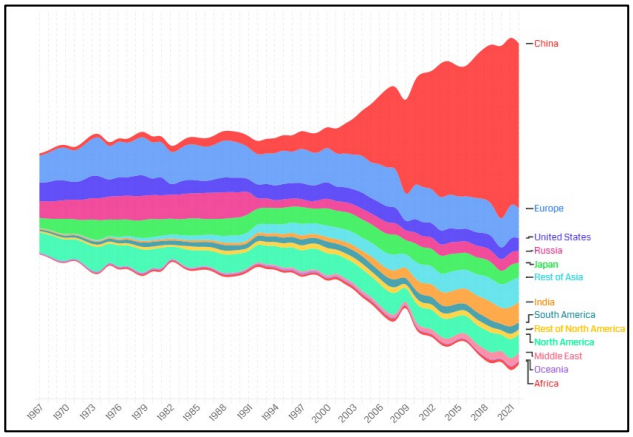
Figure 1. Steel Production in the USA, Germany and Britain, 1870-1913.



Source: Own construction based on James (2013: 93).

The end of the 19th century and the beginning of the 20th century are remarkable times of change for the world I&S industry. During that period, the leading countries of the I&S industry were Britain, Germany, and the US. In the 1870s, 43% of the world's steel had been produced in Britain. However, Britain's leadership of I&S production gradually declined and the US became the leader at the beginning of the 20th century.

Figure 2. Historical World Steel Production (1)



Source: Own construction based on WSA Steel Statistical Yearbooks (2022).

At the beginning of the second half of the 20th century, the world's largest steel producers were the USA, Russia (USSR until the 1990s), and Japan, respectively. The European region, on the other hand, produced 165 million metric tons, achieving considerable production levels in the relevant period. However, in the period from 1967 to the present, there have been considerable changes in steel production throughout the world. Especially Asian countries, which produced approximately 85 million metric tons in 1967, have reached the level of approximately 1.3 billion metric tons today. 1 billion metric tons of this belongs to China alone, making it the world leader in steel production by far. China had produced only 14 million metric tons in 1967. Likewise, India increased its annual production from 6 million metric tons to 125 million metric tons in the same period. While the steel production level remained almost stable in the European region, the US production decreased from 115 million metric tons to 80 million metric tons during the same period.

Table 1. Major Steel-Producing Countries (2020 and 2021)

Country	2021		2020	
	Rank	Tonnage	Rank	Tonnage
China	1	1 032.8	1	1 064.7
India	2	118.2	2	100.3
Japan	3	96.3	3	83.2
United States	4	85.8	4	72.7
Russia	5	75.6	5	71.6
South Korea	6	70.4	6	67.1
Türkiye	7	40.4	7	35.8
Germany	8	40.1	8	35.7
Brazil	9	36.2	9	31.4
Iran[(e)]	10	28.5	10	29.0
Italy	11	24.4	13	20.4
Taiwan, China	12	23.2	11	21.0
Vietnam	13	23.0	14	19.9
Ukraine	14	21.4	12	20.6
Mexico	15	18.5	15	16.8
Indonesia	16	14.3	16	12.9
Spain	17	14.2	18	11.0
France	18	13.9	17	11.6
Canada	19	13.0	19	11.0
Egypt	20	10.3	20	8.2

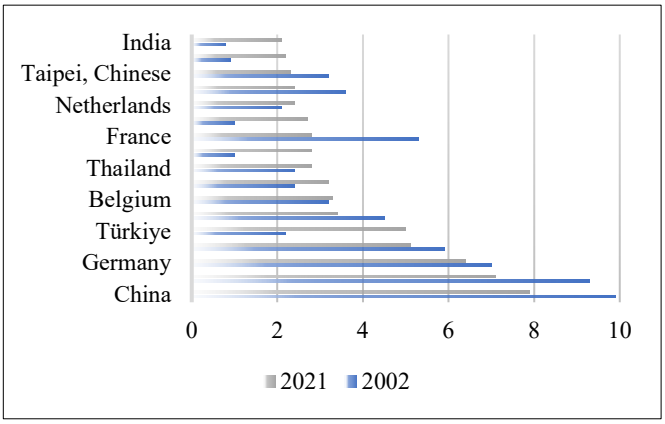
Saudi Arabia	21	8.7	22	7.8
Poland	22	8.5	21	7.9
Austria	23	7.9	24	6.8
United Kingdom	24	7.2	23	7.1
Belgium	25	6.9	26	6.1
Malaysia[(e)]	26	6.9	25	6.6
Netherlands	27	6.6	27	6.1
Australia	28	5.8	29	5.5
Bangladesh[(e)]	29	5.5	28	5.5
Thailand	30	5.5	30	4.5
Pakistan	31	5.3	35	3.8
South Africa[(e)]	32	5.0	34	3.9
Argentina	33	4.9	36	3.7
Slovakia	34	4.9	38	3.4
Czechia	35	4.8	31	4.5
Sweden	36	4.7	32	4.4
Kazakhstan[(e)]	37	4.4	33	3.9
Finland	38	4.3	37	3.5
Algeria	39	3.5	39	3.0
Romania	40	3.4	40	2.8
United Arab Emirates	41	3.0	41	2.7
Belarus[(e)]	42	2.4	42	2.5
Luxembourg	43	2.1	45	1.9
Oman[(e)]	44	2.0	44	2.0
Portugal	45	2.0	43	2.2
Serbia	46	1.7	47	1.5
Greece	47	1.5	48	1.4
Colombia	48	1.3	54	1.1
Chile	49	1.3	53	1.2
Kuwait[(e)]	50	1.3	49	1.3
Others		17.7		16.2
World		**1 951.2**		**1 879.4**
[(e)] = estimate				

Source: (World Steel Association, 2022).

According to World Steel Association data, steel production is increasing in the world. However, some countries stood out in the steel industry. The world's top 10 steel-producing countries are China, India, Japan, America, Russia, South Korea, Turkey, Germany, Brazil, and Iran, respectively. China, the world's largest steel producer, supplies approximately 53% of the steel produced worldwide, with over 1 billion tonnes as of 2021. East Asia has the world's largest I&S production, consumption, and exports and, thus, has a significant impact on the global I&S industry (Yang, 2021: 30).

The steel industry has been playing a very important role in the development of the Chinese economy for a long time. In recent decades, China's steel industry has grown rapidly, overtaking Japan, and becoming the world's largest steel producer in 1996 (Guo and Fu, 2010: 4356).

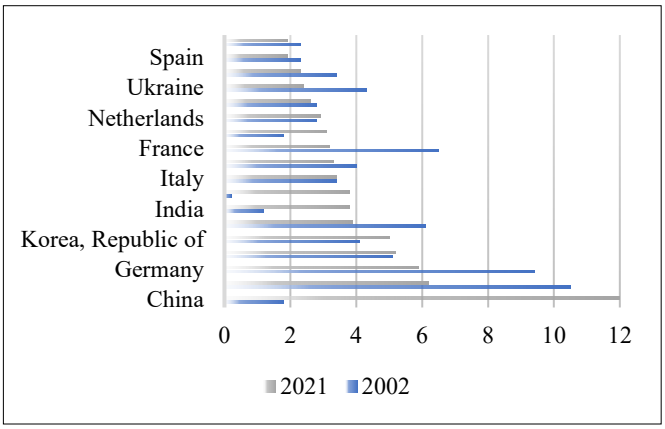
Figure 3. Share in value in world's I&S imports by countries, 2002 and 2021 (%)



Source: Own construction based on International Trade Centre (2022) data.

Figure 3 shows the percentage share of the world's largest I&S importing countries. According to the International Trade Center data, the world's largest I&S importing country is China with a rate of 7.9%. However, compared to 2002, China's share in the world I&S imports has decreased by about 2 percentage points. The same is true for the US. However, the share of imports in some countries such as Türkiye, Mexico, Indonesia, and India increased. The most striking increase was in Türkiye with a share of about 2.8%.

Figure 4. Share in value of world's iron & steel exports by countries, 2002 and 2021 (%)



Source: Own construction based on International Trade Centre (2022) data.

Figure 4 shows the percentage share of the world's largest I&S exporting countries. In 2021, China became the largest iron and steel exporter in the world, and Japan in 2002. According to the International Trade Center data, there is no significant change in most of the selected countries in 2002. But the change in China is quite striking. China's I&S exports increased by about 10 points in 9 years. It is understood that China gets its share of exports worldwide, especially from Japan and Germany.

3. The Importance of the Iron and Steel Industry for Economic Development

According to Hirschman (1958), sectors with strong backward linkages that purchase inputs from many other sectors are able to increase aggregate output by stimulating demand for the relevant sectors. On the other hand, sectors with forward connections can increase supply by selling their output to other sectors, thereby increasing overall consumption. Since the I&S industry provides inputs for many sectors, the development of the I&S industry means the development of other sectors. Probably, this is best understood by the successful economies of East Asia, namely Japan, Republic of Korea, and China. The development of the I&S industry has always been a priority for the governments of these economies.

Researchers conduct scientific research to identify the importance of the I&S steel industry for economic and social issues. The research commissioned by the World Steel Association to Oxford Economics in 2019 shows the importance of the I&S industry. The report revealed the global economic and social impacts of the I&S industry based on 2017 data. The data used in the report's summary are shown in Table 2. The Impacts of the I&S industry are impressive especially when we think that Hirschman's (1958) ideas about forward and backward linkages.

Table 2. Social and Economic Impact of the Global Steel Industry

	Indirect impact on the supply chain	**Direct impact on steel industry**	**Impact on customer sectors**	**Overall Impact**
Economic	For every $1 of value added within the steel industry itself, an additional $2.50 of value is generated as a result of purchases of equipment, raw materials, services, and energy. Thus, this contributes a total of $1.2 trillion in value added to the supply chain.	In 2017, the steel industry generated a total of $500 billion in value added by selling $2.5 trillion worth of products.	The steel industry generates a value-added output of US$1.2 trillion by providing services or selling products to other sectors.	The steel industry contributes a total value added of US$2.9 trillion, accounting for 3.8% of the global GDP.
Social	For every 2 jobs in the steel industry, 13 additional jobs are supported throughout its supply chain, and within the global supply chain of the steel sector, there are 40.5 million people employed.	The steel industry employs 6.1 million people.	The steel industry supports 49.3 million jobs in customer sectors worldwide.	The steel industry globally supports approximately a total of 96 million jobs.

Source: Own construction based on Oxford Economics Report (2019).

Industries are linked when a company acquires goods or services from another company to facilitate the manufacturing of its products. This interconnection extends across various industries, forming a continuous cycle of transactions. Additionally, the economic impact is amplified by the spending of earnings by workers employed in all industries. Consequently, similar to other sectors, I&S production

generates output and employment opportunities in a multitude of industries.

4. Industrial Policy Traces Behind the Success

Industrial policy (IP) has been the subject of one of the most heated debates in economics from the start, although the term IP did not come into general use until World War II. Central to the IP is the assumption that free markets do not produce the best results. The theoretical basis of IP lies in the assumption that to achieve rapid economic development, selective state intervention is necessary. In particular, a frequent manifestation of IP is the concern to increase productivity, industrial competitiveness and expected synergies through industrial clusters (Haar, 2014: 221).

Economic development requires the transformation of the economic structure of a country. This includes diversification into new sectors; reassign resources to more productive enterprises; and, critically, to improve the quality of goods produced (Khandelwal, 2010). It is unlikely that an unguided market economy can do this. Therefore, IP and public sector investment are necessary for economic development. Well designed and prioritized public sector investment may ensure not only technological progress and efficient use of resources but also contribute to the development of indigenous manufacturing capabilities via building up skills and knowledge.

As Chang (2008, 15) points out, "practically all of today's developed countries, including Britain and the US, the supposed homes of the free market and free trade, have become rich on the basis of policy recipes that go against the orthodoxy of neo-liberal economics." Similarly, Rodrik (2007) states, "nearly each country that could materialize fast growth and industrialization has applied some kind of industrial policy." According to Rodrik, the question to be discussed is not if an industrial policy is required but how it should be.

Akyüz, (2022: 38) suggests that IP is the main driver for the economic development of the countries. A country could have a chance to possess a strong position in a competitive world market since it has a developed industry and a high level of manufacturing ability. Otherwise, countries will likely to face with exploitation by the stronger ones. As Barnes, Kaplinsky, and Morriss (2003: 20) indicate, selective IP can have considerable success even in the countries with weak bureaucratic capacity like South Africa.

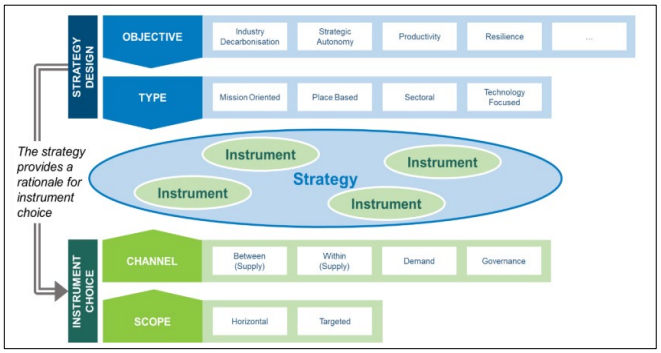
In the period after 1950, IP was discussed in detail in most developed and developing countries. Developing countries saw IP as the key to social development and independence in the post-colonial era. For the other group of countries, including Europe in particular, IP was the way to rebuild their economies' productivity and social structure (Andreoni and Chang, 2019: 136).

After the Second World War, many developing countries adopted "industrial policies" to protect traditional local activities and promote emerging industries to compete with advanced countries. However, by the 1980s, industrial policies had lost their credibility due to their tendency to hinder competition and allow governments to selectively choose winners and losers based on their preferences. This disrepute arose primarily from the perception that IPs increased the influence of vested interests within governments. Despite the emergence of powerful entities such as the European Union, which represented a new perspective on IP, the creation of the European Single Market raised questions about the sectoral and geographical implications, as well as the need for incentives to foster cooperation. These developments prompted a reevaluation of IP (Cohen, 2006: 89).

The growth of Europe after the Second World War can be attributed to the implementation of comprehensive IPs. The objective was to establish advanced production capabilities in key manufacturing sectors such as steel, chemicals, and automobiles, which were representative of the "Fordist" manufacturing model in the 1950s. Additionally, in the 1970s, Europe aimed to achieve dominance in emerging fields such as aerospace, biotechnology, and electronics. IPs played a critical role in providing the essential infrastructure for developed economies, including transportation and telecommunications networks. Furthermore, these policies contributed to ensuring a stable energy supply for economies with limited energy resources. Overall, IPs played a significant role in facilitating the development of Europe's manufacturing base and supporting its economic growth (Pianta, 2014: 277-278).

Over the past three decades, influenced by Western countries and international organizations such as the World Bank, neoliberal policies have been adopted and market-based economic models have gained prominence (Wade, 2012: 224). Sense of mainstream neo-liberal economy is based on market fundamentalism carrying the claim that state should play secondary role in economy.

Figure 5. The Formulation of Industrial Policy



Source: (Criscuolo et al., 2022: 6).

Some OECD countries are drawing attention to the policies pursued by rapidly growing economies, notably China. The need for industrial policies in developing countries generally predates financial and economic crises (Warwick, 2013: 10).

Table 3. Evolution of Theory and Practice of Industrial Policy

Phase	Key ideas	Representative contributors
1940s to late 1960s	- Industrialization is necessary for countries to achieve development. - IPs, including infant industry protection, state coordination, and ownership, are of critical importance for fostering development. - Market failures are particularly pervasive in developing countries and hinder the process of development.	Rosenstein-Rodan (1943) Hirschman (1958) Prebisch (1959) Myrdal (1957)
1970s to 1990s	-Significant barriers to IP are considered. IP encourages rent-seeking and promotes waste. -The era of the Washington Consensus. -Government failure is worse than market failure. Privatization and attracting foreign direct investment, trade liberalization, minimal government intervention, and economic stability are necessary for industrialization and growth.	Baldwin (1969) Krueger (1974;1990) Pack (1993; 2000)
2000s to present day	-Both government and market failures are present. -The "how" question of industrial policy is more important than the "why" question. -While institutional setting matters, the design is quite challenging. -National innovation systems should be promoted in the context of IP. -Flexibility in IP is noteworthy, with a fundamental focus on technological progress and innovation.	Amsden (1989) Dosi (2009) Rodrik (2004; 2007) Chang (2002; 2003; 2009) Lall (2004) Lin (2009) Nelson (1993) Robinson (2009).

Source: (Criscuolo et al., 2022: 6).

Source: (Naudé, 2010: 10).

The development of the I&S industry has always been a priority for the governments of the Republic of Korea, Japan, and China. Because these countries saw East Asia's I&S industry as a productive area and adopted the policy leadership objective from an institutional point of view. (Yang, 2021: 14).

While the average tariff rate remained relatively low in the late 19th and early 20th centuries, Germany provided strong tariff protection for the strategically important I&S industry. While Sweden has generally followed low tariff policies, it has provided very similar protection for the steel and engineering industries. Countries such as Sweden, Germany, and Japan have adopted a policy of non-tariff measures for purposes such as state aid to ventures that seem risky, subsidies for research and development, the establishment of some institutions to stimulate public-private cooperation, and the development of state "model factories" (Chang, 2003: 26).

4.1 Japan

For quite some time, the Japanese government has made the development of the I&S industry a primary goal. Indeed, Japan's leadership and intervention in the I&S sector is extremely consistent and highly productive. The Ministry of Economy, Trade, and Industry is the most authoritative institution for the I&S sector in Japan, with specific competent institutions including the Manufacturing Industry Bureau and the Trade Policy Bureau. The Manufacturing Industry Bureau is responsible for overseeing the particular affairs of the I&S sector. At the same time, the Trade Policy Bureau is a global institution that handles macroeconomic regulation, control, and policy formulation in various sectors, particularly in terms of development environment, restructuring, and enterprise reform. Additionally, the Japan Iron and Steel Federation plays a significant role in the management of the I&S industry in Japan. During the period of industrial restructuring, the government's control over the I&S industry in Japan primarily focused on the following areas:

(1) Regularly providing guidance outputs for the I&S sector, monitoring their implementation, and ensuring compliance. Encouraging businesses to collaborate and coordinate price adjustments as necessary. Coordinating steel exports and regulating the actions of steel companies concerning pricing and quantity.

(2) Intervening and adjusting the production of specific steel grades or controlling the trade of certain steel product grades based on market changes, when deemed necessary.

(3) Adjusting prices of raw materials and energy sources such as scrap and electricity and implementing trade control measures concerning the amount of imported scrap.

(4) Monitoring new investments and developments in the I&S industry and implementing measures, such as the "Interim

Measures to Stabilize Specific Depressed Industries," to address excess capacity in the sector.

(5) Providing financial support to businesses for capacity reduction or transfer and promoting participation in coordination consortia. Introducing preferential measures, particularly regarding the Employment Adjustment Assistance Funds.

(6) Collaborating with intermediary organizations that coordinate the I&S industry and its downstream sectors to develop and implement quality systems for steel products, in line with the plant certification system. Establishing standards and norms for related products.

(7) Encouraging the concentration of production capacity in large companies by compressing surplus assets.

(8) Providing tax incentives along with accelerated depreciation opportunities to companies that prioritize and invest in environmental protection equipment. Encouraging strong financial support from banks for cutting-edge technologies and fundamental research in the I&S industry. Providing government grants for major projects (Li, 2020: 8).

4.2 China

China's crude steel production reached 31.78 million tons in 1978 and increased to 128.5 million tons by the year 2000. This indicates a 4.04-fold increase in production over approximately twenty years. The corresponding compound annual growth rate is approximately 6.56%. Furthermore, in 1996, China surpassed the milestone of 100 million tons of crude steel output, making it the world's largest steel producer. Under the patronage of the government, the construction of Baosteel, China's first modern I&S production base, mobilized the nation's nearly all resources and power (Li, 2020: 7).

Strong domestic demand, primarily driven by the manufacturing, construction, and automotive sectors, has accelerated the growth of the I&S industry. One of the policies implemented by the government in 2002 was a 40% reduction in resource tax for companies engaged in mining and metallurgical processing. This policy aimed to promote integrated activities in the I&S sector, balance the tax burden, and enhance competition (Kabak et al., 2016: 532).

The policies implemented in the 1990s for the I&S industry are quite remarkable. The closure, transformation, and reconstruction of inefficient production units in line with the 8th and 9th Five-Year Plans contributed to the technological optimization of the I&S industry. These policies not only improved efficiency but also enhanced product quality. Additionally, the domestic market share of steel products from various sectors, including automobile panels, petroleum pipes, and heavy rails, has steadily increased (Li, 2020: 8).

5. Conclusion

Economic development requires the transformation of a country's economic structure and selective state intervention is instrumental to achieve structural transformation. Historical experiences make it clear that IP is the main driver for the economic development of the countries. Although industrial policy gained significant attention after World War II, it generally took a backseat between the years 1970 and 1990. In the 21st century, the idea that IP should support innovation has become predominant again.

IP is essential to prioritize the use of a country's limited resources. Industries are linked to one another when one firm buys goods or services from another to produce its own products. What we know is that countries like Sweden, Germany, and Japan systematically applied IP to strategic industries such as I&S. I&S production generates high forward and backward linkages that purchase inputs from many other sectors are able to increase aggregate output by stimulating demand for the relevant sectors. This sector also leads to creation of jobs in hundreds of industries.

Research conducted based on examples from China and Japan demonstrates that IP is the underlying factor behind these countries' prominence in the economically crucial I&S sector. Due to the pursued policies, China currently holds the top position in the I&S sector, while Japan ranks third. This highlights the critical importance of the I&S sector, particularly for developing countries in terms of their development. Furthermore, it indicates that the realization of the I&S industry through IP is feasible.

One limitation of this study is the inability of the authors to extend the historical perspective in terms of data. Specifically, creating a global dataset dating back to the period before 1967 would strengthen the testing of hypotheses.

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Import Substitute Industrialization Experience of Türkiye in the Eyes of a State-Raised Planning Specialist (1960-1980)

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Abstract

During the second half of the 20th century, many countries in the world adopted import substitute industrialization policies to construct domestic industry. Turkish experience of ISI can neither be depicted as a disaster, nor the ultimate end was achieved with this policy. This article scrutinizes implementation of ISI policies in Türkiye between 1960-1980 in comparison with Asian and Latin American countries. Also, this article traces the implementation of ISI policies in the memoirs of Ertan Yülek who witnesses the overall process when he was serving as a specialist in industrial organizations during this period. Both the academic literature and eyewitnesses of Ertan Yülek indicate that ISI policies could be beneficial for the Turkish economy if political stability could be achieved.

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1. Introduction

"Our strategy should be based on indigenization and import substitution. The government must provide opportunities for domestic companies to participate in sectors in which the country continues to depend on imports."

