The Transformative Effects of AI on International Economics

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1. Introduction

It is clear that artificial intelligence (AI) is a transformative force of a magnitude that will greatly affect the lives of humans in the decades to come. While media attention around the topic has truly ramped up only since Open AI's public release of ChatGPT in 2022, AI technologies are already widely employed within healthcare, retail, banking, manufacture and several other sectors. Having established the importance of AI in the years up ahead raises essential follow-up questions in most fields of research, including economics, to which this paper belongs. What exactly is coming, and what does it imply for the world's economies and the field of economic theory? Is AI a force of infinite wealth to be welcomed, or is it just hype, to be treated with caution? This literature review formulates two research questions:

Firstly, it asks, what does the path towards transformative AI look like, and what is the timeframe within which we can expect to see such effects take place? Secondly, it inquires, how much wealth can AI create, and how will that wealth be shared?

Throughout the review, a specific focus will be dedicated to international trade for two reasons. It has been identified that the sectors most impacted by AI are also the most tradeable sectors. At the same time, research on AI's impacts through international value chains, and attempts at integrating AI into international trade theory is rather limited. As such, an international trade lens was deemed valuable.

Los efectos transformadores de la IA en la economía internacional

Introducción

Está claro que la inteligencia artificial (IA) es una fuerza transformadora de una magnitud que afectará en gran medida la vida de los seres humanos en las próximas décadas. Si bien la atención de los medios en torno al tema realmente ha aumentado solo desde el lanzamiento público de ChatGPT por parte de Open AI en 2022, las tecnologías de IA ya se emplean ampliamente en la atención médica, el comercio minorista, la banca, la fabricación y varios otros sectores. Una vez establecida la importancia de la IA en los próximos años, surgen preguntas de seguimiento esenciales en la mayoría de los campos de investigación, incluida la economía,

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a la que pertenece este artículo. ¿Qué es exactamente lo que viene y qué implica para las economías del mundo y el campo de la teoría económica? ¿Es la IA una fuerza de riqueza infinita que debe ser bienvenida, o es solo una exageración que debe tratarse con cautela? Esta revisión de la literatura formula dos preguntas de investigación:

En primer lugar, se plantea la cuestión de cómo es el camino hacia una IA transformadora y en qué plazo podemos esperar que se produzcan esos efectos. En segundo lugar, se plantea la cuestión de cuánta riqueza puede crear la IA y cómo se repartirá esa riqueza.

A lo largo de la revisión, se dedicará un enfoque específico al comercio internacional por dos razones. Se ha identificado que los sectores más afectados por la IA son también los sectores más comercializables. Al mismo tiempo, la investigación sobre los impactos de la IA a través de las cadenas de valor internacionales y los intentos de integrar la IA en la teoría del comercio internacional son bastante limitados. Por lo tanto, se consideró valioso un enfoque del comercio internacional.

人工智能对国际经济的变革性影响

导论

人工智能(AI)显然是一种巨大的变革力量，将在未来几十年极大地影响人类的生活。尽管自2022年Open AI公开发布ChatGPT以来，媒体对这一话题的关注才真正升温，但AI技术已广泛应用于医疗保健、零售、银行、制造业和其他几个行业。确定了AI在未来几年的重要性后，引出了在大多数研究领域（包括本文所属的经济学）中的重要后续问题。究竟会发生什么，这对世界经济和经济理论领域意味着什么？AI是一种值得欢迎的无限财富力量，还是只是炒作，需要谨慎对待？本篇文献综述提出了两个研究问题：

第一，通往变革性AI的道路是什么样的，我们能预期在什么时间范围内看到这种影响发生？第二，AI能创造多少财富，这些财富将如何被分享？

整个综述过程将特别关注国际贸易，原因有二。研究发现，受AI影响最大的行业也是最能进行贸易的行业。同时，鲜有研究聚焦于AI通过国际价值链产生的影响，以及将AI融入国际贸易理论的尝试。因此，国际贸易视角被认为是有价值的。

2. How does the path towards transformative AI look and what is the timeframe within which we expect such changes to take place?

2.1 What is transformative AI?

Before embarking on the path towards transformative AI, a precise understanding of its definition is required. “Transformative AI”, has been described in several ways, such as “*…potential future AI that precipitates a transition comparable to (or more significant than) the agricultural*

or industrial revolution" (Karnofsky, 2016), or "*…advanced AI that could lead to radical changes in welfare, wealth or power*" (Dafoe, 2018).

