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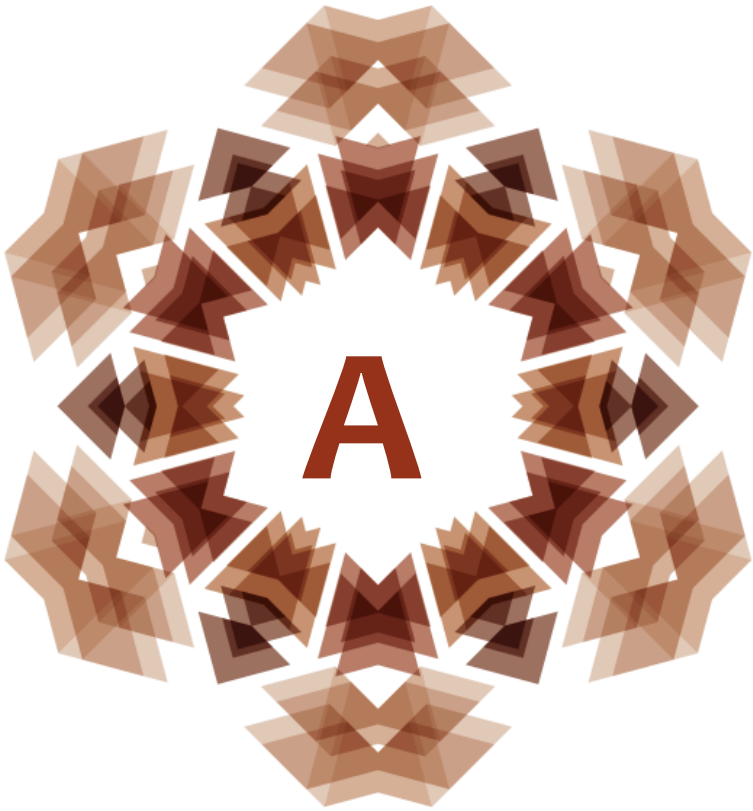
ESTABLISHING CHINA'S GREEN FINANCIAL SYSTEM

Background Paper A: Theoretical Framework of Green Finance



This is a background paper to the report: *Establishing China's Green Financial System*
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Background Paper A: Theoretical Framework of Green Finance

'Green finance policy' refers to a series of policy and institutional arrangements to attract private capital investments into green industries such as environmental protection, energy conservation and clean energy through financial services including lending, private equity funds, bonds, shares and insurance. According to our estimate, green industries require an investment of at least 2 trillion yuan (US$320 billion, or 3 percent of China's GDP) of investment each year in the coming five years (2016-2020). Among all green investments, government financing accounts for an estimated 10 to 15 percent while private capital investments will account for 85 to 90 percent. Given that current price system cannot fully reflect the positive externalities of green projects, how to steer private capital investments into green industries represents a major policy challenge.

The following problems may arise from an improperly designed policy:

- First, as a result of insufficient incentives, green investments will seriously fall short while polluting investments will become excessive (relative to the level required for maximal social welfare).
- Second, due to miscalculated positive externalities of different green industries, private capital investments have been excessively allocated to industries with inefficient emission abatement, which has led to a waste of financial resources;
- Third, as a result of underestimated risks, some green investments failed and led to bankruptcies, defaults and even financial risks.

A major reason for China's excessive energy and pollution-intensive investments over the past few decades is the lack of a policy system for green finance. Hence, green finance policy should be built systematically with the following objectives:

- First, sufficient amounts of private capital should be steered into green projects to meet national pollution abatement targets;
- Scond, funds should be allocated among numerous candidate projects under the principle of "achieving maximal fund use efficiency with given emission abatement targets"
- Third, systemic financial risks should be kept at bay.

From an economic perspective, green finance policy is designed to address the defect that the (positive) externalities of green investments or (negative) externalities of polluting investments cannot be internalized under a market-based price system through policy and institutional arrangements.

This paper identifies an economics-based theoretical framework of green finance policy. Under this framework, our study demonstrates that given the current market price system and corporate objective functions, companies are inclined to make excessive investments in polluting industries and inadequate investments on green projects. In other words, maximal social welfare requires companies to increase investments (as opposed to the decision-making for maximal corporate interests) and reduce polluting investments. Four types of policy instruments are available to change corporate decisions:

- First, increase the profitability of green project investments by such means as increasing product prices (through price subsidies, for instance), reducing the cost of green project investments (such as discounted interest rate of lending, tax exemptions for green bonds, green rating, increasing fund availability and investment risk mitigation through government participation);
- Second, reducing the profitability of polluting projects by such means as raising the tax and fees and the cost of violations for polluters;
- Third, altering corporate objective functions by replacing the single-minded pursuit of maximal corporate profitability with an equal emphasis on profitability and social responsibilities;
- Fourth, altering the objective function of consumers by replacing the single-minded pursuit of pleasure-seeking with an equal emphasis on consumer enjoyment and social responsibilities.