-Baba Kalyani

For countries, development has been a matter of concern for all countries. National desires to become achieve industrial development and thereby become an important factor in the global competitive market remained to be important. To achieve this end states developed various development models and policies. Import substitute industrialization (hereafter ISI), which has been implemented as an economic growth strategy, was a policy that was frequently preferred by developed and developing countries, especially after World War II. This policy was experienced by different countries in different ways and created different consequences. Therefore, to understand truly the anatomy of the policy, it is important to analyze ISI in comparison between countries that had adopted this economic policy together with their economic output. This will allow us to discuss the weaknesses and strengths of ISI, and to create a projection for the future economics of the countries.

In this article, ISI will be examined in its historical and contemporary dimensions; specifically, the case of Türkiye will be scrutinized by handling the economic policies of the 1960s and 1970s., when the country officially adopted ISI. In the first part of the article, why and how ISI policies emerged in world history and the consequences of these policies in different countries will be discussed relying on the existing academic literature. In the following part, the Turkish experience of ISI policies will be examined historically; in the last part, the economic policy of Türkiye will be analyzed relying on a memoir of a state-raised industry specialist Ertan YÜLEK, namely "Ömürdür Gelir Geçer" (Yülek, 2015).

Numerical data analysis and econometric modeling are the conventional way of academic methods to analyse an

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econometric policy. Still in the implementation of any adopted policy or strategy cannot be automatically implemented as coding machines. State institutions, political atmosphere, geography, and even individual attitudes had a role in shaping the economic policies of the states especially in developing states, where the institutions do not work properly. For this reason, we thought that the eyewitness of people in the field may reveal different aspects of ISI implementation in Türkiye that statistics do not show. Even though the memoirs we use only show the subjective views of the author, it still serves as complementary resource to understand time and economic policy.

2. Import Substitution: Theoretic Framework and The Experience of Different Nations

Import substitution is a strategy that indicates the production of imported goods inside the country, with domestic opportunities, by national firms that are owned by the state or backed by the state. Thanks to this policy, revitalization of the domestic economy and saving of foreign currency are tried to be achieved. In ISI the high customs duties imposed on imported products, domestic producers are trying to be protected from foreign competition. In this way, it is also aimed to reduce foreign dependency on the country's economy. In other words, import substitution is the production program of imported goods domestically within a plan and on a scale, to gradually reduce the volume of imports. (Kargül, 1976)

ISI policy is inspired by a wide range of economic approaches such as Keynesian, communitarian, and socialist economic thought, as well as dependency theory. (Thomas Perreault, 2005) Historically it traces back to the Great Depression (1929), however, it was widely implemented in the 20th century. Especially between 1930 and 1960, the consequences of World War II led many developing countries to adopt this policy to reach the level of developed countries. One of the main reasons for the preference for ISI policy in these years was the distrust for the uncontrolled functioning of markets and the high performance of the planned economy of the Soviet Union. (Eşkinat, 1997) The high level of industrialization in developed countries, made these states realize that the only way to develop their own countries was to achieve it with their domestic opportunities.

There are two important methodologies used for import substitution policies: infant industry agreement and protection of manufacturing industries. The terminology "infant industry" implies that domestic industries in a country should be protected by the state through measures such as customs barriers and incentives until they accomplish to reach the stage where they can compete with foreign industries. (List, 2007) That is to say; when a state imposes a high tax rate on an imported product, the cost of the mentioned product would increase in the local market. This would lead people to buy the cheaper domestic product.

In the second method namely; "protection of manufacturing industries" the state tries to reduce the burden on infant industries by granting some privileges to them. With paying less tax, the production cost of the domestic industry is reduced, and thereby; its growth is expected to be faster. The state can also impose a quota on imports to ensure that the amount of domestic products in the market exceeds the amount of imported goods. As a result of such concessions, the investors are expected to be motivated to enter the market, which ultimately would facilitate product diversification and growth.

Figure 1. Stages of import substitution

The import-substitution industrialization strategy consisted of three stages. In the first step, countries implementing ISI can import intermediate goods and machinery for mass production. The country at this stage does not yet have the capacity to produce the needed intermediate goods and machinery. For countries that can move to the second stage, it should now be possible to produce intermediate goods. By producing these goods domestically, dependence on foreign economies will have decreased compared to the countries in the first stage. However, even at this stage, the actual machinery for production has not yet been produced inside the country. Foreign dependence on machinery remains to exist, and equipments that are needed for production. If the transition from the first to the second stage takes too long, crises based on foreign exchange shortages are more likely to emerge. In the third step, which is the last and most difficult to reach, countries now have the necessary materials at each

stage of production and have completely broken their dependence on foreign markets. Countries that are able to achieve this in all sectors would secure total economic independency and economic progress to a large extent. Problems in balance of payment, budget deficits, and foreign exchange reserve shortages are considered the most important obstacles for one country to reach the third stage.

Latin American, African, and East Asian countries are the pioneers of the implementation of ISI policies in world history. These countries, which are classified as the "developing" stage, aimed to jump up to the level of developed countries by adopting ISI. Japan appeared as one of the early implementers of this policy by providing extensive support to the firms, not only through subsidies; but also, by increasing the profitability of firms entering the competitive market. Tax reductions or low-interest loans were provided to industrialists and merchants by the state. Singapore, China, and the Republic of Korea are among the successful countries that have tried to catch up to the level of developed countries by establishing leading state institutions that would support ISI policy, such as the Singapore Economic Development Board and the Industrial Technology Research Institute of China.

In the post-1950 years, East Asian governments played a producer, investor, and regulatory role in the economy. They also used neutral incentives in domestic and foreign markets. In countries such as Indonesia and Thailand, government intervention was minimal at first, but inspired by their other Asian counterparts they also interviewed the economy and improve industrialization. Successful examples of Asian economies such as South Korea and Taiwan had high savings and high investment rates during the period of ISI. They have pursued stable fiscal and monetary policies, have been open to technology transfers, and therefore have been protected from economic volatility and inflation.

Looking closer at the case of South Korea's success, the Chaebol system had a major role in the economy. In the early 1960s, South Korea was a steadily developing country with a high inflation rate, price controls on essential goods, fiscal deficits, limited import policies to protect domestic manufacturers, overvalued exchange rate supported by quantitative restrictions on imports. (Akarsu, 2021) To overcome the country's economic difficulties, the South Korean government adopted a strict import substitution policy and developed a system called “Chaebol" where the state directly provided economic support to privileged companies. Chaebols were formed in a family-based business structure and the founding families determine the number of loans and investments to be taken under their management. Inspired by the zeitgeist of the 1960s, they preferred to invest in heavy and technological sectors which were considered essential for national economic development.

The government used to provide cheap credit to these companies on condition that they would be engaged in a production sector that had the export potential. (Kang, 1996) Companies such as Samsung, Hyundai, and LG come to the fore as important outputs of this system. Even though South Korea was a poor country in terms of natural resources, it achieved to fulfill this gap by producing value-added products. Close to the years 1980s, South Korean companies opened up to the international market and created global brands. The example of Chebols would later inspire other Asian countries and would be the label of the success story of ISI in Asia.

However, the same success story cannot be read in Latin America due to reduced competition which made local producers more complacent. Many Latin American countries adopted ISI policy before Asian countries during the 1940s. The devastating consequences of the Great Depression led these countries to develop import-oriented economic models. States in Latin America aftermath tried to increase their foreign exchange reserves, which had fallen and almost disappeared, by imposing import quotas. However, these policies at the end of the day did not work.

Looking closer at the economic history of Latin America would facilitate understanding the reasons for this policy failure. For one thing, it has much to do with population structure. Between 1930 and 1950, mortality rates decreased, stabilized, and sometimes increased due to the end of the war. The average annual rate of growth of the population rose from 2.2 percent from 1930-50 to 2.7 percent from 1950-70. (Thorp, 1998). It seems that the growth rate was unable to meet the rising population. The new industries are making an inadequate contribution to the solution of the unemployment problem. Moreover, expected development could not be achieved due to the lack of education of local industrialists in the country. (A.O.Hirschman, 1968) . In addition. market imperfections that stem from a lack of convenient infrastructure, institutions, and socio-political structures, unfavourable income distribution, budget deficits, and insufficient savings played a crucial role in this failure. Moreover, deficits in foreign exchange reserves, and big foreign depts (as seen in the case of Argentina) did not allow countries to implement ISI properly.

As a result, during and after the 1960s, Latin America's GDP growth rate lagged behind that of Asia. While many Asian countries such as South Korea, Singapore, Taiwan, and Hong Kong became developed countries, the same achievement could not be witnessed in Latin America. During this period, East Asia tried to inflate export trough promotions, tax incentives to exporters, low trade barriers, less protectionism as well as fewer controls and regulations. Unlike Latin America, Asian countries also experienced a stable macroeconomic environment during this period. Their fiscal deficits were small and inflation rates did not fluctuate. Asian economies also avoided overvalued currencies and freedom for investment was more vivid compared to Latin America. The following table illustrates the difference in GDP between

Asian and Latin American countries in the period when both implemented ISI policies.

Table 1. Rate of growth

Country	GDP Per Capita (1960)	GDP Per Capita (1989)	The Growth of GDP (%)
South Korea	883	6.206	6,82
Taiwan	1.359	8.207	6,17
Ghana	873	815	-0,54
Senegal	1.017	1.082	0,16
Mozambique	1.128	756	-2,29
Brazil	1.745	4.138	3,58
Mexico	2.798	5.163	2,36
Argentina	3.294	3.608	0,63

Source: Dani Rodrik, „Understanding Economic Policy Reform" Journal of Economic Literature, March 1996 p:13

As seen in Table 1, the GDP per Capita ratio in South Korea and Taiwan, which are considered to be successful examples of ISI policies, have increased much more than the other countries in the table with 6.82% and 6.17% respectively. Latin American countries such as Brazil, Mexico and Argentina, which are cited as having unfavorable economic conditions and lack of policy stability, had GDP growth of less than 5% during the period under review. Based on factors such as population growth, consumption and investments that are effective in the growth of GDP, it would be difficult to conclude that the policy has contributed to these economies positively.

3. Türkiye's Experience of ISI Policies during 1960s and 1970s

Apart from Asian and American countries, states in Eastern Mediterranean also adopted the trending economic policy of the time. In this part of the world the consequences of the policies were neither disastrous as in Latin America; nor fabulous as in Far Asia. Türkiye constitutes a good example of this moderate implementation of ISI policies. As mentioned above, the role of the state in the economy, budget deficit, and foreign exchange reserves before the adaption of ISI had a decisive impact on the success or failure of the policy. Therefore, for a sound analysis, we are going to sketch out briefly the economic conditions of Türkiye before the 1960s.

The Republic of Türkiye to a large extent inherited its economic structure from the Ottoman Empire. During the Imperial period, there were significant attempts for establishing domestic industry however, because of wars, and financial and economic instabilities the Empire was unable to do so (Baycar:2021). After the proclamation of the Republic, the new regime attempted to continue the progress of creating national industry and the new conditions were suitable to do that.

For this purpose, the Republican government enacted the Law on Promotion of Industry (Teşvik-i Sanayi Kanunu) to facilitate the establishment of new companies and workhouses. In the beginning, the state pursued liberal economic policies. However, during the Great Depression, the Turkish economy was hit considerably, and it was understood that the state intervention is inevitable. After the depression, state was directly involved in the economy by investing in critical sectors such as agriculture, banking, and textile production. Inspired by the successfully implemented 5 years plan in the USSR, the Turkish government drafted the first five-year industry plan in 1934. State-led industrialization leaps were taken in line with this plan; weaving factories in Kayseri, bottle-glass factories in Istanbul, paper mills in Izmir and, Etibank for mining activities were established.

The second five years plan coincided with the outburst of the Second World War and could not be implemented. During the war, almost no investment was made and the national income per capita at constant prices dropped by 22%. (Ünal, 2009). According to some estimations due to the general scarcity of consumer goods and the blockage of imports, the general price level increased 4-5 times between 1939 and 1944 (Keyder, 1983).

After the 1950s, as Democrat Party (hereafter DP) came into power, a democratic regime and values were introduced to Türkiye. Ideologically the new government presented itself as liberal and democratic. The liberalization in economic understanding leads policymakers promotive private initiatives. During the DP period agriculture let economic growth was accepted and in ten years, considerable economic growth was achieved in this sector. (Table 2) Close to the end of the 1950s, DP faced political and economic challenges. Especially in the second term of administration, the economy was not good at all primarily because of unfavorable climate conditions, bad harvest, and financial bottlenecks. Export of agricultural goods began to decline, and the DP sought foreign loans to develop the economy but had difficulty in finding the funding it wanted. To close the balance deficit in the economy, a stabilization program was proclaimed that would provide a loan of 359 million dollars (Kaynar, 2022).

Even though the government adopted liberalism in the economy, ironically in practice, the role of the state in the economy expanded. Restrictions on foreign trade remained until 1958. Under the DP's administration, the desired economic success could not be achieved. Moreover, close to the end of the 1950s, the economy became dependent on foreign influences due to the loans and debts it received. In the end, the DP governorship ended with a military coup in 1960. Even this program could not heal the economic problems which would lead to the military coup in 1960. The anti-democratic regime will rule Türkiye for several years.

Despite the adoption of a liberalization policy, the strong role of the state in the economy remained. Between, 1954 and 1962 initial steps were taken which can be considered a precursor of import substitution. Producing a national automobile was a symbolic attempt towards establishing a national industry. Even though the dream of having a national automobile failed, the policymakers did not give up the idea of creating a national industry. To this end, imports of certain products were curtailed or even banned altogether, while domestic producers were encouraged through cheap credit, tax immunities, cheap foreign exchange allocations, and other methods.

International politics had a big say in shaping the economic strategies of countries in this period. After the end of WWII, Türkiye became a member of the NATO alliance, and this choice did not only shape its political stance but also its economic structure. In the1950s, the leading power of NATO; the USA suggested the planned economic model and import-substitution industrialization for developing countries. (Yıldız, 2020) In addition, global capitalists also lobbied many developing countries to convert their economic policy into ISI. (Sylvia Maxfield, 1990). The 1961 Constitution paved the way for the establishment of economic institutions which would lead ISI policies. Among these institutions, the State Planning Organization (Devlet Planlama Teşkilatı: hereafter SPO) comes to the fore as being responsible to centralize all investments in a scheduled program. The Office was also assigned to draft the 5-year development plan.

During the 1960s, the economic policy of Türkiye can be defined as a true ISI. Under the supervision of the SPO the planned economy and import substation were implemented and eventually, the Turkish economy witnessed unprecedented economic growth compared to the previous years. Between 1960 and 1976, the share of manufacturing in GDP rose from 17.5% to 21.2%, while the share of agriculture fell from 36.5% to 27%. (Kaynar, 2022). The growth in the industrial sector remained modest in comparison because it needed to import intermediate goods and machinery equipment. Since the reserve of foreign currency in Türkiye was scarce, the existing money was allocated to industry. In those years Türkiye could only earn foreign currency from imported agricultural products.

The administration of the time also stimulated firms that wanted to produce a new industrial product could easily obtain the necessary approvals from Ankara. In addition, they gained protection in the domestic market as the government banned the import of that new product. The main goal of the statesmen of the time in implementing ISI policies was to achieve overall economic progress. Relying on the rising population and urbanization in Türkiye they believed that domestically produced goods could be sold in the domestic market.

The first years of the implementation of the ISI focused on the production of consumer goods. Türkiye targeted the transition from non-durable consumer goods to durable consumer goods, (which was presented above as the second stage of ISI9 towards the end of the 1960s. Under conditions of a moderate shortage of foreign currency, a true process of import substitution was pursued relying on domestic savings. In this period a gradual increase in the share of domestic production over the total production was witnessed. (Pamuk, 1984)

Throughout the 1960s, a mixed economy was the prevailing model which introduced a new division of labor between the public and private sectors. The production of critical intermediate goods which required a large-scale investment such as iron&steel, petro-chemicals was undertaken by State Economic Enterprises (Kamu İktisadi Teşebbüsleri). These institutions which were established with a well-defined mission, use to manage the public resources.

The domestic market, protected by high tariffs and quotas, offered ample opportunities for domestic producers. The introduction of advanced technology, investments in infrastructure, and a rise in incomes, stimulated the entrepreneurs to produce radios, refrigerators, and other consumer durables. Between 1962 and 1977, there was no year in which the economy shrank, or per-capita income declined.

The abovementioned positive trend in Türkiye was overlapping with the development of the world economy in general. However, in some respects, Turkish economy diverted from the positive global atmosphere. The structure of industry could not be rescued from dependency of foreign exchange rates. Starting in the 1970s, export revenues started to decrease a balance of payments problems arose and the exchange rate of the Turkish lira against foreign currencies had to be adjusted. In 1973, Türkiye was caught unprepared for the oil crisis. Under these conditions normally savings are expected to increase. However, in Türkiye right the opposite happened, and the consumption level continued to rise. Thus, Türkiye had to deal with a growing external debt burden. The widening budget deficits coincided with the well-known oil crisis end up with a jump in the general price level in the domestic market.

The annual inflation rate reached up to 20 percent in the first half of the 1970s. due to the increase in foreign exchange expenditures. 1974 Cyprus Peace Operation and America's embargo exacerbated the situation and the budget deficit reached four and a half billion US dollars. (Sarıtunalı, 2021). In 1975, the government of Süleyman Demirel introduced a new application namely; Foreign Currency Convertible Deposits, which meant short-term borrowing at high interest rates and under extremely unfavorable conditions. By mid-1977, large amounts of short-term debt had accumulated, and the public sector had become no more able to repay foreign debts.

This period is also characterized by shortages of goods and energy, shortages, black markets and consumption queues. The inflation rate reach its zenith so 100%, an agricultural income of the farmers could not resist the rising inflation, income distribution deteriorated. With the words of Şevket Pamuk: "After 1977, there was a currency crisis, the industry entered a period of stagnation and; GDP , which had not been observed for a long time, fell for two consecutive years (Pamuk, 1984).

Both the characteristics of the Turkish economy and how ISI is implemented are considered for the mentioned depression. Newly established industries and investments were insufficient for the increasing population which is inclined to more from rural to urban areas. The required technological development which would be expected to enable industrial production at home with domestic opportunities could never reach to a sufficient level. That's why the production machinery was imported from developed countries which resulted in a decrease in foreign exchange reserves. The economy remained to be vulnerable to fluctuations in foreign exchange and despite the big endeavour of the government domestic saving could never reach to an appreciable level. The scarcity of foreign currency ultimately ended up with a great economic crisis that lasted between 1978 and 1979.

Table 2. Average annual growth rate

	GDP	Agriculture	Manufacturing	Rate of Import in GDP	Rate of Manufacturing in GDP
1947-1953 Growth based onagriculture	8,7	11,5	6,5	9,3	8,8
1954-1962 depression andthe return to import substitution	4	2,1	7,6	6	12
1963-1970 Rapidimport substitution withscarce foreign exchange	6,4	2,6	10,4	6,8	16
1971-1977 foreign-funded industrialization with abundant foreign currency	7,2	4,3	10,1	10,9	16,8
1978-1979 Depression	1,3	2,8	-0,9	9,4	19,7

Source: State Institute of Statistics, National Income of Turkey (1948-1972): SIS, Statistical Yearbooks : Bulutay, Tezel and Yildirim (1974).

The military coup opened the gates for the ISI and the same gates were closed by the other military coups of the 1980s. As noted above the ISI experience of Türkiye was not a disaster at all, neither it was a miracle as in Asia. The statistical records support this deduction. As seen in Table2 the ratio of manufacturing in GDP rose more than two folds, while the rate of imports remained for a long time at around 6%.

4. Import Substitution Years in the Eyes of a State Planner Ertan Yülek

This part is devoted to scrutinizing the import substitution by directly touching on the life and experiences of Ertan Yülek, a figure who had a professional career in one state-owned enterprise Sümerbank and who served as general director of Incentive Implementation. In fact, during the ISI period state institutions played a schooling role and they graduated many specialists which would have a big role in shaping the economy of Türkiye in the next coming decades.

Two reasons come to the fore on why we chose the example of Ertan Yülek for that article: First; Yülek, being a manager in one of the big state enterprises, seems to be more likely to internalize the economic mindset of the state and thereby his memories would allow us to see the overall picture of Turkish ISI experience. Presumably, his statements have the potential to fulfil the gaps that are left out by the official statistics which are considered to be the only references applied by academics. In addition, his life reveals the success or failures of the actual implementation of ISI. Secondly; as Yülek actively took place in the transition to the liberal era during the 1980s, his experiences offer us the opportunity to make a comparison between the liberal and ISI periods. However, in this article, we are going to mention only the first two chapters of his life, which are related to import substitution.

Ertan Yülek graduated from one of the most prominent universities of the time that graduated distinguished politicians and engineers namely; Istanbul Technical University. He worked in Sümerbank and in the Ministry of Industry as the General Manager of Incentive Implementation (Teşvik Uygulama Genel Müdürlüğü). While serving as a state specialist, he carried out feasibility studies of many newly established factories and contributed to the development of new operating and cost methods. He successfully took part in areas such as the establishment of the first modern stores. After he completed his carrier in state sectors, he served in the private sector as general manager, coordinator, consultant, facility manager etc. During the first years of the 1980s, he worked as a deputy undersecretary of the State Planning Organization. He actively played a role in drafting the 5th-year development plans. Ertan Yülek, who played an important role in the establishment of many industrial facilities in Türkiye, reveals to us the post-1960 economic, political, and social circumstances in his memories; 'Ömürdür Gelir Geçer'. (Yülek, 2015)

Apart from mentioning specific episodes in his life, Yülek in his book points out his point of view on economic policies relying on his experiences. According to him the most important obstacle to the development of the Turkish economy during the 1960s and 1970s, was the scarcity of capital, and even more than that the existing scarce money could not be led to investments properly. One day when he was at Technical University, an American professor rise the following question to the class; "What is the most important shortage in Türkiye which does not allow the country to develop economically?". All the students in the classroom answer it as "lack of capital". The American professor shows the USA-made the luxury automobile in the street and said: "Well you have money so you are able to buy these cars." And he added: "The problem is not about the scarcity of capital, it has much to do with lack of venture, misallocation of capital to the useless activities, and bad industrialization policy" (Yülek: p.128)

This dialogue profoundly influenced the economic views of Yülek. Accordingly, if he thought that Türkiye needs to be developed, more sources should be led directly to the industrialization. This view highly corresponded to the economic stance of a well-known politician Nacmettin Erbakan who supported the idea of a jump-start for heavy industrialization (ağır sanayii hamlesi) during the 1970s. Erbakan is generally presented, by some and unfairly, as the person who introduced political İslamism however, his most important contribution to Turkish politics was his program on the establishment of domestic industry. His views known as "milli görüş" not only defended the grasped rights of conservatives but also included the full independency of Turkish politics and economics. His views and programs would influence the next coming generation in politics and would seed the national and domestic industry of Türkiye during the 2010s. Ertan Yülek's stance on industrialization was overlapping with Erbakan's program.