The most comprehensive review of what transformative AI actually entails, however, can be found in Gruetzemacher and Whittlestone (2022), who break down its definition into three levels of impact: narrowly transformative AI, transformative AI, and radically transformative AI. For the purpose of this study, their definition of transformative AI, namely "*Any AI technology or application with potential to lead to practically irreversible change that is broad enough to impact most important aspects of life and society*.", which, according to the authors may be indicated by "*…a pervasive increase in economic productivity*" (Gruetzemacher & Whittlestone, 2022), is chosen.

2.2 Integrating AI impacts into economic theory

Another necessary step in answering the questions above is briefly examining attempts at integrating AI impacts into economic theory in general, and trade theory in specific. A function popularly used in literature is the Cobb Douglas production function, which describes output as a function of labour and capital. Building on these theoretical fundamentals, Allan Dafoe (2018) created an AI production function, where AI development is deduced as a function of data, talent, compute, time, investment and other indicators such as prior progress and achievements. The use of a modified Cobb Douglas function of that nature however is questioned by some, due to its limits in accounting for shared dependencies and interactions between the various factors of production, or in this case, AI development. Langenkamp (2022) suggests the use of Wardley Maps instead which are built around a three-step process of describing the case, defining technological capabilities and finally ordering capabilities on a map. Perhaps the most ambitious attempt to date however comes from Trammell and Korinek (2023), who focus on three types of transformative AI impacts in economics, namely output growth, wage growth and on the labour share, aiming to bridge the gap between shorter-term economic theory and more longtermist thinking using a variety of theoretical scenarios.

As for attempts at integrating AI impact into international trade theory, literature is still very limited. The only paper identified in this review is by Hazari et al. (2022) who use a Jones and Manuelli production function to introduce effects of automation and AI into an international trade framework. Both Trammell and Korinek (2023), as well as Hazari et al. (2022)'s work will be covered in more detail at a later stage in this review.

2.3 Supply chain and sectoral perspectives from international trade

When trying to predict the path of transformative impacts of AI on international trade, a supply chain/sectoral perspective is worth discussing. A twofold, yet intertwined dilemma is

presented: Firstly, what are the sectors which produce things that can be used as inputs to an AI-based transformation? Secondly, which sectors are most likely to be enhanced by AI technology first, or, put differently, in which sectors are AI innovations the most common? It is clear for example, that the manufacturing sector will be heavily affected, as it uses for instance sensors, IoT devices, advanced analytics and, now also AI, to function in the most efficient way possible (Manyika et al., 2017; Stackpole, 2020). At the same time, many of the outputs of the manufacturing sector, such as sensors and chips are being increasingly used to aid the ever-increasing hunger of AI for data and computation.

Process industries like agriculture, chemicals, metals and mining too, have a lot to benefit from AI technologies, such as AI-powered demand sensing (Ferencz et al., 2022). These sectors don't necessarily produce direct inputs into AI, but their output moves through value chains to the manufacturing sectors, which then in turn supply AI with inputs. An enhancement of efficiency can also be seen in service supply chains, where AI offers personalized recommendations, customer support and other innovations (Ferencz et al., 2022).

A further important perspective concerns the observation that AI innovations are highest for sectors which are also the most tradable, hence the most deeply integrated into global value chains. As found by Ferencz et al. (2022), sectors with the highest foreign value added in final demand, a measure for global value chain integration, also have the highest patents, trademarks and publications share in AI innovations.

What can be concluded from the above? Firstly, we can expect AI impact to happen both through forward and backward linkages in global value chains. Furthermore, we have some idea of the sectors that will be impacted and will impact the AI transformation the most. We also know that AI and international trade are heavily interlinked, as the most tradeable sectors are the ones most impacted by AI. One key question however remains: How quickly can we expect the transformative impacts of AI to appear?

2.4 Turning to past disruptions

If we attempt to take a global value chain perspective in tackling the above question, using similar datasets from the OECD which Ferencz et al. (2022) used for tradability, we don't get very far. Databases such as the ICIO (Inter-Country Input Output Tables), and the Leontief input-output methodologies behind it can show the ultimate effects of shocks to the global economy (and individual countries and sectors) however they do not provide any time perspective of when these are expected to happen.

