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WHY IS GREEN FINANCE IMPORTANT?

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Abstract

In 2017, global investment in renewables and energy efficiency declined by 3% and there is a risk that it will slow further; clearly fossil fuels still dominate energy investment. This could threaten the expansion of green energy needed to provide energy security and meet climate and clean air goals. Several developed and developing economies are still following pro-coal energy policies and the extra CO₂ generated by new coal-fired power plants could more than wipe out any reductions in emissions made by other nations. Finance is the engine of development of infrastructure projects, including energy projects. Generally financial institutions show more interest in fossil fuel projects than green projects, mainly because there are still several risks associated with these new technologies and they offer a lower rate of return. If we want to achieve sustainable development goals, we need to open a new file for green projects and scale up the financing of investments that provide environmental benefits, through new financial instruments and new policies, such as green bonds, green banks, carbon market instruments, fiscal policy, green central banking, financial technologies, community-based green funds, etc., which are collectively known as “green finance”.

Key words: green finance, renewable energy, CO₂ emissions, Paris Agreement, sustainable development goals; SDGs

JEL Classification: O44, Q56, Q59

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1. INTRODUCTION

Despite the huge bumps in the road the global economy is delivering aggregate annual growth of 3-4%, leading to a doubling of output every generation. Yet the global economy is not delivering sustainable growth in two basic senses. In many parts of the world, growth has been heavily skewed in favor of the rich and it has been environmentally destructive – indeed life-threatening when viewed on a century-long timescale, rather than in terms of quarterly reports or two-year election cycles. Climate change is the world's greatest environmental threat (although it is far from being the only one). If the current trajectory of global fossil-fuel use continues the planet's temperature is likely to rise by 4-6 degrees Celsius above its pre-industrial level, an increase that would be catastrophic for food production, human health, and biodiversity; indeed in many parts of the world it would threaten communities' survival. Governments have already agreed to keep global warming below 2°C, but have yet to take decisive action to create a low-carbon energy system (Sachs and Du Toit 2015). That climate change and global warming are mainly caused by greenhouse gas (GHG) emissions is now indisputable and the increases in GHG levels merit government intervention, which is to be guided by the Sustainable Development Goals (SDGs) and the Paris Climate Agreement.

The most disappointing aspect of the contemporary global economy is the low rate of investment. In the years leading up to the 2008 financial crisis, growth in high-income countries was propelled by spending on housing and private consumption. When the crisis hit both these kinds of spending plummeted, and the investments that should have picked up the slack never materialized. This must change. After the crisis the world's major central banks attempted to revive spending and employment by slashing interest rates and this strategy worked, to some extent. By flooding capital markets with liquidity and holding down market interest rates policymakers encouraged investors to bid up stock and bond prices. This created financial wealth through capital gains, whilst spurring consumption and - through initial public offerings – some investment. Yet this policy has reached its limit and imposed undeniable costs. With interest rates at, or even below zero investors borrow for highly speculative purposes and as a result the overall quality of investment has dropped, whilst leverage has risen. There is a real risk that there will be significant declines in asset prices when central banks finally tighten credit (Sachs 2016).

However, as monetary policy was being pushed to its limits, what went missing was an increase in long-term investments and infrastructure financing, especially for green energy projects. In most countries, and particularly in developing countries, the public sector cannot afford to fill this huge investment gap and the private sector has not shown sufficient interest. The main reasons that the private sector has not been much interested in entering into long-term financing of infrastructure projects, including green energy projects, are the low rate of return and the associated risks (Yoshino and Taghizadeh-Hesary 2018).