The suggestion of Erbaban on industrialization (which is shared by Yülek also) was immediately to produce machines at home, that would produce industrial commodities. This approach corresponds to the third stage of ISI in later produced academic literature. He believed in the capacity of the human capital of Turks which (in his views) was enough to produce an engine. Engine production was considered the most important threshold for heavy industrialization.

The dream of producing Turkish-made engine Erbakan is traced back to his college years in Germany. He was uncomfortable to see that the Turkish industry relied on the machines imported abroad and that is why it could not progress as it is supposed to. To overcome this problem, he initiated the establishment of the first diesel engine factory called "Silver Engine". The Silver engine was a very critical investment only for industry but also for agricultural improvement. Using the engine, the farmers were now able to draw water from wells to irrigate their lands. In addition, this engine was able to meet the orders of the Directorate General of State Hydraulic Works and was exported to several countries in Africa and the Middle East in small numbers.

However, the partial success of the Silver Engine challenged the interest of the established machine market which consisted of the imported engine. The Silver Engine did not influence policymakers and that's why could not get state support. Presumably, because of this reason, Silver Engine began to lose and ultimately it shut down by transferring its shares to the Cooperative of Beetroot (Pancar Kooperatifi) and Sugar Factory (Seker Fabrikası). According to some, if the needed state support was given to this initiative, Türkiye could have been producing its own engines for tractors, automobiles, and even for ships.

After the military regime of 1960s, disappeared, Erbakan entered politics to put their ideas into practice. In the coalition government of Süleyman Demirel, he was the chairman of the economic board and responsible for the activities related to investments. While serving in this position, in line with constructing domestic industry understanding, many factories such as Tümosan, Taksan, Temsan, Testaş, Gerkoksan were established. Ertan Yülek commented on this process as follows; 'There is a serious textile investment in Türkiye, but it cannot make textile machines. We import all textile machines and spare parts from abroad and pay huge money. In line with this point, it is inevitable to prepare projects to make textile machines'. (p.136)

Between 1960 and 1975, when Türkiye as a state policy completely embrace the ISI policies, the country was ruled by a series of coalitions mostly consisting of right wing political parties which were called the Nationalist Pact. In this period Erbakan's conservative-religious party Milli Selamet (National Salvation) had the chance to take seats in the cabinets. The slogan of "heavy industry" became more vocal in Nationalist Pact coalitions. In this time period, individuals and institutions started to produce projects in order to obtain loans from the World Bank and the other international organizations, however a few of them were found feasible.

Right-wing bureaucrats who are going to play a crucial role in Turkish politics started investment campaigns all over the country but especially in Anatolian cities which were not considered for a long time. Çinkur, Bakırsan, İzmit Refinery are the first examples that come to mind in this context. These were not private initiatives at all, they were backed financially by the state. According to Yülek the main problem in the failure of these initiatives was the fact that the projects were proposed and conducted by uneducated and unprofessional people. As a result, these loans and incentives could be abused.

The world order in the 1960s, and 1970s was politically bipolar. Türkiye took the side of the liberal, democratic Western block where "market economy" was accepted as the

prevailing understanding. Still Türkiye did not challenge openly the Soviet and Socialist blocks. Even sometimes it intended to avail itself of the industrialization experiences of Socialist countries. Even some specialists did not hide their admiration for the Soviet Textile industry. USSR was keen to work with Türkiye for political causes. While Ertan Yülek served as manager in Sümerbank, the company intended to produce its own machine imitating plans and schematics of the Soviet machines. Soviet delegates who were keen on technology transfer visited Türkiye several times. However, at the end of the negotiations it was understood that Soviet technology was quite backward and the production cost of this technology was not appreciable to Turkish textiles.

Still, this attempt was not a failure at all. According to Ertan Yülek, the negotiations and joint work with Socialists enabled Turkish delegates to get a broad perspective. In the Soviet system, employment, social development and value-added production were the priorities of the economy. As opposed to their Western counterparts these priorities were considered more important than "profit". Yülek gives an example as follows; "the state pays a woman sitting at home to weave carpets and sew. But it pays her a higher wage than the cost, so she earns money to survive by working. In this way, even though the state appears to be looser by giving her more money, it reduces the social burden by preventing the social benefits that she could demand from the state. (p.145)"

Between 1960 and 1980, cheap credit and input supply were granted to domestic producers. In addition quotas and high protection walls were established to protect them from the competition of foreign markets. In 1967, all these strategies began to be determined in accordance with a big investment plan and conducted a single institution namely; the Office of Investment and Export Development and Incentives (Yatırımları ve İhracatı Geliştirme ve Teşvik Bürosu) Abdullah Takım, 2018). By monopolizing the state supports the government intended to prevent the state from allocating capital to the unpromising projects of unqualified people.

In 1976, a bank was founded under the name of State Industry and Laborers' Investment Bank Ltd. (Devlet Sanayi ve İşçi Yatırım Bankası A.Ş. -DESIYAB). The purpose of this bank was to provide interest-free loans to investors and organizations and to stimulate the economy. DESIYAB's investments were mainly in the form of financing multi-partner companies. Therefore, companies suddenly emerged all over Türkiye and investments multiplied. Ertan Yülek indicated that of almost half of the state supported projects were funded by DESİYAB. For him this was a good example of public-private collaboration.

In 1980, Türkiye's democracy and thereby economic development march was interrupted once again by another military coup. After the 1980s, Türkiye just like many other countries in the world gave up ISI and adopted economic liberalism.

With ISI policies the ideal of establishing domestic industry wanted to be practiced during the 1960s and 1970s, under the circumstances of economic fragilities, social unrest, and political instabilities. During this period the state was governed by short-lived coalition governments. Unlike its many other counterparts, domestic industrialization attempts could not be supported by the state because of political fluctuations. Ertan Yülek believed in Erbakan's program and consider it to be a true part to reach industrialization. However, the political fragmentation and power politics disabled Erbakan to become the way in which it takes place in academic literature "the developmental leader". (Yülek and Akkemik:2022)

5. Conclusion

One of the most important problems facing developing countries in post-World War II period was to achieve economic growth and to maintain it sustainably. The economic history in the 20th century allows us to deduce that since developing countries were unable to adopt an export-oriented development strategy due to their limited foreign exchange reserves and insufficient export potential, they became more inclined to develop ISI strategies. State interventions and restrictions in domestic markets within the framework of import substitution industrialization policies also brought along measures taken against international markets.

Türkiye adopted ISI policies and implemented these policies within the course of twenty years. However, if not a complete disaster the ISI policies in Türkiye did not benefit the economy of the country primarily because of the unstable political atmosphere. Turkish newly established institutions were able to draft noteworthy investment programs and projects. However, many of the mentioned projects either failed or even could not be started.

Ertan Yülek's memoirs illustrated the disappointments of the adaptation process of ISI policies in Türkiye. How he perceived the causes of the failure of establishing the Turkish domestic industry overlaps the explanation of the theoretical and empirical academic studies. There was no harmony between policymakers, institutions, and the other executive powers in developing economic policies. The fragmented political structure caused projects to be held by inadequate people.

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Digital Divide, Credit Financing and Financial Inclusion: Changing Patterns of Poverty, Employment, and Income Inequalities

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Abstract

The role and effectiveness of financial inclusion and information technology to protect the lower income groups has become an important area of concern after Covid-19. The main objective of this study is to examine the impacts of information technology on poverty, income inequality and unemployment. The study is based on 14 years data of 148 countries. The results are statistically significant and parameters are robust in different alternative scenarios. Empirical evidences confirm the effectiveness of the use of internet, mobile banking and credit flows by fintech and big technology companies for poverty alleviation, creation of employment and GDP growth..

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1. Introduction

A declining gap in GDP between the countries was observed during the last two decades. However, a visible widening in rich-poor gap within the countries was also noted. Despite, a general perception that globalization will reduce the rich-poor gap, the rich have become richer and the poor even poorer during the last two decades. World Bank has indicated that inequality between and within countries has often accompanies by greater economic globalization (Ocampo: 2005). This rising of rich-poor gap was observed even in the industrialized countries including the United States, Canada, and Britain. The changes in the patterns of wealth distribution are similar in Africa, Asia and Latin America. According to Ocampo (2005), 80 percent of the world's domestic product (GDP) belongs to one billion people living in the industrially developed world, while the remaining 20 percent is shared by other people living in developing countries.

It was expected that revolutionary changes in information and communication technologies (ICT) will reduce the rich-poor gaps through efficient utilization of human resources. Unfortunately, it cannot play its role unless its understanding and accessibility to common peoples. Even it can widen the income inequalities if peoples in lower income groups are not able to afford the cost these contemporary technologies. Now, there are two categories of peoples almost in every country, particularly in least developed countries: First category belongs to the affluent peoples who have achieved the ability of culture adoptability because of their education, frequent travelling, trainings, investing their monetary resources, and developing their cross-border contacts. The other part belongs to the peoples who do not have ability to get the benefits of globalization and they will have to live in isolation without knowing the contemporary world. The situation may lead social unrest, rebellions and insurgencies against the system. This situation may be more threatening as compared to the cold war era, when world was divided geographically in two parts. The state of poverty and income inequalities have rapidly further worsened due to global pandemic in 2019-20.

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It was pointed out by Gunderson (2020) that the greatest wealth transfer in history would take place during three years of Covid-19 crisis. The new technologies lead to change in the pattern of growth. History of development reveals that the changes in the patterns of growth may lead the growing gap between winners and losers. This growing gap may be among the peoples, companies, economic sectors and countries. The growing use of information technology may widen the rich-poor gap if its benefits are not distributed evenly. In this regard, it is notable that use of financial technology, financial literacy and financial inclusion are the interrelated phenomena.

Before, exploring the relations between financial inclusion, information technology and poverty, it is important to understand the common perception about the cause of poverty. It is interesting that reasons for their poverty which are commonly perceived by the peoples are classified in 3 categories: (1) Luck or fortune; (2) Lack of efforts or capabilities at individual levels; and (3) Role of Policy makers. Poverty by inheritance, family structure, individuals working habits, health related issues of family members, natural disasters, civil wars, and change in climate conditions may be responsible for poverty and economic miseries of individuals and families. Such unanticipated conditions may shift an individual or a family at below the poverty line, while some peoples consider such conditions as a matter of luck or fortune. Sometimes, inordinate risk-taking activities by an individual, flawed planning and ill working habits may create economic miseries which are classified as issues at individual level. However, in considering the causes of poverty the role of economic system and policies cannot be ignored. The consequences of flawed economic system, ill planning, inefficiencies and corruption of policy makers and economic managers should not be transferred to those who are not responsible for such policies and actions. The spread of new technologies, rules and regulations for creating informational efficiencies, regulatory support for use of financial technology (Fintech), financial literacy, diversion of banking facilities and financial inclusion, monetary system and access to financing facilities are included in those policy variables which can affect the level of poverty in a country. Such policies determine the magnitude of poverty, unemployment, and labor participation in economic activities.

Multiple dimensions of the causes of poverty and inequality have been covered in economic literature. In the present context, World Bank (2020) has identified three factors which are responsible for the increase in global poverty and that threaten to extend its effects far into the future. The climate change, armed conflict and covid-19 are included in these factors. However, the impacts of the growing use of information technology on poverty and employment need to be properly assessed on empirical basis. It has been mentioned earlier that declining rich-poor gap and alleviation of poverty was expected by the globalization and revolutionary changes in the use of information and communication technology (ICT). However, its assessment on the basis of empirical evidence is still required. This study fills this gap.

The main objective of the study is to examine the impacts of information technology on poverty, income inequality and unemployment. This study is limited to examine the use of information technology in determination of the poverty, share of lowest 20 percent population in total income, Gini-index, rate of unemployment and labor participation rate, while use of information technology was measured through flow of funds by fintech companies, use of internet and mobile phone for transfer of money. The study is based on empirical evidences.

The next section of this study discusses the findings of previous studies related to poverty, financial inclusion and information technology in contemporary world. Section: 3 describes the global changes and comparison in the magnitudes of poverty, unemployment, GDP, use of financial technology and banks' credit to private sector. Section: 4 establishes a statistical model and methodology for empirical analysis. The empirical evidences and findings based on estimated parameters have been explained in section: 5, while conclusions and some policy implications have been described in section: 6.

2. Review of Literature: Income Distribution, Financial Inclusion, and Information Technology

Various studies have established the links between economic growth and the use of financial technology. It has been concluded that use of electronic mode of financing during the pandemic crisis may set off economic losses to some extent. Mehar (2021) found that higher share of population receiving payments by digital modes and the use of "Fintech" for payments of bills or to buy something online are significant and robust determinants of trade in services. While, the fintech was defined by Marlene, Huang, Morgan, and Shirai (2019) as "Advanced technology to improve and automate delivery and use of financial services to consumers and businesses". It covers a broad landscape from digital currencies and payment systems (e.g., mobile phone wallets, crypto-assets, remittance services) to asset management (e.g., internet banking, online brokers, robo-advisors, crypto-asset trading, personal financial management, mobile trading) to alternative finance (e.g., crowd funding, peer-to-peer lending, online balance sheet lending, invoicing, and supply chain finance)".

Stefan, Stremerscha and Gerard, J. Tellisc (2004) have tested the differences in pattern of growth in sales of products and found that the pattern of growth differs substantially across European countries. However, these differences are explained mostly by economic wealth and not by culture. It means growth in businesses is directly attached with the

economic growth which is not affected by the culture. So, use of information technology itself is not a factor to create a market of products, however, it can affect the sales revenue by creating awareness, facilitation in delivery and payments. However, its main effect will come from the economic growth. The use of financial technology can improve GDP growth and investment by improving informational efficiency and credit enhancement.

Various studies have explained the role of monetary policies and domestic credit in determination of investment and GDP growth. Economic theories have established a broad relation between money supply, investment and economic growth. Keynes (1936) and Hicks (1967) have explained the relation between economic growth and investment in macroeconomic context. Dimand (1988) and Gordon (1990) have provided the models to quantify the impacts of investment and interest rates. Recent economic literature covers various dimensions of these relations. Impacts of working capital on infrastructure development, provision of working capital for long term investment, debt-equity trade off and the banks credit to private sector for success of public-private partnership model are the areas which have been discussed in recent past. Stein (1982), Juan (2015), Mehar (2018) and Kindleberger (1970) have explained the role of credit financing and monetary policies in economic growth. Inderst (2018) have identified the role of financing to private sector for infrastructure development. Mehar (2005) had provided a model to test the role of credit financing as a substitute of equity.

In establishing relations among borrowing, interest rates and use of financial technology, Guizhou and Kjell (2022) found that central banks choose negative interest rates when they realize that the households are willing to pay the central banks for holding Central Banks Digital Currencies (CBDCs). Gormez (2019) claims that central banks that have perfectly addressed all the fundamental glitches of money and financial service provision can issue digital currencies with no reluctance. He mentioned that electronic money is not a new concept, and technology can enhance the way of dealing, but does not change the fundamental nature.

Christian and Hornuf (2019) have concluded that more fintech startup formations are possible when the economy is well developed and venture capital is readily available. Stijn, Frost, Turner and Zhu (2018) mentioned that fintech credit deals a substitute funding source for businesses and consumers and may expand access to credit for underserved fragments. It may improve the efficiency of financial intermediation. However, fintech credit sizes are greater in countries with less rigorous banking regulation. Zhong and Ruihui (2019) has explained how the government of China has implemented many regulations for fintech applications for the prevention and resolution of financial risks. They included P2P lending, third-party payment, and crypto-assets in those measures, while some additional measures including financial standardization, fintech infrastructure development, and investor protection have also been strengthened to promote sustainable fintech development. The government has tried to strike a balance between encouraging fintech innovation and strengthening regulations.

Another important aspect of the revolution in information technology is that it has facilitated the commercial banks in creation of more money by use of digital money (or digital currency). Intangible digital money is accounted for and transferred through online systems. The spread of covid-19 has further supported the use of digital and electronic money. While, the central banks in this era encouraged the commercial banks to create more money by ease of credit restrictions. This aspect further clarifies that why this study is concerned to test the impacts of credit enhancement and use of electronic and digital payments on poverty and income distribution.

In considering the importance of information technology, it is noteworthy that majority of countries in 2019-20 have adopted the soft monetary policies to mitigate the adverse effects of Covid-19 on the economy and to protect the lower income groups. The lowering interest rate and expansion in the credit to private sector were are also component of the soft monetary policy. So, in our analysis, we have included domestic credit to private sector as a policy variable. Those soft monetary policies are closely associated with the use of financial technology including use of internet, e-money, digital currency and accounts in mobile phone banking. So, the role and effectiveness of the financial inclusion and technology to protect the lower income groups has become an important area of concern after Covid-19.

It is noteworthy that growing use of financial technology is closely associated with the supply and creation of money and credit to private sector. Velde (2002) and Michael, Amar and Ryland (2014) have examined the money creation process in the modern economies. Their works compare the fiat money with the gold standard and described the historical roots of the monetary systems. The money based on precious commodities (gold and silver) have intrinsic value. While, commodity-based representative money in the form of paper notes can be exchanged with precious commodities. The global monetary system in contemporary world is a fiat system, which is based on paper currencies and metal coins as legal tender which are guaranteed by a government and notified by the central bank of the country. It does not represent intrinsic value of money. This system is based on historical integration of sovereign issued coins, credit by banks to their customers, and a common governance of commercial banks through a central bank. This system is responsible to provide money in the economy to create equilibrium in the money market. It consists of the national treasury, the central bank, the mint, and commercial banks. The volume of currencies in this system is derived through data of bank balances, records of credit or debit card

purchases, and relatively a small fraction in the forms of notes and coins issued by the central bank (Michael, Amar and Ryland: 2014). It corroborates that money is mainly created by commercial banks when they provide credit to their customers. Almost every country during the covid-19 crisis has used the enhancement of credit to private sector as a policy to protect the economic activities particularly lower income groups. To encourage the use of internet and e-money for monetary transaction is used as policy tools for this purpose.

It is notable that use of financial technology, internet and mobile banking are the important ingredients of financial inclusion, while financial inclusion, use of digital currency and e-money are also interrelated subjects. The use of digital currency and e-money is directly linked with the use of information technology and financial literacy. E-money is a digital alternative to cash, which allows its holder to make cashless payments via money stored on a phone, prepaid card, or online account. Electronic money (e-money) is broadly defined as an electronic store of monetary value on a technical device that may be widely used for making payments to entities other than the e-money issuer. The device acts as a prepaid bearer instrument which does not necessarily involve bank accounts in transactions. Electronic currency, electronic money, or digital money is managed, stored or exchanged on digital computer systems, especially over the internet. While, Electronic Money Institutions (EMI) are authorized to issue and manage e-money on behalf of its users. EMIs are not banks because they don't create money by their lending mechanism. EMIs offer contactless payment instruments like wallets and prepaid cards etc. The cost effectiveness and user-friendly properties of these instruments lead to innovations and technological advancement in EMIs. The best example electronic wallet is the mobile money service, which available allows users to store, send, and receive money using their mobile phone. While debit and credit cards are form of digital money.

To recognize a mode of payment as money it is the basic requirement that it must be acceptable commonly as a medium of exchange. However, a common question in the public mind is the power of a digital currency or e-money for its ability to store the value. In this respect two things are important: (1) value of a currency is determined by the peoples based on its demand and supply. The demand and supply of a currency is attached with the economic fundamentals of the country of issuer of a currency. (2) It is an important requirement to maintain the value and trustworthiness of currency that its copy should not be possible. This second objective relates the e-currency with the concept of 'crypto currency'. The idea behind these crypto currencies is to introduce those currencies which are globally acceptable. At present, more than 10000 crypto currencies dominated by Bitcoin are adopted by selected investors in different countries. The block chain technique which records uses of data in multiple ledgers are used in issuance of crypto currencies. The market size of these crypto currencies was recorded at 1.6 billion USD in 2021. The difference between crypto and digital currencies is only that digital currency is issued by a central bank. So, its record is maintained by the central banks of a country. Though, currency issued by a central bank is a fractional part of total money supply in the contemporary world; the bigger part of money supply is derived from the deposits of commercial banks. Even commercial banks in few countries are authorized to issue their currencies. So far as common acceptability of e-money is considered, it is also related with the financial literacy. History of money is evident that every type of currency was rejected by the peoples at its initial stage but with the passage of time every currency has got common acceptability by its users. This was an historical fact from gold coins to paper money. The plastic money was not exempted from this common principle, and now digital currencies and e-money are passing through this stage of acceptability. Earlier acceptance of changes in the system of monetary transactions can be beneficial for the poor families. But financial illiteracy is the man hindrance in financial inclusion of the poor families. So, they take more time to get the benefits of the changes. Consequently, it leads further widening in rich-poor gap.

The next section presents a global comparison of financial inclusion, use of financial technology, credit to private sector, GDP growth and poverty. After a brief review of this comparison, the section: 4 will provide a detailed statistical analysis and empirical investigation to assess the role of financial inclusion and information technology in determination of poverty, income distribution and unemployment.

3. Financial Inclusion, Credit to Private Sector and Poverty: Global Comparison

A significant change can be observed in the global pattern of GDP growth. The share of high-income countries in world GDP has dropped at 62 percent in 2021 from 72 percent in 2009. In 2009, the lowest per capita income was in South Asia but a significant continuous improvement has been observed in South Asia mainly in India. The share of South Asia in world GDP was 2.8 percent in 2009, now it is 4.2 percent.

The astonishing fact about South Asian countries belong to the level of poverty in this region. Despite lower rate of unemployment as compare to the rest of world (Table:2), the level of poverty is much higher in South Asia. A disassociation of a higher-level employment and magnitude of poverty may reflect the lower rates of wages and salaries in South Asia. It may reflect a higher dependency ratio in the region. In this situation, the contribution of financial sector become more important. The lending institutions can play their role to providing financing to startups and creation of new business entities. It is noteworthy that as compare to the

rest of world, the labor participation rate is much lower in South Asia, A lower labor participation rate with lower rate of unemployment indicates a large part of population is idle and even do not have interest to do work. This situation in South Asian context is surprising. This fact is confirmed by the registration of new business entities. Table: 3 shows that registration of new businesses is extremely low in South Asia as compare to the rest of the world. Obviously, it is an indicator that a big part of population is not able (or not interested) to establish their own businesses and they have to rely on employment opportunities in public or private sector enterprises. The more surprising aspect of this discussion is the lower proportionate of population using internet. The use of information technology including internet and mobile phone has become extremely important in contemporary business activities. It is envisaged in table: 4 that in 2020, less than 39 percent individual can use internet in South Asia. This ratio is 90 percent in high income countries, 80 percent in Europe and Central Asia (excluding high income countries) and 74 percent in Middle East in North America. The internet users in South Asia are less than World average (60 percent) and even less than middle income countries (57 percent). The share of population who have their accounts at a financial institution or with a mobile money service provide is also lower in South Asia. It is lower than world average and even lower than East Asia and Pacific.

