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What can Uzbekistan tell us about industrial policy that we did not already know

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Abstract. This paper discusses Uzbekistan's recent experience with structural shifts and industrial policy and the larger implications for existing theories of industrial policy. The paper has a particular focus on various industry policy instruments. Two major hypotheses are discussed: (1) the hypothesis of Haussmann, Hwang and Rodrik (the more technologically sophisticated the export structure, the better for growth) and (2) the hypothesis of Justin Yifu Lin (export specialization should build on existing comparative advantages and not jump over the necessary technological stages).

Keywords: Uzbekistan, economic growth, economic diversification, industrial policy, exchange rate policy, wages policy.

Секреты и перспективы промышленной политики Узбекистана

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Аннотация. В статье обсуждается опыт Узбекистана в области структурных преобразований и промышленной политики, а также важные последствия для существующих теорий промышленной политики. Проверены две основные гипотезы: гипотеза Хауссмана, Хванга и Родрика (чем более технологически диверсифицирована структура экспорта, тем лучше экономический рост) и гипотеза Джастина Ыифу Лин (экспортная специализация должна строиться на существующих сравнительных преимуществах и не перешагивать через необходимые технологические стадии). Узбекистан, создавший автомобильную промышленность с нуля, сегодня производит более 200 тыс. автомобилей в год, половина из которых экспортируется. Это, несомненно, успех промышленной политики. Вместе с тем ставка на развитие тяжелой химии может привести к замедлению экономического роста страны.

Ключевые слова: Узбекистан, экономический рост, экономическая диверсификация, промышленная политика, политика валютного курса, политика заработной платы.

I. INTRODUCTION

Uzbekistan in the past 10 years has been a successful economy. It attained high growth (8%), low unemployment, reasonable macro-economic stability, low domestic and international debt and relatively low inequality. Of note are the structural shifts, which occurred in the recent 25 years post-independence:

(1) A decrease in the production and export of cotton (previously a mono-culture), an increase in food production and the attainment of food self-sufficiency.

(2) An attainment of country's energy self-sufficiency.

(3) An increase in the share of industry in GDP and the share of machinery and equipment production in industrial output, and export as well. Point in case, a competitive export oriented auto industry was created from the ground up. In addition, in recent years, Uzbekistan promoted heavy chemical industries such as the production of synthetic fuel and polypropylene goods from natural gas.

This paper argues that Uzbekistan's achievements in development have been due to deliberate government policies rather than simply the result of economic liberalization reforms to conform to its factor endowment and/or the result of a natural comparative advantage. The paper acknowledges Uzbekistan's enjoyment of a favourable external environment; however, it attributes its rapid growth to reasonable macroeconomic stability and industrial policies. It begins with a brief discussion of industry policy and economic diversification in the post-Soviet States in Central Asia and Eastern Europe including Russia. The rest of the paper is organized as follows:

• Section III compares Uzbekistan's transition and economic performance vis-à-vis other post-Soviet States;

• Section IV discusses changes in the economic structure of Uzbekistan;

• Section V shows that the main instrument of Uzbekistan's industrial policy has been the under-valuation of the exchange rate;

• Section VI reflects on the issues of industrial upgrading — the dilemma of choosing "winning" industries in the context of the general debate about the nature of industrial policy, especially the hypothesis advanced by Haussmann, Hwang and Rodrik vis-à-vis that by Justin Yifu Lin;

• Section VII contains concluding remarks on the lessons learned from Uzbekistan's industrial policies and the lessons which Uzbekistan can benefit from vis-à-vis the experiences of successful East Asian countries, especially Singapore, in the attempt to upgrade industrial structures.

II. INDUSTRIAL POLICY AND ECONOMIC DIVERSIFICATION

Industrial structure is important for economic development. The Chenery (1960) hypothesis states that countries at similar levels of economic development should have similar patterns of resource allocation between sectors. But in theoretical models it is often assumed that there are externalities from industrialization and industrial export (Murphy, Shleifer & Vishny, 1989; Polterovich & Popov, 2004, 2005). There is growing evidence that countries which are more industrialized and countries with more technologically sophisticated industrial export are growing faster than others (Hausmann, Hwang & Rodrik, 2006; Rodrik, 2006).

Not all countries are able to climb the technological ladder, diversify, and upgrade the structure of their economy and export. In most transition economies a "primitivization" of the industrial structure occurred. In other words, secondary manufacturing and high tech industries proved to be uncompetitive and their output was curtailed after the deregulation of prices and the opening of the economy. As a matter of fact, an increase in the share of the service sector, especially trade and finance, at the expense of industry (deindustrialization) occurred in all post-communist economies. Previously in the centrally planned economies the service sector, in particular trade and finance, were underdeveloped. It seems, however, that in many of these economies deindustrialization went too far. In Tajikistan, for example, the share of services in GDP nearly doubled, increasing from about 30% in the early 1990s to 57% in 2010, whereas the share of manufacturing in GDP fell from 25% in 1990 to 10% in 2010. In Russia the share of industry in GDP fell from about 1/2 in 1990 to about 1/3 in the mid 1990s, whereas within industry itself the share of the primary sector (fuel, energy, steel and non-ferrous metals) in the total industrial output increased from 25% to over 50%.

The structure of exports in most post-Soviet states also became more primitive in the recent two decades; the share of manufactured goods in total exports either declined or did not show any clear tendency towards increase (*Figure 1*). This was partly caused by the increase in resource price and resource boom: expansion of fuel production and exports in Azerbaijan, Kazakhstan, Russia, and Turkmenistan. In Russia the share of fuel, min-
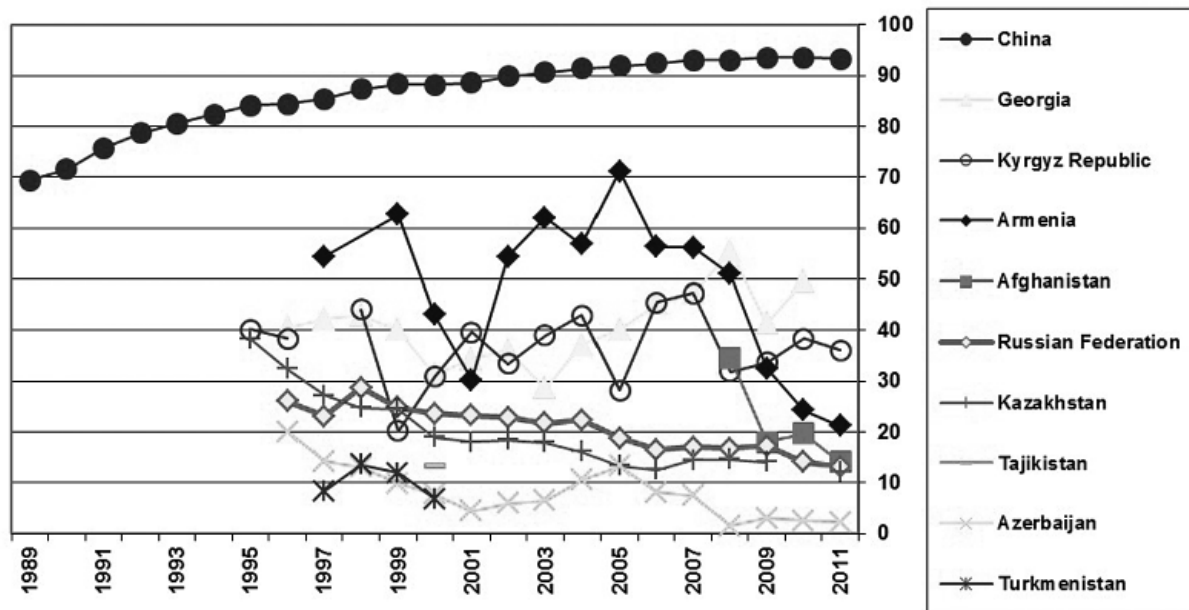
Figure 1. **Manufactures exports, % of merchandise export**

erals, metals and diamonds in total export grew from 52% in 1990 (USSR) to 67% in 1995 and 81% in 2012. In contrast, the share of machinery and equipment in total export fell from 18% in 1990 (USSR) to 10% in 1995 and 4.5% in 2012.

Such changes in the industrial structure were not solely the result of an "invisible hand of the market". Greenwald and Stiglitz (1986, 2013) state: market failures are pervasive, private rewards and social rewards virtually always differ. Governments, then, are inevitably involved in shaping the industrial structure of the economy, both by what they do and do not do. As many authors point out, the secret of "good" industrial policy in East Asia, as opposed to "bad" industrial policy in the former Soviet Union, Latin America and Africa may be associated with the ability to reap the benefits of export externalities (Khan, 2007a; Gibbs, 2007). Exporting to world markets, especially to developed countries, enables the upgrade of quality and technology standards and yields social returns in excess of the returns to particular exporters. The greatest increases in productivity are registered at companies that export to advanced (Western) markets and which export hi-tech goods (Harris & Li, 2007; Shevtsova, 2012). In addition, it has been shown that the gap between the actual level of development and the hypothetical level, which corresponds to the degree of sophistication of

a country's exports, is strongly correlated with productivity growth rates (Hausmann et al., 2006). In other words, it pays off to promote exports of sophisticated and high tech goods. Not all countries which attempt to promote such exports succeed, but those that do not try, virtually never engineer growth miracles[1].

It is worth noting that there is an opposite view as demonstrated, for example, in a recent paper from the World Bank (Gill, et al, 2014). The paper concludes that it is not clear whether diversifying exports and production is necessary for development and that governments need concern themselves less with the composition of exports, profile of production and more with their national asset portfolios — the natural resources, built capital, and economic institutions.

III. UZBEKISTAN'S TRANSITION AND ECONOMIC PERFORMANCE

After the collapse of the USSR and the market oriented reforms in successor states the comparative performance in the post-Soviet space varied greatly (*Figure 2*). In retrospect, it is clear that rapid economic liberalization did not pay off: many gradual reformers (labelled procrastinators at the time)

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[1] Botswana may be the only exception as it has one of the highest rates of per-capita GDP growth in the last 50 years (5% during 1960–2010), which was primarily driven by exports of primary commodities (namely, diamonds) and not of high-tech goods.
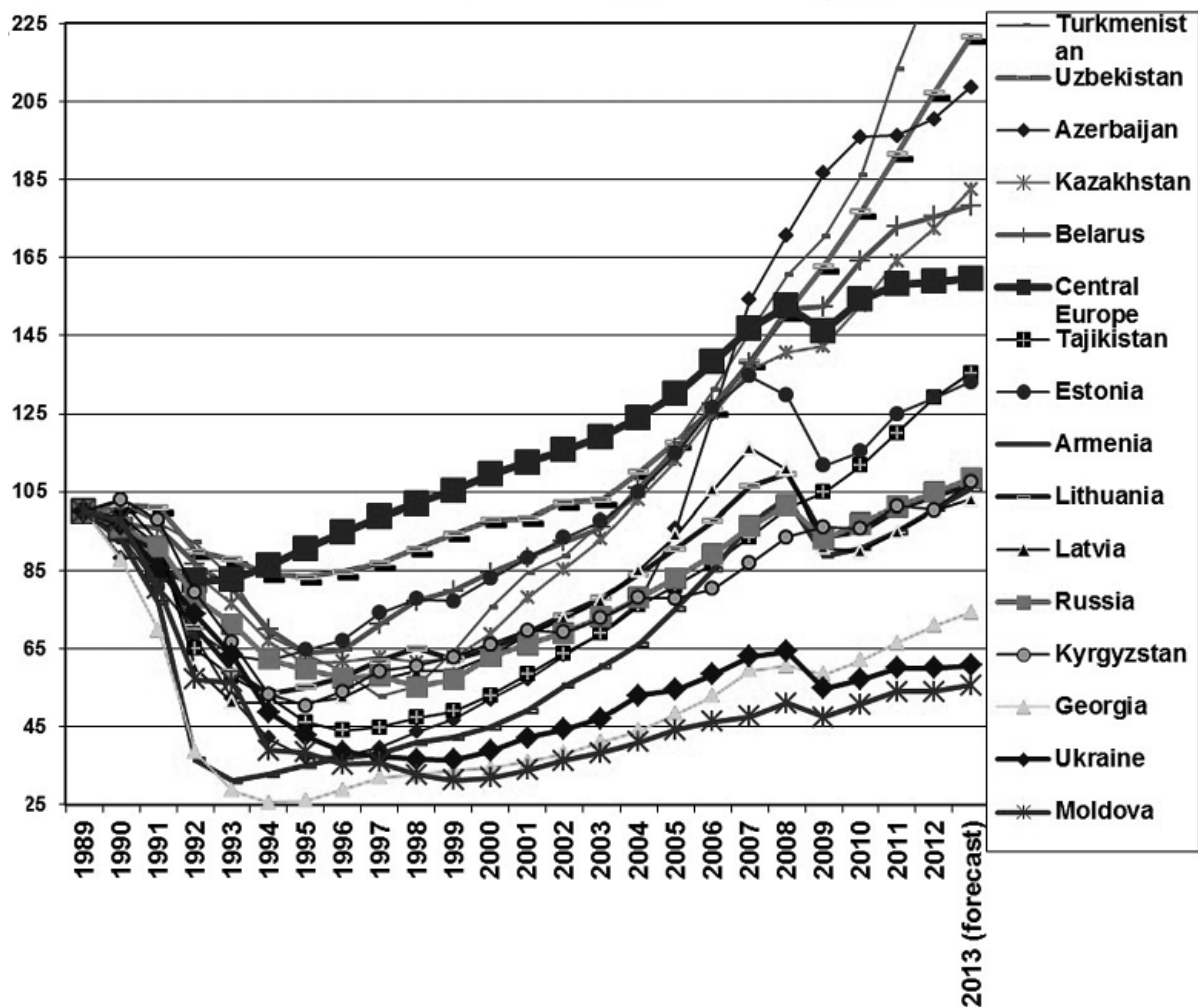
Figure 2. **GDP change in FSU economies, 1989 = 100%**

Source: EBRD Transition Reports for various years. Central Europe is the unweighted average for Czech Republic, Hungary, Poland, Slovakia and Slovenia.

from the former Soviet Union (FSU) performed better than champions of big-bang liberalization (Baltic States and Central Europe). In Belarus, Turkmenistan and Uzbekistan, for instance, privatization was slow; over 50% of GDP is created in state enterprise (*Figure 3*), yet their performance is superior to that of more liberalized economies. Recently when resource prices were high, resource abundance helped exporters such as Azerbaijan, Kazakhstan, Russia and Turkmenistan, to maintain higher income. However, this was not a *sine qua non* for growth; resource poor Belarus and self-sufficient in fuel and energy Uzbekistan did much better than resource rich Russia.

As recent research shows, the crucial factor in economic performance is the ability to preserve the institutional capacity of the state (Popov, 2007, 2011 for a survey). The story of transition was very much a government capability, rather

than a market failure. In all former Soviet republics and in the East European countries, government spending fell during transition and the provision of traditional public goods, from law and order to health care and infrastructure, worsened. This led to an increase in income inequalities, shadow economy, corruption, crime and mortality[2]. But in countries with the smallest decline in

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[2] State capacity is understood as the ability of the state to enforce rules and regulations and is measured by objective indicators such as crime rate, murder rate, the share of shadow economy, i. e. the degree of compliance with tax rules and criminal code (the murder rate is better than the crime rate due to statistical registration problems, see Popov, 2008).

There are well known problems with subjective measures of institutional capacity, such as corruption perception indices of Transparency International and the World Bank indices of government effectiveness, rule of law, etc. (Khan, 2007b; Popov, 2011). The institutional capacity declined dramatically in the 1990s in many transition economies; all three traditional monopolies of the state (on violence, tax collection and issuance of currency) were undermined (Popov, 2004).
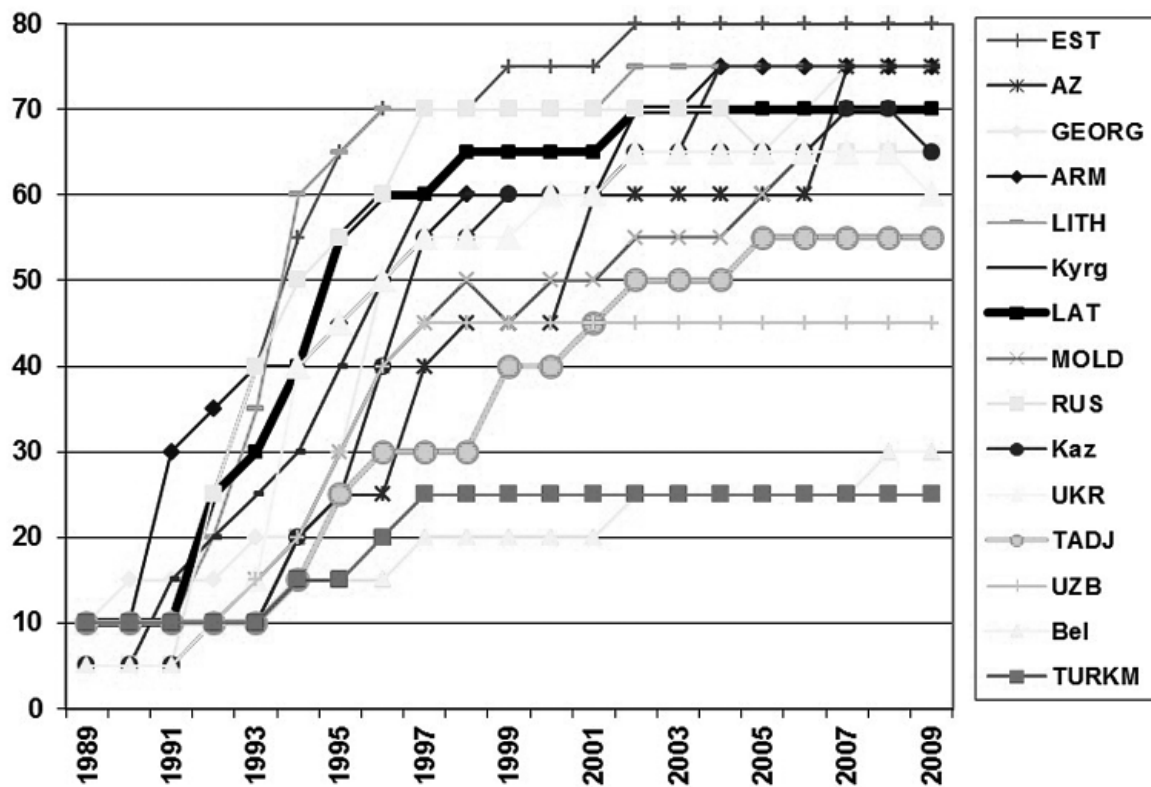
Figure 3. **The share of private sector in GDP in some former Soviet republics, 1989–2009, %**

Source: EBRD.

government spending (countries which are diverse in other respects — Central Europe, Estonia, Belarus, Uzbekistan), these effects were less pronounced and the dynamics of output was better.

Uzbekistan is an economic success story in the post-Soviet space. Its transformation-stage recession was very mild as compared to other countries of the former Soviet Union: its GDP more than doubled in 1989–2012, a better result than even in Central European countries (*Figure 2*). Its life expectancy, currently at 68 years, may have not increased much, but it did not fall as it did in other former Soviet republics in the 1990s. Its population increased from 20 million in 1989 to 30 million in 2013; and its murder rate is low (3 per 100, 000 of inhabitants, a figure lower than in the US). In 2009 during the economic recession, only Kazakhstan and Azerbaijan showed higher economic growth rates than that of Uzbekistan, whereas most post-communist countries experienced a reduction of output.

Uzbekistan's performance is not as spectacular as that of China; nevertheless, it is exceptional for the post-Soviet space. This is partly due to a good external environment; Uzbekistan exports the commodities cotton, gold and gas, which have experienced an international increase in prices in the past 2 decades. However, reasons that are more important are attributed to the good macroeconomic and industrial policies. Uzbekistan is the only country in the post-Soviet space that succeeded in increasing the share of industry in GDP and the share of machinery and equipment in the total industrial output, and export. It created a competitive export-oriented auto industry from the ground up. In 2011, it became the 15th country in the world to launch a high-speed train line (between Tashkent and Samarkand to be extended to Bukhara and Karshi by 2015). The train is made by the Spanish Talgo and runs a distance of 344 km in 2 hours, 8 minutes.

The inclusiveness of growth appears to be higher in Uzbekistan as well. In 2012, Uzbekistan's official estimates for the Gini coefficient was just above 30% (World Bank estimates for 2002–03 is 35–36%). This is lower than in most transition economies. Meanwhile, in the more liberalized economies of Russia, Lithuania, Georgia and Kyrgyzstan income distribution is noticeably more uneven, ranging between 0.38 and 0.45 (Appendix *Figure A1*).

Table 1. **Billionaires in former USSR, Eastern Europe China and Vietnam**

	Number of billionaires	Total wealth	PPP GDP, 2012	Number per 1 trillion PPP GDP	Wealth of billionaires to PPP GDP, %
China	122	260.9	12471	9.8	2.1
Russia	110	403.8	3380	32.5	11.9
Ukraine	10	31.3	338.2	29.6	9.3
Kazakhstan	5	9.2	233	21.5	3.9
Czech Republic	4	14.0	277.9	14.4	5.0
Poland	4	9.8	844.2	4.7	1.2
Georgia	1	5.3	26.6	37.6	19.9
Vietnam	1	1.5	322.7	3.1	0.5
Romania	1	1.1	352.3	2.8	0.3
Uzbekistan	0	0	107	0.0	0.0

Source: Forbes billionaires list.
(http://www.forbes.com/billionaires/#page: 1_sort: 0_direction: asc_search: _filter: All%20industries_filter: All%20countries_filter: All%20states); WDI.

Another indicator of income distribution is the number of billionaires[3]. The 2013 Forbes count placed Russia and Georgia ahead in billionaire-intensity (number of billionaires per $1 trillion PPP GDP), followed by Ukraine, Czech Republic and Kazakhstan (*Table 1*). Other former USSR countries do not have billionaires yet, although their PPP GDP is higher than that of Georgia. For example, Azerbaijan and Uzbekistan are supposed to have about 3 billionaires had they the same level of billionaire-intensity as Russia. However, in fact, they do not.

The relatively successful economic performance is even more impressive given that Uzbekistan is not a major oil and gas exporter and

that it is one of two (the other being Liechtenstein) double landlocked countries[4] in the world. It is important, however, to distinguish between growth rates and the level of per capita income. Uzbekistan remains a poor country with PPP GDP per capita of below $US 6000 in 2014 against over $20,000 in Russia and Kazakhstan, $17,000 in Azerbaijan and over $14,000 in Turkmenistan. Many Uzbeks are migrating to find jobs in Russia. The reverse is not true.

It is necessary to separate the effects associated with the dynamics of output from the effects of the terms of trade and financial flows. At the end of the Soviet period, in the 1980s, real incomes in Uzbekistan were about half of those in Russia. After the collapse of the USSR, real incomes in non-resource republics fell dramatically due to the change in relative prices; oil, gas and other resources became several times more expensive relative to ready-made goods. Uzbekistan was a large importer of oil and its trade with all countries, including other Soviet republics, if recalculated in world prices, yielded a deficit of 9% of GDP (Soviet economy, 1990). To make matters worse, the collapse of the Soviet Union dried up financial flows from Moscow. In 1990, inter-budgetary transfers

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[3] The statistics on the number of billionaires published by Forbes annually allegedly characterize income distribution at the very top of the wealth pyramid. The number of billionaires depends mostly on the total size of the country's GDP. Much less important is the per capita GDP. The relationship is non-linear: Number of billionaires in 2007 = $-0.9 + 0.367y - 0.0049y^2 + 2.6Y^2$, where
y — PPP GDP per capita in thousand $ in 2005,
Y — PPP GDP in 2005 in trillions.
N = 181, R^2 = 0.95, all coefficients significant at 1% level. Countries which exceed the predicted number of billionaires considerably (2 times and more) are: Canada, Israel, Germany, Spain, UK, India, Turkey, Saudi Arabia, Egypt, Hong Kong, Malaysia, Philippines, Brazil, Russia, Ukraine, Kazakhstan. In contrast, countries where the number of billionaires is considerably lower than predicted are Japan, China, most countries of Western Europe, Oman, Argentina, Romania, Czech Republic (Popov, 2014c).

[4] Double landlocked countries are countries fully surrounded by other landlocked countries.

from the Union budget amounted to 31% of the revenues of the republican budget (Soviet Economy, 1991).

Hence, the sharp reduction of real incomes in the early 1990s was larger than the reduction of output and was primarily due to a poor external environment and circumstance, rather than policy and choice. However, the *dynamics* of real output, i. e. the physical volume of output (*Figure 1*) which is dependent on circumstances and policy, was better than in all countries of Eastern Europe and former USSR with the exception of Turkmenistan.

IV. CHANGES IN UZBEKISTAN'S ECONOMIC STRUCTURE

Since the 1991 independence, Uzbekistan encouraged and carried out three important structural shifts in its economy: (1) a decrease in cotton production and export and an increase in food production, achieving food self-sufficiency, (2) an attainment of energy self-sufficiency and an achievement of net fuel export, (3) an increase in the share of industry in GDP and the share of machinery and equipment in industrial output, export.

Diversification in agriculture was carried out mostly via state orders: less for cotton, more for cereals. Thus, the production of cotton decreased by 50%as compared to the late

1980s, and the output of cereals and vegetables increased several folds (*Figure 4*). The increase in gas output was due mostly to state investments: gas and oil are produced by the state holding company "Uzbekneftegaz". The diversification in industry and the expansion of manufacturing exports was mostly the result of protectionism and of the policy of low exchange rate by the government / central bank. Like China, Uzbekistan maintained a low (undervalued) exchange rate due to rapid accumulation of foreign exchange reserves. In addition, there were non-negligible tax measures to stimulate the export of processed goods (50% lower tax rates for manufacturing companies that export 30% and more of their output).

Although comparable statistics from WDI for Uzbekistan is lacking, national statistics suggests that the share of non-resource goods in exports increased to over 70% against less than 30% in 1990, before independence (Foreign Affairs Department of Uzbekistan, 2013).