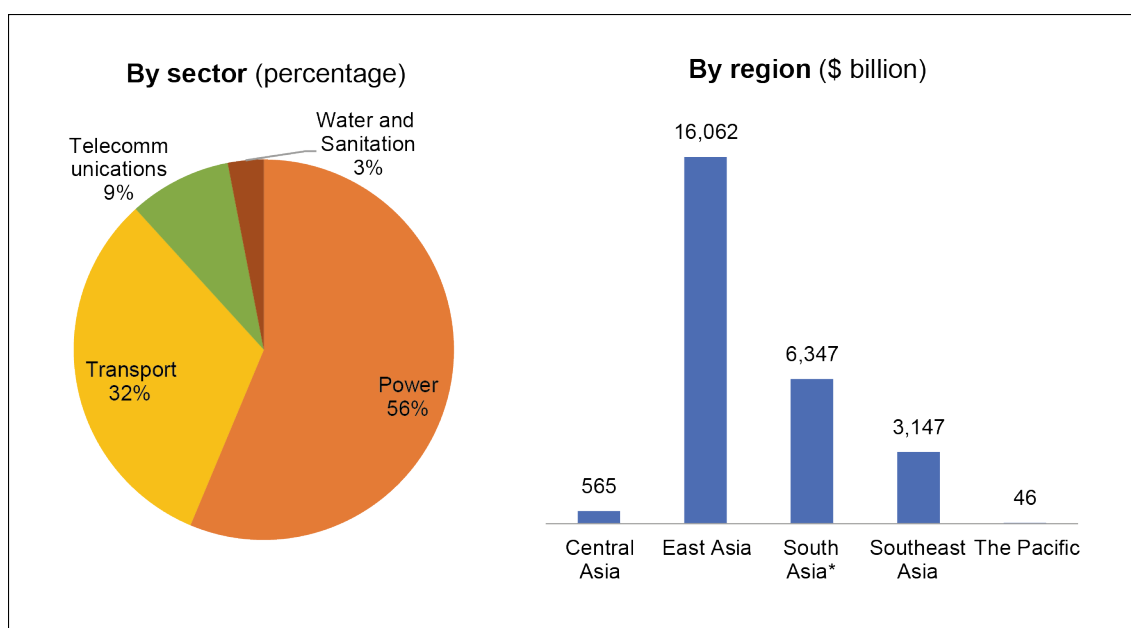
Given the aforementioned conditions, we need to scale up the financing of investments that provide environmental benefits if we want to achieve the SDGs, through new financial instruments and new policies, such as green bonds, green banks, carbon market instruments, fiscal policy, green central banking, “fintech”, community-based green funds, etc., collectively known as “green finance.”

At the moment there are three challenges facing such a strategy: identifying the right projects; developing complex plans that involve both the public and private sectors (and often more than one country); and structuring the financing. To succeed, governments must be capable of effective long-term planning, budgeting, and project implementation.

The world needs massive investment in green energy systems and an end to the construction of new coal-fired power plants. It also needs massive investment in electric vehicles (and hence advanced battery technologies), together with a sharp reduction in production of internal combustion engine vehicles. The developing world, in particular, also needs to invest substantially in water and sanitation projects in fast-growing urban areas. Low-income countries, in particular, need to expand their health and education systems.

In the developing world the largest demand for infrastructure investment is for the development of Asia. Asia will require investment of \$26 trillion between 2016 and 2030, or \$1.7 trillion per year, if the region is to maintain its growth, eradicate poverty, and respond to climate change (climate-adjusted estimate). Without climate change mitigation and adaptation costs \$22.6 trillion would be needed, or \$1.5 trillion per year (baseline estimate). Of the estimated total climate-adjusted investment requirement for 2016–2030, \$14.7 trillion is for power and \$8.4 trillion for transport. Investments in telecommunications should reach \$2.3 trillion, with water and sanitation costs at \$800 billion over the period. (Asian Development Bank; ADB 2017) – Figure 1 shows the ADB’s climate-adjusted estimate of the investment required between 2016 and 2030 for the development of Asia.

Figure 1: Climate-Adjusted Estimate of Infrastructure Investment Needs by Sector and by Region for Development of Asia and the Pacific* (2016–2030)
(percentages and billions of \$ in 2015 prices)



Note: Asia and the Pacific includes the ADB’s 45 developing member countries; Pakistan and Afghanistan are included in South Asia. ** Climate change adjusted figures include climate mitigation and climate-proofing costs, but do not include other adaptation costs, including those associated with rises in sea level.