Table: 2 envisages the dramatic decline in poverty headcount ratio in South Asia which is associated with the growth of per capita income. The accelerated enhancement in Gross Domestic Product (GDP) in South Asia is attributed mainly to India. However, no reasonable growth in GDP is observed in heavily indebted poor or low-income countries. The interest rate spread is inversely proportionated with the economic ranking of the countries based on their GDP. The interest rate spread is much higher in heavily indebted poor and low-income countries, while it is lower in high income countries. It is quite obvious that financial intermediary institutions in lower and middle-income countries earn more income on their services, so cost of debt is much higher in these countries as compare to the return on savings. Table: 4 shows also another important phenomenon that domestic credit to private sector as percentage of GDP is much lower in low and middle- income countries as compared to high income countries. This ratio is more than 100% in high income countries, while it is 70% in middle-income countries, and less than 50 percent in South Asia and other countries in 2009. In South Asia it was 44% which is lower than middle income countries average. It is envisaged in table: 4 that domestic credit to private sector is highly associated with the interest rate spread.

Table: 4 shows the trends of financing to private sector through domestic credit. The world average of domestic credit to private sector as percentage of GDP is almost 50 percent higher than domestic credit to private sector from banks as percentage of GDP. The total domestic credit to private sector in high income countries is almost twice of the domestic credit to private sector from banks. The position is same in East Asian and Pacific countries. But in rest of the world, total credit to private sector is slightly higher than their domestic credit to private sector from banks. Its mean that in higher income countries, non-banking financial sector plays an important role in providing the domestic credit to private sector. However, in the rest of world, private sector has to rely on banking sector for financing its activities through domestic credit. This table shows a consistency in the global patterns of domestic credit to private sector. The supply of credit to private sector from non-banking financial sector in high income countries and the countries in East Asia & Pacific region plays a significant role in business activities.

Domestic credit as percentage of GDP is much higher in high income countries and East Asian & Pacific countries which is more than 100 percent of their GDP but it is much lower in other countries, particularly in the countries in West and Central Africa. The magnitude of domestic credit to private sector is extremely low n West and Central Africa despite the lower interest rate spread in this region. In Asia, the position of South Asia is not comparable with East Asia and Pacific. However, a dramatic growth in the magnitude of domestic credit has been observed after covid-19 crisis.

'Domestic credit to private sector' (DCPS) refers to financial resources provided to the private sector. It covers loans, purchases of nonequity securities, and trade credits and other accounts receivable. For some countries, credit to public enterprises is also included in this definition. While, 'Domestic credit to private sector by banks' (DCPSB) refers to financial resources provided to the private sector by depository taking corporations (except central banks). It is a sub-set of monetary sector credit (DCPSM), which includes short-term securities issued by monetary authorities to the private sector. 'Domestic credit provided by the financial sector' (DCPSF) includes all credit to various sectors on a gross basis (except credit to the central government). The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies.

Table 1. Patterns of GDP growth

Region/ Group	Share in World GDP (%)	GDP growth (annual %)	GDP per capita (USD)	GDP per capita growth (annual %)
2009 (World GDP: 60809 billion USD)				
Africa Eastern and Southern	1.18	0.76	1425.31	-1.92
Africa Western and Central	0.83	6.27	1486.71	3.38
South Asia	2.77	6.93	1041.98	5.37
Middle East & North Africa[#]	2.25	2.64	4191.91	0.84
Latin America & Caribbean[#]	5.93	-2.08	6863.89	-3.20
Europe & Central Asia[#]	4.01	-5.73	6489.46	-6.18
East Asia & Pacific[#]	10.66	7.98	3321.97	7.21
High income	71.81	-3.23	37307.33	-3.92
Middle income	26.77	3.20	3174.72	2.00
World	100.00	-1.33	8890.80	-2.52
2018 (World GDP: 86413 billion USD)				
Africa Eastern and Southern	1.15	2.49	1541.03	-0.18
Africa Western and Central	0.86	2.95	1704.14	0.24
South Asia	4.08	6.37	1944.01	5.11
Middle East & North Africa[#]	1.60	1.66	3604.93	-0.03
Latin America & Caribbean[#]	5.60	1.63	8357.12	0.54
Europe & Central Asia[#]	3.68	3.15	8008.26	2.59
East Asia & Pacific[#]	19.26	6.52	7954.76	5.82
High income	63.43	2.34	44571.43	1.87
Middle income	35.69	4.91	5415.61	3.78
World	100.00	3.28	11366.07	2.14
2021 (World GDP: 96100 billion USD)				
Africa Eastern and Southern	1.13	4.30	1557.72	1.69
Africa Western and Central	0.87	3.91	1774.92	1.25
South Asia	4.25	8.32	2176.78	7.11
Middle East & North Africa[#]	1.52	4.22	3612.25	2.44
Latin America & Caribbean[#]	4.79	6.43	7727.16	5.49
Europe & Central Asia[#]	3.64	6.90	8708.06	6.65
East Asia & Pacific[#]	21.59	7.27	9776.49	6.86
High income	61.86	5.11	47886.78	5.05
Middle income	37.24	6.95	6102.00	5.98
World	100.00	5.80	12262.93	4.82

Excluding high income countries

Table 2. Unemployment and poverty

Region/ Group	Labor Force Participation (% of Population ages 15+)	Unemployment (% of Total Labor Force)		Poverty Headcount Ratio (% of Population) based on 2017 PPP at:	
	National Estimate	National Estimate	ILO estimate	USD 2.15 per day	USD 3.65 per day
2009					
Africa Eastern and Southern			6.32		
Africa Western and Central			4.58		
South Asia			5.01	29.40	68.50
Middle East & North Africa[#]	43.27	10.54	10.51		
Latin America & Caribbean[#]	65.17	7.64	7.37		
Europe & Central Asia[#]	61.70	9.13	9.13		
East Asia & Pacific[#]	71.33	4.22	4.39		
High income	60.90	8.05	7.94	0.50	0.90
Middle income		5.62	5.60		
World	64.50	6.27	6.01	17.90	38.50
2018					
Africa Eastern and Southern			6.73		
Africa Western and Central	67.88*	6.98*	6.04		
South Asia	48.40	5.16	5.12	10.00	45.60
Middle East & North Africa[#]	43.20*		11.62		
Latin America & Caribbean[#]	63.96	7.96	8.05		
Europe & Central Asia[#]	61.69	7.30	7.08		
East Asia & Pacific[#]		3.50	3.79		
High income	60.93	5.11	5.07	0.60	0.80
Middle income		5.23	5.50		
World		5.19	5.39	8.90	24.70
2021					

Africa Eastern and Southern			8.11		
Africa Western and Central			6.84		
South Asia	50.90**	4.83**	5.79		
Middle East & North Africa#			12.19		
Latin America & Caribbean #	62.16	9.71	10.12		
Europe & Central Asia#	58.04**	7.65**	7.76		
East Asia & Pacific#			4.29		
High income	60.18	5.74	5.67		
Middle income			6.32		
World			6.18		
# Excluding high income countries; * data for 2017; ** data for 2020;					

Table 3. Use of information technology and business environment

Region/ Group	New Business Registered (per 1000 peoples ages 15-64)	Ease of Doing Business Scores (0 for lowest to 100 for best)	Transparency, Accountability & Corruption in Public Sector Rating (1= for low to 6 for high)	Individuals Using the Internet (% of Population)	Account Ownership at a Financial Institution or with a Mobile Money Service Provider	
					% of population ages 15+	% of poorest 40% population ages 15+
2009						
Africa Eastern and Southern			2.61	3.22		
Africa Western and Central			2.83	5.81		
South Asia	0.09		3.06	5.12		
Middle East & North Africa#			2.75	17.87		
Latin America & Caribbean#	1.67		3.50	30.35		
Europe & Central Asia#	1.73		2.61	32.07		
East Asia & Pacific#			2.95	23.79		
High income				69.46		
Middle income			3.02	17.78		
World			2.87	25.67		
2018						
Africa Eastern and Southern	0.74	52.92	2.50	21.70		
Africa Western and Central	0.65	48.43	2.90	29.34		
South Asia	0.15	56.29	2.92	19.84	69.46*	65.54*
Middle East & North Africa#		52.91	2.00	55.53	43.42*	35.27*
Latin America & Caribbean#	1.55	59.10	3.44	64.70	54.41*	41.96*
Europe & Central Asia#	2.42	72.10	2.60	72.68	65.14*	56.23*
East Asia & Pacific#	7.11	59.34	3.04	55.74	70.37*	60.28*
High income	4.61	73.90		87.13	93.17*	89.99*
Middle income	3.14	60.09	3.05	44.48	64.86*	56.59*
World	3.17	62.23	2.84	49.40	68.50*	60.89*
2021						
Africa Eastern and Southern			2.47			
Africa Western and Central	0.79**		2.90	34.13**		
South Asia	0.17**		3.20	38.56**	67.89	64.48
Middle East & North Africa#			2.25	73.63**	48.09	41.26
Latin America & Caribbean#	2.06**		3.25	73.20**	72.95	67.14
Europe & Central Asia#	2.22**		2.88	80.19**	77.79	71.64
East Asia & Pacific#	7.19**		3.11	66.59**	80.70	74.72
High income				89.55**	93.36	94.41
Middle income	3.40**		3.13	57.26**	72.37	67.68
World	3.53**		2.87	59.94**	76.20	71.91
# Excluding high income countries; * data for 2017; **data for 2020;						

Table 4. Credit to private sector as % of GDP and interest rate spread

Region/ Group	Domestic credit	Monetary Sector credit	Domestic credit by banks	Interest rate spread (%)
2009				
Africa Eastern and Southern	79.25	42.10	42.06	8.12
Africa Western and Central	16.64	16.64	16.59	-3.60
South Asia	44.11	44.10	44.08	5.86
Middle East & North Africa#	33.27	34.92	34.81	5.48
Latin America & Caribbean#	34.73	33.43	33.42	8.15
Europe & Central Asia#	45.31	43.37	43.32	6.31
East Asia & Pacific#	111.20	110.16	110.12	5.52
High income	147.84	92.53	92.42	
Middle income	69.89	67.24	67.21	6.52
World	124.82	84.54	84.46	5.93
2018				
Africa Eastern and Southern	65.29	38.21	38.02	9.12
Africa Western and Central	13.59	13.59	13.44	
South Asia	45.97	45.97	45.94	3.31
Middle East & North Africa#		29.10	29.08	
Latin America & Caribbean#	48.90	46.45	46.44	7.12
Europe & Central Asia#	51.31	49.58	49.56	5.06
East Asia & Pacific#	144.88	143.51	143.50	4.80
High income	140.20	81.86	81.46	
Middle income	101.79	99.54	99.53	6.09
World	125.59	88.13	87.87	5.34
2020				
Africa Eastern and Southern	59.74	38.63	38.34	8.13
Africa Western and Central	14.74	14.74	14.05	
South Asia	49.49	49.48	49.46	5.58
Middle East & North Africa#	35.76	34.05	34.02	
Latin America & Caribbean#	54.66	51.75	51.74	6.55
Europe & Central Asia#	57.54	55.65	55.63	4.34
East Asia & Pacific#	167.34	166.00	165.99	4.90
High income	164.18	87.95	87.46	
Middle income	120.26	118.10	118.07	5.73
World	147.36	98.90	98.58	
# Excluding high income countries				

Table 5. List of variables and sources of data

Abbreviation	Definition	Source
30BNK	Loan from a bank, employer, or private lender is the main source of emergency funds in 30 days (% of peoples age 15+)	Global Findex database; World Bank (2022)
30PSBL	Possibility without any difficulty to arrange emergency funds in 30 days (% of peoples age 15+)	Global Findex database; World Bank (2022)
30PSBL40	Possibility without any difficulty to arrange emergency funds in 30 days (% of poorest 40% peoples age 15+)	Global Findex database; World Bank (2022)
CRCRD	Credit card users (% of peoples age 15+)	Global Financial Development; World Bank (2022)
CRDTDPS	Bank credit to bank deposits (%)	Global Financial Development; World Bank (2022)
CRPTN	Transparency, Accountability & Corruption in Public Sector Index (in units of a standard normal distribution, ranging from approximately -2.5 to 2.5)	Worldwide Governance Indicator; World Bank (2022)
DBUS	New business density (new registrations per 1,000 people ages 15-64)	World Development Indicators; World Bank (2022)
DCPS	Domestic credit to private sector (% of GDP)	World Development Indicators; World Bank (2022)
DCPSB	Domestic credit to private sector by banks (% of GDP)	World Development Indicators; World Bank (2022)
DCPSF	Domestic credit (both private and public sectors) provided by financial sector (% of GDP)	World Development Indicators; World Bank (2022)
DCPSF1	Private credit by banks and other financial institutions to GDP (%)	Global Financial Development; World Bank (2022)
EASE	Ease of doing business score (0 for lowest to 100 for best)	Doing Business Indicators; World Bank (2021)
EFCTV	Government Effectiveness Index (in units of a standard normal	Worldwide Governance Indicator;

	distribution, ranging from approximately -2.5 to 2.5)	World Bank (2022)
ELCPMT	Electronic payments used to make payments (% of peoples age 15+)	Global Financial Development; World Bank (2022)
FINTCBIG	Credit flows by fintech and big tech companies as percentage of GDP	Global Financial Development; World Bank (2022)
FOOD	Food production index (2014-2016 = 100)	World Development Indicators; World Bank (2022)
GDP	GDP (current USD)	World Development Indicators; World Bank (2022)
GINI	Gini index (for income inequality)	World Development Indicators; World Bank (2022)
GROW	GDP growth (annual %)	World Development Indicators; World Bank (2022)
INTRNT	Individuals using the Internet (% of population)	World Development Indicators; World Bank (2022)
LABR	Labor force participation rate (% of total population ages 15-64)	World Development Indicators; World Bank (2022)
LWST20	Income share held by lowest 20%	World Development Indicators; World Bank (2022)
MBLPMT	Mobile phone used to pay bills (% of peoples age 15+)	Global Financial Development; World Bank (2022)
NPL	Bank non-performing loans to gross loans (%)	Global Financial Development; World Bank (2022)
PCIGROW	GDP per capita growth (annual %)	World Development Indicators (2022); World Bank (2022)
PVRTY	Poverty headcount ratio at national poverty lines (% of population)	World Development Indicators;
		World Bank (2022)
SPRED	Difference between average lending and deposit rates of interest	Global Financial Development; World Bank (2022)
TXTPRFT	Total tax and contribution rate (% of profit)	Doing Business Indicators; World Bank (2021)
UNEMPL	Unemployment (% of total labor force)	World Development Indicators; World Bank (2022)
WORYMD	Paying for medical costs in case of a serious illness or accident is the most worrying financial issue (% of peoples age 15+)	Global Findex database; World Bank (2022)

Table 6. List of variables and sources of data

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
30PSBL	30.68	24.75	19.64	3.45	83.44
30PSBL40	20.17	13.15	17.38	1.32	73.63
30BNK	7.79	7.22	4.81	0.81	28.23
WORYMD	32.20	31.24	12.91	3.11	66.41
ELCPMT	59.05	59.14	29.32	3.53	99.93
CRCRD	21.47	12.90	22.41	0.00	82.74
GROW	5.37	4.63	5.08	-17.98	31.37
CRDTDPS	90.02	77.98	61.90	18.13	535.71
DCPSF1	58.14	50.21	43.42	6.62	193.96
PCIGROW	4.27	3.97	5.41	-18.58	30.22
CRPTN	-0.12	-0.36	1.02	-1.82	2.37
EFCTV	-0.05	-0.13	1.02	-2.38	2.29
UNEMPL	8.17	6.34	5.92	0.26	33.56

Figure 1. Effects of information and communication technology on poverty (Simultaneity in the Model)

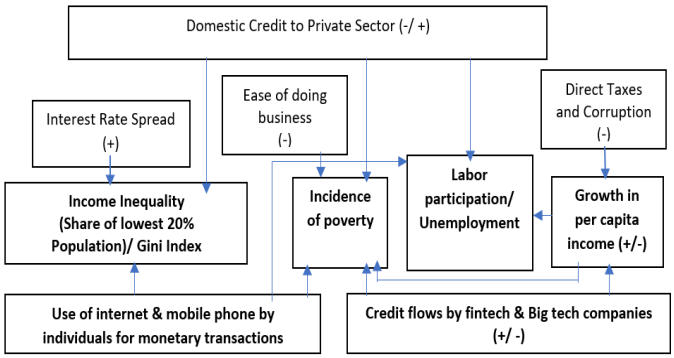
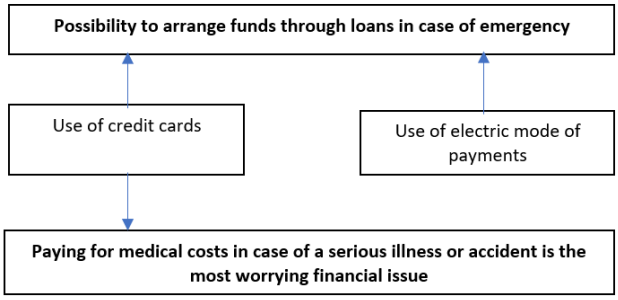


Figure 2. Financial technology in case of emergencies



4. Methodology: Role of Financial Technology and Domestic Credit

Table 4 shows a picture of the credit to private sector and compares the different regions and groups, while table 3 shows the financial inclusion and use of financial technology in economic transactions. The causes and justifications of changes in the trends of credit to private sector, interest rates, poverty and income distribution in recent past have been explained in economic literature (World Bank: 2020a, IMF: 2020a, IMF: 2020b, Krugman: 2020, Rogoff: 2020, Mehar: 2021, Marlene, Huang, Morgan, and Shirai: 2019, Gormez: 2019, Durrani, Rosmin, and Volz: 2020, Sachs at el: 2020, and University of Cambridge: 2020). Based on their justifications and economic theories in the literature, we have established the statistical models to express the relations between poverty, unemployment, economic, credit to private sector and the use of information technology.

We have attempted to assess the role of various components financial technology in alleviation of poverty, income inequality and unemployment with the help of empirical evidences. The domestic credit has been included in the study as a control variable to quantify the net effect of information technology on poverty and income distribution. We hypothesized that growing use of financial technology and enhancement in domestic credit alleviate poverty and unemployment. However, it is notable that enhancement in credit to private sector can destroy the monetary system by several ways. For instance, the excessive supply of money can accelerate inflation in the commodity market. It may be a cause of unintended increase in real estates or industrial assets prices. The positive association between the magnitude of credit to private sector and non-performing loans is another aspect of the credit enhancement policy. In this situation, domestic credit to private sector will not be an effective tool for growth and poverty alleviation. In this respect, Nguyen (2022) and Paresh and Solikin (2022) have emphasized prudential regulations and stability of banking sector for effectiveness and performance of credit enhancement policies.

Based on the above-mentioned hypothesis and current observations in global economic trends (table:1 to 4), we have established an econometric model based on 8 simultaneous equations. Specifically, we are interested to identify the role of financial technology and domestic credit in alleviation of poverty. The domestic credit to private sector and the use of financial technology for monetary transactions have been applied as explanatory variables in this study. The relations between poverty and explanatory variables can be expressed in the following equation:

$$PVRTY_{it} = \beta INTRNT_{it} + \gamma DCPS_{it} + \delta X_{it} + \mu_i + \tau_t + \epsilon_{it}$$

Where 'PVRTYit' is the poverty headcount ratio as percentage of total population in a country i for year t; 'INTRNTit' and 'DCPSit' are vectors of variables related to 'individuals using the internet as percentage of population, and 'domestic credit to private sector'; 'Xit' is a vector of exogenous control variables; 'μi' denotes unobserved time-invariant heterogeneity at the country level; 'τt' is a time-fixed effect; and 'εijt' is an independent disturbance term.

The theoretical framework which constitutes the relations between the use of internet, poverty, income inequality, domestic credit to private sector, ease of doing business, interest rate spread and non-performing loans can be described as follows:

$$PVRTY_{it} = f\,(INTRNT_{it,}\, DCPS_{it},\, EASE_{it})$$
$$GINI_{it} = f\,(INTRNT_{it,}\, SPRED_{it},\, NPL_{it})$$

Where 'GINI' is Gin-index to measure the income inequality, 'SPRED' is the difference between lending and borrowing interest rates, 'EASE' is index to measure the ease of doing business and 'NPL' is the non-performing loans as percentage of total loans. Relating the poverty headcount ration to the aforementioned factor, the estimated both direct and indirect effects can be expressed as follows:

$$\frac{dPVRTY}{dFINTCBIG} = \frac{\partial PVRTY}{\partial FINTCBIG} + \frac{\partial PVRTY}{\partial PCIGROW}.\frac{\partial PCIGROW}{\partial FINTCBIG} + \frac{\partial PVRTY}{\partial INTRNT} + \frac{\partial PVRTY}{\partial DCPS} + \frac{\partial PVRTY}{\partial EASE}$$

We have incorporated the impacts of credit flows by fintech and big tech companies as percentage of GDP (FINTCBIG), individuals using the internet, (INTRNET) and use of mobile phone to pay bills (MBLPMT) as explanatory factors of poverty headcount ratio (PVRTY), Gini index (GINI) and share of lowest 20 percent population in income (LWST20).

We supposed that flow of funds through fintech and big technology companies (FINTCBIG), use of internet by large number of individuals (INTRNT), domestic credit to private sector (DCPS) and ease of doing business (EASE) will alleviate the poverty headcount ratio (PVRTY) in a country. In the light of this supposition, we established the fowling 6 equations. The basic idea to establish these equations is to test the impacts of the use of financial technology on poverty, income distribution and growth in per capita income.