Uzbekistan is one of the few transition countries where the share of industry increased in recent years (*Figure 5*). It also was able to upgrade its structure of industrial output; the share of machinery, equipment and chemicals increased at the expense of light industry (*Table 2*). Other post-Soviet economies also experienced the decline of light in-
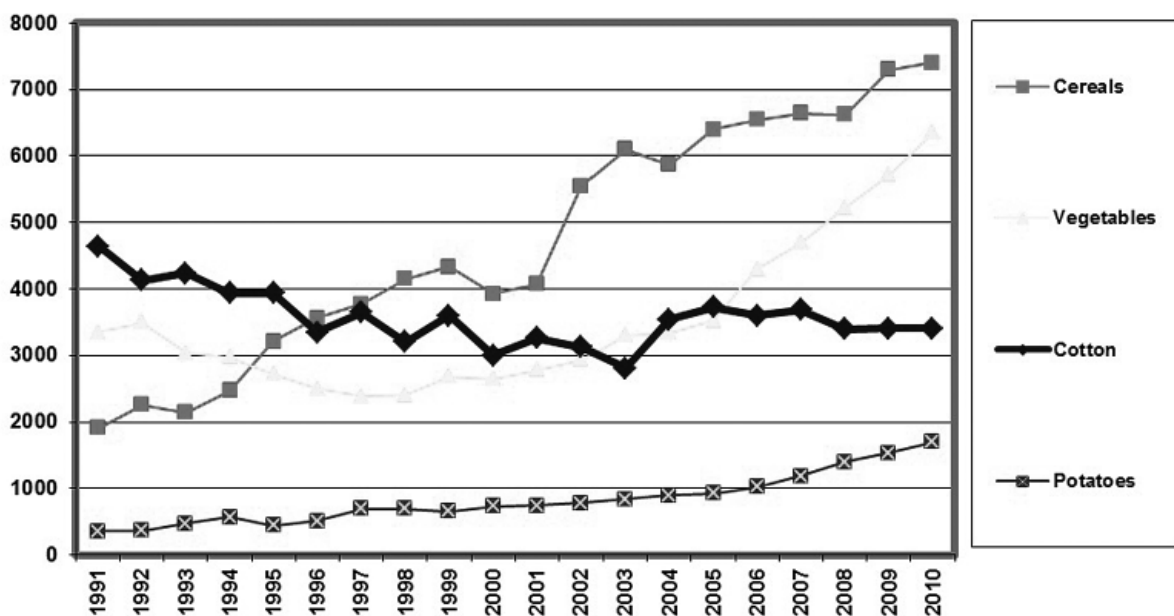
Figure 4. **Diversification in agriculture**

Source: State Committee on Statistics of Uzbekistan (http://www.stat.uz/en/).
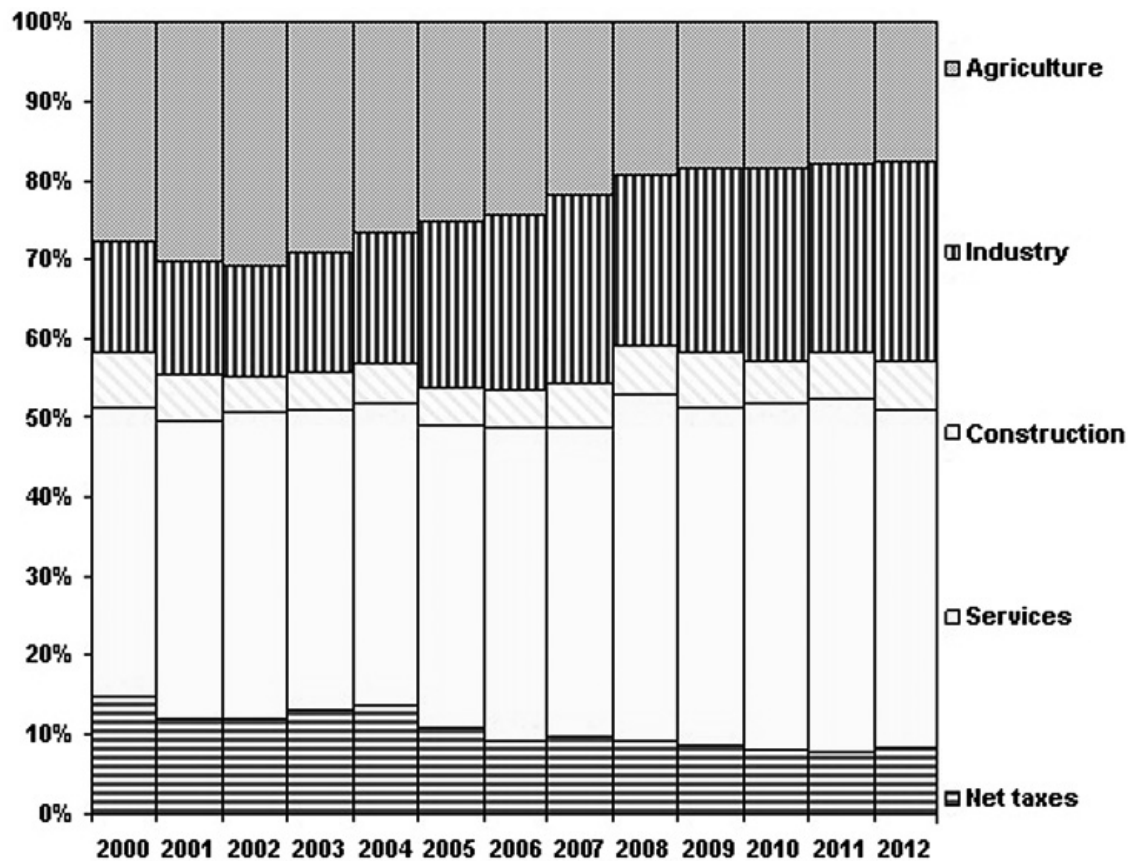
Figure 5. **GDP structure by sectors of the economy, % of total**

Source: WB, 2013.

dustry, but it happened together with the decline of machine building that created space for the expansion of fuel, energy, steel and non-ferrous metals. During the Soviet era, in a centrally planned economy, resource rent was removed from resource industries and given to secondary manufacturing through the pricing mechanism; prices for commodities and low processed goods were set at levels below the world marker, whereas prices for finished goods were established at an artificially high level. Once prices were allowed to be determined by the market after the deregulation in 1992, they got closer to the world levels and terms of trade for resource industries improved, but deteriorated for the secondary manufacturing.

After independence, an automobile industry was created in Uzbekistan from the ground up. Car production was supported by the government and the Korean auto company Daewoo. After Daewoo declared bankruptcy, US General Motors became the government's partner. The government also bought a stake in Turkey's

Koc in SamKochAvto, a producer of small buses and lorries. Afterwards, it signed an agreement with Isuzu Motors of Japan to produce Isuzu buses and lorries. In 2014 Uzbekistan produced 250,000 cars and nearly a quarter were exported[5]. In 2011 a joint venture of State Auto Company and General Motors, the engine plant in Tashkent, became operational with a capacity of 360,000 engines a year.

Uzbekistan's exports increased dramatically: from $2 billion in 1992 to $15 billion in 2011, or from $100 to $500 per capita (*Figure 6*). The share of former USSR countries in exports fell from over 60% in 1992 to less than 40% in 2012 (Appendix *Figure A2*). The share of cotton in export fell from 65% in 1992 to only 9% in 2012. The share of fuel (mostly gas) and oil products

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[5] In 2013 Uzbekistan sold over 60,000 cars to Russia and 33,000 to Kazakhstan. In 2014–15 export fell dramatically due to a recession in Russia. In 2014 car output was 246,000 including over 55,000 for export (38,000 to Russia, the rest to Kazakhstan, Azerbaijan, Ukraine, Belarus and also to Indonesia, Brazil, Turkey, South Korea). The share of joint venture company "GM Uzbekistan" in the Russian car market fell to 1.5% in 2014 from 2.2% in 2013 (UzDaily.uz, 2015 — http://www.uzdaily.uz).

Table 2. **Structure of industrial output in 1991 and in 2011 in current prices, % of total**

Industry	1991	2011
Electric energy	2.7	8.0
Fuel	3.7	17.5
Steel	0.8	2.6
Non-ferrous metals	9.7	10.4
Chemical and petrochemical	4.0	5.5
Machinery and equipment	11.6	16.1
Wood, pulp and paper	1.6	1.1
Construction materials	4.3	5.3
Light	39.8	13.5
Food	14.8	14.0
Other	7.1	6.1
Total	100.0	100.0

Source: State Committee on Statistics of Uzbekistan (http://www.stat.uz/en/).

increased from 4% to 38%. The share of machinery and equipment increased from 2% to 7% and the share of chemical products from 6% to 9%. In import, the share of food fell from 43% to 10%, whereas the share of machinery and equipment increased from 10% to 46% (*Figure 7*).

In recent years, the second round of industrial policy focused on heavy chemicals: Shurtan Gas Chemical Complex and the planned production of synthetic liquid fuels based on purified methane together with South African "Sasol" and Malaysian "Petronas"; liquefied natural gas production at Mubarek gas processing plant; Dehkonobod Potash Fertilizer Plant; and Ustyurt gas chemical complex at Surgil deposit.

V. UNDERVALUATION OF THE EXCHANGE RATE — THE MAIN TOOL OF INDUSTRIAL POLICY

In 2008–12 Uzbekistan was growing at a rate of 8–9% with a barely visible decline in growth rates during the 2008–09 recession. It had a stable inflation of 7 to 8%,[6] a positive fiscal balance and rapidly declining debt to GDP ratio, a current account surplus and growing foreign exchange reserves. Foreign reserves for end of 2012 were estimated at about $40 billion (15 months

of imports against 5 months in 2004), not including about $5 billion (2010) in the Reconstruction and Development Fund of Uzbekistan[7].

However, here Uzbekistan is not exceptional. Many countries of the former USSR have managed to put their government finances in order in recent years and they enjoy budget surpluses, moderate inflation and growing foreign reserves. What makes Uzbekistan different, even unique, is a policy of low exchange rate. This promotes export oriented development similarly to that seen in Japan in the 1950–70s, South Korea in the 1960–80s and China and ASEAN countries since the 1990s (Dollar, 1992; Easterly, 1999; Polterovich & Popov, 2004; Rodrik, 2008; Bhala, 2012). Undervaluation of the exchange rate via accumulation of foreign exchange reserves, in fact, becomes a powerful

[6] Alternative estimate of the IMF marked inflation in 2012 at 11% (WB, 2013).

[7] In 2006, Uzbekistan's Fund for Reconstruction and Development (FRD) was established. It has been used primarily for sterilization and accumulation of foreign exchange revenues, but officially it was presented as a financial institution for providing government-guaranteed loans and equity investments to strategic sectors of the domestic economy. It was established by Uzbekistan's Cabinet of Ministers, Ministry of Finance and the five largest state-owned banks. The equity capital of the fund reached USD 5 billion in 2010. The FRD provides debt financing for modernization and technical upgrade projects in sectors that are strategically important for the Uzbek economy (energy, chemicals, non-ferrous metallurgy, etc.). All loans require government approval. The credit portfolio of the FRD reached USD 871 million in 2010 (BEEBA, 2011).

Figure 6. **Export and import of Uzbekistan, million US dollars**

Source: State Committee on Statistics of Uzbekistan (http://www.stat.uz/en/).
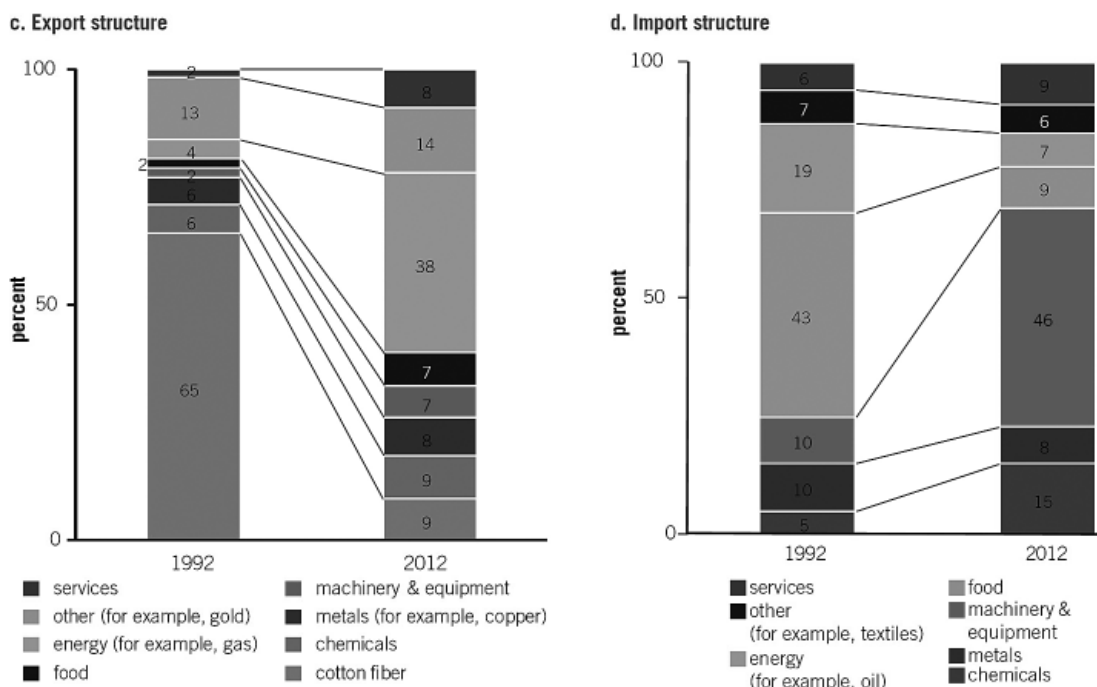
Figure 7. **Commodity structure of export and import, % of total**

Source: Trushin, Carneiro, 2013.

tool of industrial policy, creating stimuli for tradable goods at the expense of non-tradables (Greenwald & Stiglitz, 2013). Former communist countries of Eastern Europe and the USSR did not carry out such a policy; on the contrary, their exchange rates were and often are overvalued, especially in countries that export resources (they suffer from the Dutch disease).

Since 2000, Uzbekistan is probably the only country in the post-Soviet space which carries out predictable and gradual nominal devaluation of the currency that is somewhat larger than needed to counter the differences in inflation rates between Uzbekistan and its major trading partners, so that real effective exchange rate depreciates slowly. The real exchange rate of the *som* versus
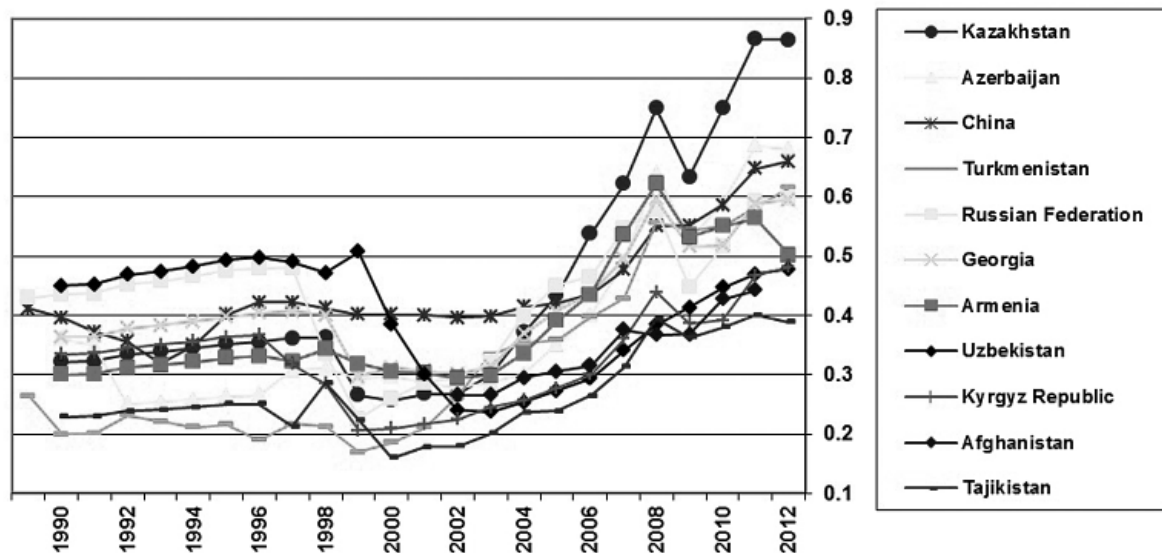
Figure 8. **Real exchange rate to the US dollar**

the US dollar has somewhat appreciated, though not as much as the currencies of other countries (*Figure 8*). However, the real *effective* exchange rate of the *som* (i. e. with respect to currencies of all major trading partners) decreased by over 50% in 2000–07. This is in sharp contrast with other transition countries of the region (North and Central Asia and Caucasus[8]) for which data are available (Appendix *Figure A3*).

Exporters in Uzbekistan are required to submit half of their revenues in foreign currency at a rate that is considerably below the street value. The rationale behind this is the centralization of foreign currency earnings and import control; it allows the government to prioritize purchases abroad. The Reconstruction and Development Fund of Uzbekistan are now performing the role of both Stabilization Fund and Investment Fund (to finance imports for national projects).

Other, more traditional tools of industrial policy exist. For example, the tax stimuli to manufacturing exporters mentioned earlier, government orders and government investment. However, undervaluation of the exchange rate is probably the most important instrument.

VI. WHICH INDUSTRIES SHOULD DEVELOP AT A FASTER PACE?

The reduction of the share of industry in GDP and the increase of the share of services is an objective process; but in the fast-growing countries (e. g., China), this decline was slower than in others (see Appendix *Figure A4*). At the same time, it appears that the increase in the share of machinery and equipment in manufacturing output, as in China, usually accompanies rapid growth or even becomes the engine of growth. We are not aware of cases of rapid growth ("economic miracles") that are based on an accelerated growth of the service sector.

The question of "What are the particular manufacturing industries which could become the engine of growth?" is a difficult one. Unfortunately, economic theory does not suggest any definite clues, with the exception of the idea that these industries should have the highest externalities, i. e. their social returns should be higher than private returns. Yet, it is not easy to measure these externalities. Nevertheless, upon examination of the literature and the experience of countries with industrial policy, it is possible to isolate methods, which can aid in our identification of industries that should be supported.

For example, one can support several industries, which seem promising with the condition that assistance ends if the increase in export is not achieved within, for example, five years. This is called "EpconEP" — effective protection conditional on export promotion (Jomo, 2013). Economic policymakers in this case are similar to the military commander who begins an offensive on several fronts, but throws reserves where there has been a breakthrough.

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[8] Afghanistan is the only non-transition economy in the region and is shown for comparison.

Alternatively, one can attempt to predict the specific industries where limited investment can give the greatest effect leading to the creation of globally competitive production. It is most likely, that it would be industries lagging behind in total factor productivity in the most advanced countries, however, by less than other industries.

It is also possible to choose at random. In this case, it is important to be consistent by embarking on the path of support for a particular industry without withdrawal even if there is no immediate success or breakthrough in world markets. After all, the modern theory of international trade explains country specialization not by comparative advantages, but rather by "learning by doing".

If the country does not have any comparative advantage, similarly to post-war Japan for example, it is necessary to create them ("dynamic comparative advantages") by mastering the production of goods that have not being produced before. Supporting such production and consistently encouraging exports, without withdrawal for some time, is likely to have the learning by doing effect, allowing the country to become gradually competitive. As the saying goes, if Japan, which does not possess any minerals or extensive agricultural land, would rely on comparative advantages, its exports today would not even be sushi (which includes rice), but only sashimi.

There are two opposing views on how advanced in technology the industries supported in the framework of industrial policy ought to be. Justin Lin, former chief economist of the World Bank, developed the idea of comparative advantages following (CAF) and comparative advantages defying (CAD) industrial strategy. The best result, according to his argument, could be achieved if countries develop industries that are consistent with their comparative advantages, as determined by their endowment structure, and do not try to overleap necessary stages aiming at exporting the goods which are exported by very advanced countries (Lin, 2011).

This view is consistent with the "flying geese" paradigm: as more competitive countries move to more advanced types of export, the vacated niches are occupied by less developed countries. It is known that relatively poor countries began to export textiles and shoes, then moved on to the export of steel products and heavy chemicals, then to the export of cars and electrical consumer products such as washing machines and refrigerators, then to consumer electronics and computers. In this case, the newcomers could benefit from the experience of other countries by trying to replicate their success.

The transition from one exported good to the other could be dictated by the cycle of innovations. As Lee (2013) suggests, the cycle is short for electronics and long for pharmaceuticals and chemicals. This may explain why East Asian countries, which focused mostly on industries with short cycles managed to avoid growth slowdowns while moving from one export niche to another.

Justin Lin believes that Uzbekistan should not leap over the consecutive stages by going from processing agricultural goods directly to auto and heavy chemistry industries. Lin suggests that Uzbekistan could gain greater benefits by developing less sophisticated industries such as food, textile and leather goods[9]. However, there are opposite arguments, which are supported by the examples of Israel and Finland, who at the end of the 20th century, mastered the production of high tech goods (electronics) and are now leading the world in the share of R&D expenditure to GDP ratio (*Figure 9*).

In contrast, Ricardo Haussmann, Jason Hwang and Dani Rodrik (Hausmann & Rodrik, 2006; Hausmann, Hwang & Rodrik, 2006; Rodrik, 2006) hypothesize that the more technologically sophisticated the export structure, the greater the stimuli for economic growth. China in 1992 and 2003 for example, had the greatest gap between the hypothetical per capita income as computed based on the technological sophistication of export structure, and the actual per capita income. That is to say, the structure of the Chinese exports was similar to that of countries with several-fold higher levels of economic development.

In another article (Hausmann & Rodrik, 2006) the process of transition from the production and export of one group of goods to the other is compared to the movement of monkeys in a forest from closer to more distant trees. The trees rich with fruit are far away, whereas closer trees do not have as much. Thus, the monkeys

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[9] Personal communication with Justin Lin. In the general form the theory is presented in (Lin, 2011).
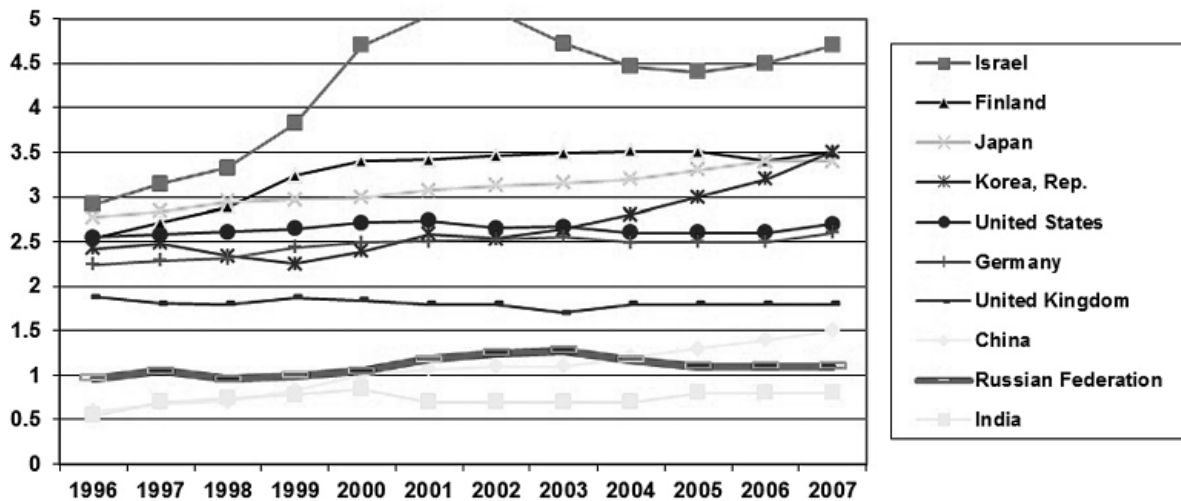
Figure 9. **R&D expenditure in selected countries, % of GDP**

must compare the movement costs with the benefits of reaching the more fruit abundant trees. Similarly to the monkeys, firms and society as a whole must compare the cost of mastering the new output and export (low for "nearby" industries which are close to existing technologies and high for "far away" industries with totally new technological processes) with the benefits (externalities) associated with developing particular industries (theoretically the higher, the more sophisticated these industries are).

It is worth noting that there was a similar debate between Justin Lin and Ha-Joon Chang (Lin, Chang, 2009). The latter was defending the idea of CAD industrial policy, which favours industries that defy the country's comparative advantages. Such industries take time to develop, yet they could be worthwhile. For example, "...Japan had to protect its car industry with high tariffs for nearly four decades, provide a lot of direct and indirect subsidies, and virtually ban foreign direct investment in the industry before it could become competitive in the world market. It is for the same reason that the electronics subsidiary of the Nokia group had to be crossing subsidized by its sister companies for 17 years before it made any profit. History is full of examples of this kind, from eighteenth-century Britain to late twentieth-century Korea" (Lin, Chang, 2009).

The difference between Chang's and Rodrik's position may be the subtle distinction between the CAD strategy and the policy to promote high tech industries and R&D in relatively poor countries. The CAD strategy does not necessarily imply a transition to more technologically sophisticated industries, but rather, to industries that are not linked to comparative advantages of a particular country. Theoretically, it could be a transition from chemicals to machine building with the same, or even lower, level of R&D intensity and technological sophistication. Rodrik's idea is that externality returns from the production and export of new products are proportional to the degree of their technological sophistication, which is measured by the comparison of export structures of rich versus poor countries. High income countries export on average more high tech products. Developing high tech production in poor countries may be costly, yet the returns from such a policy could be greater. It may well pay off for a relatively poor country to make "a big leap forward" by investing heavily in the education of the labour force and high tech industries, bypassing the intermediate stages of producing goods with medium research intensity. The implication for Uzbekistan is that investment in the auto and heavy chemistry industries could be well justified.

In the debate about "picking the winner", a distinction is made between functional and selective interventions (Lall 1994). While selective intervention refers to a policy package to create and support the "winners", functional interventions are those that remedy market failure without favouring any one activity over

another. Thus, functional interventions can be termed as "corrective" industrial policy (CIP) and selective interventions as "directive" industrial policy (DIP). CIP is based on the premise that a properly functioning market economy provides an effective self-regulating mechanism for adapting to structural change. In relation to international trade, CIP rests on the principle of comparative advantage to determine the industrial structure. CIP, therefore, signifies a movement toward a more market-oriented open economy. To some extent, Lin's position can be placed within the CIP.

On the other hand, the intellectual origin of the directive approach can be traced to the work of Schumpeter (1934, 1939). DIP derives from the notion that structural change is a dynamic process which is typically discontinuous, disruptive and unbalanced. Thus, the position of Hausmann, Hwang & Rodrik can be placed within the tradition of Schumpeter and it fits the features of DIP.

VII. CONCLUDING REMARKS
Lessons from Uzbekistan
Uzbekistan created a car industry from the ground up. Today, this industry produces more than 200 thousand cars with their engines, half

of which are exported (Popov, 2014a). It is an undisputable success of industrial policy; a breakthrough to world markets with the products of a medium level research intensity, previously achievable only by countries of a higher level of development. It remains to be seen, however, if the second round of industrial policy, with a focus on heavy chemistry, will succeed. The arguments against such a policy (Popov, 2014b) are more in line with Haussmann-Hwang-Rodrik's approach rather than Lin's approach.

First, the gas reserves are close to depletion. It is projected that gas production will begin to decline as of 2015 (World Bank, 2013). In that case, the use of gas for the production of polypropylene and other chemical products will lead to a decrease in energy self-sufficiency. Currently, the country is a net exporter of fuel. If the World Bank forecasts are correct (*Figure 10*), Uzbekistan will have to import more oil and /or gas to satisfy domestic demand for energy. In addition, production of synthetic liquid fuels from gas will further reduce the already low capacity utilization at two existing refineries in Uzbekistan.