Source: Authors, based on ADB data (2017).

Developing Asia relies heavily on coal for power generation. Statistics from the World Bank's World Development Indicators database show that in 2013, 66% of Asia's electricity was generated from coal-fired power plants, compared with 14% in non-Asian developing countries and 32% in The Organisation for Economic Co-operation and Development (OECD) countries. The region's large economies account for most of this figure: People's Republic of China (PRC) (75%), India (73%), Indonesia (51%), the Republic of Korea (41%), and Malaysia (39%). This poses significant local and global environmental challenges. Although some countries have taken action to address these challenges, considerable investment will be needed in the short to medium term to make the power sector greener, by reducing emissions and switching to renewable energy (RE) (ADB 2017).

The multilateral development banks – such as the World Bank, the ADB, and the African Development Bank – should help to finance such programs in Asia and other regions by raising vastly more long-term debt from the capital markets at the prevailing low interest rates and then lending the money to governments and public-private investment entities.

Governments should levy gradually rising carbon taxes and use the revenue to finance low-carbon energy systems. In addition the egregious loopholes in the global corporate tax system should be closed, which would boost global corporate tax revenue by some \$200 billion annually, if not more. The additional revenue should be allocated to new public investment spending.

Sustainable development must not remain an aspiration and slogan; it offers the only realistic path to green global growth and high employment. It is time to give it the attention – and investment – it deserves.

2. GREEN FINANCE, ENERGY SECURITY, AND SUSTAINABLE DEVELOPMENT

Since the Industrial Revolution finance has been a powerful enabler of human progress. The purpose of the global financial system is to allocate the world's savings to their most productive uses. When the system works properly, these savings are channeled into investments that raise living standards; when it malfunctions, as in recent years, savings are channeled into real-estate bubbles and environmentally harmful projects, including those that exacerbate human-induced climate change. (Sachs 2014).

Effective financial markets should also channel far more of the savings of high-income countries, which have relatively weak long-term growth prospects, to low-income regions, which have relatively strong growth prospects, owing to new opportunities to for accelerating development through use of smart, information-based infrastructure. Just a decade ago, hundreds of millions of rural Africans lived outside the flow of global information, but today, thanks to the rapid spread of broadband, once isolated villages benefit from online banking, transport services, and information and communication technology (ICT)-enabled agribusiness and health and education programs.

In order to realize the large-scale benefits of these new technologies and avoid investments that aggravate cascading environmental crises, the finance industry will need to understand how SDGs will reshape the investment landscape. The time has come to embrace the concept of true long-term investing, which requires marshalling the capacity of institutionally mobilized capital to support investment opportunities that will secure a sustainable future for all.

We know that enormous public and private investment is required for the transition to a low-carbon, green economy, to win the global fight against poverty and disease, and to provide high-quality education and physical infrastructure worldwide.

Today's savvy investors - and the financial industry as a whole - need to look ahead, beyond today's market prices and policies to the market prices and policies of the future.

For example, today there is no global price on carbon to drive a shift in energy investment from fossil fuels to RE; but we know that, in order to keep global warming below the 2°C limit, such a price is coming soon. As stewards of long-term capital, today's investors cannot ignore the coming introduction of a carbon price and the shift towards green and RE sources. That means devising practical ways to finance and encourage the required shift.

We believe that financial leaders want their industry to play its vital role in sustainable development and we urge them to contribute actively to the unique opportunity that this year represents.

RE projects will play a role in reducing carbon emissions in line with SDGs, but another reason to undertake RE projects is to improve energy self-sufficiency¹ and energy security by diversifying energy resources. Being over-reliant on limited energy resources (coal, oil, or gas) will reduce the resilience of the economy and make it more prone to energy price fluctuations. Several studies (see, *inter alia*, Hamilton 1983; Barsky and Killian 2004; Taghizadeh–Hesary, Yoshino, Abdoli, and Farzinvash 2013; Taghizadeh-Hesary and Yoshino 2016; Taghizadeh–Hesary et al. 2016) have evaluated the impact of oil price fluctuations on various macroeconomic indicators, generally finding that increases in oil prices disrupt economic growth and create inflation for most oil-importing countries.