We have also tested the impacts of using the digital modes of financing (credit cards and internet) on the perception of an individual about his position to deal with financial emergencies. For this purpose, we estimated 2 equations. In equation 7, we determined the individual perception about possibility of borrowing from banks or financial institutions within 30 days in case of medical emergency or critical illness or accident (30PSBL). We supposed that use of financial technology will assist the individual to arrange the funds in such conditions. In equation 8, we determined the individual perception that most worrying financial issue is the arrangement of funds for payment of medical bills (WORMD). These last two equations have been estimated for lowest 40 percent income group separately. All equations have been estimated by different alternative options (models). Several control variables to estimate the net effect of the various components of financial technology and domestic credit have been included in the estimations. The model can be expressed in the following 8 equations:

$$PVRTY_{it} = \propto_i + \beta_1 FINTCBIG_{it} + \beta_2 INTRNT_{it} + \beta_3 DCPS_{it} + \beta_4 EASE_{it} + \beta_5 PCIGROW_{it} + \varepsilon_{it} \quad (1)$$

$$GINI_{it} = \propto_i + \beta_1 INTRNT_{it} + \beta_2 SPRED_{it} + \beta_3 NPL_{it} + \beta_4 DBUS_{it} + \varepsilon_{it} \quad (2)$$

$$LWST20_{it} = \propto_i + \beta_1 INTRNT_{it} + \beta_2 SPRED_{it} + \beta_3 NPL_{it} + \beta_4 DBUS_{it} + \varepsilon_{it} \quad (3)$$

$$LABR_{it} = \propto_i + \beta_1 INTRNT_{it} + \beta_2 DCPS_{it} + \beta_3 DBUS_{it} + \varepsilon_{it} \quad (4)$$

$$UNEMPL_{it} = \propto_i + \beta_1 INTRNT_{it} + \beta_2 DCPS_{it} + \beta_3 DBUS_{it} + \beta_4 GROW_{it} + \varepsilon_{it} \quad (5)$$

$$PCIGROW_{it} = \propto_i + \beta_1 FINTCBIG_{it} + \beta_2 TXTPRFT_{it} + \beta_3 CRPTN_{it} + \varepsilon_{it} \quad (6)$$

$$30PSBL_{it} = \propto_i + \beta_1 ELCPMT_{it} + \beta_2 CRCRD_{it} + \beta_3 CRDTDPS_{it} + \beta_4 GROW_{it} + \varepsilon_{it} \quad (7)$$

$$WORYMD_{it} = \propto_i + \beta_1 ELCPMT_{it} + \beta_2 CRCRD_{it} + \beta_3 CRDTDPS_{it} + \beta_4 GROW_{it} + \varepsilon_{it} \quad (8)$$

The simultaneity in the above equations has been shown in figures 1 and 2. To test the impact of information technology and domestic credit, we hypothesized that use of information technology (FINTECBIG, MBLPMT, ELCPMT, INTRNT) and domestic credit to private sector (DCPS) are the major determinants of poverty headcount ration (PVRTY), income inequality (GINI), share of lowest 40 percent population in income (LWST20), labor participation rate (LABR), and unemployment rate (UNEMPL). While, the number of new business entities (DBUS), ease of doing business index (EASE), corruption index (CRPTN), tax on profits (TXTPRFT) and interest rate spread (SPRED) have been taken as control variables. Growth in GDP is also an important determinant of poverty, employment and income inequality. It has been taken as explanatory variable, while the factors of per capita GDP growth have been estimated in equation: 6.

We used pooled data of 148 countries for 14 years (from 2008 to 2021). The Panel (unbalanced) Least Square (PLS) technique was applied to estimate the effects of explanatory variables. The data of other countries could not be included in the model because unavailability of data on some indicators which have been included in the analysis. The data for these variables have been extracted from different sources (World Bank: 2021 and World Bank: 2022). The description of variables and sources are described in table: 5. However, equation 7 and 8 have been estimated on cross section data for year 2021. The data for the variables in these equations was extracted through individuals and households survey (World Bank: 2021).

The above-mentioned models have been estimated through regression analysis. All the equations have been estimated in 5 alternative scenarios (options). The objective of the estimations by alternative options by adding more control variables is to check the robustness of parameters. The impacts of explanatory variables have been quantified by the 'βs' associated with these variables, while 'T-statistics' show the level of significance of these 'βs'. The significances of models as whole have been checked through adjusted 'R-squares' and their associated 'F-statistics'. All these statistical parameters have been reported in table 7 to 14.

5. Results and Empirical Findings

The results of regression analysis have been presented in tables 7 to 14. The significance of parameters and overall goodness of fit in the equations have also been reported in the above-mentioned tables. The parameters associated with the betas show quantifications of the impacts of explanatory variables, however some results are surprising and against the

common views. The adjusted R-squares and F-statistics show goodness of fit in all estimated equations, which indicate that explanatory variables included in the models significantly cover the sufficient effects.

The robustness in estimated parameters have also been checked by using the alternatives options. To conduct some falsification tests, some control variables have also been included in the regression analysis.

Table 7 shows that use of internet (INTRNT) and flow of funds through fintech companies (FINTCBIG) alleviate poverty headcount ratio (PVRTY). The use of internet (INTRNT) and mobile payments (MBLPMT) cannot be used simultaneously because of multicollinearity in these two variables. The negative effects of internet (INTRNT) and flow of funds through fintech and big technology companies (FINTCBIG) on poverty headcount ratio are significant and robust in all alternative options. Similarly, the impact of ease of doing business (EASE) and domestic credit to private sector (DCPS) are also significant. The role of these variables is effective in alleviation of poverty.

Table 8 and 9 shows some important conclusion regarding the role of internet (INTRNT) and interest rate spread (SPRED). The more use of internet (INTRNT) improves the share of lower income group in total income (LWST20) and reduce the income inequality (Gini-index). Similarly, the higher interest rate spread (SPRED) leads to more income inequality. These results are consistent in equation 8 and 9. These findings are significant and robust in all alternative scenarios. Though, it is commonly urged by analysts that raising asset prices, near-zero interest rates and quantitative easing in monetary policy contribute in growing inequality, while practitioners of central banking, counter that the distributional impact have been either neutral or even egalitarian due to its employment impacts. Juan and Gerald (2015) have concluded that QE modestly dis-equalizes despite its positive impacts on employment and mortgage refinancing. Their analysis has not supported the proposition that raising interest rates would be an efficient mechanism for improving income distribution. Instead of the magnitudes of interest rates for lending and borrowing, our analysis emphasizes on the reduction in interest rate spread.

The research is mainly belonged to test the impacts of credit to private sector and use of financial technology on poverty and income distribution. The results of this research confirm the effectiveness of the use of information technology and credit to private sector.

The similar conclusions are derived for the use of internet. The growing use of internet alleviate the poverty. The domestic credit to private sector (DCPS) and ease of doing business (EASE) are also effective measures of the poverty alleviation. Higher rate of per capita GDP growth (PCIGROW) plays also a significant role in poverty alleviation, which support the trickle-down theory. However, growing number of new entities for per thousand peoples (DBUS) leads to poverty. This result is surprising but may be interpreted as an offshoot of the economies of scale. The small number of big business entities are better than the large number of small entities. The small entities do not provide handsome packages to their workers and don't have competitive prices of their products because they don't have economies of scale. So, divergence of workers into small entities may aggravate the level of poverty.

The impact of the use of information and communication technology on income inequality has been tested by two different ways. First, we tested the impact of the use of internet (INTRNT) and payments through mobile phone (MBLPMT) on Gini Index. (GINI). A higher Gini coefficient is an indicator of greater income inequality, which shows that higher income individuals are receiving much larger percentage of the population's total income. It was observed that impact of interest rate spread (SPRED) on Gini coefficient (GINI) is positive while non-performing loans affect the Gini coefficient negatively. These results are statistically significant and robust in all alternative options. These results reveal some important conclusions. The results indicates that higher interest rate spread (difference between lending and deposits rates of interests) is one of the major causes of income inequality in a country. Obviously, the role of monetary policy become more important to rectify this situation. The surprising negative impact of non-performing loans (NPL) on income inequality (GINI) may be an indicator of the pressure on banking system to write off those loans which can damage the economic conditions of individuals.

The most important result based on the empirical findings is the negative impact of the growing use of internet on income inequality (GINI). The magnitude of the beta attached with the use of internet has a negative sign, while estimated betas are statistically significant. These estimated parameters are robust in all alternative options. This finding is important from the policy formulation to promote the use of information and communication technology. The growing use of information and communication technology will reduce income inequality.

Another method to measure the inequality is the share of income held by lowest 20 percent population. The empirical evidences shows that share of lowest 20 percent population in national income can be improved by more use information and communication technology (INTRNT and MOBLPMT). The higher spread of interest rate (SPRED) reduces the share of lowest 20 percent income peoples. These results are also significant and robust. The effect of the domestic credit to private sector (DCPS) is positive but weakly significant. The positive impact of the non-performing loans (NPL) and negative impact of the number of new businesses per thousand peoples (DBUS) do not support the common opinions; their roles have been explained in above paragraphs.

In fact, the growing use of information technology promote the informational efficiency in all kinds of markets: commodity, labor financial and money markets. It is quite obvious that informational efficiency provides optimal opportunities for employment and utilizations of individual services. In this way more earnings opportunities may be available to the lower income peoples which can ultimately reduce the income inequality and poverty. Another result against the common intuitive is the positive association between growing income inequality and number of business entities in an economy (DBUS). It reflects that growing number of business entities will provide more earnings to the higher income individuals, while lower income individuals cannot establish their businesses. Though more business entities can provide employment opportunities to the lower income peoples but at the same time they widen the rich poor gap.

The results indicates that the use of information and communication technology (INTRNT and MBLPMT) improves the labor participation rate. These results are significant but both the indicators of information and communication technology (INTRNT and MBLPMT) cannot be used simultaneously because of multicollinearity in the data. The simultaneous use of both the independent variables does not show their effect. The number of new business entities (DBUS), domestic credit to private sector (DCPS and DCPSB) and ease of doing business (EASE) improves the labor participation rate significantly. However, the role of GDP growth (GROW and PCIGROW) and flow of credit by fintech and big tech companies (FINTCBIG) are not significant.

The role of internet in reduction of unemployment was also tested in the study. It has been noted that more use of internet (INTRNT) reduces the rate of unemployment. While, GDP growth (GROW) and domestic credit to private sector by banks, financial institutions and other sources (DCPS, DCPSB and DCPSF) are the strong and significant determinants of the employment. The growth in GDP and credit enhancement to private sector alleviate the unemployment. Again, it was noted the creation of more business entities for per thousand peoples create more unemployment. This result has been already interpreted in above paragraphs.

In determination of growth in per capita income (PCIGROW) and GDP growth (GROW), the flow of credit by fintech and big technology companies (FINTCBIG) is the most significant variable. It is evident that more flow of credit by fintech and big technology companies accelerates the per capita income significantly. It improves the rate of growth in per capita income. However, the use of electronic payment (ELCPMT) does not support the growth in per capita income. The taxes on profits (TXTPRFT) and corruption (CRPTN) are causes of declining in per capita income. The role of domestic credit to private sector (DCPS) and use of credit cards (CRCRD) affect the growth in per capita income (PCIGROW) negatively. Mehar (2021) has concluded the similar impact of domestic credit on GDP growth.

To capture the impacts of electronic payment (ELCPMT), use of credit cards (CRCRD) and credit to private sector by financial institutions (DCPSF1) on financial emergencies, we established two models. The estimations of these models are based on the survey data (World Bank: 2022b). The dependent variable in the first model is the percentage of peoples who perceive that they can arrange money within 30 days in case of financial emergencies. To capture their perceptions, we divided their responses in 3 categories: (1) peoples who perceive that they can easily arrange money within 30 days in case of financial emergencies, (2) Peoples who belong to lowest 40 percent income group and perceive that they can easily arrange money within 30 days in case of emergencies, and (3) peoples who can perceive that they can arrange money through bank borrowing within 30 days in case of emergencies. Table (13) shows the empirical findings. According to the statistical results the more use of electronic payment (ELCPMT) and credit cards (CRCRD) play a very positive and significant role in developing this perception. The more use of electronic payments (ELCPMT) and credit cards (CRCRD) improves the peoples' perception that they can arrange money during the crisis. The aggregate credit to deposit ratios in the banks also plays a positive role in developing this perception. Surprisingly, these three factors are not significant for arranging the money through banks financing in case of emergencies. The role of GDP growth is not clear. Similarly in determination of the peoples' perception that their top most financial problem is to arrange money in case of a medical emergency due to a critical disease or accident, availability of credit cards is the only significant variable. The more credit card holders in a country lead to lower percentage of peoples who are worried because of the fear of medical emergencies in future. This fear is not affected by GDP growth, employment or banks' credit to deposit ratio.

Table 7. Dependent Variable: Poverty Headcount Ratio at National Poverty Lines (PVRTY)

Method: Panel Least Square
Sample (adjusted): 2013-2019
Periods included: 7; Cross-sections included: 70
Total panel (unbalanced) observations: 235

Independent Variable/ Option	I	II	III	IV	V
Constant	69.15*** (14.83)		40.70*** (4.68)	55.00*** (10.61)	47.98*** (4.88)
FINTCBIG: Credit flows by fintech and big tech	-3.76*** (-3.25)	-4.10*** (-3.72)	-2.83** (-2.08)	-2.81** (-2.57)	-2.85** (-2.61)

companies as percentage of GDP					
INTRNT: Individuals using the Internet (% of population)		-0.17*** (-4.32)	-0.13** (-2.30)	-0.22*** (-5.67)	-0.22*** (-5.68)
EASE: Ease of doing business score (0 for lowest to 100 for best)	-0.64*** (-8.31)	-0.24** (-2.41)	-0.17 (-1.21)	-0.20** (-1.99)	-0.20** (-1.95)
DCPS: Domestic credit to private sector (% of GDP)		-0.05*** (-2.98)	-0.06** (-2.09)	-0.07*** (-4.64)	-0.07*** (-4.56)
DCPSB: Domestic credit to private sector by banks (% of GDP)	-0.08*** (-4.46)				
DBUS: New business density (new registrations per 1,000 people ages 15-64)	0.50*** (3.10)			0.65*** (4.41)	0.66*** (4.46)
PCIGROW: GDP per capita growth (annual %)				-1.48*** (-5.09)	-1.48*** (-5.08)
SPRED: Difference between average lending and deposit rates of interest			0.64* (1.94)		
FOOD: Food production index (2014-2016 = 100)					0.07 (0.84)
Adjusted R-squared	0.48	0.50	0.44	0.58	0.57
Akaike info criterion	7.11	7.11	7.47	6.92	6.93
Schwarz criterion	7.19	7.18	7.61	7.04	7.06
Hannan-Quinn criterion	7.14	7.14	7.53	6.97	6.98
F-statistic	49.34	58.58	17.93	47.81	41.02

Table 8. Dependent Variable: Gini Index for Income Inequality (GINI)

Method: Panel Least Squares
Sample (adjusted): 2008-2019
Periods included: 12; Cross-sections included: 62
Total panel (unbalanced) observations: 336

Independent Variable/ Option	**I**	**II**	**III**	**IV**	**V**
Constant	42.39*** (11.10)	47.22*** (21.71)	41.90*** (29.38)	42.00*** (30.13)	43.76*** (8.82)
INTRNT: Individuals using the Internet (% of population)	-0.08*** (-4.23)	-0.13*** (-4.45)	-0.08*** (-4.20)	-0.07*** (-3.83)	-0.13** (-2.78)
SPRED: Difference between average lending and deposit rates of interest	0.41*** (6.06)	0.55*** (6.31)	0.41*** (6.10)	0.40*** (6.09)	1.36** (2.24)
NPL: Bank non-performing loans to gross loans (%)	-0.56*** (-7.73)	-0.56*** (-3.12)	-0.56*** (-8.21)	-0.56*** (-8.10)	-0.15 (-0.33)
DBUS: New business density (new registrations per 1,000 people ages 15-64)	0.47*** (3.11)	0.29 (1.50)	0.44*** (2.98)	0.50*** (3.34)	0.42 (1.44)
DCPS: Domestic credit to private sector (% of GDP)	-0.01 (-0.86)	-0.03* (-1.67)	-0.01 (-1.06)		
DCPSB: Domestic credit to private sector by banks (% of GDP)				-0.02* (-1.90)	
DCPSF: Domestic credit (both private and public sectors) provided by financial sector (% of GDP)					-0.02 (-0.71)

PCIGROW: GDP per capita growth (annual %)			-0.08 (-0.71)	-0.09 (-0.80)	
FINTCBIG: Credit flows by fintech and big tech companies as percentage of GDP		-0.25 (-0.29)			-3.87 (-0.88)
LABR: Labor force participation rate (% of total population ages 15-64)	-0.01 (-0.23)				
Adjusted R-squared	0.28	0.36	0.28	0.27	0.33
Akaike info criterion	6.71	6.57	6.73	6.74	6.78
Schwarz criterion	6.79	6.72	6.81	6.81	7.04
Hannan-Quinn criterion	6.74	6.63	6.76	6.77	6.88
F-statistic	22.90	13.89	23.24	22.98	5.28

Table 9. Dependent Variable: Income Share held by Lowest 20% (LWST20)

Method: Panel Least Squares
Sample (adjusted): 2008-2020
Periods included: 13; Cross-sections included: 64
Total panel (unbalanced) observations: 361

Independent Variable/ Option	**I**	**II**	**III**	**IV**	**V**
Constant	6.65*** (20.14)	6.75*** (12.77)	6.48*** (11.91)	6.32*** (19.30)	6.72** (7.05)
INTRNT: Individuals using the Internet (% of population)	0.01* (1.76)		0.01* (1.78)	0.01 (1.29)	0.01 (1.38)
MBLPMT: Mobile phone used to pay bills (% of peoples age 15+)		0.08** (2.11)			
SPRED: Difference between average lending and deposit rates of interest	-0.10*** (-6.22)	-0.12*** (-3.04)	-0.15*** (-3.12)	-0.09*** (-5.75)	-0.09*** (-5.45)
NPL: Bank non-performing loans to gross loans (%)	0.11*** (6.33)	0.09*** (3.44)	0.14*** (6.25)	0.12*** (7.15)	0.12*** (6.50)
PCIGROW: GDP per capita growth (annual %)	0.001 (0.03)				
DBUS: New business density (new registrations per 1,000 people ages 15-64)	-0.13*** (-3.54)	-0.12 (-1.52)	-0.18*** (-3.31)	-0.14*** (-3.76)	-0.14*** (-3.75)
DCPS: Domestic credit to private sector (% of GDP)				0.01** (2.10)	0.01** (2.07)
DCPSF: Domestic credit (both private and public sectors) provided by financial sector (% of GDP)			0.001 (0.35)		
LABR: Labor force participation rate (% of total population ages 15-64)					-0.01 (-0.44)
Adjusted R-squared	0.20	0.28	0.30	0.23	0.22
Akaike info criterion	3.97	3.99	4.02	3.94	3.94
Schwarz criterion	4.04	4.16	4.14	4.01	4.02
Hannan-Quinn criterion	4.00	4.06	4.07	3.97	3.97
F-statistic	19.03	6.97	14.46	21.25	17.03

Table 10. Dependent Variable: Labor Force Participation Rate- % of total population ages 15-64 (LABR)

Method: Panel Least Squares
Sample (adjusted): 2008-2019
Periods included: 12; Cross-sections included: 147
Total panel (unbalanced) observations: 1386

Independent Variable/ Option	I	II	III	IV	V
Constant	61.48*** (101.91)	65.65*** (65.35)	63.97*** (52.44)	63.26*** (42.03)	49.79*** (13.42)
INTRNT: Individuals using the Internet (% of population)	0.08*** (6.76)		0.06*** (2.96)		-0.03 (-0.89)
MBLPMT: Mobile phone used to pay bills (% of peoples age 15+)				0.36*** (3.31)	0.25** (2.47)
DCPS: Domestic credit to private sector (% of GDP)	0.03*** (4.04)	0.04*** (3.93)	0.02 (1.41)	0.05** (2.54)	
DBUS: New business density (new registrations per 1,000 people ages 15-64)	0.20** (2.74)	0.44*** (3.91)	0.35*** (3.06)	0.26 (1.50)	
EASE: Ease of doing business score (0 for lowest to 100 for best)					0.29*** (3.63)
FINTCBIG: Credit flows by fintech and big tech companies as percentage of GDP		1.08 (0.95)	1.65 (1.46)		
GROW: GDP growth (annual %)	0.17** (2.55)	-0.02 (-0.15)	0.05 (0.34)	-0.05 (-0.19)	
PCIGROW: GDP per capita growth (annual %)					0.27 (1.14)
Adjusted R-squared	0.13	0.11	0.13	0.15	0.14
Akaike info criterion	7.29	7.33	7.29	7.30	7.36
Schwarz criterion	7.31	7.37	7.34	7.38	7.43
Hannan-Quinn criterion	7.30	7.35	7.31	7.34	7.39
F-statistic	53.48	17.21	15.69	10.67	11.26

Table 11. Dependent Variable: Unemployment -% of total labor force (UNEMPL)

Method: Panel Least Squares
Sample (adjusted): 2008-2020
Periods included: 13; Cross-sections included: 148
Total panel (unbalanced) observations: 1529

Independent Variable/ Option	I	II	III	IV	V
Constant	8.91*** (8.06)	9.54*** (27.18)	8.14*** (16.89)	9.88*** (27.99)	10.81*** (13.39)
INTRNT: Individuals using the Internet (% of population)	-0.03*** (-3.00)	-0.01* (-1.76)		-0.01** (-1.95)	-0.03* (-1.89)
GROW: GDP growth (annual %)	-0.33*** (-8.04)	-0.32*** (-9.04)	-0.47*** (-6.46)	-0.32*** (-8.96)	-0.20** (-2.57)
DBUS: New business density (new registrations per 1,000 people ages 15-64)	0.18*** (4.04)	0.23*** (5.17)	0.18*** (3.41)	0.25*** (5.67)	0.43*** (4.03)
DCPSB: Domestic credit to private sector by banks (% of GDP)				-0.02*** (-3.80)	
DCPSF: Domestic credit (both private and public sectors) provided by financial sector (% of GDP)					-0.01** (-2.50)
DCPS: Domestic credit to private sector (% of GDP)		-0.01*** (-2.95)	-0.01* (-1.72)		
FINTCBIG: Credit flows by fintech and big tech companies as percentage of GDP			-0.32 (-0.58)		

EASE: Ease of doing business score (0 for lowest to 100 for best)	0.02 (0.69)				
Adjusted R-squared	0.05	0.06	0.09	0.06	0.06
Akaike info criterion	6.40	6.33	5.86	6.37	6.50
Schwarz criterion	6.42	6.35	5.90	6.39	6.56
Hannan-Quinn criterion	6.40	6.34	5.88	6.38	6.52
F-statistic	19.66	25.52	14.19	26.49	6.45

Table 12. Dependent Variable: GDP Per Capita Growth- annual % (PCIGROW)

Method: Panel Least Squares
Sample (adjusted): 2013-2019
Periods included: 7; Cross-sections included: 95
Total panel (unbalanced) observations: 594