Second, the focus on the development of heavy chemistry industries can lead to a slowdown of growth or even a reduction of the level of TFP. Calculations by the Uzbek Institute
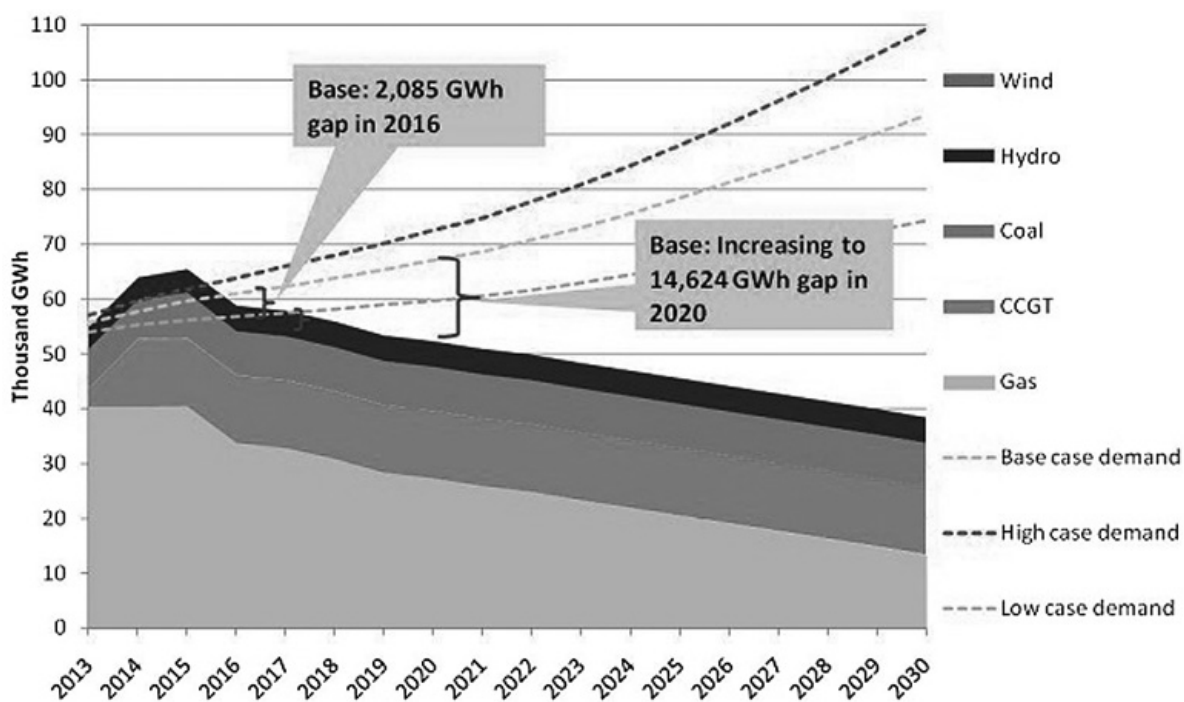
Figure 10. **World Bank forecast of energy production & consumption in Uzbekistan till 2030**

Source: World Bank, 2013.

of Forecasting and Macroeconomic Research (Chepel et al., 2014) reveal that the level of labor productivity and TFP, and the growth rates of these indicators in the past 10 years, were the highest in engineering, light and food industries, but not in petrochemicals and chemicals.

Third, the focus on medium tech engineering goods, the auto industry, has vindicated itself. Since it is a proven route, it might be better to develop successes in this area, and along these lines of specialization, rather than to attempt to create a new competitive industry from the ground up. The scale of the Uzbek economy may not be sufficient to specialize in more than one group of industries.

What can Uzbekistan learn from Singapore?

There is a general consensus that similar to East Asian economies such as South Korea and Taiwan, Singapore could break through in international competitiveness by ensuring a docile labor force and a market-driven flexible labor market. Although many see the depression of wages through subordination and attenuation of labor rights as purely an industrial relations matter, this in effect was a deliberate industrial policy, which keeps the unit labor costs and the real exchange rate low[10]. Yet, it was the only alternative Singapore had when it monetary and exchange rate policies were constrained due to a currency board system in place until 1973. Even after 1973, Singapore's monetary system maintained the principles of a currency board. Singapore held net foreign reserves equal to about 100 percent of the monetary base and its monetary policy centered on the management of the exchange rate since the early 1980s. An undervalued real exchange rate, achieved through wage-depression, is an economy-wide policy and affects all industries equally. Thus, there was no need for picking the winners, although the government encouraged particular industries, such as petro-chemicals.

Singapore continued to use labor-market, in particular wage policies during the later phase, to restructure its industries by phasing

out labor-intensive activities. However, it is obvious that at a later stage of development of wages depression is not possible; wages must rise commensurate with the higher levels of per capita GDP. The symbiotic relationship between the union and the government helped Singapore's economy without union resistance. Trade union leaders, being part of the policy-making process, understood the need for economic restructuring to remain internationally competitive. Trade union leaders also helped the government devise compensation packages and retraining programmes for workers who lost jobs due to restructuring. The government of Singapore introduced a Skills Development Fund (SDF) to collect levies from the "sunset" industries (low-skill, low-wage), thereby encouraging firms to retrain workers and making sure they remain employable. Employers were also required by law to contribute to workers' retirement funds. The government, by legislating compulsory employer contribution to the government-managed Central Provident Fund (CPF), has been able to create a sense of fairness in industrial relations. As the sunset firms exited under the pressure of rising costs, their workers did not fear losing their entitlements.

Finally, the tripartite wage-fixing mechanism at the national level accelerated the industrial restructuring process. By de-linking productivity-based wage increases at the enterprise level and adhering to the industry-wide average productivity-based wage increases, the system raised the unit labor cost of firms with below-industry-average productivity, thereby forcing them to exit. This also meant that firms with above-industry-average productivity enjoyed lower unit labor costs, hence higher profit rates for reinvestment[11].

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[10] See Chowdhury (2008) for industrial policies in East and Southeast Asia.

[11] See Salter (1960) for a formal analysis of productivity-linked wage increases and industrial restructuring. It is generally believed that wage increases according to productivity growth are noninflationary. This forms the basis for labour market deregulation or enterprise bargaining. However, as pointed out by Salter (1960), this adversely affects structural change as low-productivity industries would be able to continue operating while the high-productivity activities would lack incentive because their profit margin would remain stagnant. As a result, the overall economic growth would be low and inadequate for lowering the unemployment rate.

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APPENDIX
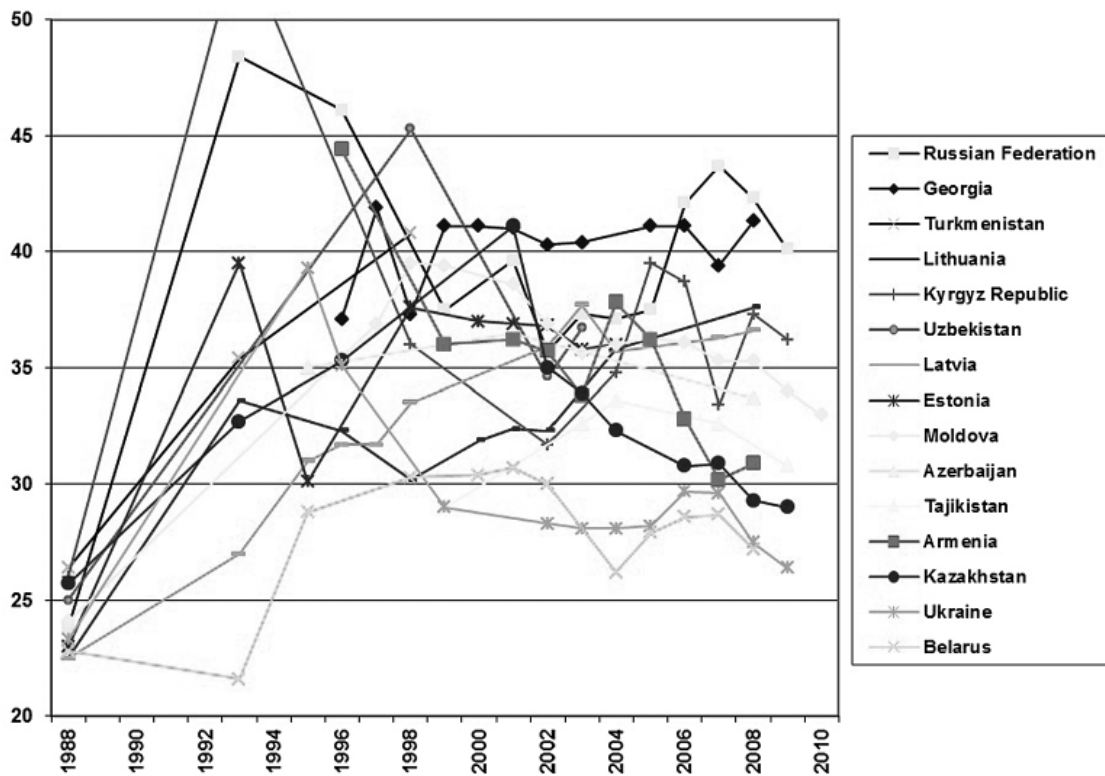
Figure A1. **Gini coefficient of income distribution in post Soviet states**

Source: WDI.
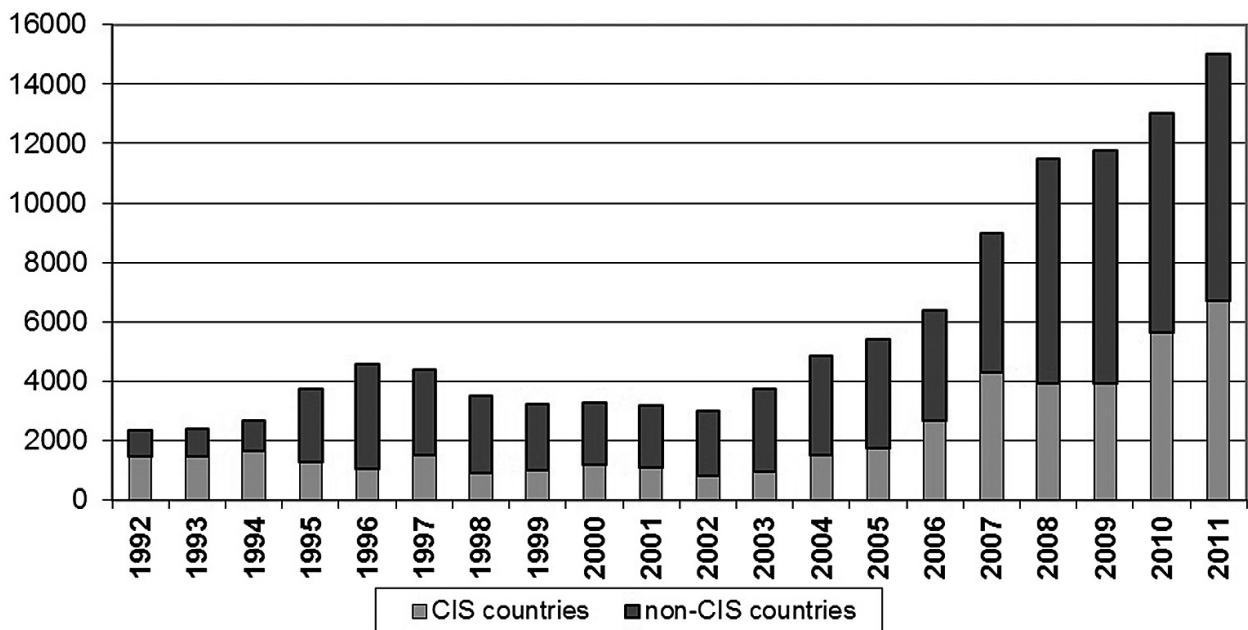
Figure A2. **Export to CIS & other countries, million US dollars**

Source: State Committee on Statistics of Uzbekistan (http://www.stat.uz/en).

Real effective exchange rate, 2005=100%

Uzbekistan: Real Exchange Rate, 2000–07

2000=100
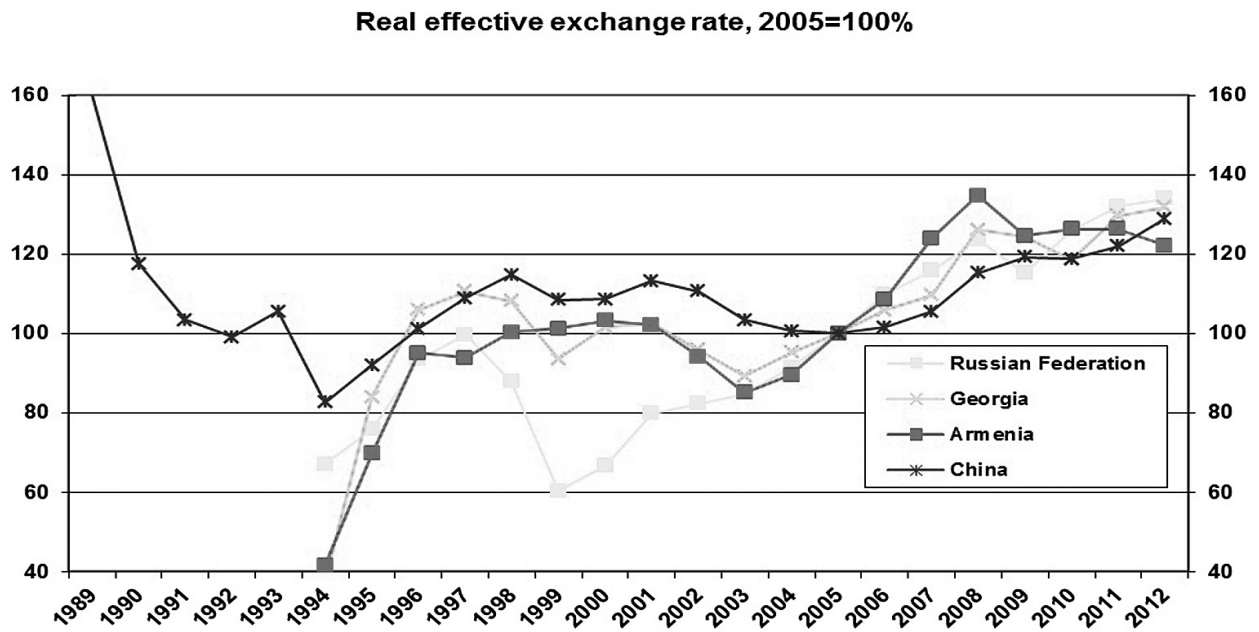
Sources: Uzbek authorities; and Fund staff estimates.

Figure A3. **Real effective exchange rate of Uzbek som**

Source: WDI, IMF, 2008.
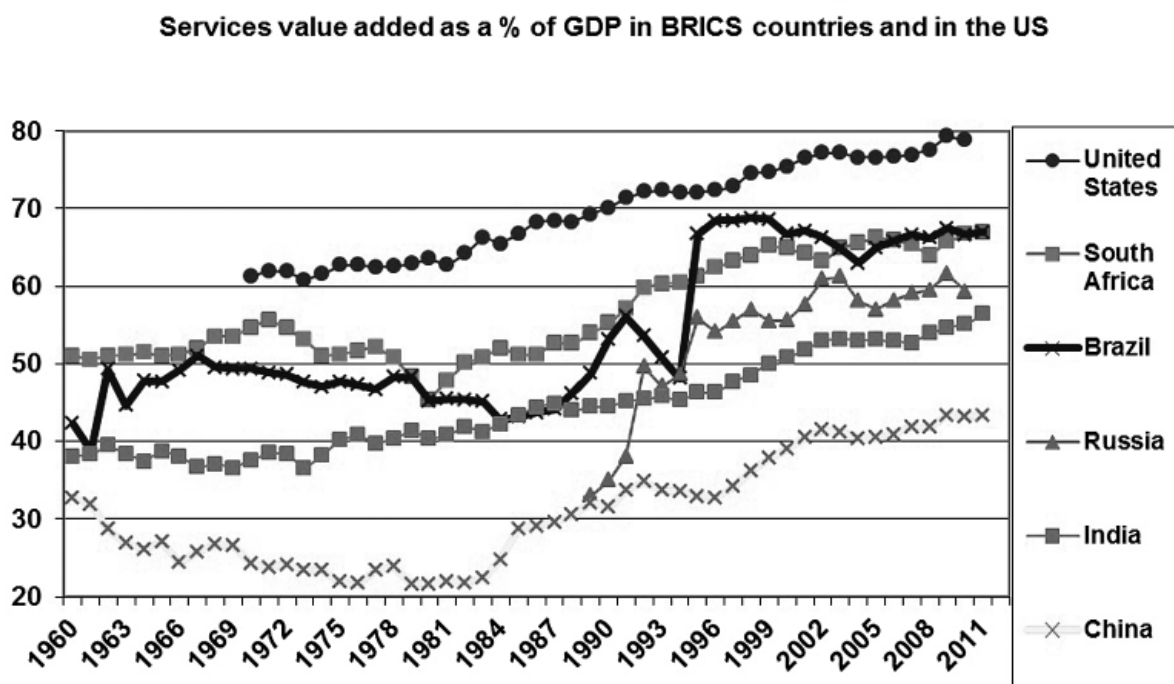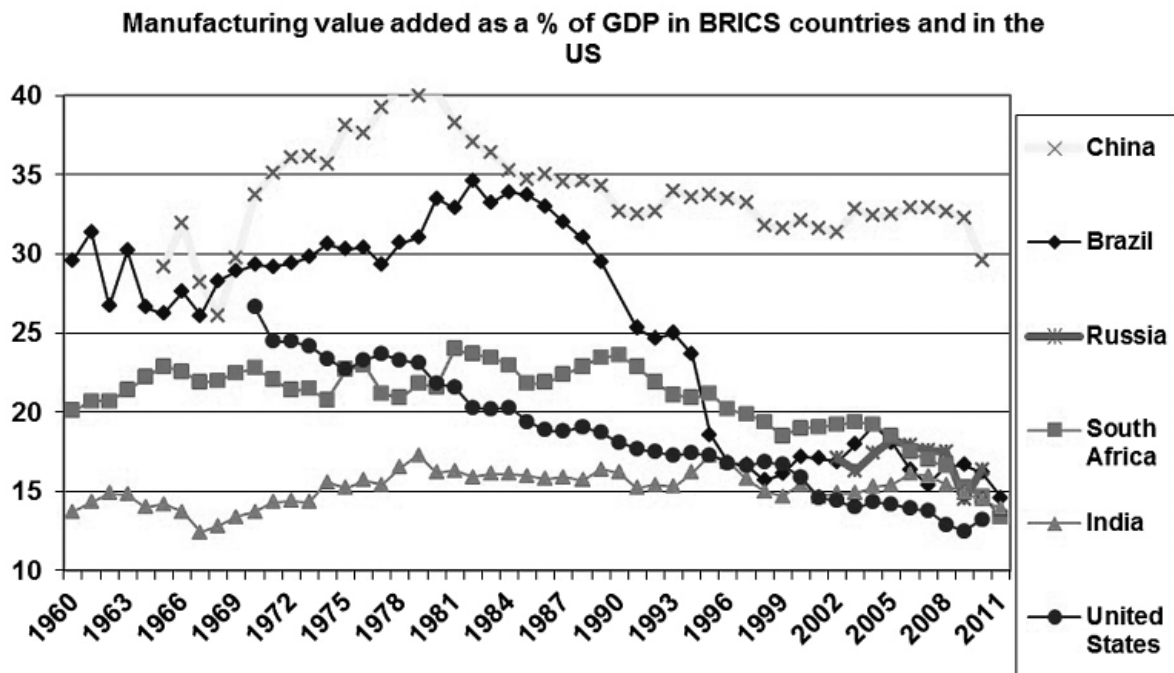
Manufacturing value added as a % of GDP in BRICS countries and in the US

Services value added as a % of GDP in BRICS countries and in the US

Figure A4. **The share of manufacturing & services in GDP, the share of industry in employment, the share of machinery in manufacturing value added**

Source: World Development Indicators.

Employment in industry, % of total employment

Machinery and transport equipment, % of value added in manufacturing in BRICS countries and in the US
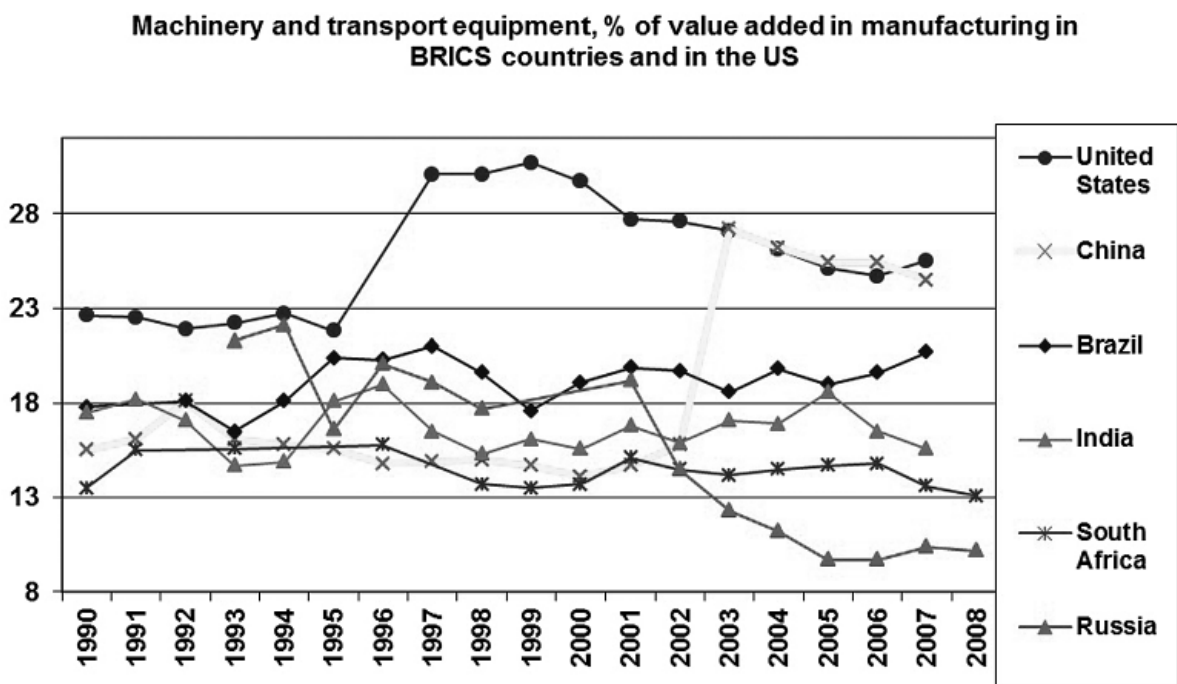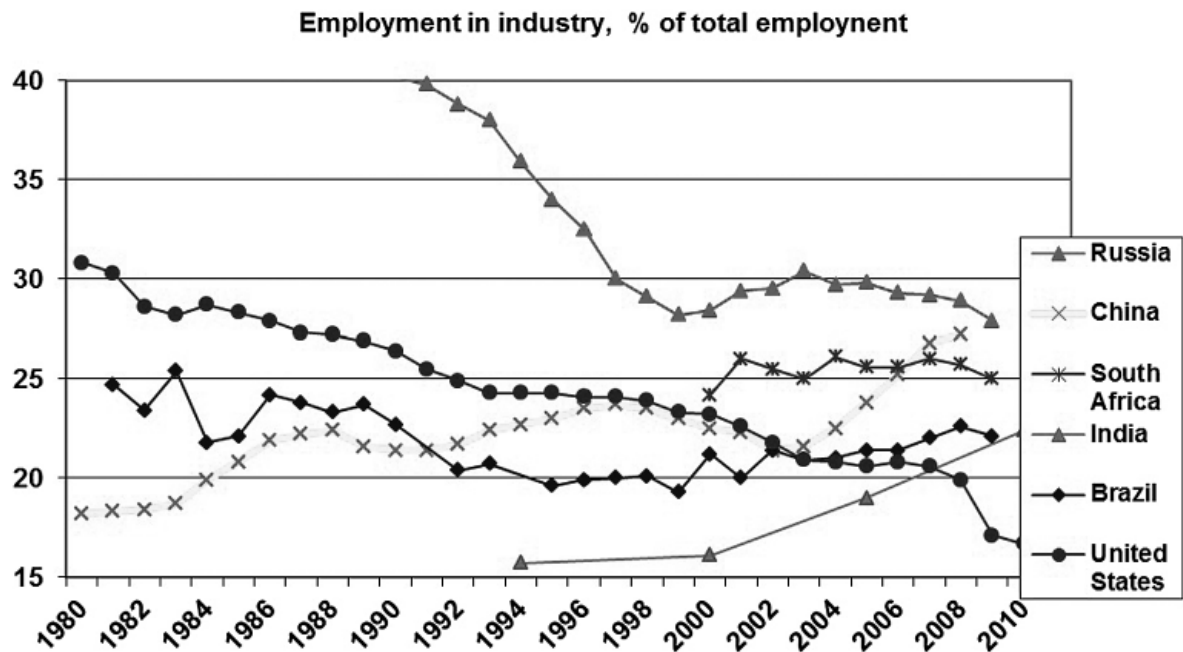
Figure A4. **The share of manufacturing & services in GDP, the share of industry in employment, the share of machinery in manufacturing value added**

Source: World Development Indicators.

Russia: searching for friendly-oriented countries

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Abstract. We are convinced that Russia is not alone in the world. Thus, the theme of our inquiry will be searching for friendly-oriented countries — economically and politically as well. In the first part of article, we present the main dates concerning level of external debts in low- and middle-income countries per capita. First, we describe the compilation of the major components of external debt included in the IDS tables and database and the relationship between them. Then, we focused on financial flows, trends in external debt, and other major financial indicators for low-, middle-, and high-income countries. Among those countries with the best indicators, we will be search economically sustainable and politically friendly-oriented countries, as potential partners for Russia.

Keywords: Russia, World Bank, Low — and Middle-Income Countries, external debt, debt reporting system (DRS), debt statistics.

Россия в поисках дружественно ориентированных стран

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Аннотация. Какие страны из числа лояльно относящихся к России сегодня можно рассматривать в качестве ее потенциальных партнеров? Какие критерии необходимы для этого выбора? Эти и другие вопросы — тема данной статьи. В ее первой части представлены основные данные по уровню внешней задолженности в странах с низким и средним показателем национального продукта на душу населения. Подробно рассмотрены состав основных компонентов внешней задолженности, включенных в таблицы и базы данных международной статистики задолженности (*IDS*), и соотношения между ними. В статье также анализируются ситуация, связанная с финансовыми потоками, трендами внешней задолженности, и другие финансовые показатели в странах с низким, средним и высоким уровнем дохода на душу населения. Из числа этих стран, показавших наилучшее показатели, выбраны экономически состоятельные и политически дружественные страны в качестве потенциальных партнеров России.

Ключевые слова: Россия, Всемирный банк, страны с низким и средним уровнем дохода, внешний долг, система отчетности по внешним долгам, статистика задолженности.

We are convinced that Russia is not alone in the world. Thus, the theme of our inquiry will be searching for friendly-oriented countries-economically and politically as well.

In January 2016, the World Bank has issued several papers, among others reports:

INTERNATIONAL DEBT STATISTICS 2016

COMMODITY MARKETS OUTLOOK JAN 2016 with Special Focus: *Weak growth in emerging market economies: What does it imply for commodity markets?*

DIGITAL DIVIDENDS. World development report 2016

GLOBAL ECONOMIC PROSPECTS. *Spillovers amid Weak Growth*. January 2016.