A more recent study by Taghizadeh–Hesary, Yoshino, and Rasoulinezhad (2017) showed that Japan's energy security suffered in the aftermath of the Fukushima nuclear disaster in March 2011, which resulted in the shutting down of nuclear plants and the substitution of fossil fuels for nuclear power. This study showed that in some economic sectors the absolute value of elasticity of oil consumption decreased after the disaster, due to increased dependence on oil, and this endangered the country's energy security. The authors suggested Japan should diversify its energy supply in order to increase its energy self-sufficiency and energy security. As a result of eliminating nuclear power and substituting fossil fuels, Japan's energy self-sufficiency fell from 19.6% in the 2000 fiscal year to 8.6% in the 2013 fiscal year (Ministry of Internal Affairs and Communication 2015). Before the 2011 earthquake Japan was the third largest consumer of nuclear power in the world, after the United States and France. In 2010 nuclear power accounted for about 13% of Japan's total energy supply (Taghizadeh–Hesary et al. 2016) but in 2012 nuclear energy accounted for just 1% of total energy supply (it contributed similarly to primary energy consumption in 2013 as only two reactors were operating for just over six months of the year) (Taghizadeh–Hesary and Yoshino 2015).

A large body of literature has estimated the effect of energy security drivers on RE deployment using import dependence as a proxy for energy security, but this approach that ignores the potential effects of other energy security strategies, such as diversification of energy sources. Lucas, Francés, and González (2016) used panel data for the energy sector from 21 EU member states to investigate the effect of

¹ Domestic production of primary energy (including nuclear)/domestic supply of primary energy x 100 (Yoshino, Taghizadeh–Hesary, and Tawk 2017).

different energy security strategies on the RE development. Their primary findings confirm that (i) RE deployment is a consequence of a combination of energy security strategies and environmental concerns, rather than being solely due to a shift towards more sustainable energy policies; and (ii) diversification of energy sources through RE deployment is a more coherent strategy than using RE to reduce dependency.

Hence, increasing the share of the energy basket contributed by green energy resources would not only reduce emissions - in line with SDGs and Paris Agreement - but would also increase energy security.

3. HOW TO FILL THE GREEN FINANCE GAP?

In recent years, several new methods for financing green projects have been developed, including green bonds, green banks, village funds, etc. Green banks and green bonds have some potential to support clean energy development. The advantages of green banks include offering better credit conditions for clean energy projects, the ability to aggregate small projects to achieve a commercially attractive scale, creation of innovative financial products, and market expansion through dissemination of information about the benefits of clean energy. Supporters of green bonds believe that they can provide long-term, reasonably priced capital to refinance a project once it has passed through the construction phase and is operating successfully (Natural Resources Defense Council 2016).

Although the aforementioned methods do provide some support for development of low-carbon/green projects the data suggest they are inadequate. Global energy investment totaled USD 1.8 trillion in 2017, a 2% decline in real terms from the previous year according to the 2018 World Energy Investment report (International Energy Agency 2018). More than US\$ 750 billion went to the electricity sector while US\$ 715 billion was spent on oil and gas supply globally. Global energy investment in 2017 failed to keep up with energy security and sustainability goals. After several years of growth, combined global investment in renewables and energy efficiency declined by 3% in 2017 and there is a risk that it will slow further this year. This could threaten the expansion of green energy that is needed to meet energy security, climate and clean air goals.

Clearly fossil fuels still dominate energy investment. A major concern in the transition to low-carbon energy provision, therefore, is how to steer investments towards RE (Mazzucato and Semieniuk 2017). Because of the restrictions that the Basel capital requirements place on lending by financial institutions, and because banks consider most RE projects to be risky, banks are reluctant to finance them. Another problem is that banks' resources come from deposits, and deposits are usually short to medium term, whereas green infrastructure projects require long-term finance, resulting in a maturity mismatch for banks. Banking finance cannot, therefore provide all the finance for green projects and we need to look for new channels of finance for this sector to fill the financing gap. Bank lending has to be allocated to safer sectors and businesses.