Dependent Variable	**Per Capita Income Growth**			**GDP Growth**	
Independent Variable/ Option	**I**	**II**	**III**	**IV**	**V**
Constant	0.72 (0.68)	2.87*** (8.49)	2.74*** (4.53)	4.64*** (14.16)	4.87*** (14.39)
FINTCBIG: Credit flows by fintech and big tech companies as percentage of GDP	0.99*** (2.13)	0.99*** (3.11)		1.15*** (3.71)	0.86** (2.68)
ELCPMT: Electronic payments used to make payments (% of peoples age 15+)			-0.02** (-2.09)		
TXTPRFT: Total tax and contribution rate (% of profit)		-0.02** (-2.60)	0.00 (0.39)	-0.01* (-1.82)	-0.03*** (-4.34)
CRPTN: Transparency, Accountability & Corruption in Public Sector Index		-0.31** (-2.30)	0.17 (0.58)	-0.31** (-2.19)	-0.75*** (-5.53)
EASE: Ease of doing business	0.03* (1.77)				
score (0 for lowest to 100 for best)					
CRCRD: Credit card users (% of peoples age 15+)	-0.03** (-2.46)				
DCPS: Domestic credit to private sector (% of GDP)				-0.01*** (-3.40)	
DBUS: New business density (new registrations per 1,000 people ages 15-64)		0.04 (1.12)	0.10** (2.20)		0.02 (0.68)
Adjusted R-squared	0.04	0.03	0.02	0.09	0.10
Akaike info criterion	4.35	4.80	4.69	4.79	4.80
Schwarz criterion	4.42	4.84	4.76	4.82	4.84
Hannan-Quinn criterion	4.38	4.82	4.72	4.80	4.82
F-statistic	3.60	5.49	2.01	15.01	15.95

Table 13. Dependent Variable: Possibility to arrange Emergency Funds in 30 days (30PSBL)

Method: Ordinary Least Squares (Cross Section)
No. of Countries: 155
Year: 2021

Dependent Variable	**30PSBL**		**30PSBL40**		**30BNK**
Independent Variable/ Option	**I**	**II**	**III**	**IV**	**V**
Constant	3.51 (0.92)	2.95 (0.75)	-1.54 (-0.41)	-1.54 (-0.40)	5.50*** (3.04)
ELCPMT: Electronic payments used to make payments (% of peoples age 15+)	0.24*** (3.86)	0.24*** (3.88)	0.18** (2.90)	0.18** (2.88)	-0.01 (-0.23)
CRCRD: Credit card users (% of peoples age 15+)	0.48*** (5.83)	0.46*** (4.98)	0.45*** (5.45)	0.45*** (4.91)	0.08* (1.90)

GROW: GDP growth (annual %)	-0.35 (-1.03)	-0.29 (-0.82)	-0.37 (-1.10)	-0.37 (-1.06)	0.30* (1.82)
CRDTDPS: Bank credit to bank deposits (%)	0.06** (2.74)	0.05* (1.91)	0.05** (2.24)	0.05* (1.86)	0.01 (0.50)
DCPSF1: Private credit by banks and other financial institutions to GDP (%)		0.02 (0.69)		0.0001 (0.00)	-0.02 (-1.29)
Adjusted R-squared	0.75	0.75	0.69	0.69	0.06
Akaike info criterion	7.49	7.51	7.47	7.49	5.96
Schwarz criterion	7.62	7.67	7.61	7.66	6.12
Hannan-Quinn criterion	7.55	7.57	7.53	7.56	6.03
Durbin-Watson Statistics	1.82	1.83	1.60	1.60	2.01
F-statistic	72.69	57.91	54.18	42.87	2.28

Table 14. Dependent Variable: Paying for Medical Costs is the Most Worrying Financial Issue (WORYMD)

Method: Ordinary Least Squares
No. of Countries 155 (Cross Section)
Year: 2021

Independent Variable/ Option	**I**	**II**	**III**	**IV**	**V**
Constant	41.46*** (11.66)	41.56*** (10.51)	42.92*** (9.72)	35.44*** (10.45)	36.41*** (10.45)
CRCRD: Credit card users (% of peoples age 15+)	-0.26*** (-3.01)	-0.26*** (-2.98)	-0.26*** (-3.00)	-0.21** (-2.41)	-0.21** (-2.48)
GROW: GDP growth (annual %)		0.12 (0.35)	0.12 (0.35)	0.14 (0.40)	
PCIGROW: GDP per capita growth (annual %)	0.20 (0.64)				0.24 (0.74)
CRDTDPS: Bank credit to bank deposits (%)	0.003 (0.13)	0.003 (0.15)	0.004 (0.18)	0.01 (0.35)	0.01 (0.42)
UNEMPL: Unemployment (% of total labor force)			-0.15 (-0.70)		-0.15 (-0.71)
EFCTV: Government Effectiveness Index				-0.88 (-0.29)	-1.73 (-0.55)
ELCPMT: Electronic payments used to make payments (% of peoples age 15+)	-0.08 (-1.31)	-0.08 (-1.28)	-0.09 (-1.33)		
CRPTN: Transparency, Accountability & Corruption in Public Sector Index				-3.15 (-1.17)	-2.55 (-0.92)
Adjusted R-squared	0.33	0.33	0.33	0.34	0.34
Akaike info criterion	7.56	7.57	7.58	7.56	7.57
Schwarz criterion	7.70	7.70	7.74	7.72	7.76
Hannan-Quinn criterion	7.62	7.62	7.65	7.62	7.65
Durbin-Watson Statistics	1.57	1.54	1.52	1.51	1.52
F-statistic	12.89	12.77	10.26	10.91	9.20

6. Policy Recommendations and Limitations

The empirical evidences in this study confirm the effectiveness of the use of financial technology in poverty alleviation and creating employment opportunities. Similarly, the use of financial technology and growth in credit to private sector enhance the magnitude of labor participation (LABR) and alleviate unemployment. It implies that monetary policy can play an important role by encouraging the size of credit to private sector (DCPS) and recognition of the digital modes of monetary transactions (flow of funds by fintech companies, use of internet and use of mobile phone for monetary transactions).

Based on empirical evidences, the most important and interesting conclusion belongs to the role of credit flows by fintech and big technology companies. The negative sign with the beta associated with the credit flows by fintech and big technology companies indicates that higher credit flows by fintech and big technology companies alleviate the poverty. This relation was tested in five alternative options, where some control variables have been added. Another objective of the estimation of poverty trough alternative option was to conduct the falsification tests. It can be observed that results are statistically significant and parameters are robust in all scenarios.

This study has recognized the role of growth in per capital income in alleviation of poverty, however, growth in GDP or per capita GDP is not significant in determination of income inequality (Gini index). In establishing the relation between economic growth and income distribution, Asian Development Bank (2010) has mentioned that strong economic growth in Asia is accompanied by the emergence of a sizable middle class and a significant reduction in poverty. According to the report, higher share of urban population, share of services in GDP, trade openness and share of services in trade are the significant factor of rise in the number of middle-class peoples.

According to the statistical results the more use of electronic payment and credit cards play a very positive and significant role in developing the perception that peoples can arrange money withing 30 days in case of financial emergencies. The more use of electronic payments and credit cards improves the peoples' perception that they can arrange money during the crisis. The aggregate credit to deposit ratios in the banks also plays a positive role in developing this perception. Similarly in determination of the peoples' perception that their top most financial problem is to arrange money in case of a medical emergency due to a critical disease or accident, availability of credit cards is the only significant variable.

All these findings are important for monetary policy to devise the mechanism to recognize and encourage the use of electronic modes of monetary transactions.

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Economic Growth without Structural Transformation: A Review of Industrial Policy in Ghana

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Abstract

The present review examines Ghana's past experience with industrial policy implementation, and pinpoints the factors that led to their failure to produce the desired outcome, shedding light on the challenges encountered and their implications for future policy endeavors. Furthermore, the review delves into the current model of development and how it has not been successful in promoting economic growth or transforming the structure of the economy. Noteworthy obstacles faced by the country include limited linkage between economic growth and structural and economic transformation. To overcome these obstacles, this review argues for a return to industrial policy implementation in Ghana. The current shifts in the global context, coupled with the enhanced state of fundamental institutions and favorable macroeconomic conditions in Ghana, present an opportune moment for the implementation of industrial policies. By tackling these issues head-on, Ghana can achieve sustainable economic growth and develop a more resilient and diversified economy.

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1. Introduction

The role of economic transformation in economic development has received increased attention from scholars in recent years. Recently considerable literature has grown up around the topic. (Worldbank, 2021), (McMillan & Headey, 2014), and (McMillan, Rodrik, et al., 2017), all highlight the importance of economic transformation and the lack of it as the explaining factor behind the weak linkage between economic growth and welfare improvement in many African countries. Economic transformation encompasses a persistent process characterized by the reallocation of labor and other resources from sectors characterized by lower productivity to those exhibiting higher productivity levels, commonly referred to as structural change. Simultaneously, it entails efforts aimed at enhancing productivity growth within sectors, fostering advancements in the economic performance (McMillan & Headey, 2014; Worldbank, 2021).

Structural transformation and structural change are related concepts but have slight differences. Structural transformation is a process of long-term and systemic changes in an economy's composition and organization that involves a fundamental shift in economic structure towards high-productivity sectors. It includes changes in sectoral composition, technology advancements, employment patterns, and overall improvements in the economy's productive capacity. The role of structural transformation in promoting countries' development has been long observed and is well documented in the works of Timmer & Akkus (2008), Duarte & Restuccia (2010), and (McMillan & Headey, 2014). Whereas structural change focuses specifically on the shifts in the relative importance or composition of different economic sectors. It refers to the changes in the relative size and contribution of various sectors. Structural change can occur within the framework of structural transformation, as it represents a subset of changes that contribute to the broader transformation process (Kanbur, 2017).

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There is currently an observable trend of structural change characterized by a shift towards a service-led economy, bypassing the traditional manufacturing sector. This phenomenon has been widely documented across developing nations. Likewise, in Ghana, this pattern of structural change is clearly following this pattern. The deviation from the conventional industrialization path is known as "structural change without industrialization," which indicates premature deindustrialization (Rodrik, 2013). The negative consequences of premature deindustrialization include a lack of employment opportunity, reduced productivity in alternative sectors such as agriculture or services, and overreliance on these sectors which is less capable of generating high-paying jobs. There is a growing body of literature that prescribe the adoption of industrial policy in many African countries, as an instrument to bring about structural, and economic transformation (Ayelazuno, 2014).

Industrial development, particularly the growth of manufacturing industries, is widely recognized in the literature as a pivotal factor in structural and economic transformation. Its significance lies in its capacity to generate employment opportunities, foster technological advancements, and stimulate economic growth (McMillan, Rodrik, et al., 2017). The foundation for understanding the role of industries, specifically manufacturing, can be traced back to the work of Nicholas Kaldor and his formulation of Kaldor's three laws[1]. These laws provide a comprehensive framework that elucidates the interplay between industrial development, productivity gains, and overall economic progress (Yülek, 2018). Rodick (2013) has shown the importance of manufacturing in achieving unconditional labor productivity convergence, across regions and countries, convergence between poorer and richer countries is faster when resources are channeled toward manufacturing sectors (McMillan, Page, et al., 2017).

Rapid industrial development has been the most remarkable in East Asia, positioning the region as a global economic powerhouse (Stiglitz, 1996). The growth experience of East Asia economies has demonstrated the importance and the interlinkage between industrial policy, fast economic growth, structural and economic transformation. Industrial policy plays a vital role in the technology gap reduction relative to the world technological frontier and generating international competitiveness (Cimoli & Porcile, 2013; J. Y. Lin & Monga, 2013). The successful economic performance of East Asian economies has been widely attributed to the effective implementation of industrial policies (Stiglitz, 1996; Akkemik, 2008; Cimoli & Porcile, 2013; J. Lin & Stiglitz, 2013; Yülek, 2018).

In the case of Africa, the push for industrialization started in the 1950s and 1960s, when newly independent countries sought to promote industrial development by implementing industrial policies. Recognizing industrialization as the primary vector of growth, different industrial promotion policies have been tried (Marti & Ssenkubuge, 2009). Industrial policy has long been a subject of debate and experimentation in Africa, with policymakers and scholars grappling with the challenges of promoting economic development through industrialization. While numerous policies and strategies have been aimed at improving agricultural and industrial sectors, the efficacy of these efforts remains questionable. However, there has been a recent resurgence of interest in industrial policy as an instrument to stimulate economic growth and development in the continent.

When implementing industrial policies, African countries prioritized import substitute industrialization (Marti & Ssenkubuge, 2009; Grabowski, 2015). This policy is believed to have shifted resources out of the sectors where the continent had a comparative advantage (mining, primary sectors) toward sectors where it did not have it (final goods). Tools such as tariffs, quotas, and foreign exchange controls were used to protect domestic industries. State ownership was used to ‘guarantee supply chain stability’ and resource allocation. Agriculture was neglected due to its low productivity. Tools such as tariffs, quotas, and foreign exchange controls were used to protect domestic industries. State ownership was used to ‘guarantee supply chain stability’ and resource allocation. The state used its monopsony power to push down agriculture prices, effectively shifting resources out of agriculture -one consequence of this policy of neglecting agriculture can be felt even today; agriculture production didn’t keep up with population growth. According to Grabowski, from 1961 until 2009 food production in Africa all but stagnate, however, the protected sectors failed to gain in productivity, and countries facing financial constraints dictate the failure of this strategy. The first industrial policy implementation attempt lasted until the end of the 1970s and the beginning of the 1980s when industry policy fell out of fashion (due to substantial financial strain on countries' public finances) and was replaced by the neoliberal agenda (Ansu et al., 2016; Geiger et al., 2019). This period of neoliberalism materialized in the Washington Consensus policy package, which became the dominant ideology in the world and Africa. This period saw a move (under external advice and conditionality) toward the liberalization of the markets, privatization of State-Owned Enterprises (SOE), macroeconomic stabilization, economic opening, and so on. It was a period of declining GDP per capita and a decline in the industrialization process in Africa (Noman & Stiglitz, 2015; Stiglitz et al., 2013).

Against this background, this study proposes to critically review Ghana's current development model and assess its effectiveness in achieving structural and economic transformation. The study argues for the reintroduction of industrial policy implementation in Ghana as a representative

[1] These laws provide provides the rationale for manufacturing promotion, the first law states that the manufacturing is the engine of growth, the second law focuses on the role of labor productivity in industrial growth, and finally, the third law addresses the relationship between industrial growth and its positive effect on the growth of the non-manufacturing sector.

case of failed industrialization in Africa, considering the observed weak linkage between economic growth and structural and economic transformation. The research examines Ghana's previous experiences with industrial policy implementation and analyzes the country's current industrial structure and development plan, which includes provisions for the implementation of industrial policy.

The paper begins by providing the theoretical foundations of industrial policy, followed by a historical overview of industrial policy implementation in Ghana. Additionally, as evaluated Ghana's present industrial structure is analyzed, and its alignment with the country's development strategy is evaluated. The ultimate aim is to provide insights into the importance of industrial policy in driving structural and economic transformation in Ghana.

2. Industrial policy: Theoretical underpinning

The industrial policy encompasses a set of governmental measures and interventions aimed at fostering and accelerating economic development, particularly in the context of promoting industrialization. This term is often associated with the Japanese government's strategic initiatives and policies implemented to facilitate and expedite the process of economic growth and industrial advancement (Akkemik, 2008). Industrial policies are designed to affect resource allocation, complement market failure, and income distribution. It targets selected industries based on their potential for technological upgrade, productivity growth, and high-income elasticity (Itoh et al., 1991). In a recent study, (J. Y. Lin & Monga, 2013) makes a case for comparative advantage as the guideline for sectorial targeting. This definition of industrial policy stresses the "vertical" (picking the winner) approach to industrial policy. A "horizontal" (level playfield) approach also focuses on improving the general macroeconomic and social environment. The industrial policy usually targets manufacturing promotion, as manufacturing more easily checks the boxes of desirable characteristics (technological potential, high-income elasticity, productivity growth) for sectorial promotion. However, if we take a broader view of industrial policy, Rodrik (2004), defines it as any policy designed to affect the structure of an economy; it can be the service sector, for instance. Market failure (information asymmetry, issues of investment coordination, information asymmetry) is among the most compelling arguments favoring government intervention.

The widespread presence of market failures in developing countries presents a compelling argument for the implementation of industrial policies. The historical achievements of economies in East Asia (e.g. Korea, Taiwan) provide empirical evidence that supports the proactive adoption of such policies (Akkemik, 2008; Wade, 2010; Chang & Andreoni, 2020). Nevertheless, doubts persist regarding the feasibility of effectively implementing industrial policies. These concerns arise from the experiences of various economies, particularly in Latin America and Africa, where the outcomes of industrial policy implementation have failed to replicate the successes witnessed in East Asia. Such instances have engendered skepticism regarding the effectiveness and applicability of industrial policies, particularly within the Sub-Saharan Africa (SSA) region. It was argued that implementing the industrial policy requires certain "first-rate institutions" and a cadre of bureaucrats which is supposedly challenging to be found in these countries (Chang & Andreoni, 2020; J. Y. Lin & Monga, 2013). In the context of Sub-Saharan Africa (SSA), detractors of industrial policy implementation have highlighted the presence of weak institutional frameworks, politically challenging environments, significant natural resource endowments (which are believed to discourage the pursuit of industrial policy), geographical factors, and other pertinent considerations (Chang, 2013). However, as the author argues, these same types of arguments were used in the past to argue against industrial policies in East Asia. Hence, these are not credible arguments against the industrial policy in SSA. However, it's important to keep in mind the external factor that eventually will limit industrial policy options for Ghana, these include, limited resources, dependence on donor support, and international institutions that will certainly constrain policy options available.

Following a period of waning popularity, industrial policy has regained prominence as a result of several influential factors, including the ascendance of China, the global financial crisis of 2008, and the imperative to address climate change. These developments have rekindled interest in government intervention, particularly in the form of industrial policies, and have renewed discussions regarding their applicability and significance (Chang, 2013; Cherif & Hasanov, 2019; Akkemik & Yülek, 2020). The shifting paradigm within the international sphere, combined with the relatively enhanced state of basic institutions and macroeconomic conditions in Sub-Saharan Africa (SSA), creates a conducive environment for a renewed attempt at implementing industrial policies in the region (Chang, 2013). Given the inadequacies observed in the realms of economic growth and transformation in Ghana, there has been a growing demand for the reintroduction of industrial policy as a means to rectify these deficiencies (Chang, 2013). For instance, Ayelazuno (2014) argues that the failure of Ghana to diversify its economy into industrialization (i.e., manufacturing) explains the paradox of growth without structural transformation. Allocative inefficiency has been identified as a significant factor contributing to the absence of structural transformation in Ghana, particularly in the realms of transportation and the mitigation of transaction costs. Additionally, issues such as risk aversion and information asymmetry have been recognized as potential further hindrances factors (McMillan & Headey, 2014). Conversely, the concept of industrial policy as aforementioned has long been associated with the imperative of facilitating efficient

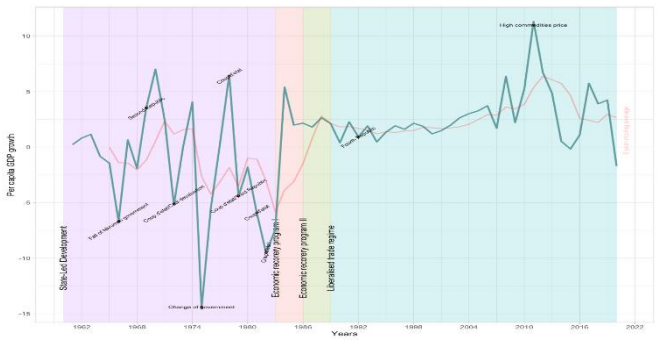
resource allocation and rectifying market failures (Akkemik, 2008; Itoh et al., 1991; Stiglitz, 1996). Henceforth, it is recommended that the implementation of industrial policy be considered as a means to efficiently facilitate both structural and economic transformation.

3. Industrial policy: Theoretical underpinning

3.1 Economic growth performance

Ghana is at the forefront of economic reform in Sub-Sahara Africa. For instance, after independence, the country implemented an import substitute industrial policy; later on, when the industrial policy was out of favor, the country was at the vanguard of reforms toward the market economy (Kolavalli et al., 2011). However, the results of these reforms have received mixed evaluations. While some scholars credit it for the high economic growth performance attained ever since others argue that the lack of economic transformation and structural change remains the biggest obstacle. Considering the current development level of Ghana and the competitiveness of its industrial base, one can safely argue that there is a need for significant economic transformation and structural changes, which will likely lead the way for further economic and social development. A specific-purpose industrial policy, which aims to nurture specific industries, is arguably a viable way to achieve such a high aim in industrial development. Therefore, before launching industrial policy discussions, it is pertinent to take a brief historical look into industrial policies in Ghana.

Figure 1. Per capita GDP growth



Source: Authors' elaboration based on World Development Indicator.

Note: The GDP per capita growth was determined by dividing the total GDP at a constant local currency by the total population.

Ghana's economic history since gaining independence has been marked by notable fluctuations in GDP growth, mainly due to its overreliance on commodity exports (Gocking, 2005). As shown in Figure 1, In the initial decades following independence, the country pursued a State-Led Development approach, which involved Import Substitution Industrialization (ISI). During this period, the government implemented various policy measures such as import tariffs, price controls, import restrictions, foreign exchange rationing, and import licensing to protect domestic industries (Killick, 2010a). Figure 1 demonstrates that this phase of Ghana's economic history was characterized by significant volatility in GDP growth, with an average growth rate of only 0.46% during the first ten years of independence. This period of economic instability was closely linked to political turmoil and uncertainty. However, due to factors such as high inflation (averaging 40% in the 1970s), fiscal deficits, imbalances in the balance of payments, and depletion of foreign reserves, Ghana sought assistance from the International Monetary Fund (IMF). Consequently, an economic recovery program was implemented, leading to a shift in the economic strategy (Ackah et al., 2016; Gocking, 2005). The new approach embraced a neoliberal agenda, characterized by economic liberalization. This change in strategy yielded positive outcomes, as reflected in the growth of GDP per capita. The long-term growth, represented by the five-year moving average, exhibited an inflection point and turned positive. In the decade prior to the onset of the COVID-19 pandemic, Ghana's economy experienced an average per capita GDP growth rate of 4.5%. This performance positioned Ghana as one of the fastest-growing economies in Sub-Saharan Africa and globally during that period.

Despite this positive result, there is mixed feeling in the academic community regarding evaluating the impact of this liberal agenda in Ghana. Some scholars credit it for its stable and steady economic growth. In contrast, others point to the lack of economic transformation, structural change, and persistence of low productivity, joblessness, and poverty (Aryeetey & Kanbur, 2008). What (Ayelazuno, 2014) characterizes it as the "paradox of growth without development". As opposed to the first development period, it is argued that Ghana achieved transformation without economic growth.