We will analyze some publications of Inter-

national Monetary Fund (IMF), especially their "World Economic Outlook" (WEO) with the last update of the key WEO projections and "The Global Financial Stability Report", which provides an assessment of the global financial system and markets, and addresses emerging market financing in a global context. It focuses on current market conditions, highlighting systemic issues that could pose a risk to financial stability and sustained market access by emerging market borrowers. The Report draws out the financial ramifications of economic imbalances highlighted by the IMF's "World Economic Outlook". It contains, as special features, analytical chapters or essays on structural or systemic issues relevant to international financial stability.

We have also taken into account "Report of the Economic and Social Council for 2015". General Assembly Official Records. Seventieth Session. Supplement No. 3. United Nations. New York, 2015, and other publications of international and commercial organisations too. At its 1-st plenary meeting, on 21 July 2014, the Economic and Social Council decided to adopt the following themes for its 2015 and 2016 sessions:

(a) 2015 session (July 2014 to July 2015): "Managing the transition from the Millennium Development Goals to the sustainable development goals: what it will take";

(b) 2016 session (July 2015 to July 2016): "Implementing the post-2015 development agenda: moving from commitments to results".

First, we have prepared outlook of "INTERNATIONAL DEBT STATISTICS 2016" publication.

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INTRODUCTION

"International debt statistics 2016" is a product of the staff of The World Bank with external contributions. The findings, interpretations, and conclusions expressed in that work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent. The World Bank does not guarantee the accuracy of the data included in that work.

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International Debt Statistics 2016, successor to Global Development Finance and World Debt Tables, and the fourth in the series, is designed to respond to user demand for timely, comprehensive data on trends in external debt in low- and middle-income countries.

It also provides summary information on the external debt of high-income countries and public (domestic and external) debt for a select group of countries.

The World Bank's Debtor Reporting System (DRS), from which the aggregate and country tables presented in that report are drawn, was established in 1951. World Debt Tables, the first publication that included DRS external debt data, appeared in 1973 and gained increased attention during the debt crisis of the 1980s. Since then, the publication and data have undergone numerous revisions and iterations to address the challenges and demands posed by the global economic conditions.

Presentation and access to data have been refined to improve the user experience. The printed edition of International Debt Statistics 2016 now provides a summary overview and a select set of indicators, while an expanded dataset is available online (datatopics.worldbank.org/debt/ids).

By providing comprehensive and timely data that reflects the latest additions and revisions, and by expanding the scope of the data available online, that report aims to serve the needs of users and to reach a wider audience. Improvements in data dissemination are matched with ongoing efforts to improve the quality and timeliness of data collection. In partnership with the major providers of debt data management systems to low- and middle-income countries, the

Commonwealth Secretariat (COMSEC) and the United Nations Conference on Trade and Development (UNCTAD), the staff is working toward an established standard code and a set of system links that will enable countries to provide their DRS reports electronically in a seamless and automated data exchange process.

This International Debt Statistics 2016 volume was prepared by the Financial Data Team of the Development Data Group (DECDG), led by Evis Rucaj under the management of Neil Fantom, and comprising Parul Agarwal, Peter Bourke, Cynthia Nyanchama Nyakeri, Malvina Pollock, Rubena Sukaj, Sun Hwa Song, Rasiel Vellos, and Alagiriswamy Venkatesan, who worked closely with other teams in DECDG.

The team was assisted by Elysee Kiti. The overview of current developments was prepared by Malvina Pollock, Evis Rucaj, and Rasiel Vellos in consultation with the staff of DECDG; country economists reviewed the data tables. The work was carried out under the direction of Haishan Fu. Valuable advice was provided by the Operations and Strategy unit of the Vice Presidency.

The production of that volume was managed by Azita Amjadi. The online database was prepared by Shelley Fu and William Prince.

International Debt Statistics electronic products were prepared by a team led by Malarvizhi Veerappan under the supervision of Soong Sup Lee and comprising Prasanth Alluri, Rajesh Danda, Jean-Pierre Djomalieu, Ramgopal Erabelly, Shelley Fu, Ancy Kachappilly, Gytis Kanchas, Karthik Krishnamoorthy, Ugendran Machakkalai, Vilas Mandlekar, and Nacer Megherbi. The cover was designed by Jomo Tariku. Susan Graham, Jewel McFadden, and Nora Ridolfi from the Publishing and Knowledge Division of the World Bank coordinated the publication and dissemination of the book.

DATA SOURCES AND METHODOLOGY

Data Sources

Debtor Reporting System
The principal sources of information for the tables in International Debt Statistics 2016 are reports to the World Bank through the **World Bank's Debtor Reporting System** (DRS) from member countries that have received either International Bank for Reconstruction and Development (IBRD) loans or International Development Association (IDA) credits. The DRS has its origin in the World Bank's need to monitor and assess the *financial position* of its borrowers. Since 1951, borrowers have been required to provide statistics on their public external debt and private sector debt that benefit from a public guarantee. In its design, consistency, and continuity of coverage, the DRS is a unique resource. Reporting countries submit detailed reports on the annual status, transactions, and terms of the long-term external debt of public agencies and that of private ones guaranteed by a public agency in the debtor country. The DRS maintains these records on a loan-by-loan basis.

In 1973, coverage of the DRS was expanded to include private sector nonguaranteed borrowing, but for this category of debt, data are provided by borrowers in aggregate rather than loan-by-loan basis.

Data submitted to the DRS are processed in the World Bank External Debt (WBXD) system, along with additional information received from the files of the African Development Bank, the Asian Development Bank, the Inter-American Development Bank (IDB), the International Monetary Fund (IMF), institutions of the World Bank Group (IBRD and IDA), and the European Bank for Reconstruction and Development (EBRD). The WBXD is an internal system of the World Bank. Among its outputs is the International Debt Statistics (IDS) database, from which the tables in that publication and online database are produced.

Data on exports and imports (on a balance of payments basis), international reserves, current account balances, foreign direct investment (FDI) on equity, portfolio equity flows, and primary income of FDI are drawn mainly from the files of the IMF, supplemented by United Nations Conference on Trade and Development (UNCTAD) reports and country data. Balance of payments data are presented according to the sixth edition of the IMF's Balance of Payments Manual (BPM6, 2013). Official aid flows come from data collected and published by the Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development (OECD). Short-

term external debt data are as reported by debtor countries or are estimates based on the Bank for International Settlements (BIS) quarterly series of commercial banks' claims on low- and middle income countries.

For some countries, estimates were prepared by pooling creditor and debtor information. Data on the gross national income of most low- and middle-income countries are collected from national statistical organizations or central banks by visiting and resident World Bank missions.

Every effort has been made to ensure the accuracy and completeness of the external debt statistics.

Coverage has been improved through the efforts of the reporting agencies and close collaboration between the Bank and our partners, Commonwealth Secretariat (COMSEC) and UNCTAD, which provide debt recording and reporting systems across the globe, as well as through the work of the World Bank missions, which visit member countries to gather data and to provide technical assistance on debt issues.

Nevertheless, quality and coverage vary among debtors and may vary for the same debtor from year to year too. Data on long-term external debt reported by member countries are checked against, and supplemented by, data from several other sources. Among these sources are the statements and reports of several regional development banks, government lending agencies, and official government Web sites.

Quarterly External Debt Statistics
The ***Quarterly External Debt Statistics*** (QEDS) database, jointly developed by the World Bank and the IMF, brings together detailed external debt data of countries that subscribe to the IMF's ***Special Data Dissemination Standard*** (SDDS) and a selected number of countries that participate in the IMF's ***General Data Dissemination System*** (GDDS).

In October 2014, the World Bank, in collaboration with the IMF, launched the new QEDS database in line with the classifications and definitions of the *2013 External Debt Statistics: Guide for Compilers and Users* (2013 EDS Guide) and sixth edition of the *Balance of Payments and International Investment Position Manual* (BPM6, 2013).

The QEDS database reflects new concepts and definitions, classifications of external debt data, as well as expanded coverage that enhances the analytical use of the data. The database provides quarterly information on the stock of outstanding external debt, categorized by maturity as well as by borrowing entity and debt instrument. Reporting is voluntary but as of end 2014, 72 countries plus the Euro Area reported under the SDDS, and 47 countries reported under GDDS. The benefit of bringing together comparable external debt data is to facilitate **macroeconomic analysis and cross-country data comparison.**

The ***Quarterly External Debt Database***, which is maintained by the World Bank, can be accessed via the Bank's web site through the ***World Bank Open Data*** at www.databank.worldbank.org.

Quarterly Public Sector Debt
As part of the World Bank Open Data Initiative, in December 2010, the World Bank launched for the first time an online, quarterly, ***Public Sector Debt*** (**PSD**) database (www.worldbank.org/qpsd), developed in partnership with the IMF, which allows researchers and policy makers to explore questions about recent developments in public sector debt. The PSD database, with the endorsement of the Inter-Agency Task Force on Finance Statistics (TFFS), initially focused only on low- and middle-income, and emerging market countries; now in partnership with the OECD and Eurostat, the PSD database has been expanded to include the advanced economies. The launch of the database is one of the recommendations in the ***G-20 Data Gaps Initiative***[1].The PSD database facilitates timely dissemination in standard formats of external debt data. By bringing such data and metadata together in one central location, the database supports macroeconomic analysis and cross-country comparison.

The database is organized into five sets of tables on the following sectors: General government; o/w central government; o/w budgetary central government; nonfinancial public corporations; and financial public corporations. The database is structured by instruments, ma-

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[1] Please see http://www.imf.org/external/np/g20/pdf/102909. pdf. The Public Sector Debt Database is recommendation number 18 in the Data Gaps Initiative Report.

turity, and by creditors as the presentation format articulated in the table 4.3 in the IMF ***Public Sector Debt Guide***. While central government is identified as having the most important key of macroeconomic analysis, the PSD database provides data on other levels of public sector, valuation methods, and debt instruments, and clearly defined tiers of debt where appropriate for central, state, and local governments, as well as extra-budgetary agencies and funds.

As of end 2014, 75 countries participated in the Quarterly Public Sector Debt Database, which is maintained by the World Bank; it can be accessed through the Bank's web site through the World Bank Open Data at www.databank.worldbank.org.

Methodology

Aggregations
Total debt stock and other aggregate measures are derived from the summation of loan-level data on stocks and flows after conversion to a common currency. Other tabulations are compiled using terms and conditions reported in the loan-level data, such as currency composition, cancellations, rescheduling of other liabilities into long-term public and publicly guaranteed external debt, and debt buybacks.

Aggregates for regional and income groups are based on the World Bank's operational classifications, which may differ from common geographic usage or income groups used by other organizations. Country classifications of DRS reporting countries in 2014 are shown in country groups in the back of the publication. The same classification is used for all historical data shown in International Debt Statistics and the online tables and online database.

Currency Conversion
Data on external obligations are normally reported to the World Bank in the currency of repayment and are converted into a common currency (U. S. dollars) using official exchange rates published by the IMF.

Commitments, disbursements, and debt service payments (flows) are converted to U. S. dollars at the annual average exchange rate for the year.

Debt outstanding (disbursed and undisbursed) at the end of a given year (stock) is converted at the exchange rate in effect at the end of the rel-

evant year. Consequently, year-to-year changes in debt outstanding and disbursed may not be equal to net flows (disbursements less principal repayments); similarly, changes in debt outstanding (including undisbursed debt) may not equal commitments less repayments. Discrepancies will be particularly significant when exchange rates have moved sharply during the year. Projected debt service is converted to U. S. dollars at rates in effect at the end of December 2014.

Beginning with 1991, all ruble debt owed to the former Soviet Union has been converted at a rate of US$1 = 0.6 ruble, except in cases where a bilateral agreement specifying a different conversion rate is in place. Adoption of this methodology does not constitute an endorsement by the World Bank staff of the appropriateness or validity of the exchange rate used. That matter must be resolved bilaterally between the Russian Federation and its debtor countries.

Starting with the 1988–89 edition of World Debt Tables (a predecessor of IDS), all data pertaining to IBRD loans from 1985 onward are recorded at their current market value. Starting with the 1991–92 edition, all data pertaining to Asian Development Bank loans from 1989 onward are recorded at their current market value. Starting with the 1998 edition, all data pertaining to African Development Bank and African Development Fund loans from 1997 onward are recorded at their current market value.

Debt Stock and Flow Reconciliation
Because of currency conversions and the timing of transactions, there may be differences between the change in aggregate stocks from one period to the next and flows during the relevant period; changes in debt outstanding, including undisbursed amounts, will therefore differ from commitments less repayments.

Changes in the stock of debt from one period to the next can be attributed to five factors: the net flow of debt, the net change in interest arrears, the capitalization of interest, a reduction in debt resulting from debt forgiveness or other debt reduction mechanisms, and cross-currency valuation effects. Any residual difference in the change in stock not explained by one of those five factors may indicate inconsistencies in the reported data or specific phenomena prevailing in an individual country (for example, an incom-

plete historical series for all categories of debt). Starting in 1989, the IDS includes the debt stock reconciliation, but not all components are shown in the IDS print edition and online tables.

External Debt Restructuring
Starting in 1985, the WBXD includes information on the restructuring of debt by official creditors in the context of the Paris Club, restructuring by commercial creditors, debt swap operations, buybacks, and bond exchanges. It attempts to capture accurately the effect of debt restructuring on both external debt stocks and external debt flows, consistent with the terms on which the restructuring takes place. In the compilation and presentation of external debt data, a distinction is made between *cash flows* and *imputed flows*. According to this criterion, restructured service payments and the shift in liabilities from one financial instrument to another because of debt restructuring are considered to be imputed flows. Both cash flows and imputed flows are recorded separately in WBXD.

The imputed flows and stock changes associated with debt restructuring are included in the IDS tables and online database to complement the cash basis transactions recorded in the main body of the data. Such data encompass information on the debt stock and debt flows restructured each year, the amount of principal forgiven (interest forgiven is shown as a memorandum item), and the amount of external debt stock reduced either by forgiveness or by a debt buyback operation. Changes in creditors and debtors that result from debt restructuring are also reflected. For example, when insured commercial credits are rescheduled, the creditor classification shifts from private to official (bilateral), reflecting the assumption of the assets by the official credit insurance agencies in the creditor country. The IDS data will show a reduction in the external debt owed to the original private creditors equal or similar to the amount of debt restructured and a corresponding increase in the debt owed to the new official creditor. Similarly, on the debtor side, when a government accepts responsibility for the payment of restructured debt previously owed by a private enterprise, the relevant change in the debtor category will be reflected. Likewise, if short-term external debt is restructured into a

long-term obligation, the stock of short-term external debt will decline and the stock of long-term external debt will rise by the amount of short-term debt restructured. In the event of a debt swap of long-term external debt (external debt to equity, external debt for nature, or external debt for development), the face value of the external debt swapped will be recorded as a decline in long-term external debt stock, but no flow transaction (principal repayment) will be recorded.

Projections of Future Disbursements and Debt Service Payments
The WBXD system projects future disbursements and future debt service payments on the assumption that every existing loan commitment will be fully used and repaid in full.

Future Disbursements
Disbursement projections are made using one of the following methods:
• Specific schedules. Debtor countries are requested to submit a schedule of future disbursements, if available, at the time each new loan is first reported.
• Standard schedules. In the absence of specific schedules, the WBXD system projects the future disbursement schedule according to the undisbursed balance of each loan at the end of the most recent reporting period.

These projected schedules are based on profiles derived from the disbursement pattern of comparable loans that fully disbursed. Thirty different profiles have been compiled corresponding to each category of creditor and, in the case of official creditors, for concessional and non-concessional loans. Each profile is derived by applying regression analysis techniques to a body of data on actual disbursements for each fully disbursed loan in the WBXD database. The profiles are periodically updated to take into account the evolving pattern of disbursements observed for fully disbursed loans.

Future principal payments are generated by the WBXD system according to the repayment terms of each loan. Principal repayments (amortization) are based on the amount of the loan commitment. If the amortization schedule follows a set pattern (for example, equal semiannual payments), the WBXD system calculates repayments automatically using the loan com-

mitment amount, the first and final payment dates, and the frequency of the payments. If future payments are irregular, the WBXD system requires a schedule.

Future interest payments are generated by the WBXD system according to the disbursed and outstanding balance of the loan at the beginning of the period. Using the interest rate specified in the loan contract, the first and final interest payment dates, and the frequency of payments, the WBXD system calculates the stream of future interest payments due. If interest payments are irregular, the WBXD system requires a schedule.

Future debt service payments are the sum of future principal and interest payments due on existing commitments, including the undisbursed portion. They do not include debt service payments that may become due because of new loans contracted in subsequent years, nor do they take into account the effect of any change to future debt service obligations resulting from actions such as prepayment or rescheduling or from cancellations that occurred after the most recent year-end data reported to the DRS.

Both projected disbursements and future debt service payments are converted into U. S. dollars using end-December 2014 exchange rates. Likewise, future interest payments on loans with a variable interest rate (for example, loans from commercial banks tied to the **London Interbank Offered Rate** [LIBOR]) are based on the interest rate prevailing at end-December 2014.

Treatment of Arrears

The DRS collects information on arrears of both principal and interest. Principal in arrears is included in the amount of long-term external debt outstanding and is shown separately. Interest in arrears on long-term external debt
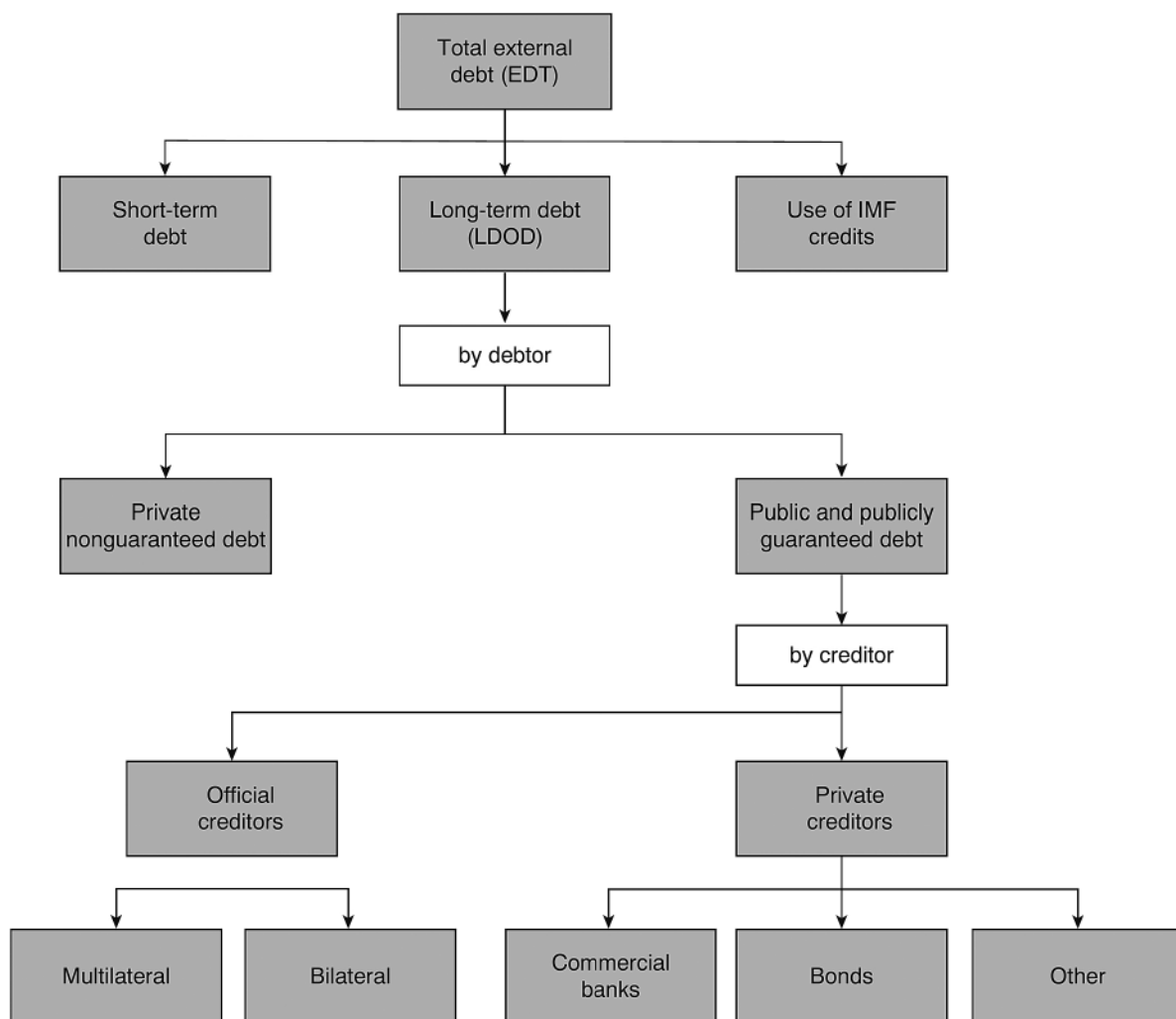
Figure 1. **External Debt and Its Components**

and interest in arrears on the use of IMF credit are included as part of short-term external debt outstanding and are shown separately. Clearance of interest in arrears by repayment will be recorded as an interest payment in the relevant creditor category of the loan (or loans) on which the arrears were incurred, as a corresponding reduction in the level of short-term debt outstanding, and as a net reduction in interest arrears. Clearance of interest arrears through debt restructuring or forgiveness will be recorded as a reduction in the level of short-term debt outstanding and a net reduction in interest arrears. When interests are rescheduled, they will be capitalized: This change will be recorded as an increase in long-term debt outstanding equal to the amount of interest capitalized and the reduction in short-term debt outstanding noted previously.

EXTERNAL DEBT AND ITS COMPONENTS

This section describes the compilation of the major components of external debt included in the IDS tables and database and the relationship between them, as shown in figure A. 1 on the next page. Information about general methods of compiling external debt data is discussed in the previous section titled "Methodology." For concise definitions, see the glossary.

Total External Debt

Total external debt shown in the IDS is the sum of long-term external debt, short-term debt, and IMF credit. It represents the total debt owed to nonresident creditors and is repayable in both foreign and domestic currency.

Short-Term Debt

Short-term debt is defined as external debt with an original maturity of one year or less. The DRS requires debtor countries to report only on their long-term external debt. However, to gain a comprehensive picture of total external obligations, the World Bank encourages debtor countries to provide voluntarily information on their short-term external obligations.

By its nature, short-term external debt is difficult to monitor: Loan-by-loan registration is normally impractical, and monitoring systems typically rely on information requested periodically by the central bank from the banking sector.

The World Bank regards the debtor country as the authoritative source of information on its short-term debt. Unless otherwise specified in the country tables, the data for short-term debt are derived from the data provided by the quarterly external debt statistics database (see QEDS). BIS data on international bank lending is the second source of the short-term debt. These data are reported on the basis of residual maturity, but an estimate of short-term external liabilities by original maturity can be derived by deducting from claims due in one year those that, 12 months earlier, had a maturity of between one and two years. However, not all commercial banks report to the BIS in a way that allows the full maturity distribution to be determined, and the BIS data include liabilities only to banks within the BIS reporting area.

Consequently, the results should be interpreted with caution.

The flow of short-term debt may be derived from the change in claims (stock) data in the BIS quarterly series over consecutive periods, but valuation adjustments resulting from exchange rate movements will affect the calculations, as will prepayment and refinancing of long-term maturities falling due. When short-term external debt has been rescheduled, lags in reporting and differences in the treatment of the rescheduled external debt by debtors and creditors may result in double counting.

Interest in arrears on long-term external debt and interest in arrears on the use of IMF credit are added to short-term debt and are separately identified.

Use of IMF Credit

Data related to the operations of the IMF are provided by the IMF Treasurer's Department. They are converted from special drawing rights (SDR) into dollars using end-of-period exchange rates for stocks and average-over-the-period exchange rates for flows. IMF trust fund operations under the Enhanced Structural Adjustment Facility, Extended Fund Facility, Poverty Reduction and Growth Facility, and Structural Adjustment Facility (Enhanced Structural Adjustment Facility in 1999) are

presented together with all of the IMF's special facilities (buffer stock, supplemental reserve, compensatory and contingency facilities, oil facilities, and other facilities). SDR allocations are also included in this category. According to the BPM6, SDR allocations are recorded as the incurrence of a debt liability of the member receiving them (because of a requirement to repay the allocation in certain circumstances, and also because interest accrues).

This debt item was introduced for the first time in IDS 2013 with historical data starting in 1999.

Long-Term Debt

Long-term debt has an original maturity of more than one year. It comprises the obligations of both public and private debtors. Private nonguaranteed debt comprises the external obligations of private debtors that are not guaranteed for repayment by a public entity in the debtor country.

Public and publicly guaranteed debt comprises the external obligations of public debtors and has two components: (a) public debt, which is borrowing by the national government or agency, by a political subdivision or agency, or by autonomous public bodies, and (b) publicly guaranteed debt, which is borrowing by a private agency that is guaranteed for repayment by a public entity.

Private Nonguaranteed Debt

The DRS reporting requirements were expanded in 1973 to include long-term private nonguaranteed debt. Data are reported annually on an aggregate basis and include, for the reporting year, the total amount of disbursed and outstanding debt; the amount of disbursements, principal repayments, and interest payments; the principal and interest rescheduled; and the projected principal and interest payments for future years. The aggregate data are usually reported in U. S. dollars, and no information on the underlying currency composition is given.

DRS reporting countries recognize the importance of monitoring borrowing by their private sector, particularly when it constitutes a significant portion of total external debt, but many countries acknowledge the difficulty of this process. Detailed data are available only when countries have registration requirements for private nonguaranteed debt in place, most commonly in connection with exchange controls. When formal registration of private nonguaranteed debt is not mandatory, compilers must rely on balance of payments data and financial surveys.

The data on private nonguaranteed debt in this publication is as reported or as estimated for countries where this type of external debt is known to be significant. The estimation of private nonguaranteed debt is based on the national data on quarterly external debt statistics (QEDS) or IMF data. Flows are derived from the change in stock over consecutive periods and are adjusted for the effects of exchange rate movements (assuming the currency composition mirrors that of public and publicly guaranteed debt) and for any known debt restructuring. Principal repayments are estimated based on the average maturity observed for loans to private sector borrowers in countries reporting to the DRS and based on the stock of debt outstanding. Interest payments are estimated based on the stock of debt outstanding and interest rates prevailing in international capital markets.

Balance of payments data provide a useful guideline in the estimation process: private nonguaranteed external debt may be derived as a residual between net long-term external borrowing recorded in the balance of payments and net long-term public and publicly guaranteed external debt reported to the DRS.

Public and Publicly Guaranteed Debt

Data related to public and publicly guaranteed debt are reported to the DRS on a loan-by-loan basis. The data provide annual information on the disbursed and outstanding balance and the undisbursed balance of each loan, the cumulative disbursements, the principal and interest paid and principal and interest restructured in the reporting year, and the stock of any outstanding payment's arrears of principal and interest. Detailed information on the terms and conditions of each loan is reported too. Public debt and publicly guaranteed debt are shown as a single line in this publication and then further disaggregated by creditor type and, in the case of private creditors, by type of credit instrument.