One possible solution is to stimulate non-bank financial institutions, including pension funds and insurance companies, to invest in green projects (Gianfrate and Lorenzato 2018). Insurance companies and pension funds hold long-term financial resources that are suitable for green infrastructure investment. Institutional investors are the largest suppliers of capital to listed companies, managing almost \$100 trillion asset in OECD

countries alone². Because of their size and their role as conduit of savers' climate concerns to the capital markets, institutional investors are ideally positioned to steer corporate capital allocation towards more sustainable uses.

As for emission trading and carbon pricing schemes, as of 2016, 40 countries had a carbon pricing system in place (World Bank 2017) and that number is expected to increase significantly over next few years, in the wake of the climate change agreement reached in Paris in 2015.

In the context of current systems of carbon pricing "carbon price risk" has emerged as a new form of political risk for both companies and investors. This risk is related to the probability of the emergence of future international climate agreements and changes in carbon-related national policies. Which real and financial assets are affected and when will be crucially influenced by the timing and scope of carbon-related policies. The risk is technological as well as political, as there is uncertainty surrounding possible future technologies that might affect the speed and scope of the transition toward a low-carbon economy. This uncertainty further influences investors' ability to formulate long-term expectations about assets in which they could invest (Gianfrate and Lorenzato 2018).

Another important factor that needs to be considered when it comes to filling the green financing gap is role of green central banking. Responsibility for financial and macroeconomic stability lies implicitly or explicitly with central banks, which ought, therefore, to address climate-related and other environmental risks at a systemic level. Furthermore, central banks - through their regulatory oversight over money, credit, and the financial system - are in a powerful position to support the development of green finance models and enforce adequate pricing of environmental and carbon risk by financial institutions. The important consideration is the financial governance policies through which central banks, as well as other relevant financial regulatory agencies, can address environmental risk and promote sustainable finance (Dikau and Volz 2018).

The role of fiscal policy in increasing rate of return for green projects and thereby elevating the private sector's share of investment in these projects is crucial. Countries could make extensive use of tax relief or tax credit to promote renewable energy deployment. The US uses production tax credit extensively to promote wind energy and investment tax credit to promote solar energy. A company could use these tax credits to reduce income tax or corporate tax deductions in exchange for investing in renewable energy. The US has extended its production tax and investment tax credit policies until 2020 (Azhgaliyeva, Kapsaplyamova, and Low 2018).

Other ways of incentivizing and supporting RE deployment through fiscal policy could include using or refunding the increase in tax revenue resulting from the spillover effect of privately funded green infrastructure. Several studies have discussed the spillover effects of green energy projects to other sectors and to regional GDP, which countries could partially or entirely return to private sector investors (Yoshino and Taghizadeh-Hesary 2018).

Community-based funds and village funds are a good way of funding small- and medium-sized green projects. The Hometown Investment Trust (HIT) Fund is a new source of community-based trust funds created to support solar and wind power. The basic objective of the HIT fund is to connect investors with projects in their own locality, where they have personal knowledge and interests. Individual investors choose their

² <http://www.worldbank.org/en/news/feature/2015/06/18/institutional-investors-the-unfulfilled-100-trillion-promise> (Accessed November 13, 2018).