One option is to turn to past technological disruptions and assume that AI impacts will look somewhat similar. Mateos-Garcia (2020) theorizes that AI impacts will take longer to materialize than newspaper headlines make us believe. Jobs will not disappear completely, but will rather change and

evolve over time, similarly to the evolution of the internet. He argues that prediction machines like AI do not only increase the amount of decisions to be made based on AI recommendations, but also the number of decisions which need to be made in order to integrate AI into our economies and societies in a safe and regulated manner. More about the decision-making bottleneck will be discussed below, however the comparison of the AI revolution to the impacts of the internet should be nuanced. On August 6, 1991 the World Wide Web as we know it became commercially available to consumers (Bryant, 2011), and it reached a hundred million users in a little over 8 years, or about 100 months later, on November 12, 1999 (The New York Times, 1999). Meanwhile, Bing AI, powered by Open AI's ChatGPT engine reached 100 million users in about a month (Mashable, 2023). While the above is undeniably not a completely fair comparison, it may give us an indication regarding the sheer magnitude of the rate of AI adoption.

2.5 Feedback loops

Another way to attempt to quantify the leap towards transformative AI is by investigating feedback loops. One such loop is linked to the automation of computer production. If AI could theoretically replace all the labour needed in the production of computers, it could technically produce itself, which would fuel a loop leading potentially to exponential growth in adoption. This review did not find any research exploring such a scenario with a time frame included. According to a study by McKinsey Global Institute, half of today's work activities could be automated by 2055 (Manyika et al., 2017). In addition, it is predicted that physical activities, such as those found in manufacturing have the highest (81 percent) automation potential. Krishanswamy meanwhile explores the possibility of fully automating semiconductor assembly and testing. He concludes that full (level 5) automation is no longer an unreachable myth but provides no timeline for when this could be achieved. A last perspective stemming from the field of molecular biology comes from Kriegman et al (2021), who managed to create an AI designed, self-replicating and configurable organism called a xenobot, which marks one of the very first steps towards a future where self-replication of organisms is no longer just a concept of science fiction.

Feedback loops however need not to be limited to manufacturing but can also be knowledge based. Davidson (2021) explores how AI could affect growth over the long term. He introduces an additional feedback loop apart from the well-known *more ideas → more people → more ideas*, which has traditionally driven economic growth. The new loop, *more ideas → more AI systems → more ideas* could potentially lead to exponential growth, and thus significant impacts of AI on the world. Davidson (2021) assigns a higher than 30% probability that human-level AI has been developed in time for economic growth to reach 30 percent by the year of 2100. Furthermore, he theorizes that over a third of that growth would happen due to the birth of human-level AI.

2.6 Bottlenecks

A further approach that can be taken is to consider possible bottlenecks for rapid AI adoption. These, along with an evaluation of their solvability can provide us with valuable information regarding the feasibility of transformative AI within the next decades.

Bottlenecks can be broadly classified into four categories: supply chain, regulatory, technological, and knowledge based. To keep up with exponential economic growth, inputs to production such as raw materials (Davidson, 2021), will need to be extracted, as well as intermediate products, such as chips and semiconductors will need to be produced, at a rate that can keep up. In addition, logistics lines and power grids will also need to be scaled up to a very significant extent. Next, as covered earlier, the number of decisions on how to safely integrate AI into our economies and societies will vastly increase (Mateos-Garcia, 2019). This also relates to Davidson (2021)'s argument regarding the possibility that humanity will simply decide to harness the potential of AI in a sustainable and more controlled way, even if it was possible to choose exponential growth. Furthermore, technical and technological limits, such as a roof to the type and percentage of tasks automatable by AI, or the requirement of technologies for upscaling that we do not yet possess could slow down progress (Davidson, 2021). Finally, perhaps too few new innovations will be made and too slowly, and perhaps we will lack the resources to upskill and reskill people at a rate fast enough to keep up. All of the above could prove to be detrimental for fast paced, AI supported growth, however at the same time, many could be alleviated by AI technologies themselves.