Official Creditors

Official creditors include multilateral and bilateral lenders. In general, official creditors provide loans (and, in some cases, provide grants) to public bodies, although in some cases they may lend to other entities with a public guarantee.

Multilateral creditors are international financial institutions such as the World Bank, regional development banks, and other multilateral and intergovernmental agencies whose lending is administered on a multilateral basis. Funds administered by an international financial organization on behalf of a single donor government constitute bilateral loans (or grants). For lending by a number of multilateral creditors, the data presented in this publication are taken from the creditors' records. Such creditors include the African Development Bank, the Asian Development Bank, the IDB, IBRD, and IDA. (IBRD and IDA are institutions of the World Bank.)

Bilateral creditors are governments and their agencies, including central banks, aid agencies, official export credit agencies, and autonomous agencies such as the U.S. Department of Agriculture or the Federal Home Loan Bank.

Member countries of the OECD Development Assistance Committee (DAC) and some other countries also report information on loans extended bilaterally or officially guaranteed to the Creditor Reporting System of the OECD.

Private Creditors

Private creditors include commercial banks, bondholders, and other private creditors. This line includes only publicly guaranteed creditors. Nonguaranteed private creditors are shown separately. Bonds include publicly issued or privately placed bonds. Commercial bank loans are loans from private banks and other private financial institutions.

Credits of other private creditors include credits from manufacturers, exporters, and other suppliers of goods, plus bank credits covered by a guarantee of an export credit agency. This line is included in the online database but is not shown in the published tables. It can be obtained as the difference between (a) credits of total private creditors and (b) bonds and commercial bank loans.

USER GUIDE TO TABLES

International Debt Statistics 2016 focuses on financial flows, trends in external debt, and other major financial indicators for low-, middle-, and high-income countries. The report includes more than 200 time series indicators from 1970 to 2014 for most reporting countries. This edition of International Debt Statistics (IDS) has been reconfigured to offer a more condensed presentation of the principal indicators, along with additional tables showcasing Quarterly External Debt Statistics and Public Sector Debt.

Tables

Aggregate Tables

The aggregate tables are labeled by region name. Data are shown for all low- and middle-income countries and six regional groups (East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa).

Country Tables

Country tables are labeled by country name and ordered alphabetically. Data are shown for 120 low- and middle-income countries that report public and publicly guaranteed external debt to the World Bank's Debtor Reporting System (DRS). The tables also include key debt ratios and the composition of external debt stocks and flows for each country.

Each table shows a time series with the most recent six years, as well as 2000 and 2006 as companion years. Full time series data are available for all countries in the World Bank's Open Data website (http://data.worldbank.org/data-catalog/international-debt-statistics).

Statistics

The general cutoff date for countries to report data for this publication was end-September 2015. The economic aggregates presented in the tables are prepared for the convenience of users. Although debt ratios can give useful information about developments in a debt-servicing capacity, conclusions drawn from them will not be valid unless accompanied by careful economic evaluation.

The macroeconomic data provided are collected from national statistical organizations, which in some cases may be subject to a considerable margin of error. The usual care must be taken in interpreting the ratios, particularly for the most recent years, because figures may be preliminary and subject to revision.

Notes at the bottom of each country table summarize major events that have taken place in the country in recent years; describe the sources of information for short-term and private non-guaranteed external debt if the reports were not provided by the country; and highlight main issues in the data collection process. Unless otherwise specified, data on long-term public and publicly guaranteed external debt for 2014 are based on reports provided by the country.

Aggregate Measures for Income Groups and Regions
Aggregate measures for income groups and regions include the 120 low- and middle-income countries that report public and publicly guaranteed external debt to the World Bank's DRS, whenever data are available. The aggregate "All low- and middle-income countries" is the sum of data for 120 countries.

Classification of Countries
For operational and analytical purposes, the World Bank's main criterion for classifying countries is gross national income (GNI) per capita (calculated by the World Bank Atlas method).

Every country is classified as low-income, middle-income, or high-income. Low- and middle-income countries are sometimes referred to as developing countries. The term is used for convenience; it is not intended to imply that all countries in the group are experiencing similar development or that other countries have reached a preferred or final stage of development. Because GNI per capita changes over time, the country composition of income groups may change from one edition of International Debt Statistics to the next. Once the classification is fixed for an edition, based on GNI per capita in the most recent year for which data are available, all historical data presented are based on the same country grouping.

Symbols
0 or 0.0 means zero or small enough that the number would round to zero at the displayed number of decimal places.

.. means that data are not available or that aggregates cannot be calculated because of missing data in the years shown.

$ indicates current U. S. dollars unless otherwise specified.

User Guide to IDS Online Tables
The extended version of country tables that were previously available in the International Debt Statistics print edition is now available online. Using an automated query process, these reference tables will be updated based on the revisions to the International Debt Statistics database.

Users can access all the online tables, download the PDF version of the publication, view the report as an eBook on ISSUU, as well as access the database and download the archived editions of the publication by going to http://data.worldbank.org/products/ids.

How to Access IDS Online Country Tables
To access the IDS online tables, visit http://datatopics.worldbank.org/debt/ids and select from "Country," "Region," or "Topic" options.

To access a specific country table directly without going through the above landing page,

Table 1. **All low — and middle-income countries**
(US$ billion, unless otherwise indicated)

	2000	2005	2009	2010	2011	2012	2013	2014
Summary external debt data								
External debt stocks	**1,743.3**	**2,090.8**	**3,174.9**	**3,630.8**	**4,078.6**	**4,564.2**	**5,056.1**	**5,391.5**
Long-term external debt	1,461.3	1,623.0	2,346.7	2,538.1	2,814.4	3,169.9	3,493.1	3,770.6
Public and publicly guaranteed	1,053.4	1,115.6	1,268.1	1,359.4	1,428.1	1,644.3	1,788.7	1,942.9
Official creditors	648.4	651.5	736.7	790.6	823.7	844.6	869.8	869.2
Use of IMF credit	53.4	50.9	128.9	138.7	138.7	130.4	112.6	97.0
Private creditors	405.0	464.0	531.4	568.8	604.5	799.7	918.8	1,073.7

Table 1 continued

	2000	2005	2009	2010	2011	2012	2013	2014
of which: Bonds	224.2	312.3	386.6	418.6	461.6	627.6	701.3	807.4
Private nonguaranteed	407.9	507.5	1,078.6	1,178.8	1,386.3	1,525.6	1,704.4	1,827.7
of which: Bonds	81.0	115.1	187.6	231.1	255.7	287.8	352.6	395.1
Short-term external debt	228.6	416.8	699.2	954.0	1,125.5	1,264.0	1,450.4	1,523.8
interest arrears on long-term	27.2	17.7	15.3	16.0	12.4	14.5	13.2	14.9
Long-term external debt								
Disbursements	**199.2**	**304.5**	**433.1**	**565.4**	**621.2**	**674.8**	**805.0**	**846.5**
Public and publicly guaranteed	117.7	125.4	179.5	235.7	191.6	256.2	291.4	326.4
Official creditors	48.2	43.9	95.7	107.0	87.3	86.1	103.6	101.2
Private creditors	69.5	81.5	83.8	128.7	104.3	170.0	187.8	225.2
of which: Bonds	42.0	56.8	60.7	90.1	76.7	128.6	109.7	145.7
Private nonguaranteed	81.5	179.1	253.6	329.7	429.5	418.6	513.6	520.1
of which: Bonds	10.7	33.6	35.6	68.0	86.7	92.8	128.4	96.2
Principal repayments	**178.8**	**236.9**	**303.3**	**324.1**	**349.3**	**354.9**	**411.6**	**452.9**
Public and publicly guaranteed	92.1	116.3	96.6	96.1	110.0	93.8	112.3	113.9
Official creditors	43.1	48.2	42.8	44.0	55.2	50.0	58.2	56.1
Private creditors	49.0	68.2	53.9	52.2	54.8	43.9	54.1	57.8
of which: Bonds	16.5	39.4	25.5	26.5	24.8	17.4	23.3	29.6
Private nonguaranteed	86.8	120.6	206.7	227.9	239.3	261.0	299.2	339.0
of which: Bonds	13.2	15.6	14.4	15.3	19.1	24.6	32.4	36.5
Interest payments	**75.1**	**69.3**	**85.9**	**84.4**	**103.1**	**118.9**	**112.6**	**122.2**
Public and publicly guaranteed	50.0	51.2	44.3	43.4	47.5	72.0	55.8	58.5
Official creditors	22.4	20.3	15.7	14.6	15.4	17.1	16.2	15.9
Private creditors	27.6	30.9	28.6	28.8	32.1	54.9	39.6	42.6
of which: Bonds	16.0	25.1	23.4	24.6	27.8	50.2	34.5	36.6
Private nonguaranteed	25.1	18.0	41.6	41.0	55.5	46.9	56.8	63.8
of which: Bonds	6.4	6.3	10.2	11.5	16.8	12.4	18.1	23.3
Net financial flows								
Net inflows	**144.8**	**400.7**	**674.6**	**1,105.2**	**1,020.6**	**1,054.8**	**1,190.4**	**1,132.3**
Net debt inflows	2.2	97.7	213.9	508.7	447.5	447.9	563.5	463.9
Official creditors	−2.7	−37.3	79.4	76.4	32.6	27.7	27.6	43.8
of which: World Bank	7.4	4.1	18.1	22.9	6.8	12.5	14.0	17.3
of which: IMF	−7.9	−33.0	26.4	13.4	0.5	−8.4	−17.7	−1.3
Private creditors	4.9	135.0	134.5	432.3	414.9	420.1	535.8	420.1
Long-term	15.2	71.9	76.8	178.3	239.8	283.7	348.0	348.5

Table 1 continued

	2000	2005	2009	2010	2011	2012	2013	2014
Bonds	23.0	35.3	56.4	116.4	119.5	179.4	182.4	175.8
Banks and other private	−7.8	36.5	20.4	61.9	120.2	104.3	165.6	172.7
Short-term	−10.3	63.1	57.8	254.0	175.1	136.4	187.8	71.6
Net equity inflows	142.6	303.0	460.7	596.4	573.1	607.0	626.9	668.4
Foreign direct investment	124.7	237.9	348.6	472.5	569.4	514.5	554.6	575.7
Portfolio equity	17.9	65.1	112.0	124.0	3.7	92.5	72.3	92.7
Major economic aggregates								
Gross national income (GNI)	5,033.0	8,266.7	14,376.7	17,607.7	20,612.5	21,799.7	23,169.9	24,271.5
Exports of goods, services & prim. Income	1,423.4	2,720.3	4,009.9	5,033.2	6,083.5	6,430.2	6,642.2	6,813.5
Imports of goods, services & prim. Income	1,517.6	2,789.0	4,122.6	5,271.3	6,485.6	6,810.3	7,140.4	7,278.2
Primary income on FDI	59.7	162.0	287.7	401.6	483.7	454.0	486.6	190.4
Personal transfers & comp. of employees	76.2	176.3	280.5	312.5	348.5	372.1	383.4	421.8
International reserves	529.8	1,667.7	4,165.5	4,843.3	5,325.1	5,586.6	6,109.9	6,120.1
Ratios								
External debt stocks to exports (%)	122.5	76.9	79.2	72.1	67.0	71.0	76.1	79.1
External debt stocks to GNI (%)	34.6	25.3	22.1	20.6	19.8	20.9	21.8	22.2
Debt service to exports (%)	20.0	13.3	10.1	9.0	8.2	8.3	8.5	8.9
Short-term to external debt stocks (%)	13.1	19.9	22.0	26.3	27.6	27.7	28.7	28.3
Multilateral to external debt stocks (%)	17.0	16.5	13.1	12.7	11.8	11.0	10.5	9.9
Reserves to external debt stocks (%)	30.4	79.8	131.2	133.4	130.6	122.4	120.8	113.5

use the URL http://datatopics.worldbank.org/debt/ids/ and thecountry.code(for example, http://datatopics.worldbank.org/debt/ids/country/DZA to view the table for Algeria). Similarly, to view the regional table, click on the "Region" tab and select one of the listed regions (for example http://datatopics. worldbank.org/debt/ids/region/SAS to view the table for South Asia).

How to Use the DataBank
DataBank (http://databank.worldbank.org) is an online web resource that provides simple and quick access to collections of time series data. It has advanced functions for selecting and displaying data, performing customized queries, downloading data, and creating charts and maps. Users can create dynamic, custom reports based on their selection of countries, indicators, and years. All these reports can be easily edited, shared, and embedded as widgets on websites or blogs. For more information, see: http://databank.worldbank.org/help.

OVERVIEW OF INTERNATIONAL DEBT STATISTICS 2016
International Debt Statistics 2016 presents data and analysis on the external debt of low-
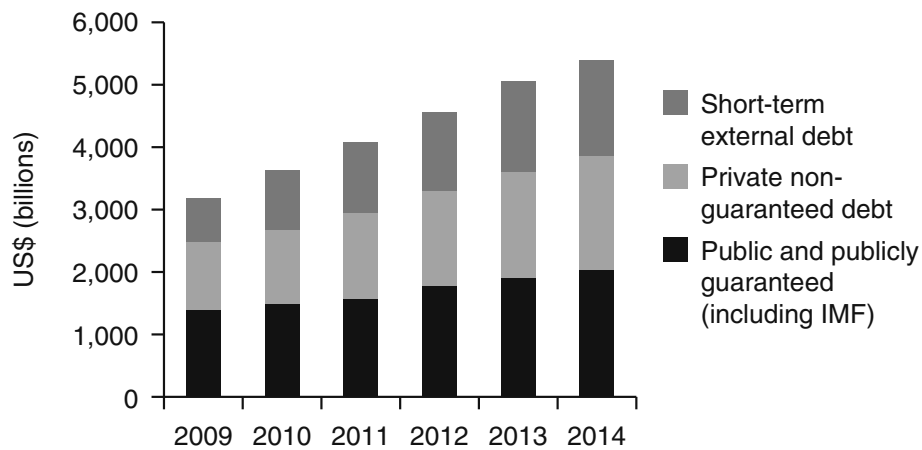
Figure 2. **External Debt Stock of Low- and Middle-Income Countries, 2009–14**

Source: World Bank Debtor Reporting System.

and middle-income countries for 2014, based on actual flows and debt-related transactions reported to the World Bank Debtor Reporting System (DRS) by 120 low- and middle-income countries. The International Debt Statistics 2016 provides users with comprehensive stock and flow data on the external debt of individual low- and middle-income countries and for regional and analytical groupings and data on aggregate net capital flows (debt and equity) in 2014. In addition, International Debt Statistics (IDS) showcases other debt data collected and compiled by the World Bank. These include the high-frequency, quarterly data for high-income and low- and middle-income countries reported to the joint World Bank — International Monetary Fund (IMF) Quarterly

External Debt Statistics (QEDS) and to the Public Sector Debt (PSD).

The main messages from the 2014 data are:

(a) Net debt flows to low- and middle-income countries were $464 billion in 2014, a decrease of 18 percent from the comparable figure for 2013. The decline was driven down by a precipitous fall in net short-term debt flows that fell 60 percent to $72 billion ($188 billion in 2013).

(b) Net equity inflows, $668 billion, were 7 percent higher than the 2013 level propelled by a 4 percent increase in net foreign direct investment and robust portfolio equity flows, which were up 29 percent.

Aggregate net financial flows totaled $1,132 billion, 5 percent lower than 2013, but stable
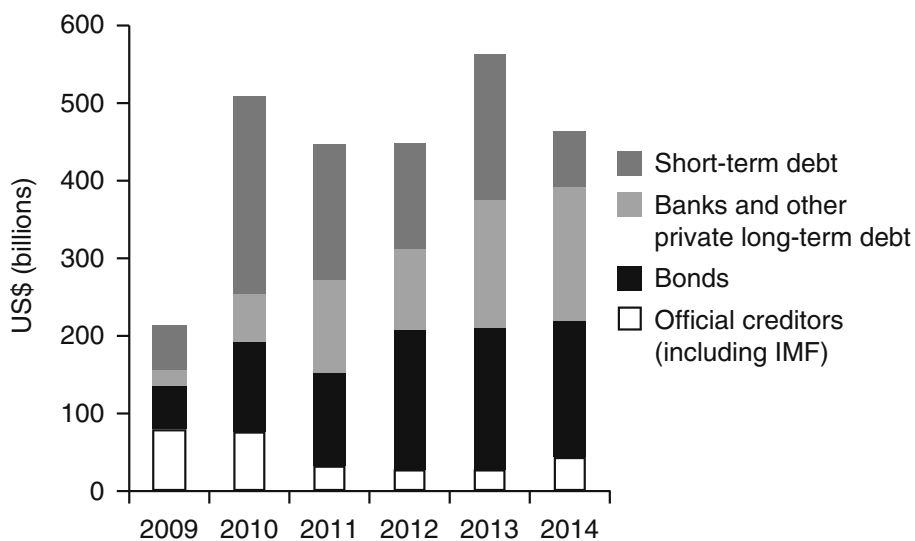
Figure 3. **Net Debt Flows to Low — and Middle-Income Countries, 2009–14**

Source: World Bank Debtor Reporting System.

when measured relative to low- and middle-income countries' gross national income (GNI) at 5 percent.

(c) External debt burdens in low- and middle-income countries remained moderate. The ratio of external debt to GNI averaged 22 percent in 2014, and the ratio of external debt to exports averaged 79 percent. International reserves stood at 114 percent of external debt stocks.

(d) Countries reporting to the QEDS and PSD confirm that external debt levels in high-income countries are, on average, much higher than those of low- and middle-income countries, but that government debt-to-GDP ratios moderated in 2014.

DEBTOR REPORTING SYSTEM

Trends in Debt Stocks and Flows, 2014

The total debt outstanding to low- and middle-income countries rose 7 percent in 2014, compared with an 11 percent increase recorded in 2013, and driven largely by the much slower rate of accumulation of short-term debt stocks. They rose only 5 percent compared with 15 percent in 2013. Public and publicly guaranteed debt and private non-guaranteed debt stocks increased at much the same pace, 9 percent and 7 percent, respectively. The combined stock of external debt of low- and middle-income coun-

tries rose from $5.1 trillion in 2013 to $5.4 trillion at the end of 2014. This reflects net debt inflows of $464 billion, debt forgiveness, and the effect of year-on-year exchange-rate adjustments between local currencies and the U. S. dollar (approximately one-third of the debt of low- and middle-income countries is denominated in U. S. dollars). The stock of long-term debt at end 2014 was divided somewhat evenly between public and publicly guaranteed and private non-guaranteed debt. Short-term debt, as a share of total debt outstanding was 28 percent, unchanged from 2013.

Net debt flows fall 18 percent as short-term debt inflows contract sharply

Net debt flows totaled $464 billion in 2014, 18 percent lower than the comparable figure for 2013, driven almost entirely by a 62 percent drop in net short-term debt flows, which fell to $72 billion ($188 billion in 2013). Net debt inflows from official creditors (including the IMF) were $44 billion, up over 50 percent from their 2013 level; but as a share of total net debt inflows, it remained small. Private creditors accounted for 91 percent of net debt inflows in 2014. Long-term debt inflows from private creditors held steady at $349 billion, thanks to another record year for bond issuance and resilient commercial bank flows. Viewed from the borrower perspective, there was a noticeable
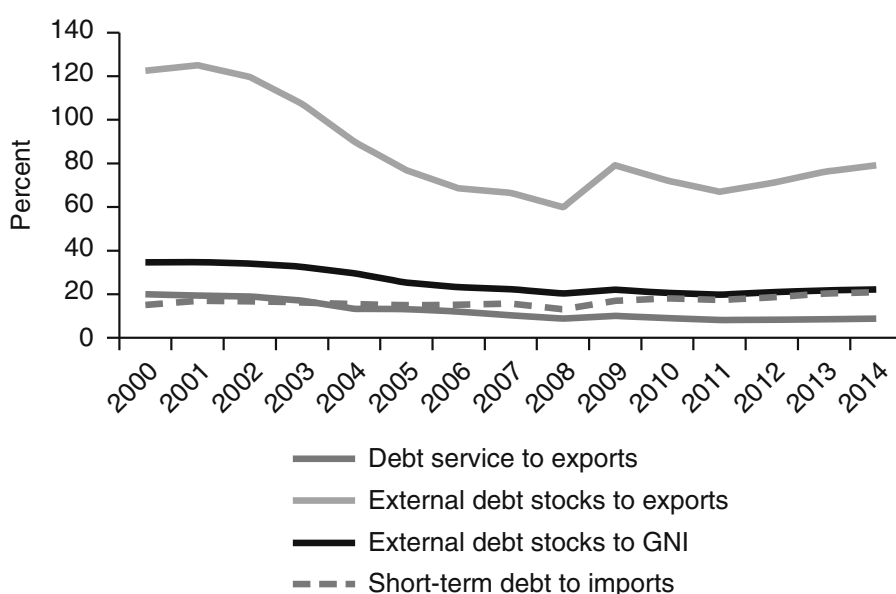
Figure 4. **Key Debt Indicator Trends in Low — and Middle-Income Countries, 2000–14**

Sources: World Bank Debtor Reporting System and International Monetary Fund.
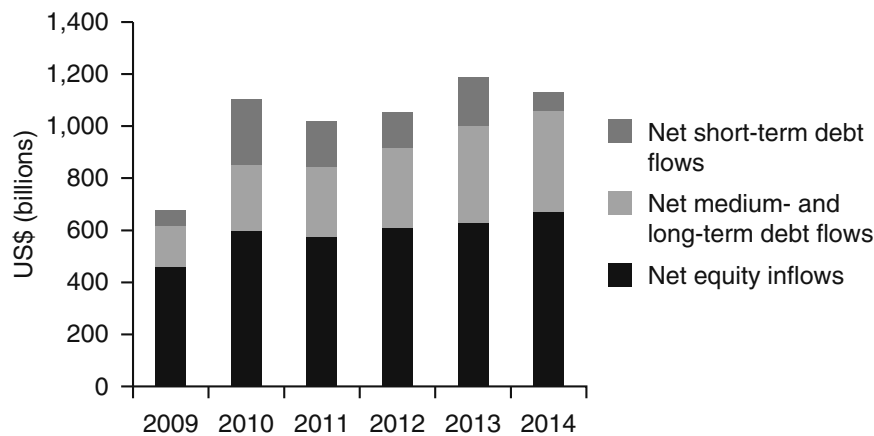
Figure 5. **Net Financial Flows, Debt and Equity, 2009–14**

Sources: World Bank Debtor Reporting System, International Monetary Fund, and Bank for International Settlements.

change in the composition of debt inflows from private creditors in 2014. The sharp contraction in short-term inflows reduced their share of debt flows to 17 percent in 2014, from approximately 35 percent in 2013. With regard to long-term debt inflows, just over 50 percent went to non-guaranteed private sector borrowers in 2014 as compared with 62 percent in 2013.

External debt burdens remain moderate
The majority of low- and middle-income countries have seen the ratio of outstanding external debt to GNI and to export earnings stay relatively steady: an average of 22 percent of GNI and 79 percent of export earnings at end 2014, broadly in line with 2013 and sharply below the comparable ratios for 2000 (35 percent and 123 percent, respectively). Risks associated with short-term debt (28 percent of external debt stocks) were mitigated by international reserves in excess of total external debt stocks, 114 percent at end 2014. There has been a significant improvement in external debt servicing capacity over the past decade as a consequence of increased export earnings, debt restructuring, and outright debt relief from official and private creditors, primarily in the context of the Heavily Indebted Poor Countries (HIPC) Initiative and the Multilateral Development Relief Initiative (MDRI). Additionally, an increasing number has been able to access international capital markets and secure attractive borrowing terms. The debt service-to-export ratio averaged 9 percent in 2014, a marginal increase over its 2013 level but less than half the 20 percent recorded in 2000.

Aggregate Financial Flows to Low- and Middle-Income Countries, 2014

Net financial flows fall 5 percent in 2014 and net short-term debt inflows plunge
Net financial flows, debt and equity combined, totaled $1,132 billion in 2014, 5 percent lower than 2013. The decline was driven by a precipitous fall in net short-term debt flows, which fell by over 60 percent in 2014 to $72 billion ($188 billion in 2013). Net equity flows rose to $668 billion, 7 percent higher than their 2013 level, propelled by a 4 percent increase in net foreign direct investment and robust portfolio equity inflows, up 29 percent above their 2013 level, to $93 billion. China was dominant, accounting for 51 percent of net equity flows to low- and middle-income countries in 2014 and for 42 percent of the contraction in net short-term debt inflows. Low- and middle-income countries, other than China, saw a slightly higher (6 percent) decline in net financial flows in 2014 to $706 billion, with net equity flows rising only 2 percent and net debt inflows down by 12 percent to $379 billion.

Foreign direct investment was half of net financial flows but the recipient country picture is mixed
Foreign direct investment proved resilient, accounting for slightly over half of net financial inflows in 2014. This is consistent with UNCTAD's World Investment Report 2015[2], which finds that low- and middle-income coun-

[2] UNCTAD (United Nations Conference on Trade and Development). 2015. World Investment Report 2015: Reforming International Investment Governance. New York and Geneva: UNCTAD.

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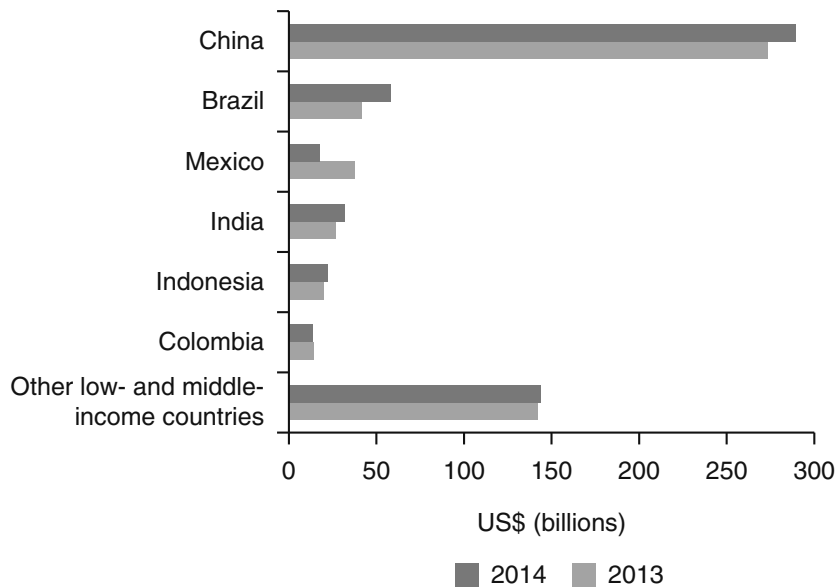
Figure 6. **Net Foreign Direct Investment Inflows to Major Recipients, 2013 and 2014**

Source: International Monetary Fund.
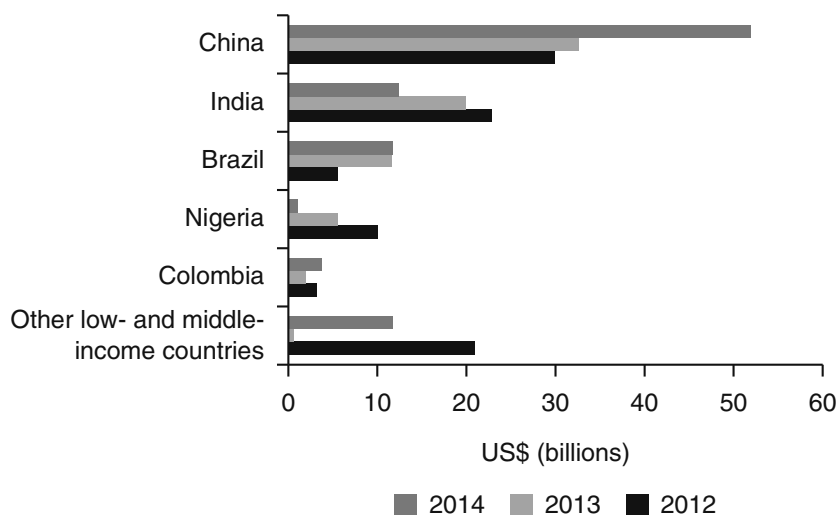
Figure 7. **Net Inflow of Portfolio Equity to Major Recipients, 2012–14**

Source: International Monetary Fund.

tries were the destination for more than half of global foreign direct investment in 2014. Investors continue to be attracted by improved business and regulatory environments, growth prospects, and buoyant and expanding domestic markets. The net inflow of foreign direct investment was $576 billion in 2014, 4 percent higher than the 2013 level ($555 billion) with half of these inflows directed at China. Elsewhere the picture was mixed. In Brazil, the second largest recipient of foreign direct investment after China, net inflows were up 38 percent in 2014. In contrast, in Mexico they fell back to their

2012 level, reflecting the one-off nature of the record $20 billion 2013 purchase of Grupo Modelo by AM-Bev Belgium. Countries in Sub-Saharan Africa recorded the sharpest contraction in net foreign direct investment inflows in 2014 (18 percent), while those in South Asia enjoyed the most rapid (17 percent) increase.