This report claims that the weight of social responsibilities in the objective function of companies (investors) and consumers can be increased in a step-by-step manner through investor and consumer education, establishment of green investment networks, increased transparency of environmental impacts of listed companies, as well as heightened intervention of NGOs on polluting industries. The aforementioned four policy measures should comprise the key elements of green finance policy.

(I) Three types of green finance policies from corporate perspectives

The traditional assumption of microeconomics is that enterprises pursue maximal profitability. On the basis of given output prices and input costs, enterprises arrive at an optimal output to achieve maximal profitability. But the reality is that the market prices of output and input goods fail to sufficiently reflect the externalities brought about by the manufacturing and consumption of these products. In this sense, allowing the quantity of output to be determined by the objective of maximal profitability is contradictory to maximal social welfare. For instance, coal price and production costs cannot fully reflect air pollution caused by coal combustion and its impacts on human health, which means that coal output and consumption are above the quantity required by maximal social welfare. Meanwhile, compared with the objective of maximal social welfare,

excessively low pricing of clean energy output has led to an undersupply of clean energy. Meanwhile, another cause of the oversupply of polluting products and undersupply of clean products is the absence of CSR elements in the corporate objective function. Here, we would like to explain the above-mentioned view with a simple model of microeconomics.

Objectives of socially responsible companies = a × profit + b × social responsibilities

Where, profit is defined in the sense of traditional microeconomics, i.e. sales revenue minus production cost and tax. It is assumed that this company makes two types of products: first, clean products; second, polluting products. The specific expression of corporate profitability is expressed as below:

Profit = profit of clean products + profit of polluting products

= {(1 - tax of clean products) × price of clean products × output of clean products – cost × output of clean products}

+ {(1 - tax of polluting products) × price of polluting products × output of polluting products – cost × output of polluting products}

Where, output costs includes the cost of capital (of which the interest rate is one part). Assuming that output reflects a diminishing return to scale, if the objective of a company is to seek maximal profitability, the equation has a unique solution under the conditions that the first-order derivative is zero and that the marginal revenue and marginal costs are equal (optimal outputs of two products are arrived at). We refer to these two outputs as the **output of clean products with maximal profitability and output of polluting products with maximal profitability.**

As is commonly known, the following problems may occur if externalities are not internalized:

The output of clean products with maximal profitability is *smaller than* their output of maximal social welfare.

The output of polluting products with maximal profitability is *greater than* their output of maximal social welfare.

Where, social welfare is defined as corporate profit + personal consumption + externalities (such as health damages to third parties), while these health damages are positively correlated with the manufacturing and consumption of polluting products.

Then, the question is how to internalize externalities in order to reduce the output of polluting products and increase the output of clean products? Judging by the above-mentioned corporate issues, at the least the following policy measures are available:

1. **Increase the revenues for producing clean products/ reduce the revenues for producing polluting products**. Increase the returns to producers of clean products (by such means as providing price subsidies to clean energy) in order to effectively increase investment

return for clean products; reduce price subsidies (if any) for polluting products, so as to reduce their investment return.

2. **Reduce to costs to produce clean products/ increase the cost to produce polluting products.** Reduce the tax, fees and other costs of clean products (such as lending interest rate), so as to increase their investment return for clean products; increase the tax, fees and costs of polluting products (such as lending interest rate), so as to reduce their investment return.
3. **Increase the weight of social responsibilities in corporate objective function**.

The first two types of policy can reduce the output of polluting products and increase the output of clean products. Given its simple mechanism for those who have studied microeconomics, we will not make repetitive deductions here. The third type of policy does not exist in traditional economics but is considered by this paper as a low-cost and highly effective environmental policy option.

This paper defines social responsibilities as a concept that is positively correlated with the output of clean products manufactured by companies while negatively correlated with the output of their polluting products. Inclusion of social responsibilities in the corporate objective function has been reflected in the public information disclosures by some large financial institutions and listed companies of developed countries. For instance, Deutsche Bank stated in its CSR report of 2012 to the effect that "we believe that the scope of corporate responsibilities already goes beyond our core services. Expectations for prosperity and progress have driven our efforts to carry out various educational, social and cultural projects". (Deutsche Bank, 2012) General Electric (GE) also mentioned that "as a technology company with 130 years of history, the responsibility of sustainable development has been deeply embedded into our corporate culture and business strategies" (General Electric, 2012) .