2.7 AI problems require AI solutions?

When it comes to specific benefits of AI for economies, the literature is fairly vast, and some of the improvements discussed could alleviate, or completely eliminate bottlenecks discussed above. For instance, AI helps the development of more proactive and efficient global supply chains through its predictive capabilities (Jayathilaka, 2022; Achar, 2019; Ferencz et al, 2022), which may alleviate supply chain and logistical bottlenecks. AI is also used for boosting the efficiency of compliance software, streamlines contract creation (through simplifying legal language) (Jayathilaka, 2022; Jones, 2023), and bolsters trade negotiations (through advanced translation) (Achar), all of which could reduce regulatory and decision burdens. Furthermore, technological capabilities already are, and will be further improved using AI technology, such as significant advances in computing power and decreasing costs (Anderson & Rainie, 2018). Finally, AI is to an increasing degree used for education management and delivery. AI technologies can both be employed to reduce regulatory and administrative burden on educators, freeing up precious time for teaching, as well as enhance students' learning through adaptive learning techniques (Miao et al., 2021).

3. How much wealth can transformative AI create and how will that wealth be shared?

Based on the first part of this review, it is clear that while faced with large uncertainty, and several bottlenecks, AI has the potential to strongly boost the efficiency of global value and production chains and bring about strong economic growth. Is it possible however to predict how much wealth transformative AI can create and how that wealth will be shared?

3.1 Scenarios of growth

Predicting how much growth a technology in its beginning stages can bring to the world economy is exceedingly difficult, hence we must rely on scenario building and assumptions. Furthermore, outcomes vary widely depending on the type of model used. Both Davidson (2021) and Trammell and Korinek (2023) employ various models in their analyses, such as complete or partial substitution of AI into a production function, inclusion of AI into task-based functions, as well as standard and exogenous growth models. While a variety of scenarios are used, broadly speaking we can discern between three main ones: standard growth, explosive growth and stagnation. Standard growth is exponential, as has been over the last 150 years, meanwhile explosive growth can be much higher than that. Combined with historical evidence concerning the increasing pace of growth, and the above detailed idea-based feedback loops leads Davidson (2021) to assign a 10 percent probability to explosive growth occurring by 2100. Trammell and Korinek (2023) conclude that AI aided explosive, even super-exponential growth is possible for a certain time, until production reaches limiting factors such as energy production or land usage. Still, Trammell and Trammell and Korinek (2023) note that as of now, we can't put a timeframe to transformative impacts from AI, if these even were to take place.

Apart from standard and explosive growth scenarios, both Davidson (2021) and Trammell and Korinek (2023) consider possibilities of stagnation, and they also introduce an interesting and relevant gap between futurist research and economic theory, noting the absence of considerations regarding existential risks of AI. This omission, they argue, is not due to lack of interest, but rather the inherent challenges in incorporating such risks into growth models. More broadly, they theorize that the key here is the degree to which AI will replace human labour. As long as human labour will remain a bottleneck for AI growth, and AI self-replication feedback loops won't take place, humans will maintain control over AI, and not vice versa. Early attempts at bridging this gap have been made by Acemoglu and Lensman (2023), as well as Jones (2024). The former seek to predict optimal adoption rates of AI technologies by considering costs firms would incur in reverting back to non-AI technologies in the event of an AI catastrophe, while Jones (2024) employs welfare functions to trade off growth and existential risk. Future research in this field stands to benefit from more concrete forecasts of the costs incurred from various types of

AI disasters, for which, methodologies like inoperability analysis, originally developed for natural disasters (Haimes & Jiang, 2001; Santos & Jaimes, 2004) may prove useful.

A somewhat more concrete attempt at predictions of growth comes in the form of a 2018 discussion paper by Bughin et al. from McKinsey Global Institute. By 2030, the value-added gains boost stemming from AI is predicted to be 26 percent, with externalities and transition costs bringing the net impact to 16 percent. An important point brought forward in the paper is the magnifying power of competitive pressure on AI adoption. By 2030, competitive pressure is expected to boost AI adoption by 13 percentage points, from 25 to 48 percent (Bughin et al., 2018). Goldman Sachs Research, meanwhile, takes a more conservative stance, forecasting a cumulative boost to GDP of 7 percent in the period 2023-2033 (Goldman Sachs, 2023).