Portfolio equity flows remain strong but highly concentrated in a small number of countries
Portfolio equity flows rebounded in 2014 to $93 billion, on a par with the 2012 level and up 29 percent over the comparable figure for 2013

($72 billion). Investors sought emerging markets perceived as offering high returns, leading to some diversification in the destination of portfolio equity flows but, in general, they remained highly concentrated in only a handful of low- and middle-income countries. China was the destination of choice and absorbed 56 percent of portfolio equity flows in 2014, with Brazil and India each accounting for an additional 12 percent. Trends were diverse with China recording a 58 percent rise in net portfolio equity flows in 2014 to $52 billion; India a 40 percent ($12 billion) decline; and Brazil net inflows of $12 billion, unchanged from 2013. Portfolio equity flows were susceptible to political turmoil, as exemplified by strong outflows from Thailand and Ukraine. Concerns over economic prospects also led to a downturn in oil-exporting countries like Nigeria.

HIGHLIGHTS

All Low- and Middle-Income Countries

Brazil and China command a major share of net debt inflows in 2014

Forty percent of the combined net debt inflows to low- and middle-income countries in 2014 went to just two countries, Brazil and China. Together they received $183 billion but there was a sharp difference in the evolving trend. Net debt flows to China registered a 37 percent decline, whereas in Brazil the compa-

rable flows soared to $98 billion, 120 percent higher than the 2013 level. For the top ten borrowers, measured on the basis of end 2014 external debt stocks, combined net debt inflows dropped 27 percent, although collectively the top ten commanded 74 percent of net debt flows to low- and middle-income countries in 2014. When Brazil and China are excluded, the decline in net debt flows to the remaining eight countries in the group in 2014 was an even steeper 37 percent, largely because of the precipitous fall in net debt flows to Malaysia and Thailand. Low — and middle-income countries, excluding the top ten borrowers, saw net debt flows dropped by only 5 percent in 2014. This was in large part attributable to a much lower level of volatility in short-term debt flows.

Across regions the composition of net debt inflows varies considerably

Debt flows to low- and middle-income countries comprise long-term flows from official creditors and long- and short-term flows from private creditors. In 2014 the composition of net debt flows was: official creditors 9 percent, private creditors (long-term) 75 percent, and (short- term) 15 percent. At the regional level, the composition varied considerably. Net inflows from official creditors constituted 36 percent of net debt inflows to Sub-Saharan Africa and 30 percent to coun-
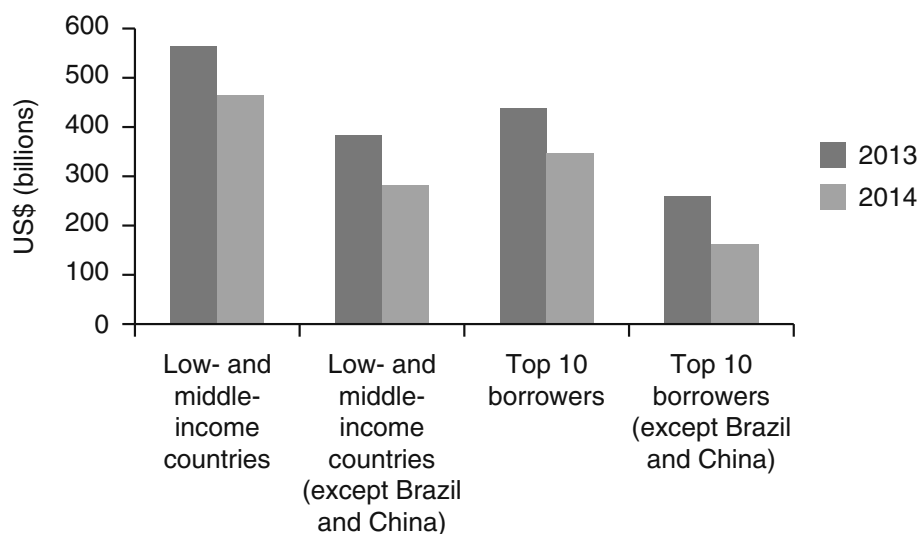
Figure 8. **Net Debt Flows for Select Country Groups, 2013 and 2014**

Source: World Bank Debtor Reporting System.
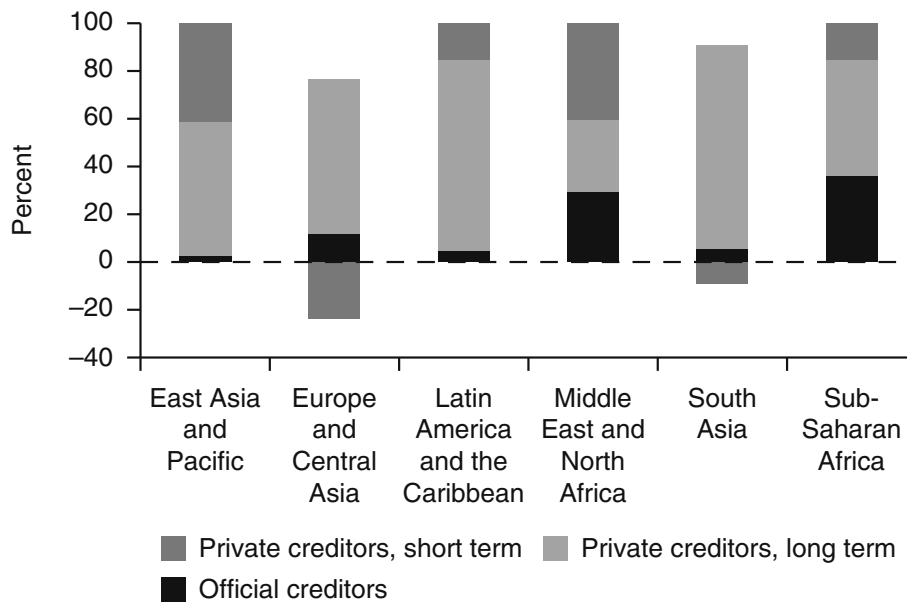
Figure 9. **Regional Composition of Net Debt Flows 2014**

Source: World Bank Debtor Reporting System.

tries in the Middle East and North Africa; in other regions, the share was negligible. Private creditors accounted for 97 percent of net debt inflows to East Asia and Pacific, and 95 percent to Latin America and the Caribbean. Short-term inflows accounted for over 40 percent of net debt inflows in East Asia and Pacific and the Middle East and North Africa regions, but only 15 percent in Latin America and the Caribbean. In contrast, the Europe and Central Asia and South Asia regions recorded an outflow of short-term debt in 2014.

Private sector external borrowing accounts for the greatest share of net debt flows

In recent years, the external debt of low- and middle-income countries has become increasingly characterized by an important shift from public and publicly guaranteed debt to non-guaranteed debt of the private sector. Since 2009, over 50
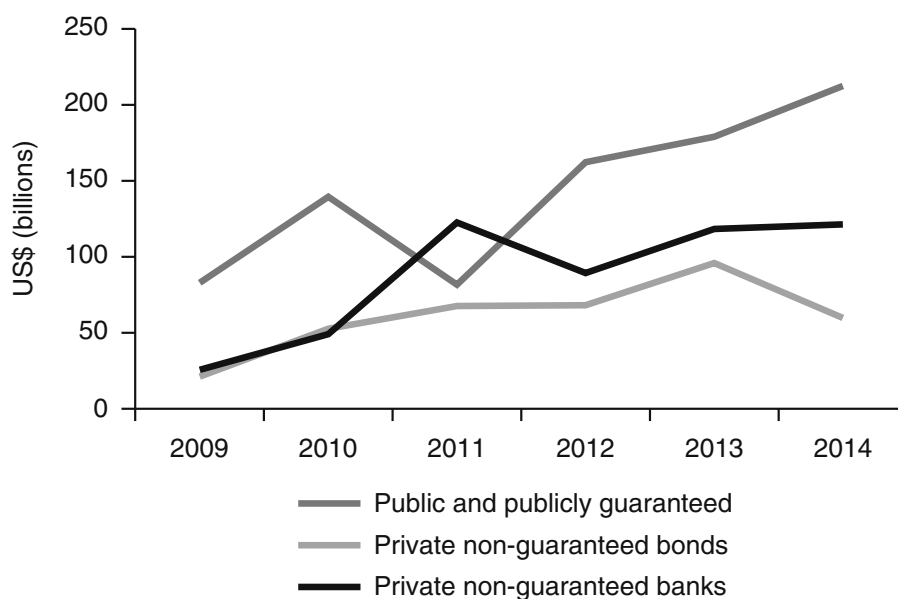
Figure 10. **Composition of Net External Debt Flows by Type of Borrower, 2009–14**

Source: World Bank Debtor Reporting System.

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percent of net long-term debt flows have gone to private sector borrowers not benefiting from any public guarantee, and as a result, at end 2014 they accounted for close to 50 percent of all outstanding long-term external debt of low- and middle-income countries. Paralleling this rise has been an evolution in the composition of these flows, with bond issuance by private sector entities constituting an increasingly important component: it averaged 44 percent of net long-term debt inflows to private sector entities in 2013–14 as compared to 35 percent in 2012. Net debt flows to private sector borrowers are heavily concentrated in countries in the East Asia and Pacific, and Latin America and Caribbean regions, which accounted for 67 percent of these flows in 2014.

Bond issuance continues apace

Bond issuance remained an important source of external financing for many low- and middle-income countries, totaling $242 billion in 2014, up marginally from 2013. There was an important shift in borrower composition and in the regional distribution. Bond issuance by public sector borrowers rose 32 percent to $146 billion, equivalent to 60 percent of total bond issuance in 2014 (46 percent in 2013). A principal driver was the purchase of domestically issued bonds by non-residents, in particular in India, a 25 percent increase in issuance by borrowers in Latin America and the Caribbean, and a 29 percent rise in sovereign bonds in Sub-Saharan Africa, including debut sovereign issues by Ethiopia and Kenya. Bond issuance by corporate borrowers fell
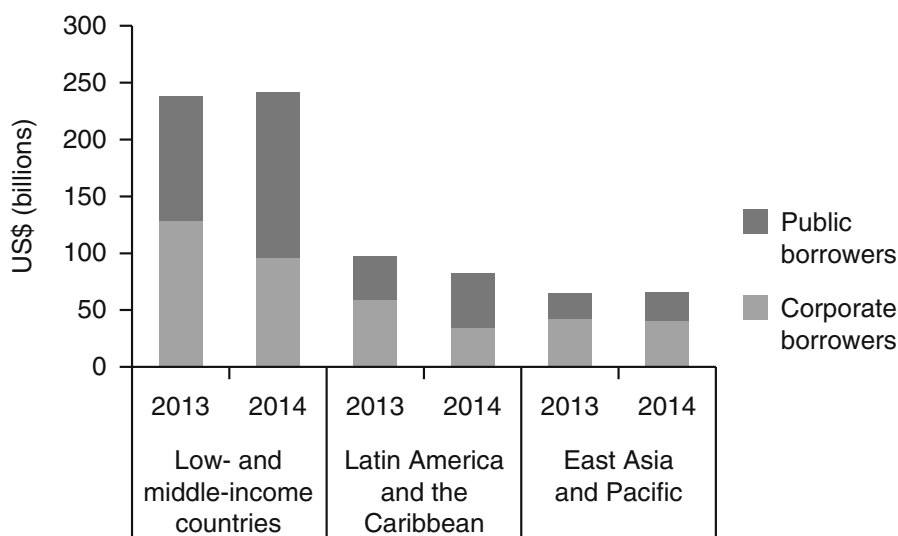
Figure 11. **Bond Issuance by Public and Private Sector Borrowers, 2013 and 2014**

Source: World Bank Debtor Reporting System.
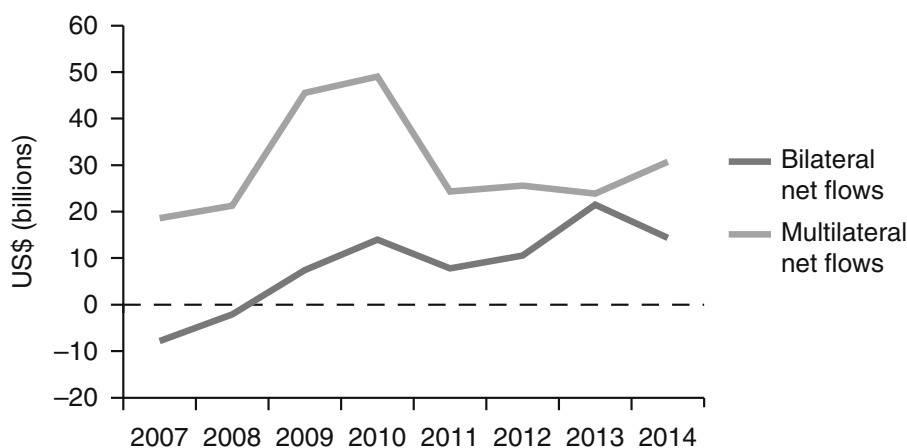
Figure 12. **Bilateral and Multilateral Net Debt Flows, 2007–14**

Source: World Bank Debtor Reporting System.

25 percent, reflecting a sharp slowdown in issuance by corporations in Latin America and the Caribbean and Europe and Central Asia.

Inflows from multilateral creditors are more than double those of bilateral creditors in 2014
Net debt inflows from official creditors, excluding the IMF, fell by 4 percent in 2014 to $43 billion. This moderate decline masked a divergent trajectory in 2014 relative to 2013 for multilateral and bilateral inflows. The former rose by 29 percent in 2014 to $31 billion, while the latter fell by one-third, to $14 billion. The rebound in net inflows from multilateral creditors was driven by a 24 percent rise in those from the World Bank (IBRD and IDA). Net inflows from other multilateral institutions increased at a much slower pace, 5 percent in 2014. The principal beneficiaries of inflows from multilateral creditors were countries in Sub-Saharan Africa and South Asia: together they accounted for close to two-thirds of such flows in 2014. The sharp reversal of the upward trajectory in net inflows from bilateral creditors of recent years was in large part attributable to the sharp fall in those to the Arab Republic of Egypt. This decline reflects the exceptionally high level of the bilateral support the country received in 2013.

The World Bank dominates inflows from multilateral creditors
Gross disbursements by the World Bank (IBRD and IDA) rose to $29 billion, an increase of

13 percent over the comparable figure for 2013, and equivalent to 47 percent of gross disbursements from all multilateral institutions, excluding the IMF. Gross disbursements from other multilateral institutions dipped 2 percent in 2014. IBRD disbursements were concentrated in creditworthy countries in Latin America and the Caribbean, East Asia and Pacific, and Europe and Central Asia. Those disbursements from IDA, reserved for the world's poorest countries, were directed primarily at Sub-Saharan Africa and South Asia. These regions received 46 percent and 36 percent, respectively, of IDA disbursements (excluding IDA grants) in 2014. The World Bank, the most important source of multilateral financing, accounted for 63 percent of multilateral disbursements to Sub-Saharan Africa in 2014. The Inter-American Bank accounted for 40 percent of disbursements from multilateral creditors to countries in Latin America and the Caribbean in 2014, and the Asian Development Bank for 45 percent to East Asia and Pacific.

East Asia and Pacific

China drives the trend in net financial flows in the region
Net financial flows to the region fell moderately, 3 percent, in 2014 to $545 billion, and remained broadly unchanged relative to the region's gross national income (GNI) at 4 percent. But there was a marked shift in composition with net debt flows falling 31 percent from the 2013 level, to $145 billion — equivalent to
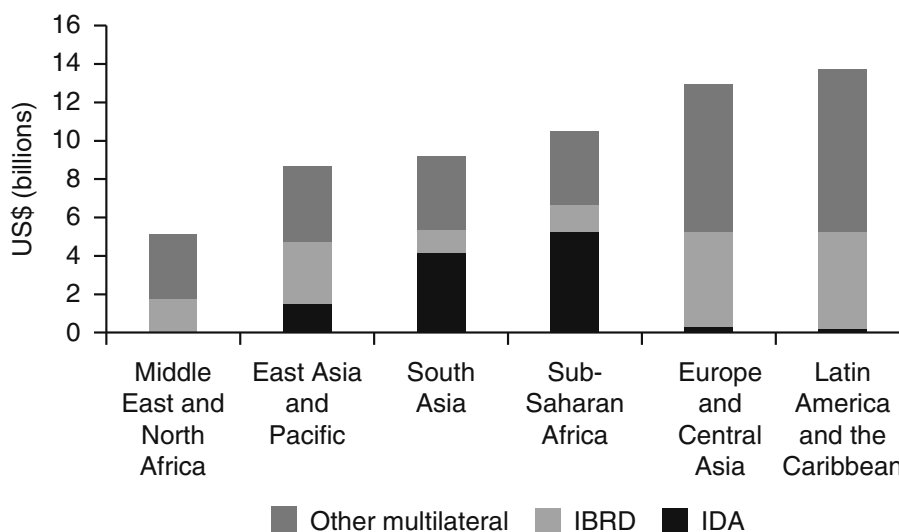
Figure 13. **Disbursements from IBRD and IDA, Regional Distribution, 2014**

Source: World Bank Debtor Reporting System.
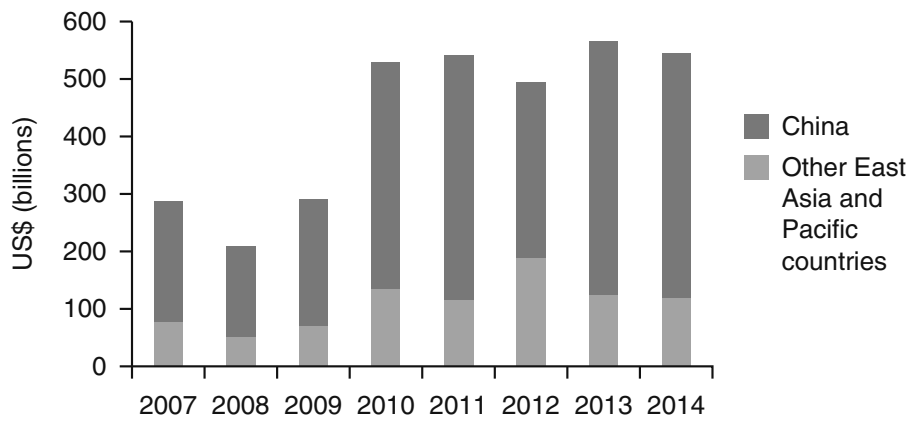
Figure 14. **Net Financial Flows, 2007–14**

Source: World Bank Debtor Reporting System.

a little over a quarter of net financial flows in 2014, down from close to 40 percent in 2013. In contrast, net equity flows rose 13 percent to $349 billion on the back of resilient net foreign direct investment and strong portfolio equity inflows; the latter jumped 76 percent in 2014 to $51 billion ($29 billion in 2013). China remained dominant, accounting for 76 percent of net financial inflows to the region in 2014, and driving the downturn in net debt flows; these plummeted to $85 billion, 37 percent below their 2013 level ($135 billion). Countries in the East Asia and Pacific region, excluding China, also saw only a moderate, 4 percent decline in net financial flows in 2014.

Net debt inflows to the region present a mixed picture in 2014

The downturn in net debt flows was driven by China, which accounted for 59 percent of net

debt flows to the region in 2014 (64 percent in 2013) and where net debt inflows fell 36 percent in 2014 to $85 billion ($135 billion in 2013). In Malaysia and Thailand, net debt inflows plummeted to around 10 percent of their 2013 level on account of a sharp contraction in short-term debt flows. Other major borrowers, notably Indonesia and the Philippines, recorded increased net debt inflows in 2014. In Indonesia they rose 45 percent due to the combined effect of increased bond issuance by public sector borrowers and a 70 percent jump in long-term net inflows from commercial banks to private non-guaranteed borrowers. In the Philippines the driving force was a rapid surge in net long-term commercial bank flows to private sector borrowers. The same was true for Vietnam, which recorded a 10 percent increase in net debt inflows in 2013, and again in 2014, underpinned by a surge in net debt inflows to the private sector.
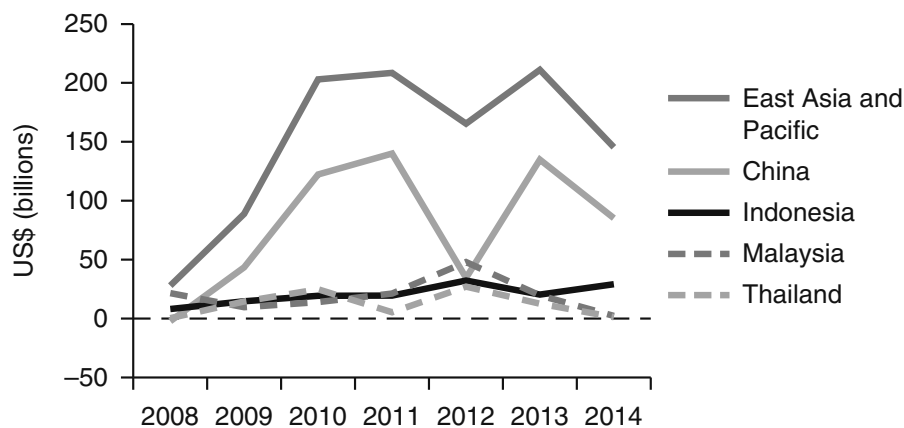
Figure 15. **Net Debt Flows, 2008–14**

Source: World Bank Debtor Reporting System.
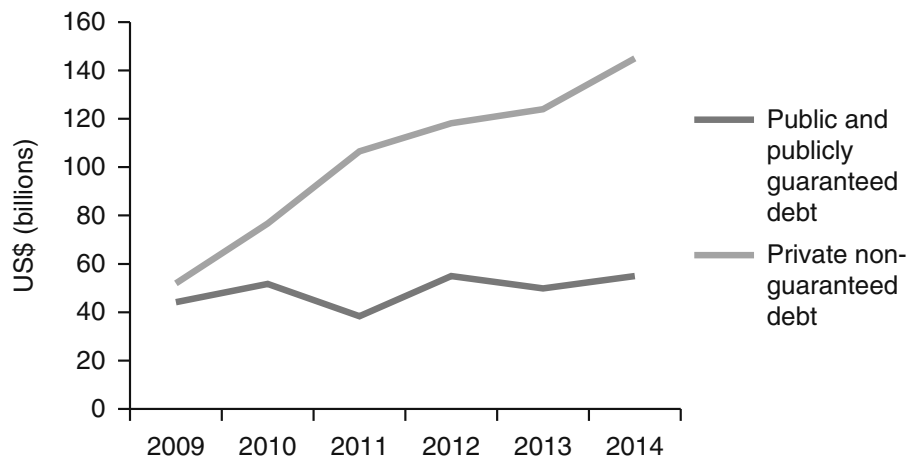
Figure 16. **Gross Disbursements by Type of Borrower, 2009–14**

Source: World Bank Debtor Reporting System.

Private sector borrowers account for the largest share of external borrowing

In 2009, disbursements of long-term debt to countries in East Asia and Pacific, excluding China, were almost equally divided between public and publicly guaranteed (51 percent) and private non-guaranteed (49 percent) borrowers. Since then, long-term debt inflows to private sectors across the region have been on a sharp upward trajectory and by 2014 accounted for almost 73 percent of disbursements of long-term debt. They were, however, highly concentrated in three countries, Indonesia, the Philippines, and Thailand, which together absorb around 80 percent of these inflows. Commercial bank and intra-company lending associated with foreign direct investment was an important catalyst of these increased flows, but access to international capital markets has also been an important factor. Bonds issued by corporations in the region was $46 billion in 2014, close to 35 percent of total long-term disbursements of private non-guaranteed debt.

Europe and Central Asia

Net debt flows drop sharply in 2014 but equity flows remain stable

Net financial flows to the region fell 38 percent in 2014, to $84 billion ($135 billion in 2013). Debt flows were volatile, down 56 percent in 2014 to $41 billion — a marked turnaround from 2013 when comparable flows surged 80 percent, to $93 billion. In stark contrast, equity flows remained stable at $41 billion. Driving the downward trajectory for debt flows was the sharp contraction in short-term debt inflows to an outflow of $18 billion in 2014, a pronounced reversal from net inflows of $35 billion in 2013. Much of this shift was attributable to Turkey, where net short-debt flows plunged to $2 billion ($30 billion in 2013). There was a significant fall in overall net debt flows in 2014 to Kazakhstan, down $6 billion and, not surprisingly, Ukraine with an outflow of $11 billion, against an inflow of $7 billion in 2013. Inflows from official creditors to the region accounted for 22 percent of net debt inflows in 2014. They rose to $9 billion (an outflow of $9 billion in 2013), reflecting multilateral and bilateral support for Ukraine and much lower outflows to the IMF.