preferred projects and make investments via the Internet (Yoshino and Kaji 2013). One of the main applications of HITs in Japan has been wind power and solar power projects, which have raised money from individuals (about US\$100 to US\$5,000 per investor) interested in promoting green energy. These funds allow many Japanese people to invest small amounts of money in the construction of wind power and solar power. Advertising all the wind power and solar power projects on the Internet plays an important role in pushing people to invest in these projects. Internet marketing companies provide the platform for investment in these projects and are able to market them. Local banks have started to make use of the information provided by HIT funds. If these projects are done properly and are well received by individual investors, then banks start to grant loans to them. Thus RE projects (wind and solar), most of which are considered risky, can be supported by HIT funds until they are able to borrow from banks. The use of alternative financing vehicles, such as HIT funds, has therefore assisted the growth of solar and wind projects in Japan, where the finance sector is still dominated by banks (Yoshino and Kaji 2013; Yoshino and Taghizadeh-Hesary 2014). HIT funds have expanded from Japan to Cambodia, Viet Nam, and Peru. They are also attracting attention from the government of Thailand, Malaysia's central bank and Mongolia. The venture capital market is generally not well developed in many countries including in many Asian economies and the financial system of many developing countries remains dominated by banks, but Internet sales are gradually expanding and the use of alternative financing vehicles, such as HIT funds, will help risky sectors to grow (Yoshino, Taghizadeh-Hesary and Nakahigashi 2018).

An example of community-based green finance is the Hokkaido Green Fund, which was established in 2000 by individual investors and donors in order to finance wind power projects in northern Japan. As it was very difficult to raise money from banks, only 20% of the Fund's total investment was financed by banks and the other 80% was obtained from individual investors and donors (Hokkaido Green Fund). Community wind power corporations run wind power schemes and sell electricity to the power company that supplies power to the region. In many cases, wind power costs 5% more to generate than other forms of electricity, but users are willing to pay 5% extra to save the environment. More than 19 wind power projects have been constructed in northern Japan using similar methods. There are also examples of solar power projects in Japan where local governments have put seed money into a community fund as an incentive for private investors.

Last but not least, new financial technologies ("fintech"), such as blockchain, the Internet of Things and big data, could unlock green finance over the same timeframe as the Paris Agreement and the SDGs. According to Nassiry (2018) there are three possible broad applications of fintech to green finance: blockchain applications for sustainable development; blockchain use-cases for renewable energy, decentralized electricity markets, carbon credits, and climate finance; and innovation in financial instruments, including green bonds.

REFERENCES

- Asian Development Bank. (2017). *Meeting Asia's Infrastructure Needs*. Manila: Asian Development Bank.
- Azhgaliyeva, D., Z. Kapsaplyamova, and L. Low. (2018). *Implications of Fiscal and Financial Policies for Unlocking Green Finance and Green Investment*. ADBI Working Paper 861. Tokyo: Asian Development Bank Institute.
- Barsky, R. B., and L. Kilian. (2004). "Oil and the Macroeconomy since the 1970s." *Journal of Economic Perspectives* 18(4): 115–34.
- Dikau, S., and U. Volz. (2018). *Central Banking, Climate Change and Green Finance*. ADBI Working Paper 867. Tokyo: Asian Development Bank Institute.
- Gianfrate, G., and G. Lorenzato. (2018). *Stimulating Non-Bank Financial Institutions' Participation in Green Investments*. ADBI Working Paper 860. Tokyo: Asian Development Bank Institute.
- Hamilton, J. D. (1983). "Oil and the Macroeconomy since World War II." *Journal of Political Economy* 91(2): 228–48.
- Handbook of Green Finance Energy Security and Sustainable Development (2019). Eds. Jeffrey D. Sachs, Woo Wing Thye, Naoyuki Yoshino, Farhad Taghizadeh-Hesary, Tokyo: Springer.
- International Energy Agency. (2018). *World Energy Investment 2018*. Paris: International Energy Agency.
- Lucas, J. N. V., Francés, G. E., and González, E. S. M, (2016). "Energy security and renewable energy deployment in the EU: Liaisons Dangereuses or Virtuous Circle?" *Renewable and Sustainable Energy Reviews* 62(C): 1032-46.
- Mazzucato, M., and G. Semieniuk. (2017). "Financing Renewable Energy: Who is Financing What and Why it Matters." *Technological Forecasting & Social Change*. dx.doi.org/10.1016/j.techfore.2017.05.021.
- Ministry of Internal Affairs and Communication. (2015). *Statistical Handbook of Japan 2015*. Tokyo: Statistics Bureau, Ministry of Internal Affairs and Communication.
- Nassiry, D. (2018). *The Role of Fintech in Unlocking Green Finance: Policy Insights for Developing Countries*. ADBI Working Paper 883. Tokyo: Asian Development Bank Institute.
- Natural Resources Defense Council. (2016). *Clean Energy Finance Outlook: Opportunities for Green Banks and Green Bonds in Chile*. New York, NY: Natural Resources Defense Council.
- Sachs, J. D. (2014). "Financing Climate Safety." <https://www.project-syndicate.org/commentary/fossil-fuels-carbon-pricing-tax-by-jeffrey-d-sachs-2014-12?barrier=accesspaylog> (Accessed November 12, 2018).
- . (2016). "Investment for Sustainable Growth." <https://www.project-syndicate.org/commentary/investment-for-sustainable-growth-by-jeffrey-d-sachs-2016-10?barrier=accesspaylog> (Accessed November 10, 2018).
- Sachs, J. D., and Du Toit, H.J. (2015). "Earth Calling The Financial Sector." <https://www.project-syndicate.org/commentary/sustainability-finance-leaders-by-jeffrey-d-sachs-and-hendrik-j--du-toit-2015-02?barrier=accesspaylog> (Accessed November 8, 2018).