3.2 Scenarios of growth: Lessons from the history of general-purpose technologies

Predictions of significant short-term accelerations in productivity and growth may be somewhat nuanced by insights from studies on productivity gains from previous general-purpose technologies (GPTs). GPTs can be described as technologies that spread to all sectors of an economy, improve over time, and completely transform the ways in which we invent and produce (Bresnahan et. al, 1995). Examples include steam power, electricity and computers, which despite wide adoption did not yield significant productivity benefits, at least not in the short to medium term. Questions have been raised about whether this perplexing phenomenon, coined the Solow Paradox (Solow, 1987), might also apply to transformative AI (Brynjolfsson et. al, 2017; Ding & Dafoe, 2023). It is plausible that, akin to previous GPTs, the productivity benefits of AI will manifest only after a significant time lag, due to more time needed for its wide diffusion, and the development and implementation of complementary innovations like cloud infrastructure and service-based business models.

3.3 Trade frictions: lessons from the present and past

Many of the benefits that AI brings to global value chains have already been discussed above. Most of the examples brought up all have one common theme: reduction of trade frictions. Thus, taking a trade frictions perspective in attempting to answer how much wealth transformative AI can bring to the world economy is worthwhile.

In looking at the scene of online trade, some conclusions can be drawn. For example, it has been found that trade frictions caused by physical geographic distance when it comes to trade in goods are lower for online trade than for offline trade, with distance coefficients nearly halved (for the EU) of -0.747 for online, and -1.294 for offline trade (Gomez-Herrera et al, 2014). A study on a Norwegian dataset meanwhile found that a high degree of internet availability could actually

lead to a slight increase in elasticity of trade when it comes to distance, and thus make trade even more sensitive to distance than it was before (Akerman et al., 2018). It seems, given the above, that even when it comes to more historic technological advances such as the adoption of internet, consensus is lacking on whether, and if so, how much such technologies have reduced trade frictions. Much of this can most likely be attributed to the sheer magnitude and diversity of the online trading space, and the lack of datasets that might be used to tackle this problem.

That being said, even for AI, specific use cases can provide proof of concept for its potential in reducing trade frictions, specifically when it comes to AI language translation models. Brynjolfsson et al. (2018) found that the introduction of improved machine translation systems could increase international trade on eBay by 10.9 percent, a clear testament for the usefulness of AI in this specific case. While research in this field is still in its infancy, it can be expected that an increasing number of studies relating to specific cases will be published in the years to come. Provision of a macro perspective will however surely prove to be a difficult challenge.

3.4 Sectoral divide

When trying to answer the question of how AI induced wealth will be shared, it is a good exercise to take a sectoral perspective first. It is clear, as one might also have read in one of numerous media articles, that some sectors will benefit more from AI innovations than others. The list of sectors is long, and predictions varied, however a few clear winners, such as manufacturing, education, healthcare, agriculture, computer manufacturing and transport seem to emerge (Forbes, 2022; Miao et al., 2021; Ferencz et al, 2022). Based on earlier findings in this review, it can also be hypothesized that sectors in which AI innovations are the highest are also sectors where AI innovation is needed the most, and these are consequently also the most tradeable sectors.

Focus is therefore once again directed towards global value chains, and the role of international trade in progressing, or hindering AI induced growth. That being said, while hypothesizing about which sectors will be the most affected provides some value, this review is not aware of any papers that aim to quantify differences of magnitude in economic impact between sectors. In Bughin et al. (2018), the macroeconomic impact of AI is predicted to be 2.3 times the magnitude for telecom and high-tech sectors than healthcare, which is a substantial difference. It is also noted in the paper, that more firm- and sector-level data is needed for a more comprehensive analysis of sectoral impacts.

3.5 Country divide: Lessons of history

Another dimension to consider is the country divide, more specifically the gap between developed and developing countries. Will AI induced growth close the gap or widen it further? Again,

lessons of history should be examined, with internet access an obvious choice for a proxy. Again, literature seems to be scarce. According to a 2022 review by the World Bank, some studies have found that internet enabled technologies, such as mobile money in Kenya have managed to increase incomes and reduce poverty. Furthermore, five studies seem to support the theory that internet infrastructure has increased incomes and consumption in Africa. At the same time, it was also found that subsidizing internet access to individuals already possessing a phone contract, but who did not use roaming data, had limited effects on well-being (Hjort & Sacchetto, 2022). It is concluded that while research is scarce, effects seem to be promising.