Private sector borrowing has accelerated sharply over the past three years

After being hard hit by the global economic crisis of 2008, private sectors across the region recovered strongly. In 2013 net long-term inflows to private entities, without public sector guarantee, climbed to $44 billion, surpassing comparable flows to public and publicly guaranteed borrowers ($31 billion) and accounting for 60 percent of net long-term debt flows to the region. The momentum slowed in 2014 when net long-term inflows to the private sector declined by 27 percent, compared with a 6 percent drop in those to public and publicly guaranteed borrowers, driven by a sharp contraction in flows to Ukraine, which turned negative, and a marked decline in those to Kazakhstan. In the past five years, Kazakhstan and Turkey commanded around 80 percent of inflows to private sector entities in the region, but most European and Central Asia countries have
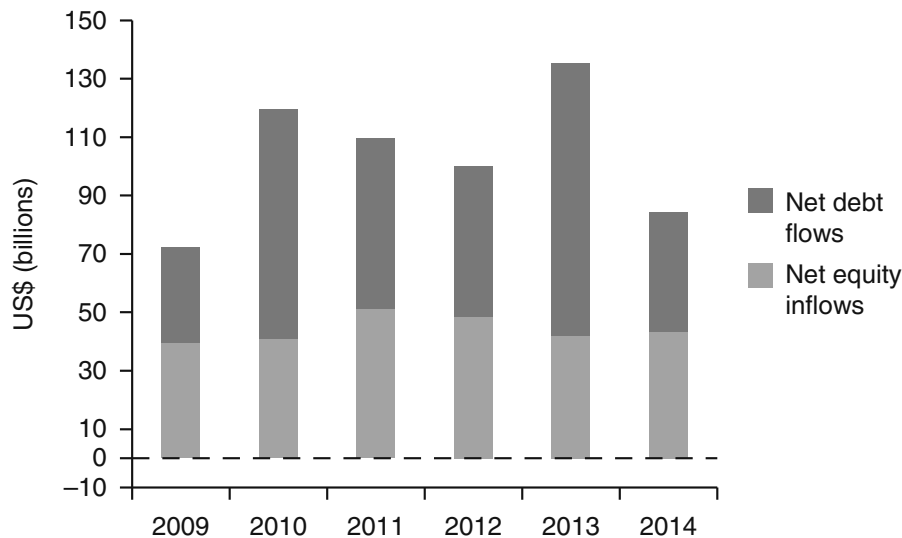
Figure 17. **Net Capital Flows, 2009–14**

Source: World Bank Debtor Reporting System.
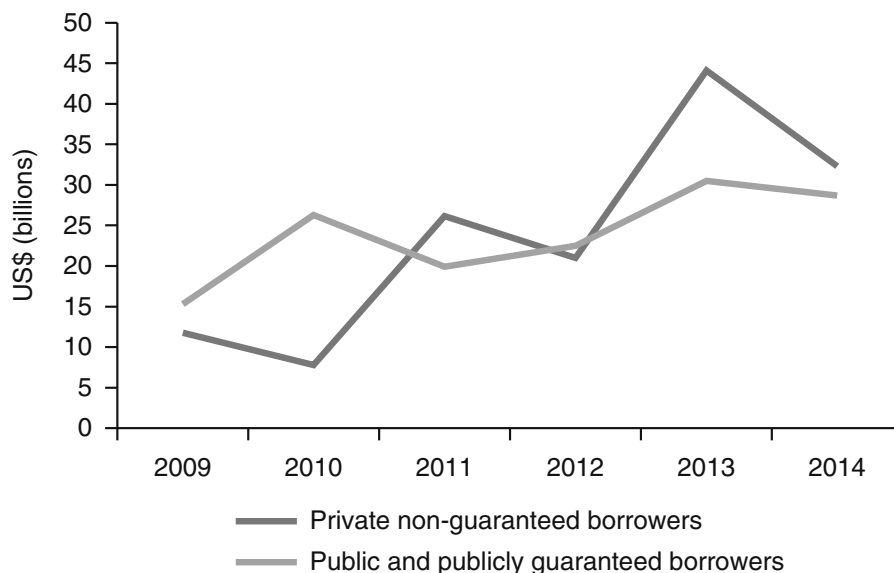
Figure 18. **Net Long-Term Debt Inflows by Type of Borrower, 2009–14**

Source: World Bank Debtor Reporting System.

recorded an increase in private non-guaranteed debt. The composition of net long-term debt inflows to private sector borrowers has evolved with bond issuance averaging one-third of these flows in 2013–14.

Equity inflows remain strong for the majority of countries in the region

Equity, as a share of net financial flows, rose significantly in 2014, and accounted for half of such flows, compared with a little over 30 percent in 2013. With the exception of Ukraine, where equity flows fell precipitously, most countries across the region attracted a rising volume of equity flows. The region as a whole, excluding Ukraine, was up 16 percent from the 2013 level to $43 billion, with Azerbaijan, Kazakhstan, Turkey, and Turkmenistan together accounting for 68 percent of foreign direct investment flows and 91 percent of portfolio equity flows in 2014. Net inflows of foreign direct investment to other countries in the region, excluding Ukraine, rose by a more moderate 3 percent. There was significant growth in some of the smaller countries in the region, notably Albania and Georgia, where foreign direct
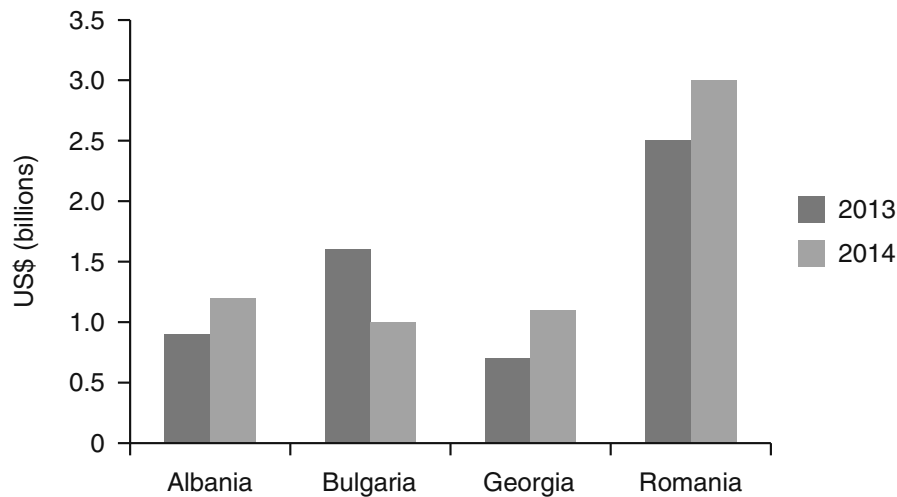
Figure 19. **Foreign Direct Investment Inflows, 2012–14**

Source: World Bank Debtor Reporting System.
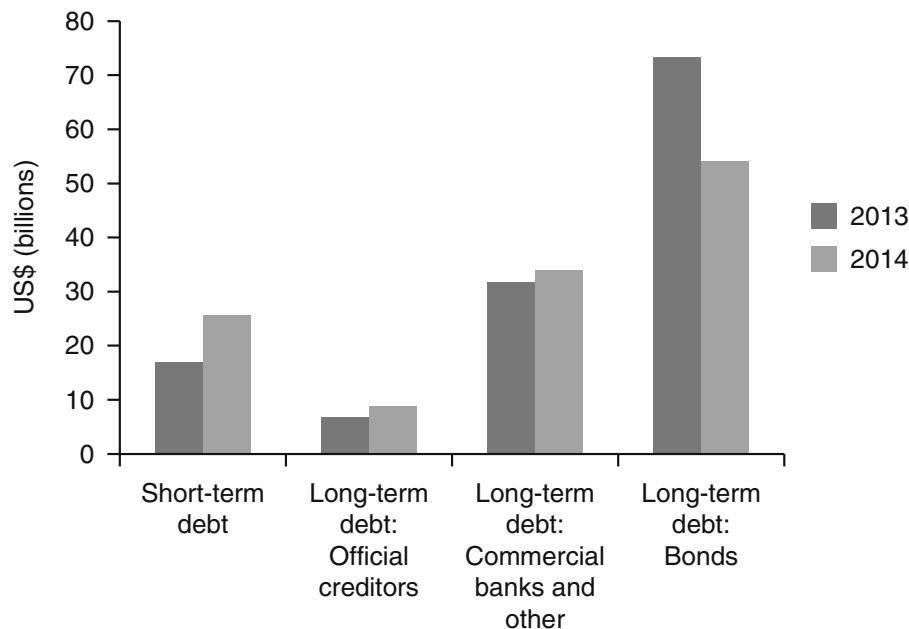
Figure 20. **Composition of Net Debt Inflows, 2013 and 2014**

Source: World Bank Debtor Reporting System.

investment inflows were up 37 percent and 49 percent, respectively, in 2014, while those to the Former Yugoslavic Republic of Macedonia soared 94 percent, albeit from a relatively low base.

Latin America and the Caribbean

Long-term debt inflows from private creditors remain stable in 2014 but their composition shifts

Net debt inflows rose moderately in 2014 to $168 billion ($161 billion in 2013) but were characterized by a marked change in composition. Short-term inflows rose 51 percent to $26 billion and accounted for 15 percent of net debt inflows to the region (10 percent in 2013). In aggregate the change in the level of long-term debt inflows from private creditors in 2014 was moderate, $168 billion compared with $161 billion in 2013, but shifts within this category of debt flows were more pronounced. Long-term net inflows from commercial banks rose 18 percent over their 2013

level, to $75 billion, while net inflows from bond issuance fell 26 percent in the same period, to $54 billion. A fall in bond issuance by private corporations was the main reason for the sharp, 66 percent drop in net inflows from bonds in 2014. New issues by these borrowers were down to around half those of the previous year. Official creditors accounted for only a modest, 5 percent share of net debt flows, although they rose 28 percent in 2014, to $8.7 billion.

Net financial inflows to Mexico and Brazil display a very divergent trend in 2014

Net financial flows to Brazil and Mexico combined totaled $217 billion in 2014, equivalent to 73 percent of those to the region as a whole. However, there was wide disparity in trend and composition. Net financial flows to Brazil, $167 billion in 2014, were 71 percent higher than the 2013 level and more than triple the comparable 2014 flows to Mexico. This increase was the result of a significant rise in net debt inflows to both public and publicly guaranteed and non-guaranteed private sector borrowers, which rose by 63 percent and 73 percent, respectively, in 2014. In parallel, net foreign direct investment jumped 39 percent to $58 billion, making Brazil the second most important destination, after China, for foreign direct investment in low- and middle-income countries. In stark contrast, net financial flows to Mexico dropped by 41 percent in 2014, to $50 billion, due to an 87 percent fall in net debt flows to private sector borrowers and a 53 percent downturn in foreign direct investment.

Net debt inflows accelerate in other countries in Latin American and the Caribbean

Since 2009, external debt stocks of countries in Latin America and the Caribbean, excluding Brazil and Mexico, have grown on average by 12 percent annually. At end 2014, their combined external debt outstanding totaled $357 billion, equivalent to 27 percent of the region as a whole ($1,347 billion). Net financial flows to this group (excluding Brazil and Mexico) rose 18 percent in 2014, with net debt inflows increasing by 32 percent, to $42 billion, and net equity inflows posting a more moderate 5 percent increase to $39 billion. The growing dominance of debt flows was attributable to several factors. Notably a 20 percent rise in bond issuance by public sector borrowers (mainly in Colombia, Ecuador, and Panama) in 2014 and an 18 percent increase in external borrowing by private sector entities. After peaking in 2012, the net inflow of foreign direct investment leveled off to $35 billion in 2014, with the Dominican Republic, Honduras, and Peru as the principal recipients.
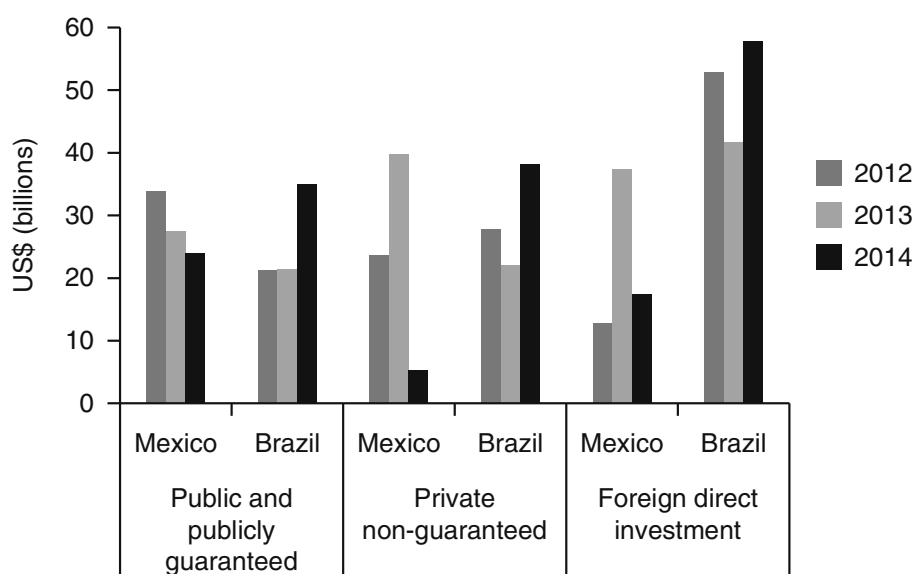
Figure 21. **Net Financial Flows to Brazil and Mexico by Type, 2012–14**

Source: World Bank Debtor Reporting System.

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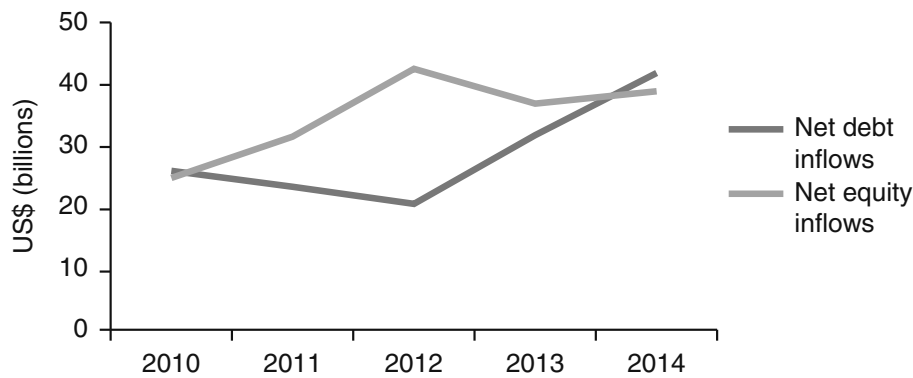
Figure 22. **Net Financial Flows, Excluding Brazil and Mexico, 2010–14**

Source: World Bank Debtor Reporting System.

Middle East and North Africa

Net financial flows fall due to a marked reduction in net long-term debt flows

Net financial flows to the region fell 28 percent in 2014, to $21.5 billion, primarily because of the sharp drop in net debt flows to $8 billion, half the 2013 level. Net equity inflows continued on a downward trajectory, falling by a further 5 percent in 2014 to $13.3 billion, with foreign direct investment flows down by 10 percent, while portfolio equity inflows turned positive for the first time since 2010. They rose to $0.6 billion, a marked turnaround from the net outflow of $0.3 billion recorded in 2013, largely accounted for by a re-emergence of net portfolio equity flows into Egypt. There was a moderate increase in foreign direct investment flows to Jordan, Lebanon, and Morocco in 2014; together they accounted for two-thirds of those to

the region as a whole, but inflows to the Islamic Republic of Iran fell 30 percent, to $2.1 billion ($3 billion in 2013). The fall in net debt flows reflects the retrenchment by official, notably bilateral, creditors from an unusually high level in 2013, and a slowdown in bond issuance by sovereigns and other public sector borrowers.

Net debt inflows to the region rise sharply but are heavily concentrated

Net debt flows declined in 2014 and there was a marked change in composition and destination. Net short-term debt inflows rose to $3.3 billion, a reversal of the net outflow of $0.6 billion in 2013, which served in part to offset the 70 percent fall in net long-term debt flows. These flows were heavily concentrated in Morocco, $2.3 billion, and Egypt, $0.5 billion. It was a similar story for long-term debt flows: net outflows of
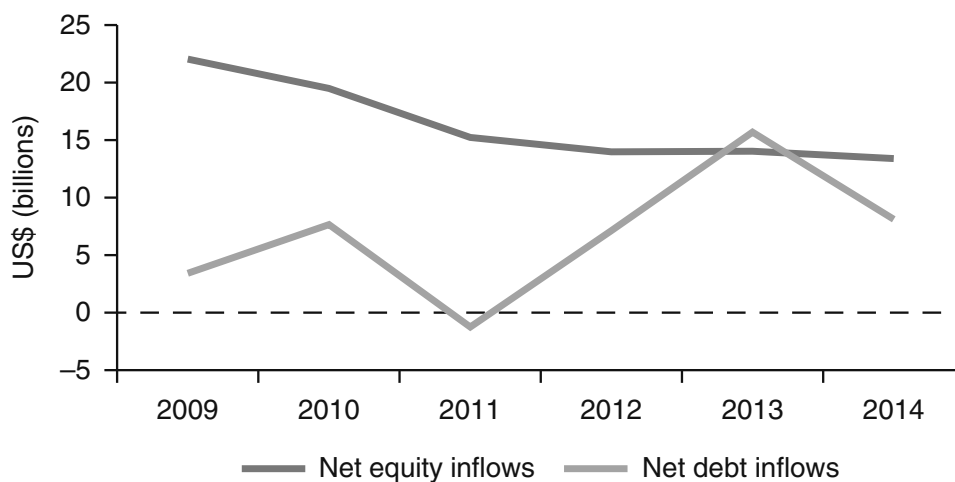
Figure 23. **Net Financial Flows, 2009–14**

Source: World Bank Debtor Reporting System.
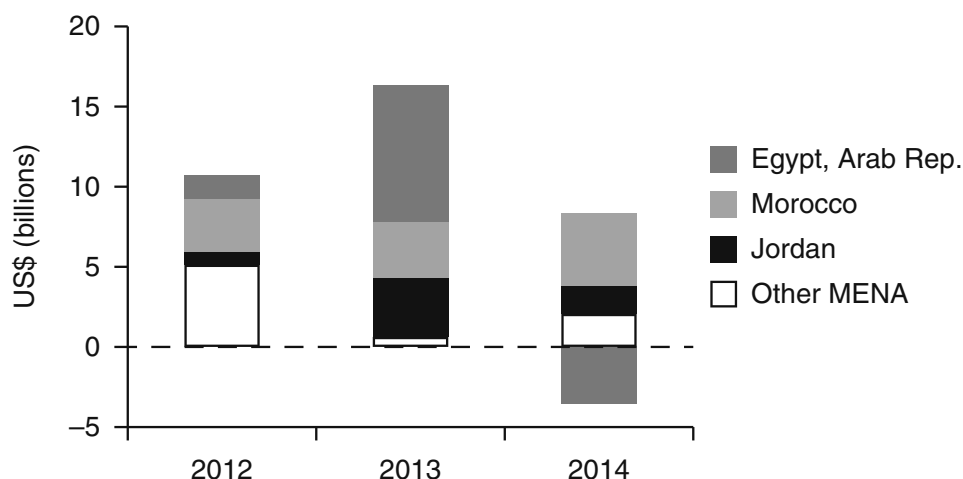
Figure 24. **Net Debt Inflows by Country, 2012–14**

Source: World Bank Debtor Reporting System.

$3.5 billion from Egypt (as compared with inflows of $8.4 billion in 2013) dominated the regional trend. This reversal resulted from a sharp fall in net debt inflows from bilateral creditors, which fell back to their historic level following the large-scale budgetary support from bilateral lenders in the Gulf in 2013. Added to this was a $2.5 billion bullet payment on a short duration bond issued in 2013. Net long-term debt inflows to Jordan also fell in 2014 to $1.3 billion, less than half the 2013 level. In marked contrast, those to Morocco rose 30 percent to $4.5 billion.

Debt-to-export ratios remain much lower than in other low- and middle-income countries

The ratio of external debt to exports and to GNI for the region averaged 55 percent and 15 per-

cent, respectively, in 2014, broadly unchanged from 2013 and well below those for low- and middle-income countries: 79 percent of exports and 22 percent of GNI at end 2014. The debt service-to-exports ratio jumped to 5.5 percent in 2014 (4.9 percent in 2013) reflecting the 12 percent increase in debt service payments, mainly for Egypt. Nevertheless, it remained well below the average of 8.9 percent for low- and middle-income countries. The region's favorable debt indicators result from the high share of equity in net financial flows in prior years and robust export earnings over the past decade, although these fell back markedly in 2013–14. International reserves were equivalent to 146 percent of external debt stock at the end of 2014, but the regional aggregate was heavily
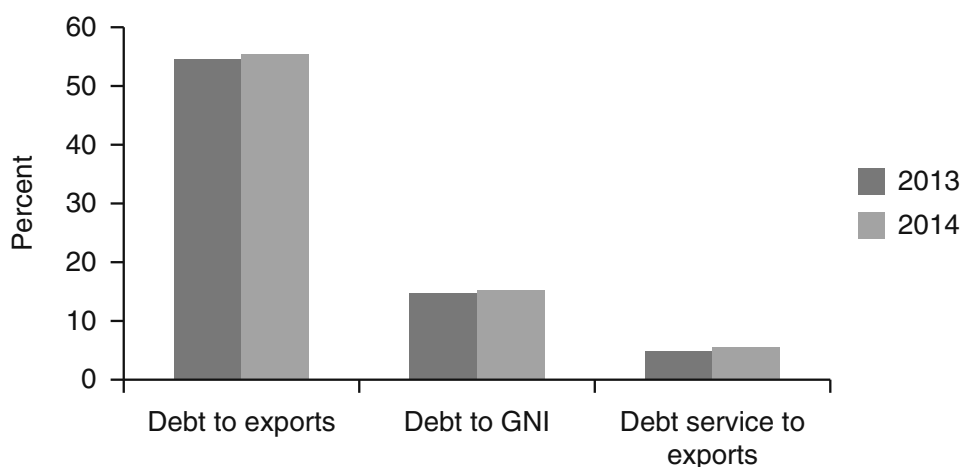
Figure 25. **Debt Ratios, 2013–14**

Source: World Bank Debtor Reporting System.
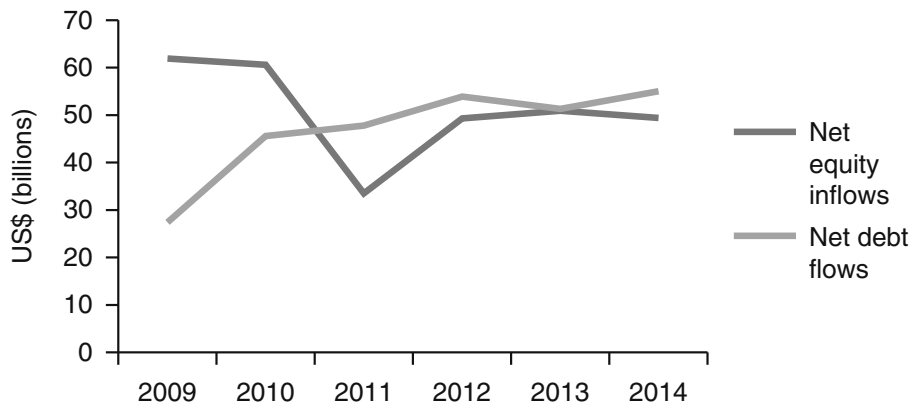
Figure 26. **Net Financial Flows by Type, 2009–14**

Source: World Bank Debtor Reporting System.

influenced by Algeria, where international reserves, $179 billion, are high, and external debt stock is low, $5.5 billion, equivalent to only 8 percent of exports.

South Asia

India dominates the trend in net financial flows

Net financial flows to the region rose marginally, 2 percent, in 2014 with the rise in net debt flows and foreign direct investment, 7 percent and 17 percent, respectively, largely offsetting the 33 percent fall in portfolio equity flows. The dominant factor was India, by far the largest South Asian economy, which accounted for over 82 percent of net financial flows in the region in 2014. Private creditors accounted for the majority of debt flows, 93 percent in 2014, and again directed primarily at India. The 33 percent rise in long-term net debt from private creditors

in 2014 to $57 billion was accompanied by an important change in composition. Whereas in 2013 the bulk of these inflows came from commercial banks, in 2014 they were mainly in the form of bonds. This was a consequence in part of the return to international bond markets by Pakistan and Sri Lanka in 2014 but, overwhelmingly, reflected the surge in the purchase of bonds issued in the Indian domestic market by non-residents.

Debt indicators vary widely across the region

The ratio of external debt stock to GNI for the region, 24 percent in 2014, and the ratio of external debt stock to exports, 104 percent, were broadly in line with those of 2013. Additionally, and not surprisingly, these averages were determined by, and closely correlated with, India's debt ratios (23 percent to GNI and 93 percent to exports), given the weight of the Indian econo-
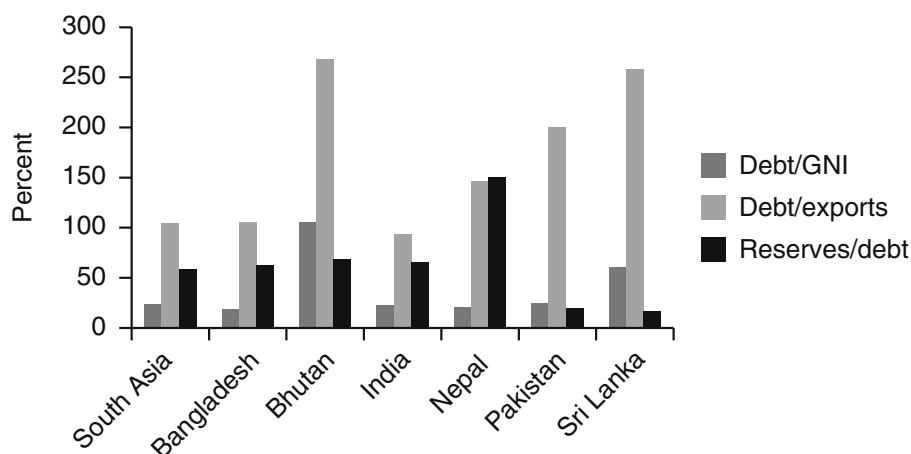
Figure 27. **Debt Indicators for Selected Countries, 2014**

Source: World Bank Debtor Reporting System.

my compared with that of its neighbors. Across the region, however, there was a wide disparity in ratios. The debt-to-export ratio ranged from a high of 268 percent and 258 percent for Bhutan and Sri Lanka, respectively, to a low of 105 percent for Bangladesh. Bhutan had the highest ratio of external debt to GNI, 105 percent, which contrasts with Bangladesh and Nepal, around 20 percent in both countries. Predictably, the ratio of international reserves to debt for the region, 59 percent, also mirrors that of India, 66 percent, given its regional dominance, but it masks a wide range from 150 percent for Nepal to 17 percent for Sri Lanka.

Net financial flows increase 24 percent, excluding India

Net financial flows to South Asian countries, excluding India, rose 24 percent in 2014 to $18.5 billion, because of a 23 percent increase in net debt flows and a 25 percent jump in net equity inflows, principally from portfolio equity that more than doubled. Net debt flows accounted for 71 percent of net financial flows to the group in 2014, similar to the share in 2013. Net debt flows to Pakistan jumped to $5.2 billion, from an outflow of $0.07 billion in 2013 (a consequence of the $3.6 billion repayment to the IMF). Contrasting this, Bangladesh saw net debt inflows drop to $2.6 billion, around half the 2013 level, due to a 33 percent fall in inflows from official creditors and a collapse in inflows to private sector borrowers. In Sri Lanka, net debt inflows fell 15 percent because of lower inflows to, and higher principal payments by, non-guaranteed private sector borrowers. The rise in net equity inflows was more broadly based but particularly strong in Pakistan, where they rose to $2.6 billion in 2014 ($1.6 billion in 2013), reflecting rising Chinese investment in large-scale infrastructure projects.