If the weight of CSR *b* exceeds zero, it may replace economic means such as fiscal instruments to some extent to achieve the objective of changing corporate conduct. Specifically, a weight *b* can be adopted to achieve the same effect on output compared with price subsidies for clean products. We have made following mathematical expressions concerning unit production of clean products by the two types of companies:

Objectives of socially responsible companies = a × profit + b × social responsibilities

= a × (unit output price × output - cost) + b × reputational value × output

Corporate objective of maximal profitability = a× [(unit output price + price subsidies) × output – cost]

If the above two expressions can achieve the same objective, they can be combined into the following equation:

a × (unit output price × output-cost) + b × reputational value × output = a × (unit output price + price subsidies) × output – cost

By combining the expressions, we may arrive at the following condition for the substitution between social responsibilities and subsidies:

B × reputational value = a × price subsidies

Under the above conditions, corporate attention of reputation may substitute government price subsidies of clean products.

(II) The fourth type of green finance policies from consumer perspectives

The above section has described that, under given market prices, if companies pursue maximal profitability without policy instruments to internalize pollution externalities, there will be an excessive output of polluting products and an undersupply of clean products. Therefore, increasing the weight of CSR can become an instrument for changing corporate conduct. However, what is not considered in the above section is that market prices are jointly decided by companies and consumers through the mechanism of market equilibrium. That is to say, consumer preferences will affect market prices and thus determine the magnitude of externalities. Thus, it is also necessary for us to investigate consumer issues, particularly the means to influence market prices by changing consumer preferences to reduce externalities.

Classical microeconomics assumes that consumers pursue maximal utility while the utility of products purchased by consumers can be measured and aggregated. Despite the likely diminishing of marginal utility, utility from each product is positively correlated with the quantity of consumption. This study has proposed a new utility function:

Consumer utility function = a × utility of consumer products + b × consumer social responsibilities

Where, utility of consumer products is the utility function in the traditional sense. Assuming that only two types of product exist, we may define the function as follows:

Utility of consumer products = U (consumption of clean products) + U (consumption of polluting products)

Consumer social responsibilities are reflected in their social reputation gained from the consumption of a certain type of product and defined by us as follows:

Consumer social responsibility = c × consumption of green products – d × consumption of polluting products

Where, c and d are both greater than zero.

For many consumers in developed countries, product price and utility may not be the only factors affecting their purchase decisions. These consumers are starting to put premium on a sense of

morality and ethics. Instead, these consumers are placing greater values on ethics and social responsibility, through such considerations as how the product is made, which country and factory the product comes from, whether the factory has poor environmental records, or whether it employs child labour, infringes on intellectual properties, or engages in other ethically questionable or illegal activities. If such problem exists, then these consumers will not buy the product even if it is cheaper than the competition. CSR networks, social pressures on corporate disclosure of pollution information and NGO efforts all make it possible for consumers to realize their social responsibilities. Under special circumstances, consumers will also urge companies to terminate or rectify negative environmental impacts arising from product manufacturing and sales by boycotting those products.

The following are a few well-known cases of this kind: Greenpeace organized a consumer boycott in many countries against Nestlé products in a protest against the damages of Indonesian rainforest and peat land by its raw materials supplier Sinar Mas Group. Consumer pressures ultimately forced Nestlé to terminate its procurement of palm oil from Sinar Mas Group (Ionescu-Somers and Albrecht Enders, 2012). Many other companies including KFC, P&G and Coca-Cola all encountered similar types of consumer boycotts over recent years. By refusing to buy their familiar or convenient products, consumers have contributed to the development of corporate environmental responsibilities through such acts of 'voting by their feet' and gained 'CSR utility'. In another instance of clean energy, some consumers of developed countries began to take pride in driving electric vehicles (many of them attached a 'Save the Earth' label at the back of their cars to demonstrate that "I support saving the environment" to other people). This is similar to the psychology of some companies that regard charity as an honour (exemplified by the charitable acts of entrepreneurs inspired by Bill Gates and Warren Buffett). According to a Gallup survey on 31,000 consumers from 26 countries around the world conducted in 2011 on behalf of wind power company Vestas, 90 percent of consumers believe that the share of renewables in energy mix should be increased and **50 percent of consumers are willing to pay an additional price for products made with clean energy** (Vestas/Gallup, 2011). This percentage reveals that the utility of a consumer product itself is no longer the only factor in the purchase decision-making of