3.6 Country divide: General predictions

Perhaps the most prominent perspective in research relating to sharing of AI induced wealth is that of a country divide, between developed and developing countries. Some findings are favourable towards developing countries. For instance, it is speculated that an AI aided shift towards more skill intensive industries could be utilized by developing countries to transform the structure of their own economies and can penetrate sectors that were not previously available to them, because their resources had been tied up (Kouka & Magallanes, 2022). It is also theorized that developing countries, which are more integrated into global value chains than developed ones (both backward and forward linkages of non-OECD countries are stronger than OECD economies'), will benefit greatly from reductions in international trade frictions (for instance through AI powered translation). In addition, reduced compliance costs and an overall decreased regulatory burden brought forward by AI technology can increase accessibility of trade financing (Jayathilaka, 2022), which in combination with reduced trade barriers could disproportionately benefit especially the least developed countries.

That being said, an overwhelming share of the research in the field points towards a bleak future for developing countries, if we follow the trajectory currently lined out. A common theme that can be identified is control over technology. Those who control the production (for example chip production), and those who control the development of AI technologies, and technologies adjacent to AI, will be the big winners of the next few decades. Firstly, as AI is introduced into economies and societies, those in control of the technology will have a very high economic and political bargaining power against those who don't (Brynjolfsson et al, 2019; Kouka & Magallanes, 2022).

Risks of onshoring also await developing countries. As AI enabled automation of production reduces the need for cheap labour, multinationals could choose to bring production closer to home, which can lead to further decrease on growth potential and comparative advantage for countries which depend highly on foreign direct investment (FDI) (Artuc et al, 2023; Spence, 2022). As a result, large labour market

adjustments would be needed, at a pace that many countries may not be able to keep up with. Further disparities may be created in developing countries through the widening gap between more advanced, internationally active firms that account for a large portion of exports and small informal firms that account for a large share of low skilled and manual employment (Artuc et al, 2023). Furthermore, as access to up to date, advanced databases becomes essential for competitiveness, SMEs, especially in less advanced economies, will suffer (Jayathilaka, 2022). Finally, obstacles of international law also prove to be detrimental. Tariff rates are the highest in developing countries, many of which do not participate in the WTO Information Technology Agreement. This in itself will act as a barrier for adoption of AI technologies via trade, as well as for the development of in-house AI technologies. Bughin et al. (2018) come to similar conclusions, where net GDP impact of AI adoption hovers around 20 percent for advanced economies, but doesn't even reach 10, for the least advanced economies by the year 2030.

3.7 Country divide: International trade theory perspective

A final perspective on wealth sharing can be examined through the only known attempt at integrating AI impacts into international trade theory. Hazari et al. (2022) find that AI could reverse trade patterns and lead to factor intensity reversals, resulting in the creation of a Leontief paradox (Hazari et. al, 2022). This finding resonates with the conclusions in Kiyota and Kurokawa (2021), who conclude that factor reversals already exist, based on an analysis of Japanese prefectural data. A factor intensity reversal essentially entails a scenario where the relative abundance of specific factors shifts in a direction opposite to a country's competitive advantage (Hillman, A.L. and Hirsch, 1979). A historical example of this is the decline in manufacturing in developed countries alongside its rise in developing countries, leading to a relative abundance of labour in developing countries, thus giving them a comparative advantage in manufacturing.

A Leontief paradox occurs when a country with a higher capital per worker ratio has a lower capital per labour ratio in exports rather than imports. In other words, if a country is labour abundant, it would have capital intensive exports and imports of labour-intensive goods. The exact implications of a scenario where developing countries experience factor intensity reversals are hard to predict. However, generally speaking, a factor reversal for developing countries would imply a shift away from their competitive advantage, namely exports of labour-intensive goods, and also be in line with predictions of increased onshoring by developed countries, putting developing countries under high pressure to adapt in a short amount of time.

4. Discussion and Summary

Perhaps the most overarching conclusion that can be drawn from this review is the need for more research. When it comes to integration

of AI into economic theory, we are very much at the beginning stages, and that applies to international trade especially. As for impacts of AI, specific use cases have been discussed in detail, however overarching perspectives weighing benefits against costs and timeframes have been provided to a much lesser extent, rather unsurprisingly so.