- Taghizadeh–Hesary, F., and N. Yoshino. (2015). “Macroeconomic Effects of Oil Price Fluctuations on Emerging and Developed Economies in a Model Incorporating Monetary Variables.” *Economics and Policy of Energy and the Environment* 2: 51–75.
- . (2016). “Monetary Policy, Oil Prices and the Real Macroeconomic Variables: An Empirical Survey on China, Japan and the United States.” *China* 14(4): 46–69.
- Taghizadeh–Hesary, F., N. Yoshino, and E. Rasoulinezhad. (2017). “Impact of the Fukushima Nuclear Disaster on the Oil-Consuming Sectors of Japan.” *Journal of Comparative Asian Development* 16(2): 113–134. doi: 10.1080/15339114.2017.1298457.
- Taghizadeh–Hesary, F., N. Yoshino, G. Abdoli, and A. Farzinvash. (2013). “An Estimation of the Impact of Oil Shocks on Crude Oil Exporting Economies and their Trade Partners.” *Frontiers of Economics in China* 8: 571–591.
- Taghizadeh–Hesary, F., Yoshino, N., Mohammadi Hossein Abadi, M., and Farboudmanesh, R. (2016). “Response of macro variables of emerging and developed oil importers to oil price movements.” *Journal of the Asia Pacific Economy* 21(1): 91–102. doi:10.1080/13547860.2015.1057955.
- World Bank. (2017). *Carbon Pricing Watch 2017*. Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/26565> License: CC BY 3.0 IGO.
- Yoshino, N., and F. Taghizadeh–Hesary. (2014). *Hometown Investment Trust Funds: An Analysis of Credit Risk*. ADBI Working Paper 505. Tokyo: Asian Development Bank Institute.
- . (2018). “Alternatives to Private Finance: Role of Fiscal Policy Reforms and Energy Taxation in Development of Renewable Energy Projects.” In *Financing for Low-carbon Energy Transition: Unlocking the Potential of Private Capital*, edited by V. Anbumozhi, K. Kalirajan and F. Kimura, 335–357. Tokyo: Springer.
- Yoshino, N., and S. Kaji (eds.). (2013). *Hometown Investment Trust Funds*. Tokyo: Springer.
- Yoshino, N., F. Taghizadeh–Hesary, and N. Tawk. (2017). “Decline of Oil Prices and the Negative Interest Rate Policy in Japan.” *Economic and Political Studies* 5(2): 233–50. doi: 10.1080/20954816.2017.1310798.
- Yoshino, N., Taghizadeh–Hesary, F., and Nakahigashi, M. (2018). “Modelling the social funding and spill-over tax for Addressing the green energy financing gap.” *Economic Modelling*. doi: 10.1016/j.econmod.2018.11.018.