4. Industrial policies in Ghana: A retrospective review

Economic planning in Ghana precedes the country's independence in 1957. In the period leading to the sovereignty, at least three ten-year plan was devised by the then-colonial governorship (Huq & Tribe, 2018). In 1946, the governor of the Golden Coast, as Ghana was denominated then, approved the country's first Ten-Year development plan, which was followed by another plan in 1950, later transformed into a Five-Year plan (Aryeetey & Kanbur, 2017). The plan was intended to promote the development of the industrial development (Aryeetey & Kanbur, 2017). In fact, the first plan that effectively called for the protection of infant industries in Ghana was developed by the celebrated Nobel laureate economist Arthur Lewis. The plan recommended the use of tariffs and quotas to protect domestic industries, increase agriculture productivity, and the expansion of infrastructures (Gocking, 2005; Huq & Tribe, 2018).

From independence, Ghana aimed to develop an independent economy, which implies being independent of

importing consumer goods; hence the country experimented with an industrial policy based on an import substitution strategy. After 1984, Ghana embarked on an open economy under the auspices of the IMF intervention. For the last two decades, the country has been experimenting with a private-led, natural resource processing industrialization strategy (Aryeetey & Kanbur, 2017; Killick, 2010). Ackah et al. (2016) summarize the phases of Ghana's industrialization can be summarized as follows:

- Import-substitute industrialization (ISI): 1965-1983
- Outward-oriented liberalization strategy: 1984-2000
- Private-led natural resource processing-based industrial development: 2000-present

Killick (2010) further categorizes the initial period into two distinct phases: pre- and post-toppling of the Nkrumah government, spanning from 1951 to 1966[2]. Within this framework, the author asserts that this period represents a significant epoch characterized by a heightened pursuit of developmental objectives.

4.1 Import-Substitute Industrialization (ISI): 1965–1983

During import-substitute industrialization (ISI), Ghana's government adopted a policy of protecting domestic industries from foreign competition. After independence, Ghana was mainly an import-dependent economy based on natural resource extraction (Ackah et al., 2016; Aryeetey & Kanbur, 2008; Gocking, 2005; Killick, 2010b). The industrial policy in this phase aimed to break away from the colonial system of over-reliance on imported goods. Ghana's economic structure heavily relied on imports for the acquisition of capital and consumer goods (Killick, 2010a).

The government invested significantly in large-scale, capital-intensive manufacturing industries where state-owned enterprises (SOEs) dominated (Gocking, 2005). The main targeted sectors were infrastructure investment, production of previously imported consumer goods, processing and export of primary products, and expansion and development of building materials, electronics, and machinery industries. Industrial policy at this stage primarily targeted increasing manufacturing output. About 90 percent of firms operating in the industrial sector (mining, quarrying, manufacturing, energy, and construction) were manufacturing firms. Light industries such as textiles, garments, soap, wooden products, aluminum, and metal were among the high-priority sectors. The textile industry accounted for 27 percent of the total manufacturing output. The aim was to develop sectoral linkages between the existing sectors and future industries to be developed (Ackah et al., 2016).

The aim was to develop sectoral linkages between the existing sectors and future industries to be developed. The ISI strategy gave special preeminence to SOEs to the detriment of private sector development. During this period, the private sector output went into decline. Policy tools such as tariff and non-tariff protection of domestic industries, licensing, price controls, quantitative import restrictions (quotas), and foreign exchange rationing were widely used. However, these did not produce the desired outcome. It resulted in excess capacity and inadequate linkages with other growth-enhancing sectors, the balance of payments problems, inflationary pressure, and currency devaluation (Ackah et al., 2016). Overall, the ISI strategy did not bring about the desired GDP growth. GDP growth remained negative in most years and averaged -1.67% from 1960-1983.

4.2 Outward-oriented liberalization: 1984–2000

By 1983, Ghana's production capacity and social infrastructure were in decline. The country went under an Economic Recovery Program (ERP) and Structural Adjustment Program (SAP) by the IMF. These programs generally entail economic liberalization, i.e., the dismantling of industrial policy under implementation. Measures in the SAP include liberalization of the exchange rate, removal of price controls, financial sector liberalization, abolition of the import licensing system, privatization, and the rationalization of the import tariff and taxation system (Ackah et al., 2016; Aryeetey & Kanbur, 2008). The ultimate aim was declared as the development of an internationally competitive economy capable of competing in the domestic market with imported goods and enhancing the capacity to export while developing private-sector-led industrialization as opposed to government-led industrialization previously implemented, which can absorb labors released by the privatization of SOE (Ackah et al., 2016). The liberalization era of the 1980s and the 1990s also witnessed the decline of manufacturing's share in GDP. During the heydays of industrial policy, i.e., the 1960s and the first half of the 1970s, this share was more than 10%. It remained between 10%-15% bad but declined to below 10% during the liberalization era.

Liberalization of the economy emphasized macroeconomic stability through short-run macro policies, and long-run industrial policies were neglected. The macroeconomic results of the liberalization measures, on the other hand, were favorable, as evidenced by the return of positive economic growth. The per capita GDP growth rate improved largely compared to the previous period and averaged 1.96 from 1983-2004 (see Figure 1). The average growth of the industry was an incredible 11.2% during the first five years of the program (Ackah et al., 2016). However, this growth was mainly led by the energy sector (water and electricity), not manufacturing growth. In addition, due to the over-exposition

[2] Ghana achieved independence in 1957, however, by 1951 it had already achieved self-governance (Killick, 2010).

of domestic firms to international competition and high production costs resulting from a weak currency, among others, the growth of the industry was short-lived. Soon afterward, there was a return to the sluggish growth rate. The government implemented measures such as setting up business assistance funds, export subsidies, support for small and medium enterprises, and establishing exporting processing zones. However, the impact of these measures was negligible despite being positive (Ackah et al., 2016). As a result of these measures, the share of manufacturing in total industrial output (mining, manufacturing, energy, and construction combined) decreased. The mining sector, which benefited from economic opening thanks to better legislation brought by FDI and better capital equipment, outperformed the manufacturing sector, which still accounted for a large share of industrial output. However, this share was on a declining trend (Ackah et al., 2016).

4.3 Private-led natural resource processing based industrial development: 2000-present

In the 2000s, Ghana witnessed a shift in its development strategy, with the government focusing on enhancing economic welfare through poverty reduction, job creation, and inclusive economic growth (Ackah et al., 2016). During this period, the government identified several key challenges that hindered the country's development. One of the identified obstacles was the high cost of credit, which impeded access to financing for businesses and individuals. To address this issue, the government implemented policies and initiatives to promote financial inclusion, enhance the banking sector, and facilitate easier access to credit for productive activities. Another significant challenge was the unreliable power supply. Ghana faced frequent power outages, which negatively impacted industrial productivity and economic growth. The government undertook various measures to address this issue, including investment in power generation infrastructure, encouraging private sector participation in the energy sector, and promoting renewable energy sources.

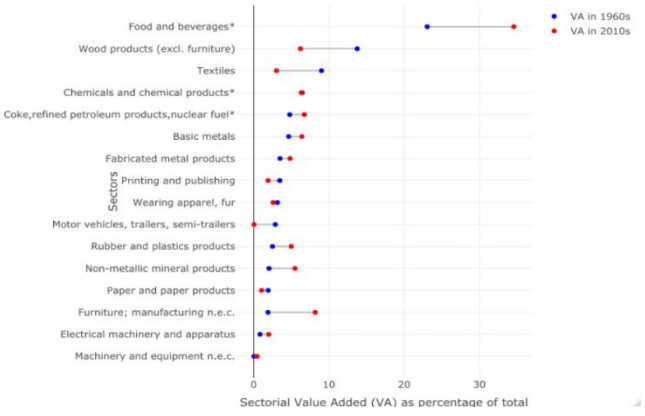
Rising fuel costs also posed a challenge to Ghana's development efforts. Fluctuating global oil prices affected the cost of fuel imports, leading to increased transportation costs and inflationary pressures. The government implemented strategies to mitigate the impact of rising fuel costs, such as promoting domestic oil exploration and production, encouraging energy efficiency measures, and diversifying the energy mix. Furthermore, intense competition with domestically imported goods was identified as a hindrance to Ghana's development. To address this, the government implemented trade policies aimed at protecting domestic industries, promoting local production, and reducing the reliance on imported goods. Overall, during the 2000s, Ghana's development strategy focused on overcoming challenges related to credit availability, power supply, fuel costs, and competition with imported goods. The government aimed to create an enabling environment for sustainable economic growth, poverty reduction, and job creation, fostering inclusive development across various sectors of the economy.

5. The current state of industrial policy in Ghana

5.1 An outlook of manufacturing industries

Ghana's economic growth has been heavily reliant on commodities exports, particularly oil and gold. Mining, in particular, has played a significant role, contributing to approximately 20% of the country's GDP between 2013 and 2019. However, despite its contribution to GDP, mining is a capital-intensive activity that does not generate substantial employment opportunities. This dependence on commodities exports also exposes Ghana to the risks of price fluctuations, leading to macroeconomic instability (Worldbank, 2021). A relatively small proportion of Ghana's labor force, approximately 15%, is employed in the mining, manufacturing, and energy sectors. Within the manufacturing sector, productivity levels are relatively low, with only a 20% productivity difference compared to agriculture. In contrast, China's manufacturing sector demonstrates a much higher productivity level, with a 500% difference compared to the agriculture (Grabowski, 2015). This disparity indicates a significant productivity gap in Ghana's manufacturing sector. Furthermore, there is a declining trend in productivity as firms employ more workers, suggesting a low absorption capacity in general. This highlights the challenges faced by Ghana in terms of increasing productivity and creating meaningful employment opportunities within the manufacturing sector. These factors collectively underscore the need for Ghana to address its overreliance on commodities exports and enhance productivity within the manufacturing sector. Diversifying the economy, promoting industries with higher value-added activities, and implementing measures to improve productivity are crucial for achieving sustainable economic growth and employment generation in Ghana.

Figure 2. Sectors in Ghana



Source: Authors' elaboration based on United Nations Industrial Development Organization (UNIDO).

Note: The data source is based on Industrial inquiries conducted annually and quarterly, data were converted from ISIC Revision 2 to Revision 3. In the top right corner of the figure, you'll notice "VA" which stands for "value-added." The data displayed represents the average calculated over a 10-year period, spanning from the 1960s and 2010s respectively.

Figure 2.2 depicts the share of different industries in Ghana's total manufacturing value added during the 1960s (blue) and the 2000s (red). Several notable trends can be observed. First, industries such as wearing apparel and fur, food and beverages, and fabricated metal products have experienced a significant increase in their share of total manufacturing value added over time. This suggests that these industries have grown in importance within the manufacturing sector. However, it is important to note that the observed growth in these industries does not necessarily imply substantial technological deepening. Without further evidence, it is challenging to ascertain the extent to which technological advancements have occurred within these sectors. In comparison to East Asian countries like Singapore, where industries with higher value-added and technological content, such as electrical and electronic machines, have increased their share, the Ghanaian manufacturing sector's progress in technological deepening appears constrained (Akkemik, 2008). Moreover, there are industries, such as wood products and motor vehicles, that have experienced a decrease in their share of total manufacturing value added. This decline could be indicative of challenges in these sectors, potentially including limited technological advancements and competitiveness. To better understand the level of technological deepening in Ghana's manufacturing sector, additional research and analysis are required. Detailed assessments of technological capabilities, research and development investments, and the adoption of advanced manufacturing techniques would provide more insights into the country's progress in this regard.

5.2 Recent industrialization strategy in Ghana (2018 to present)

Ghana's industrialization strategy is currently centered around promoting privately-led agro-processing industries as a means to bridge the productivity gap, diversify the economy, and foster private sector-led growth. This strategy encompasses various sectors, including agriculture and agro-processing, manufacturing, tourism, and digital services. The government aims to facilitate the development of these sectors by improving the business environment, enhancing access to finance and technology, and encouraging innovation and entrepreneurship.

To achieve these objectives, the Ghanaian government has implemented several policy initiatives. One such initiative is the One District, One Factory (1D1F) program, which aims to establish at least one factory in each district of the country. This program seeks to promote local industrial development and generate employment opportunities. Additionally, the Ghana Automotive Development Policy focuses on promoting the local production of vehicles and auto parts. The government has also established industrial parks and special economic zones to attract foreign investment and stimulate the growth of key industries. Examples include the Ghana Free Zones Authority, the Western Nzema Industrial Park, and the Appolonia Business Park. These initiatives provide dedicated spaces and infrastructure to support industrial activities and facilitate business operations. Overall, the industrialization strategy in Ghana is geared towards creating a more diversified, competitive, and resilient economy that can generate higher levels of economic growth and employment. By prioritizing agro-processing industries, improving the business environment, and implementing targeted policies and initiatives, the government aims to foster industrial development and enhance productivity and skill levels across various sectors.

Ghana's industrial policy plan, developed by the Ministry of Trade and Industry, outlines a comprehensive framework for transforming the country into an industry-driven economy. The plan reflects extensive consultations with stakeholders and aims to achieve sustainable economic growth, job creation, and equitable income distribution. Manufacturing is identified as the key sector to be promoted, with 21 thematic areas grouped into four main components: production and distribution, technology and innovation, incentives and regulatory regimes, and cross-cutting issues. The plan sets multiple goals, including diversifying the economy and creating jobs through industrialization and manufacturing promotion, fostering the growth of small and medium-sized enterprises (SMEs) and entrepreneurship, driving innovation and technology transfer through research and development, encouraging value addition and local processing of raw materials, developing infrastructure and services that support industrial growth, and attracting private sector investment in industrial development. Furthermore, Ghana's industrial development priorities include expanding productive employment in the manufacturing sector, modernizing the economy by promoting high-value-added sectors, and enhancing industries' technological capacity. Financial deepening, technological promotion, and macro management are also highlighted as important aspects of industrial policy. Ghana's current industrial policy aligns with the concept of strategic industrial policy, as defined by Chang (2020). It emphasizes correcting market failures in a static sense while promoting innovation to enhance productivity. The policy focuses on creating a level playing field rather than adopting the traditional industrial policy approach of picking winners, as observed in East Asia. Overall, Ghana's industrial policy plan demonstrates a comprehensive and strategic approach to industrial development, emphasizing the promotion of manufacturing, innovation, and private-sector investment. By addressing market failures and facilitating technological advancement, the plan seeks to foster sustainable economic growth, job creation, and a diversified industrial base in Ghana.

6. Conclusion

In conclusion, this study presents a comprehensive analysis of industrial policy and its historical implementation in Ghana, emphasizing the urgent need for structural and economic transformation. Through an examination of Ghana's current industrial development and the theoretical rationale behind industrial policy, the study underscores the importance of addressing market failures and promoting diversification.

By exploring sector targeting guidelines and the chronological experience of industrial policy implementation in Ghana, the study provides valuable insights into past failures and their implications for future policy endeavors. It highlights the pressing challenges of limited diversification, heavy reliance on commodities, and a weak manufacturing sector, emphasizing the need to move beyond a commodity-dependent model.

The study calls for a renewed emphasis on industrial policy implementation in Ghana, emphasizing the favorable global context, improved institutional capacity, and conducive macroeconomic conditions. The importance of industrial policy in addressing the issue of weak linkage between growth and structural and economic transformation is emphasized, as this is a common challenge faced by many African countries. The Ghanaian experience with industrial policy and its prevailing development model bears significant relevance for other developing nations grappling with the challenge of weak linkages between economic growth and structural and economic transformation. This experience underscores the fundamental significance of government policies in effectively addressing resource allocation issues and mitigating market failures.

In summary, this study contributes to the understanding of Ghana's industrial policy implementation and highlights the significance of achieving structural and economic transformation. By recognizing past failures, understanding current challenges, and advocating for the return to industrial policy, Ghana can pave the way for sustained and inclusive economic growth, ultimately fostering a more balanced and resilient economic landscape.

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Fair Division of Scarce Resources: A Brief Survey of Claims Problems

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Abstract

This paper studies the fair division of a scarce resource among competing claimants, a problem commonly referred to as the claims problem in the literature. This model has numerous practical applications, ranging from estate division and rationing to bankruptcy and even fundamental taxation issues. An axiomatic approach is utilized to examine the properties of division rules, which are represented as mathematical axioms. The paper presents a comprehensive examination of prominent division rules, including the proportional, egalitarian, and parametric rules, and provides their respective axiomatic characterizations. Ultimately, the paper presents a comprehensive framework for achieving a fair and equitable allocation of scarce resources among competing claimants.

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C71, D63, D81

1. Introduction

What is the best way to divide a resource when competing claims exceed the available amount? This is known as a "claims problem", and a division rule is used to determine how the resource should be allocated among the claimants.

The model we are studying has many applications in real-life situations. One of the primary applications is estate division, where a man dies and his estate is insufficient to cover his debts, and we need to decide how to divide it among his creditors. The problem of inheritance is the earliest recorded example of the rationing problem, as evidenced by sources such as O'Neill (1982) and Rabinovitch (1973) who cite examples from the Babylonian Talmud. Another related application is the bankruptcy problem, where the liquidation value of a bankrupt firm needs to be allocated among its creditors (see Aumann and Maschler (1985)).

Another example of the application of this model is rationing, where a firm has to allocate a limited amount of a commodity among its consumers who have placed orders for it. This rationing problem can also occur at the level of nations, where scarce resources such as food, clean water, medical supplies, or shares of the global carbon budget must be distributed among different states or provinces. Similarly, when international agencies distribute aid to impoverished countries, they often have to contend with limited resources that are insufficient to meet all the needs.

Our model can also serve as a formalization of basic taxation problems. In this scenario, the agents are taxpayers whose incomes exceed the cost of a given project. The question arises as to how much each taxpayer should contribute towards the overall cost in a fair and equitable manner (see Young (1988, 1990)).

More generally, this model can be used when a resource needs to be allocated among a group of agents when the amount is insufficient to satisfy their claims, needs, or demands.

In this paper, we will follow the axiomatic approach. We begin with examining the properties of rules, which are expressed as mathematical axioms. These axioms represent our intuition about how a rule should operate in different situations. An axiomatic study typically concentrates on a small set of properties, examines their logical connections, and explores the consequences of imposing these properties in different combinations. The results obtained through the axiomatic approach can be categorized into two types. In some cases, certain properties are found to be incompatible, resulting in an impossibility theorem. On the other hand, a list

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of properties may be found to be compatible, and the family of rules satisfying them can be described which is called an axiomatic characterization of the rule. The main goal of the axiomatic program is to delineate the boundary between compatible and incompatible lists of properties and to obtain comprehensive and explicit descriptions of which rules or families of rules satisfy all of the compatible properties. For readers interested in exploring the axiomatic characterization of division rules in more depth, we recommend the comprehensive surveys by Moulin (2002) and Thomson (2019).

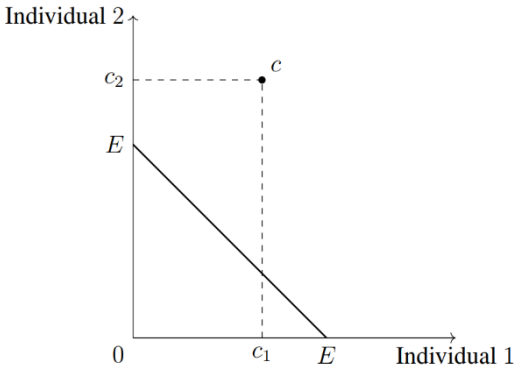
The paper is structured as follows. In Section 2, we present preliminaries for the claims problem. In Section 3, we discuss various well-known division rules from the literature. Next, in Section 4, we introduce standard axioms that capture important properties such as efficiency, fairness, monotonicity, and consistency and we provide axiomatic characterizations for the division rules discussed in Section 3. Finally, in Section 5, we offer concluding remarks.

2. Preliminaries

An infinitely divisible resource $E \in \mathbb{R}_+$ is to be divided among a group of agents N where individual $i \in N$ has a claim $c_i \in \mathbb{R}_+$ on the resource. The vector $c = (c_i)_{i\in N}$ represents the claims of all individuals. We assume that N is finite and subset of the set of natural numbers indexed by $\{1, 2, \dots, n\}$.

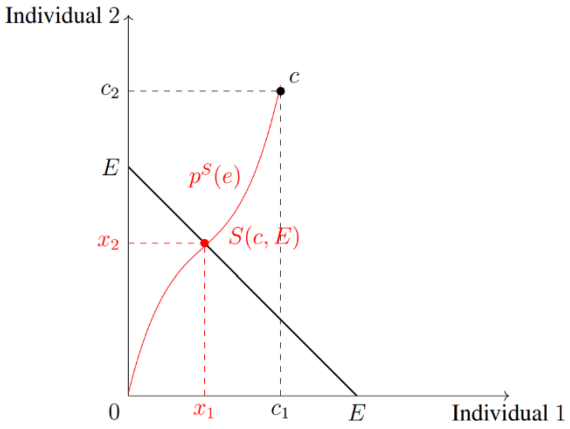
To define a "claims problem", we require that the total claims of the individuals exceed the amount of the resource available, that is, $\sum_{i\in N} c_i \geq E$. The pair $(c, E) \in \mathbb{R}_+^N \times \mathbb{R}_+$ is referred to as "claims problem". Let the set C^N represent the entire collection of problems under consideration. We represent the claims problem for two individuals with $c_1 < c_2$ in Figure 1 below.

Figure 1. Claims Problem for $|N| = 2$ and $c_1 < c_2$.



Our objective is to find a solution that assigns a list of "awards" to each claimant, such that their sum of awards equals the resource. We further assume that each claimant receives an award that is non-negative and no greater than their claim. Formally, for each problem (c, E) a vector $x \in R_+^N$ is awarded such that $0 \leq x \leq c$ and the division is balanced, i.e., $\sum_{i\in N} x_i = E$ The set of awards vectors for a problem (c, E) is denoted by $X(c, E)$. A division rule is represented as a function denoted by S, which assigns an awards vector in $X(c, E)$ to each problem (c, E). For a two-person problem, the division rule can be represented by *path of awards*, denoted by $p^S(e)$ for the division rule $S(c, E)$, where $e \in [0, \sum_{i\in N} c_i]$, as shown in Figure 2 below.

Figure 2. $p^S(e)$, the path of awards for the division rule $S(c, e)$ for $|N| = 2$ and $c_1 < c_2$ where $e \in [0, c_1 + c_2]$.