Still, some conclusions can be drawn, which are presented below. The path towards transformative AI looks complex, as expected. It seems that certain sectors will both be impacted and drive AI innovation to a larger extent than others, such as manufacturing and high technology. It is also clear that most of these sectors are highly tradeable, which implies the importance of international trade in driving AI innovation forward. Past disruptions such as the introduction of the internet point towards a more gradual adoption of AI, and thus more gradually appearing impacts. Yet, some examples, such as the adoption rate of Bing AI could imply that something entirely different is about to unfold. If certain feedback loops become reality, such as the self-replication of machines, or AI based rapid knowledge enhancement, a scenario of rapid integration of AI into our economies and societies could occur, where human level AI has been developed, and economic growth could reach 30 percent by the year 2100 (Davidson, 2021). Several supply chain, regulatory, technological, and knowledge-based bottlenecks stand in the way however, some of which could be solved or alleviated by AI technology itself, and some which can't.

Predicting how much wealth AI can create is difficult, too. We may employ various growth scenarios, starting from the current norm of exponential growth to explosive growth, or even stagnation. Some predict explosive growth to take place by 2100 with a 10 percent probability (Davidson, 2021), while others simulate a global value-added boost of 26 percent by 2030 (Bughin et al., 2018). Growth predictions in the short-to-medium term are further complicated by historical observations of similarly transformative technologies failing to produce promised productivity benefits, and the lack of research considering catastrophic AI impacts as a limiting factor.

Taking an international trade perspective, AI technologies show potential in reducing trade frictions, which could in turn reduce supply chain bottlenecks in the way of explosive growth. Still, more overarching studies are needed to be able to state this with any confidence.

The division of wealth created by AI can be viewed on for instance a sectoral level, or with a developed versus developing countries perspective (while recognizing that all countries are different and will need to make decisions on how to best parry the AI revolution based on their economies' individual characteristics). It can be speculated that sectors in which AI innovations are the highest, and which contribute the most to AI innovation, will see the most growth, and thus gain an increasingly dominant position in national and international value chains. Interestingly,

sectors with the highest level of AI innovation are also most integrated into global value chains, and therefore international trade will most likely become a key battling ground where rapid adoption of AI technologies will be one of the key factors to ensure competitiveness.

Looking at a historical perspective, we see some proof that the introduction of new technologies can create wealth in disadvantaged countries, however more research is needed for conclusive evidence. While AI technologies will surely bring some opportunities to such countries, such as the chance for a shift towards more skill intensive economies, and a reduction in trade frictions, the former may also lead to their doom, if they can't adapt on time. Furthermore, those in control of the knowledge, and manufacturing capabilities linked to AI will gain further bargaining power against those who don't. Lastly, as AI replaces increasing shares of the workforce, offshoring may turn to onshoring, further decreasing the competitive advantage for countries exporting labour intensive goods. It is estimated that the net impact on advanced economies from AI technologies will be up to 4 times larger than for the least advanced economies (Bughin et al., 2018).

Integration of AI impacts into international trade theory is still very limited, however emerging research raises the question: What may happen if the adoption of AI technologies leads to factor intensity reversals? The implications, again, for developing countries could be more negative than positive.

5. Conclusion

What then, can we conclude from the above? We are currently at a point where research in this field remains significantly underdeveloped. In other words, we do not yet fully comprehend the economic implications AI has in store for us. Some studies suggest the potential for explosive growth, which could greatly benefit the development of humanity. However, it is evident that more research, particularly with considerations of AI risk, and costs of AI-induced catastrophes is necessary to add nuance to the overly optimistic projections of current models. Additionally, based on the knowledge we currently possess, it appears that the divide between developed and developing countries will widen as a consequence of AI adoption.

In light of this, it is recommended to apply the precautionary principle and select a measured path of AI adoption. Policymakers should ensure that introduction of AI technologies into economies and societies happen in a controlled manner. Emphasis must be placed on AI safety and the numerous unknowns in this domain. Simultaneously, policy frameworks must be established to better equip developing countries for the transformative effects of AI. This can be achieved by ensuring their access to AI technologies, easing trade barriers for ICT goods, and preparing economic safety nets to mitigate labour market impacts. Rather than fully replacing labour, our focus should be on augmenting it with AI, thereby ensuring that the bargaining power of workers in less advantaged countries is preserved.

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