3. Division Rules

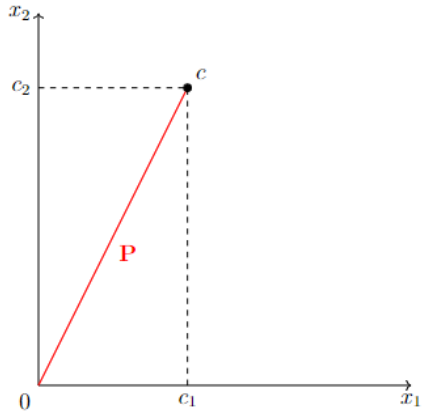
In this section, we will present the most prominent division rules in the literature. Their axiomatic characterization will be provided in Section 4.

Proportionality has been the primary method for handling simple division problems for a long time, as documented in history. Aristotle, who is frequently quoted in this context, considered proportionality as equity as his maxim states: "A just act necessarily involves at least four terms: two persons for whom it is in fact just, and two shares in which its justice is exhibited. And there will be the same equality between the shares as between the persons, because the shares will be in the same ratio to one another as the persons ... What is just in this sense is what is proportional and what is unjust is what violates the proportion."

Accordingly, the proportional rule in claims problems ensures that each claimant should receive a share of the available resources that is proportional to their claim. The proportional rule embodies Aristotle's idea that equals should be treated equally and unequals unequally, by distributing resources in proportion to the size of each claim. In this way, the proportional rule ensures that each person receives a share that is proportional to their contribution to the situation, and thus achieves a sense of justice and equity.

The Proportional (P) Rule: For all $(c,E) \in C^N$, $P(c,E) = \lambda E$ where $\lambda = \frac{c}{\sum_{i\in N} c_i}$

Figure 3. The path of awards for the proportional rule where $c_1 < c_2$.

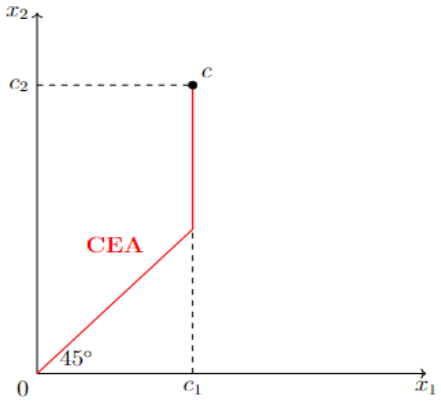


We can view proportional division as a type of equal division. Specifically, in the context of resolving competing claims, proportional division treats all "units of claims" equally, regardless of who holds them, and allocates these units equally among claimants. Each claimant is then awarded partial payments corresponding to the units allocated to them.

We are now shifting our attention from equal division based on equality per unit of claim to equal division in absolute terms. The next rule retains the idea of equal division provided that no individual receives more than their claim. Numerous medieval scholar such as Maimonides has advocated this rule.

The Constrained Equal Awards (CEA) Rule: For all $(c,E) \in C^N$, $CEA(c,E) = (min\{c_i,\lambda\})_{i\in N}$, where $\lambda \in \mathbb{R}_+$ is such that $\sum_{i\in N} min\{c_i,\lambda\} = E$.

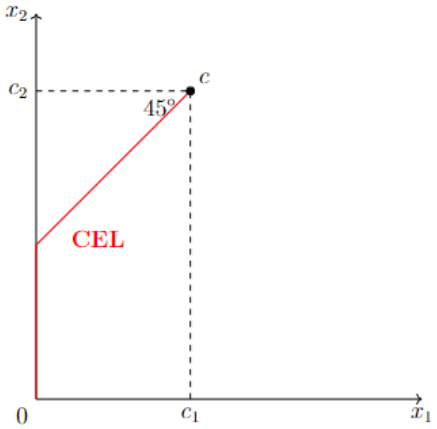
Figure 4. The path of awards for the CEA rule where $c_1 < c_2$.



The next rule shares similarities with the constrained equal awards rule in that it promotes the concept of equality. However, it takes a different perspective by focusing on the losses experienced by claimants instead of what they receive. The rule attempts to make losses as equal as possible while ensuring that no one receives a negative amount. This rule has been mentioned in Maimonides' writings as well.

The Constrained Equal Losses (CEL) Rule: For all $(c,E) \in C^N$, $CEL(c,E) = (max\{c_i - \lambda, 0\})_{i\in N}$ where $\lambda \in \mathbb{R}_+$ is such that $\sum_{i\in N} max\{c_i - \lambda, 0\} = E$.

Figure 5. The path of awards for the CEL rule where $c_1 < c_2$.



Both the CEA and the CEL rules aim to equalize, respectively, the awards x_i and the losses $(c_i - x_i)$ across individuals while respecting the feasibility constraints of the division rule. It is easy to see that $CEA(c,E)$ is the unique solution that maximizes the leximin ordering over awards, which lexicographically maximizes the smallest coordinate x_i, then the next-smallest coordinate, and so on.[1] Similarly, $CEL(c,E)$ is the unique maximizer of "leximin" ordering applied to the vector of losses $(c_i - x_i)$.

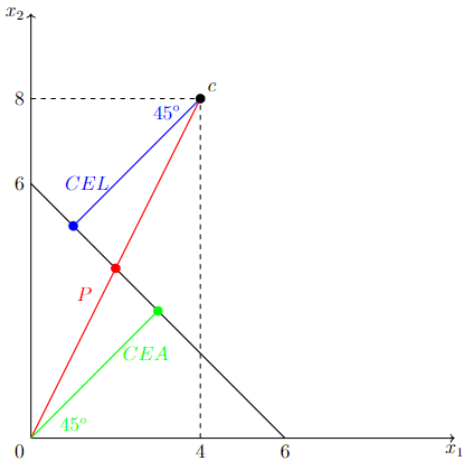
Example. Let us provide an example to illustrate the three main rules defined above. Consider a bankruptcy problem with an estate value of $E = 6$. Individual 1 has a claim of $c_1 = 4$, and individual 2 has a claim of $c_2 = 8$. Under the proportional rule, the estate is divided in proportion to the claims, meaning each individual would receive half of their claims. In this case, individual 1 would receive $x_1 = 2$, and individual 2 would receive $x_2 = 4$. Alternatively, under the CEA rule, the awards are equalized, resulting in $x_1 = x_2 = 3$. Both individuals would receive an equal share of 3. On the other hand, the CEL rule equalizes the losses, which means the difference between the claim and the award is the same for both individuals. In this scenario, $c_1 - x_1 = c_2 - x_2 = 3$. As

[1] To formally define the lexicographic ordering, let $x, y \in \mathbb{R}^n$ and let $x^*, y^* \in \mathbb{R}^n$ be obtained by rearranging the coordinates of x, y in increasing order. We say x and y are indifferent with respect to leximin ordering if $x^* = y^*$. We say that x is preferred to y with respect to leximin ordering if there exists an integer $m = 0,1,\dots,n-1$ such that $x_i^* = y_i^*$ for $i = 1,2,\dots,m$ and $x_{m+1}^* > y_{m+1}^*$.

a result, individual 1 would receive $x_1 = 1$, while individual 2 would receive $x_2 = 5$.

In Figure 6, we present the path of awards for P, CEA, and CEL rules based on the example mentioned above.

Figure 6. The path of awards for P, CEA, and CEL rules where $E = 6$, $c_1 = 4$, $c_2 = 8$.



The issue commonly referred to as the *contested garment problem* concerns a dispute between two individuals over the rightful ownership of a garment, which leads to conflicting claims regarding its value. The question then arises as to how the value of the garment should be fairly distributed between the two parties. A solution to this problem is presented in a passage from the Talmud, which states that in the case where "Two hold a garment... If one of them says, "It is all mine", and the other says "Half of it is mine", ... the former receives three quarters and the latter receives one quarter."[2]

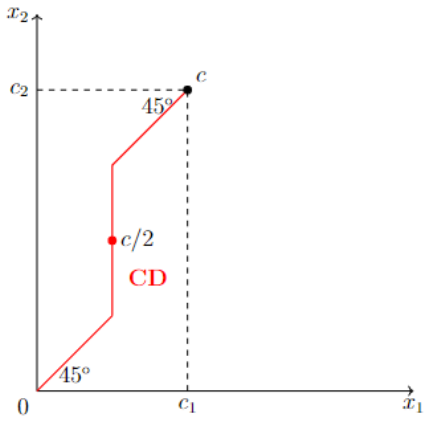
To formally define the rule, let us consider a scenario involving two claimants, represented by i and j. In this scenario, each claimant specifies a claim value, denoted by c_i and c_j, respectively. The fundamental principle behind the rule is that if one claimant specifies a claim value, they are effectively conceding the remaining value to the other claimant. More specifically, if $E - c_1$ is non-negative, then claimant i concedes the amount $E - c_i$ to claimant j, and if $E - c_i$ is negative, then claimant i concedes nothing to claimant j. Similarly, if $E - c_j$ is non-negative, then claimant j concedes the amount $E - c_j$ to claimant i, and if $E - c_j$ is negative, then claimant j concedes nothing to claimant i.

In the first step of the rule, each claimant is assigned the amount that the other has conceded to them. In the second step, the remaining value, which is the part that is truly contested, is divided equally between the claimants.

The Concede-and-Divide (CD) Rule: Let $|N| = 2$. For all $(c, E) \in C^N$,

$CD_i(c, E) = max(E - c_j, 0) + \frac{E - max(E - c_j, 0) - max(E - c_i, 0)}{2}$ for all distinct $i, j \in N$.

Figure 7. Path of awards for the CD rule where $c_1 < c_2$.



We will now introduce a division rule that can be viewed as a generalization of the CD rule for more than two claimants. Aumann and Maschler (1985) defined the *Talmud rule* to extend the rules in the Talmud to situations where there are more than three people. Although the Talmud doesn't provide an example for such cases, they found the underlying reasoning compelling, and the rule coincides with the recommendations for two people (contested garment problem) and three people (marriage contract problem)[3]. To define the Talmud rule formally, it involves dividing the claims in half and applying the CEA rule to each half until it is fulfilled. Then, the CEL rule is applied to the remaining half claims.

The Talmud (T) Rule: For all $(c, E) \in C^N$, and for all $i \in N$

$$T_i(c, E) = \begin{cases} min\left\{\frac{c_i}{2}, \lambda\right\} & \text{if } E \leq \frac{\sum_{i \in N} c_i}{2} \\ c_i - min\left\{\frac{c_i}{2}, \lambda\right\}, & \text{otherwise} \end{cases}$$

where $\lambda \in \mathbb{R}_+$ is such that $\sum_{i \in N} T_i(c, E) = E$.

[2] See Baba Metzia, Babylonian Talmud I. All references to the relevant passages of the Talmud and of the secondary literature are taken from O'Neill (1982), Aumann ve Maschler (1985), and Dagan (1996).

[3] Kethubot 93a by Rabbi Nathan: If a man who was married to three wives died and the kethubah of one was one maneh (100 zuz), of the other two hundred zuz, and of the third three hundred zuz, and the estate (was worth) only one maneh (one hundred zuz), the (the sum) is divided equally. If the estate (was worth) two hundred zuz (the claimant) of the maneh (one hundred zuz) receives fifty zuz (and the claimants respectively) of the two hundred and three hundred zuz (receive each) three gold denarii (seventy-five zuz). If the estate (was worth) three hundred zuz (the claimant) of the maneh receives fifty zuz and (the claimant) of the two hundred zuz (receives) a maneh (one hundred zuz) while (the claimant) of the three hundred zuz (receives) six gold denarii (one hundred and fifty zuz). Similarly, if three persons contributed to a joint fund and they had made a loss or profit they share in the same manner.

Now, we focus our attention on the family of rules introduced by Young (1987), known as parametric rules. To formally define this family, we represent each function f in Φ as follows: $f: \mathbb{R}_+ \times (\underline{\lambda}, \bar{\lambda}) \to \mathbb{R}_+$, where $-\infty \leq \underline{\lambda} < \bar{\lambda} \leq \infty$. These functions are continuous and non-decreasing with respect to their second argument. Additionally, for every $c_0 \in \mathbb{R}_+$, they satisfy the conditions $f(c_0, \underline{\lambda}) = 0$ and $f(c_0, \bar{\lambda}) = c_0$.

To apply this definition to a problem $(c, E) \in C^N$, we determine λ such that the sum of the values taken by the functions $\{f(c_i, .)\}_{i \in N}$ when their second argument is λ equals E. We then choose the vector $\{f(c_i, \lambda)\}_{i \in N}$ as the awards vector. It is formally defined as follows:

The Parametric (PAR) Rules: For all $(c, E) \in C^N$, $f(c, E) = (f(c_i, \lambda))_{i \in N}$ where $\lambda \in \mathbb{R}_+$ is such that $\sum_{i \in N} f(c_i, \lambda) = E$.

We can interpret $f(c_0, \lambda)$ as the reward needed for an individual with a claim of c_0 to attain a welfare evaluation at λ. This evaluation remains independent of the individual's identity, as well as the identities of other claimants with their respective claims. Consequently, parametric rules exhibit the consistency principle, which will be further discussed in the next section. It is worth noting that the parametric rules family encompasses a substantial number of division rules, among which are the aforementioned rules, namely the proportional, CEA, CEL, and Talmud rules.

4. Axiomatic Characterizations

This section presents axiomatic characterizations of the rules introduced in the previous section. Our first set of axioms consists of nonnegativity, balance, and claim boundedness, which are assumed as a definition of the rule. Here we are presenting them as separate axioms.

Our first axiom is that a rule should allocate the entire endowment for each problem.

Balance: For all $(c, E) \in C^N$, $\sum_{i \in N} S_i(c, E) = E$.

The next axiom ensures that no individual receives a negative amount.

Non-negativity: For all $(c, E) \in C^N$, $S_i(c, E) \geq 0$ for all $i \in N$.

The following axiom establishes an upper bound on awards, stating that each individual should receive at most his claim.

Claim boundedness: For all $(c, E) \in C^N$, $S_i(c, E) \leq c_i$ for all $i \in N$.

All three axioms presented above are fundamental to the definition of the rule and are highly relevant to the context of claims problems such as bankruptcy and inheritance discussed in the introduction. These axioms embody crucial aspects of fair division, and it is difficult to conceive of a rule that does not adhere to them.

The axioms discussed in this section revolve around a fundamental notion in the theory of fair allocation, which asserts that agents with similar characteristics should be treated equally. However, when agents differ in dimensions that are not accounted for in the model, unequal treatment may be necessary. Our subsequent axiom encapsulates this fundamental concept of symmetry. Note that all the rules defined in Section 3 satisfy this axiom.

Equal treatment of equals: For all $(c, E) \in C^N$, and for all $\{i, j\} \subseteq N$, if $c_i = c_j$ then $S_i(c, E) = S_j(c, E)$.

Our next axiom establishes a lower bound for a claimant's award in a problem. This lower bound is based on the difference between the endowment and the sum of the claims of the other agents, if this difference is non-negative, and 0 otherwise. Formally, $m_i(c, E) = max\{E - \sum_{j \neq i} c_j, 0\}$ represents the minimal right of individual i. We require that each claimant receive at least his minimal right.[4]

Minimal rights lower bounds on awards: For all $(c, E) \in C^N$, $S_i(c, E) \geq m_i(c, E)$ for all $i \in N$.

Our next requirement on a rule is that, for each problem, it is possible to calculate the awards vector either directly or in two steps, as follows: in the first step, the rule assigns to each claimant their minimal right. In the second step, the rule revises the claims down by the minimal rights and distributes the residual endowment. The revised claims are ensured to be non-negative, and their sum is at least as large as the remainder, making the problem of the second step well-defined.

Minimal rights first: For all $(c, E) \in C^N$, $S(c, E) = m(c, E) + S(c - m(c, E), E - \sum_{i \in N} m_i(c, E))$.

Our next axiom is an invariance property which stipulates that for each problem, truncating claims at the endowment should not affect the awards vector it chooses. Given $(c, E) \in C^N$, let the truncated claim of individual i be denoted by $t_i(c, E) = min(c_i, E)$.[5]

Claims truncation invariance: For all $(c, E) \in C^N$, we have $S(c, E) = S(t(c, E), E)$.

We will now introduce two more invariance axioms concerning changes in the endowment. The first axiom, known as "composition down", applies to situations where the endowment decreases. In this scenario, there are two possible approaches: one can either cancel the initial division and reapply the rule to obtain new awards based on the revised value, or use the awards calculated based on the initial value as claims and reapply the rule to divide the revised value. The

[4] The minimal rights lower bounds axiom is satisfied by all rules satisfying balance, non-negativity, and claim boundedness.

[5] The concept of truncation was initially presented by Aumann and Maschler (1985). Claims truncation invariance was later introduced by Curiel et al. (1987), and subsequently proposed as a formal axiom by Dagan (1993).

"composition down" axiom ensures that both approaches result in the same awards vector.[6]

Composition down: For all $(c, E) \in C^N$, and $E' < E$, we have $S(c, E') = S(S(c, E), E')$.

We now turn our attention to the opposite scenario of what we considered above. The "composition up" axiom applies to situations where the endowment decreases. In this new situation, we have two options similar to those we discussed earlier. The first option is to cancel the initial division and apply the rule again to divide the revised value. The second option is to let the claimants keep their initial awards, adjust their claims based on these awards, and reapply the rule to divide the incremental value. This would result in each claimant receiving their assignment in two installments. As before, the "composition up" axiom requires that both options result in the same awards vector.[7]

Composition up: For all $(c, E) \in C^N$, and $E' > E$ such that $\sum_{i \in N} c_i \geq E'$, we have $(c, E') = S(S(c, E), E')$.

Before we start with our axiomatic characterizations, it is crucial to highlight the significance of "duality" in claims problems, as it profoundly influences our analysis. A "claims problem" can be approached from two distinct perspectives. The first perspective centers on the resources that are available, while the second perspective focuses on the deficit, which represents the difference between the total claims and the available resources. This notion of "symmetry" between the perspectives becomes evident in definitions like the constrained equal awards and constrained equal losses rules. This symmetry is also fundamental to the lower and upper bounds, as well as the two composition properties. We define two problems as dual if they share identical claims vectors, and the endowment in one problem is equivalent to the deficit in the other.

Dual of rule $S = S^d$: For all $(c, E) \in C^N$, $S^d(c, E) = c - S(c, \sum_{i \in N} c_i - E)$

It is important to note that the constrained equal awards (CEA) and the constrained equal losses (CEL) rules are dual rules to each other. A rule is considered self-dual when its dual is equal to itself, i.e., $S^d = S$. From a geometric perspective, self-duality can be interpreted as the path of awards demonstrating symmetry in relation to half of the claims. It is worth mentioning that both the proportional rule and the Talmud rule are self-dual.

The concept of duality can be extended to properties of rules as follows: Two properties are considered dual if whenever a rule satisfies one of them, its dual satisfies the other. Notably, the properties of "non-negativity" and "claim boundedness" are dual to each other. Similarly, the properties of "truncation invariance" and "minimal rights first" are dual to each other. Likewise, the properties of "composition down" and "composition up" exhibit duality. A property is self-dual if it is identical to its dual. For instance, the property of "equal treatment of equals" is a self-dual property.

Now we will start with the characterization of the constrained equal awards (CEA) rule which is due to Dagan (1996).

Theorem 1. The constrained equal awards (CEA) rule is the unique rule satisfying equal treatment of equals, claims truncation invariance, and composition up.

The next characterization theorem is the dual of the theorem mentioned above, wherein we replace each rule and property with its dual counterpart.

Theorem 2. The constrained equal losses (CEL) rule is the unique rule satisfying equal treatment of equals, minimal rights first, and composition down.

Next, we give a characterization of the concede-and-divide (CD) rule, which is self-dual and can be regarded as a hybrid of the constrained equal awards (CEA) and constrained equal losses (CEL) rules. This characterization is provided in Dagan (1996).

Theorem 3. For $|N| = 2$, the concede-and-divide (CD) rule is the unique rule satisfying equal treatment of equals, claims truncation invariance, and minimal rights first.

The concede-and-divide (CD) rule can be also characterized by minimal rights first and self-duality. Additionally, by the use of duality, its characterization can be achieved by combining claims truncation invariance and self-duality.

Now, we will provide a characterization of the proportional rule which is due to Young (1988).

Theorem 4. The proportional rule is the unique rule satisfying composition up and self-duality.

Furthermore, through the application of duality, another characterization of the proportional rule can be achieved by combining composition down and self-duality.

Finally, we proceed to present the axiomatic characterization of the parametric rules. To achieve this, we introduce the consistency axiom, which basically states that if we remove one individual (or multiple individuals) from society N, along with the resources allocated to these individual(s) within N, the allocation of shares within the reduced society remains unchanged.

To formally define the concept of consistency, let N represent the initial population of claimants, $(c, E) \in C^N$ the problem they encounter, and $x = S(c, E)$ be the awards vector chosen by the rule S. Now, consider a scenario where some claimants leave with their respective awards, and let $M \subset N$ denote the population of remaining claimants. Consider the

[6] Moulin (1987) introduced this axiom as "path independence" for surplus sharing problems, while Moulin (2000) referred to it as "upper composition".

[7] Young (1988) introduced the "composition" axiom in the context of taxation, while Moulin (2000) refers to it as the "lower composition" property.

reduced problem of (c_M, E_M) where c_M is the claim vector of the remaining individuals with the residual endowment of $E_M = \sum_{i \in M} x_i$. In this reduced problem, we demand that the rule assigns to each $i \in M$ the same amount as initially, namely x_i.

Consistency: For all $M \subset N$, and all $(c, E) \in C^N$, if $S(c, E) = x$, then $S(c_M, \sum_{i \in M} x_i) = x_M$.

To achieve the desired characterization, we should introduce the continuity axiom, which stipulates that small changes in the data of the problem being solved should not result in large changes in the awards vector.

Continuity: For all sequences $\{(c^t, E^t)\}$ and for all $(c, E) \in C^N$, if $(c^t, E^t) \to (c, E)$ then $S(c^t, E^t) \to S(c, E)$.

Finally, we are ready to present the characterization of the parametric rules, which is due to Young (1987).

Theorem 5. The parametric rules are the only rules satisfying equal treatment of equals, continuity, and consistency.

5. Conclusion

The claims problem is a fundamental problem that arises in many real-life situations, such as estate division, bankruptcy, rationing, and taxation. The allocation of a resource among competing claimants requires the use of a division rule, which is determined based on a set of axioms that capture important properties such as efficiency, fairness, monotonicity, and consistency.

In this paper, we have presented a survey of various well-known division rules from the literature and provided axiomatic characterizations for them. The axiomatic approach has allowed us to examine the logical connections between different properties and to obtain comprehensive and explicit descriptions of which rules or families of rules satisfy all the compatible properties.

In summary, the claims problem remains a vibrant area of research that continues to attract the attention of economists, mathematicians, and computer scientists. The axiomatic approach has been a valuable tool for studying this problem, and we hope that this brief survey has provided a useful introduction to this approach and to the different division rules that have been proposed.

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