Sub-Saharan Africa

Net debt inflows offset the decline in net equity flows

Net financial flows to Sub-Saharan Africa rose 10 percent in 2014, to $78 billion, with a 20 percent drop in net equity flows, more than offset by a 48 percent rise in net debt flows. The decline in net equity flows was driven in large measure by the $3.9 billion outflow of foreign direct investment from Angola and much lower net inflows of portfolio equity to Nigeria. Net debt inflows rose to $47 billion ($31 billion in 2013) of which 64 percent were accounted for by private creditors. Around 26 percent of net debt flows to the region went to South Africa: its share of comparable debt flows in 2013 was 11 percent. Net financial inflows to the region, excluding South Africa, fell 3 percent in 2014 with a 23 percent rise in net debt inflows, to $34 billion ($28 billion in 2013), not enough to offset the 23 percent drop in net equity flows.
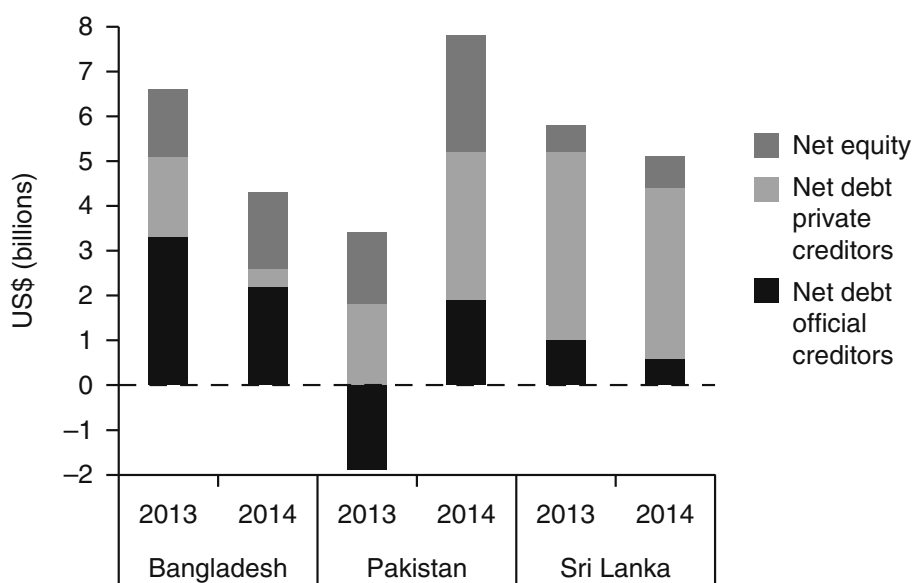
Figure 28. **Net Financial Flows to Select Countries, 2013 and 2014**

Source: World Bank Debtor Reporting System.
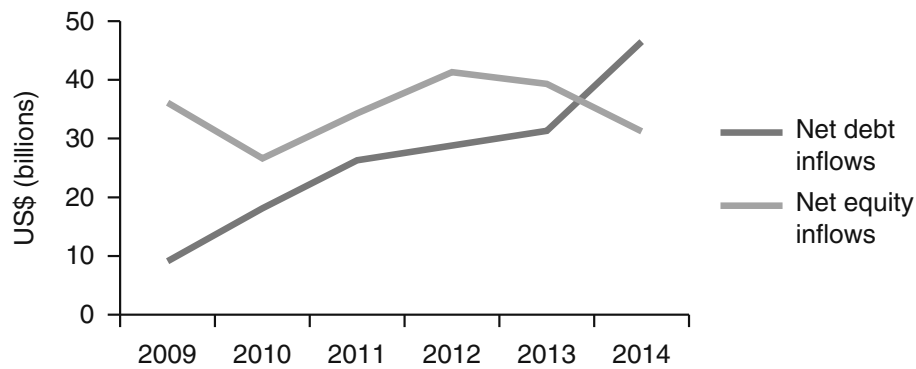
Figure 29. **Net Financial Flows, 2009–14**

Source: World Bank Debtor Reporting System.
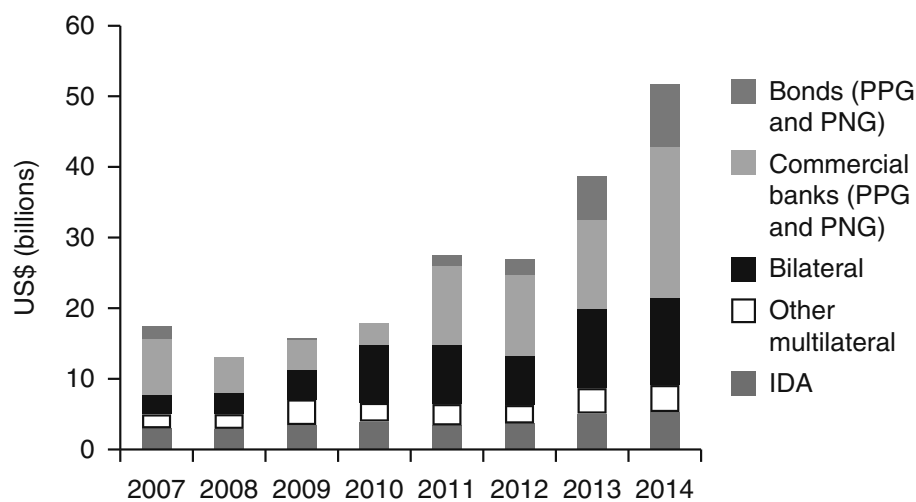
Figure 30. **Disbursements to the Region, Excluding South Africa, 2007–14**

Source: World Bank Debtor Reporting System.

Long-term debt inflows rise 34 percent with private creditors dominant

Notes: PNG = private non-guaranteed; PPG = public and publicly guaranteed.

External borrowing by countries in the region, excluding South Africa, has risen rapidly and been marked by a distinct change in borrowing patterns and creditor composition. Disbursements of long-term debt increased 34 percent in 2014 (to $54 billion), triple the comparable figures for other low- and middle-income countries, with private creditors accounting for 60 percent (50 percent in 2013). Disbursements from private creditors have also become more diversified. In 2010, all long-term private debt was attributable to banks and other private creditors, whereas in 2014, 27 percent was accounted for by bond issuance. Borrowing pat- terns have also changed with disbursements from private creditors now going primarily to nonguaranteed private-sector borrowers. Dis- bursements from official creditors (excluding the IMF) rose 30 percent between 2010 and 2013. The momentum continued in 2014 when they rose a further 8 percent to $21.5 billion. This increase was largely attributable to a 14 percent rise in disbursements by multilateral creditors, notably those from the World Bank. Disbursements from IDA, $5 billion in 2014, were unchanged from their 2013 level, but IDA remained by far the single largest multilateral creditor. China was again the continent's most important bilateral creditor.

Bond issuance booms

Historically, bond issuance in Sub-Saharan Africa was confined to South Africa, but fol-
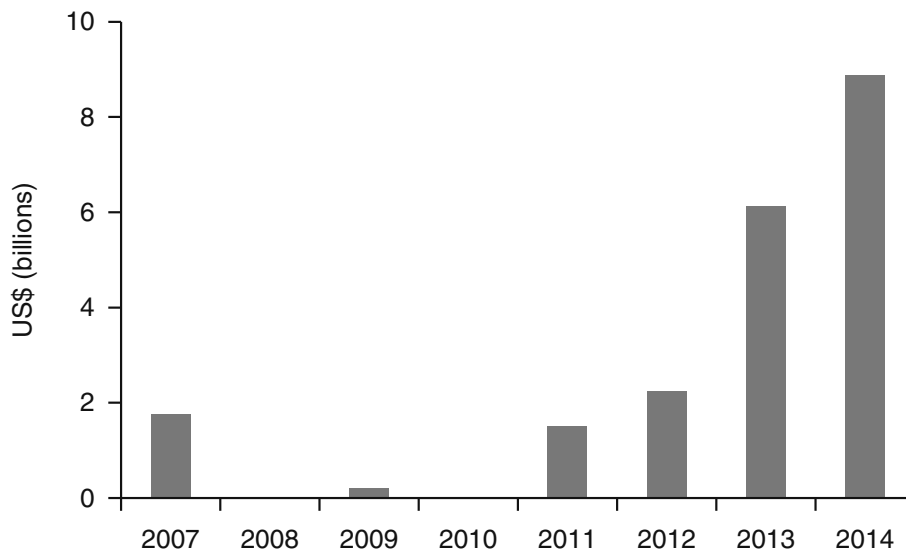
Figure 31. **Bond Issuance in the Region, Excluding South Africa, 2007–14**

Source: World Bank Debtor Reporting System.

lowing Ghana's debut issue in 2007, sovereign bond issuance by countries in the region, including those that benefited from HIPC and MDRI debt relief, has been a rapidly rising phenomenon. Benign global market conditions and the investor desire for higher returns have facilitated access to international capital markets. Sovereign borrowers, excluding South Africa, issued $6 billion in 2014, equivalent to 29 percent of disbursements from official creditors and 25 percent of foreign direct investment inflows. The debut sovereign bonds issued by Ethiopia ($1 bil-

lion) and Kenya ($2 billion) were massively over-subscribed, and the same applied for countries returning to the market, such as Ghana and Zambia. Proceeds of sovereign bonds are used to benchmark for future government and corporate bond markets issues, to manage the public debt portfolio, and for infrastructure financing. In Ethiopia, the 10-year, 6.625 percent Eurobond issued in December, 2014, is earmarked for development of sugarcane plantations, a hydropower dam, and amelioration and extension of the railway network.
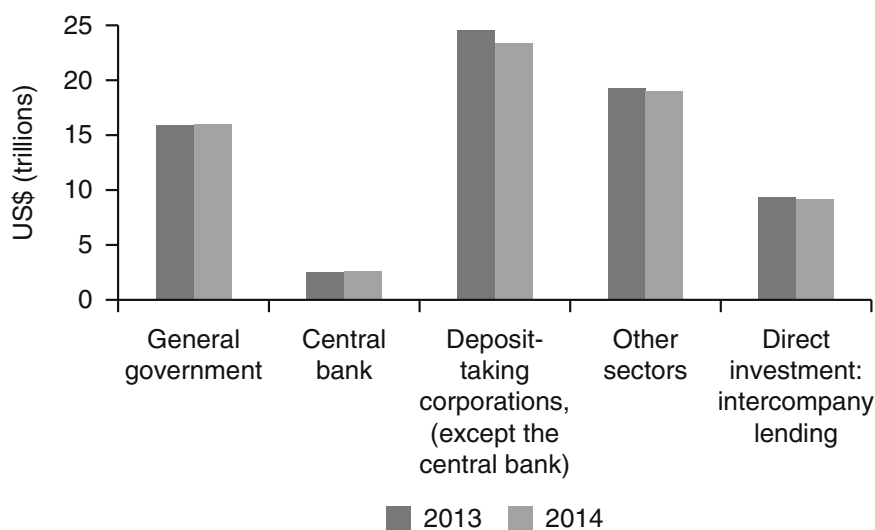
Figure 32. **High-Income Countries, External Debt Stock by sector, 2013 and 2014**

Source: World Bank Quarterly External Debt Statistics.

Quarterly External Debt

External debt stocks in high-income countries fell slightly in 2014

After five consecutive years of growth, the external debt stock of high-income countries reporting to the QEDS saw a marginal, 2 percent, decline in 2014 to $70.0 trillion at year-end. This was largely the result of a contraction in the external debt of the private sector, specifically a $1.1 trillion (5 percent) reduction in the external debt liabilities of commercial banks. The combined external debt stock of general governments, $15.9 trillion at end 2014, was largely unchanged from its year-end 2013 level, while obligations in respect of debt securities rose slightly, to $30.1 trillion. Although some countries, notably Australia, Belgium, Italy, Spain, and the United States, saw external obligations of the general government, measured in U. S. dollars, rise in 2014, this increase was offset by a reduction in comparable external debt stock in most European countries.

G-7 countries record divergent external debt trends in 2014

The combined external debt stock of the Group of Seven (G7) countries stood at $44.2 trillion at end 2014, virtually unchanged from 2013, and equivalent to 63 percent of the external debt stock of all high-income countries reporting to QEDS. The aggregate masks disparate trends at the individual country level. Both Canada and the United States recorded an increase in external debt stock in 2014, 7 percent and 5 percent, respectively. In contrast, the other five countries in the group all saw external debt stock decline over the same period, with the most pronounced reduction recorded by Germany and Italy: both saw outstanding external debt fall 7 percent in 2014. In high-income countries, other than those in the G7, external debt stocks fell 5 percent in 2014, in U. S. dollar terms. Here again trends were divergent, but the key countries to reduce external debt in 2014 were Ireland, Luxembourg, Netherlands, the Russian Federation, and Spain. Taken together, they

Table 2. **High-Income Countries, External Debt Stock, 2010–14**
US$ trillions

	2010	**2011**	**2012**	**2013**	**2014**
Gross External Debt	64.045	66.985	69.657	71.437	69.987
of which, G7 countries	*40.455*	*42.612*	*43.941*	*44.280*	*44.247*
Other high-income countries	*23.590*	*24.373*	*25.716*	*27.157*	*25.740*

Source: World Bank Debtor Reporting System.
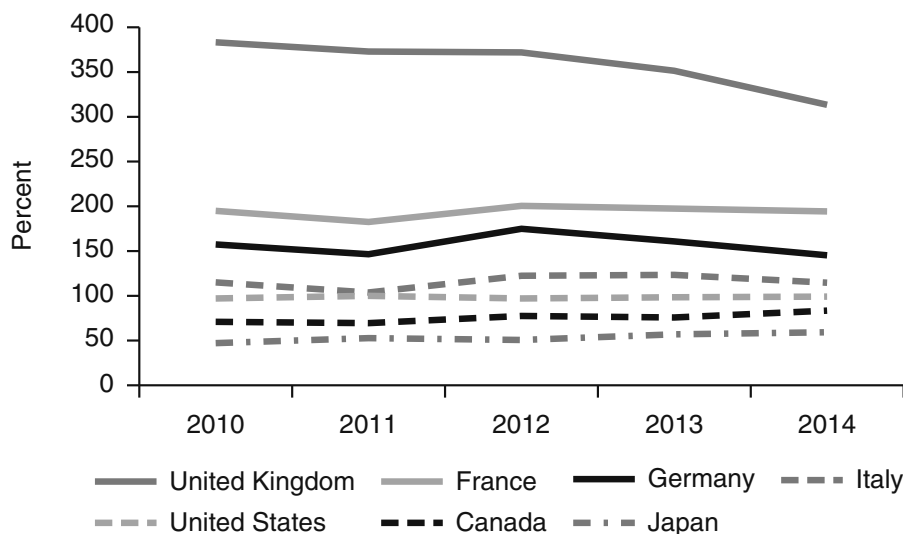
Figure 33. **G7 Countries, External Debt to GDP Ratio, 2010–14**

Source: World Bank Quarterly External Debt Statistics.

accounted for about 70 percent of the decline in external debt in non-G7 countries.

External debt-to-GDP ratios post a moderate improvement in 2014

High-income countries reported a slight improvement in the external debt-to-GDP ratio in 2014, to 140 percent, from 145 percent in 2013. This resulted from the combined effect of growth in output and a reduction in external debt stock in many high-income countries. Among G-7 countries, Canada recorded the largest increase in the external debt-to-GDP ratio: it deteriorated from 76 percent in 2013 to 83 percent in 2014, while in Japan and in the United States, the ratio was broadly unchanged, 59 percent and 99 percent, respectively. The other countries in the group all saw the ratio improving in 2014. The reduction was most pronounced in Germany, where GDP growth and prudent fiscal policies served to bring the debt-to-GDP ratio down to 145 percent, from 161 percent at end 2013. The United Kingdom has by far the highest external debt-to-GDP ratio among G-7 countries, but there too the debt-to-GDP ratio stayed on its downward trajectory to 313 percent at end 2014.

Public Sector Debt

Government debt-to-GDP ratios in EU-15 countries continued to rise in 2014

Government debt levels in the EU-15 countries, measured in U. S. dollars, fell by an average of 7 percent in 2014, to $12.8 trillion ($13.6 trillion in 2013), but this decline was in part attributable to Euro — U. S. dollar exchange rate movements. While many countries in this group have reduced government debt in relation to GDP, for others it continued to rise. For EU-15 countries as a whole, the government debt-to-GDP ratio averaged 84.4 percent in 2014, as compared to 83.2 percent in 2013. Greece remains the most indebted country in the group. Despite concerted efforts by the authorities to tighten fiscal policies and implement structural economic reforms in 2014, the government debt-to-GDP ratio increased by a further 3 percentage points, to 181.4 percent, its highest level to date. Portugal and Italy had the second and third highest debt-to-GDP ratios among the EU-15 countries; 138 percent and 127 percent, respectively, at end 2014. In Ireland, the debt-to-GDP ratio fell by 10 percentage points in 2014 to 114 percent.

Japan has by far the highest government debt-to-GDP ratio of OECD countries

Since the 2008 global financial crisis, government debt levels in many OECD countries have remained on a rising trajectory, despite concerted efforts at fiscal consolidation. However, government debt burdens vary significantly as evidenced by the debt-to-GDP ratio that ranged, in 2014, from as low as 7 percent for Estonia to as high as 206 percent for Japan, which relies primarily on the domestic bond market to raise the funds needed to finance the continuously rising costs
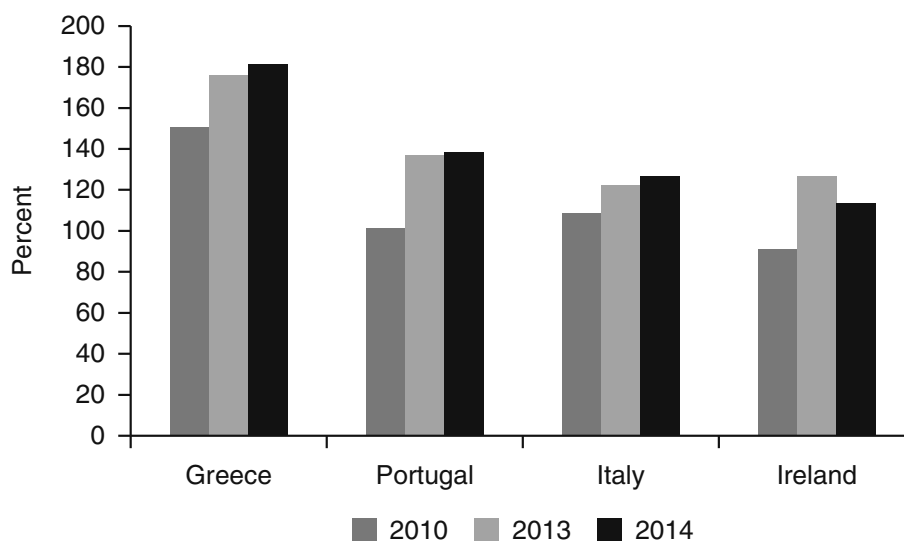
Figure 34. **Select EU-15 countries: Government Debt-to-GDP Ratio, 2010 and 2013–14**

Source: World Bank Public Sector Debt Database.
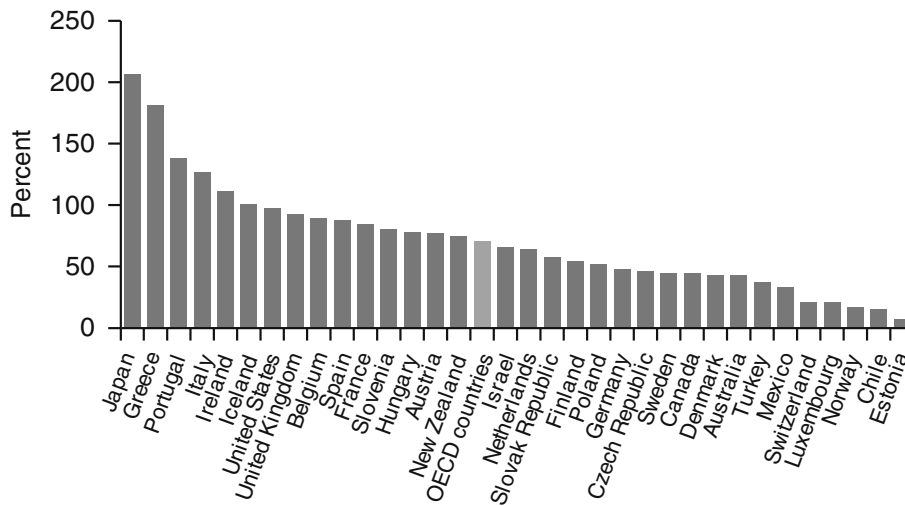
Figure 35. **OECD Countries: Government Debt-to-GDP Ratio, 2014**

Source: World Bank Public Sector Debt Database.

of supporting its aging population. OECD countries outside the Euro Zone, with the second and third highest debt-to-GDP ratio, were the United States and the United Kingdom, 97 percent and 94 percent, respectively, at the end of 2014. Although ratios for the United Kingdom and the United States are similar, their debt profiles differ. Virtually, all government debt of the United Kingdom is financed by the domestic creditors, whereas over one-third of government debt in the United States is owed to external creditors.

Emerging market countries government debt levels and composition vary widely
In the aftermath of the 2008 global economic crisis, government debt, in relation to GDP, has

been on a rising trend in some emerging market countries. In Brazil and Mexico, government debt-to-GDP ratios increased from 47.8 percent and 27.1 percent, respectively, in 2009 to 54.4 percent and 33.2 percent, respectively, in 2014. However, the composition of government debt in these countries is dissimilar. In Brazil, domestic debt constitutes around 97 percent of total government debt, and virtually all government bond issuance is in the domestic market. For Mexico, two-thirds of the government debt, is owed to external creditors with around 88 percent financed by government bonds. In contrast, China and India have seen the central government debt-to-GDP ratio improve in response to fiscal consolidation policies. At the end of 2014,
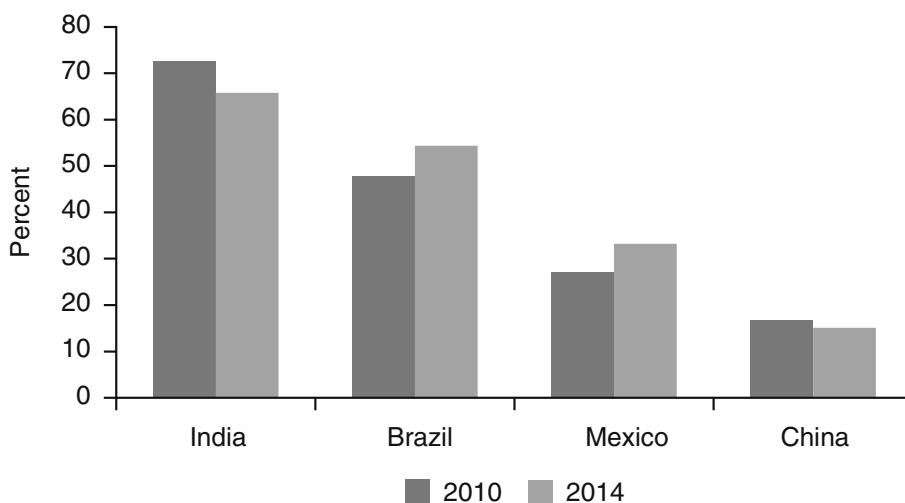
Figure 36. **Government Debt-to-GDP Ratio for Select Emerging Markets, 2010 and 2014**

Source: World Bank Public Sector Debt Database.

it stood at 15.1 percent in China and 65.8 percent in India, as compared to 16.8 percent and 72.5 percent, respectively, in 2010.

SOURCES OF THE MACROECONOMIC INDICATORS

The macroeconomic data are prepared by The World Bank from a variety of sources.

Data on Personal Transfers and Compensation of Employees are prepared by World Bank staff based on IMF balance of payments statistics.

Data on foreign direct investments are prepared by World Bank staff based on IMF balance of payments statistics and UNCTAD publication.

Other macroeconomic data are from IMF balance of payments statistics.

Data on exports of goods, services, and primary income are gap-filled with countries' balance of payments statistics for the following countries: Algeria (2014) Ghana (2014) Morocco (2014) Angola (2014) Grenada (2014) Nigeria (from 2013) Benin (2013) Guinea-Bissau (2013) Peru (2014) Burkina Faso (from 2011) Indonesia (2013) Samoa (2014) Cambodia (2014) Iran (2011–14) São Tomé and Príncipe (2013) China (2014) Jordan (2014) Senegal (2013) Comoros (from 2005) Kazakhstan (2014) Serbia (2014) Côte d'Ivoire (2014) Lebanon (2014) Solomon Islands (2014) Djibouti (2014) Malawi (from 2013) Togo (2013) Dominica (2014) Mauritania (from 2006–11) Uganda (2014) Ecuador (2014) Mongolia (2014).

Data on imports of goods, services, and primary income are gap-filled with countries' balance of payments statistics for the following countries: Algeria (2014) Ghana (2014) Morocco (2014) Angola (2014) Grenada (2014) Nigeria (from 2013) Benin (2013) Guinea-Bissau (2013) Peru (2014) Burkina Faso (from 2011) Indonesia (2013) Samoa (2014) Cambodia (2014) Iran (2011–14) São Tomé and Príncipe (2013) China (2014) Jordan (2014) Senegal (2013) Comoros (from 2005) Kazakhstan (2014) Serbia (2014) Côte d'Ivoire (2014) Lebanon (2014) Solomon Islands (2014) Djibouti (2014) Malawi (from 2013) Tanzania (2013) Dominica (2014) Mauritania (2006–2011) Togo (2013) Ecuador (2014) Mongolia (2014) Uganda (2014).

Data on current account balance are based on countries' balance of payments statistics for the following countries: Algeria (2014) Gabon (from 2006) Papua New Guinea (from 2013) Benin (from 2013) Ghana (2014) Peru (2014) Burkina Faso (from 2011) Guinea-Bissau (from 2013) Samoa (2014) Cambodia (2014) Indonesia (2014) Senegal (from 2012) Central African Republic (from 2005) Jordan (2014) Kazakhstan (2014) Serbia (2014) Solomon Islands (2014) Chad (from 2005) Malawi (from 2013) St. Lucia (2014) China (2014) Malaysia (2014) St. Vincent (2014) Comoros (from 2005) Mali (2014) Tanzania (2014) Congo, Rep. (from 2010) Mauritania (2007–2011) Togo (from 2012) Côte d'Ivoire (2014) Mongolia (2014) Uganda (2014) Ecuador (2014) Niger (2014) Vietnam (2014) Fiji (2014) Nigeria (from 2013) Zimbabwe (from 2005).

Data on personal transfers and compensation of employees are based on countries' balance of payments statistics for the following countries: Honduras (2014); Mongolia (2014); Nigeria (from 2013); Solomon Islands (2014).

Data on portfolio equity are based on countries' balance of payments statistics for the following countries: Burkina Faso (from 2011); China (2014); Ecuador (2014); Malawi (from 2013); Mongolia (2014); Nigeria (from 2013); Uganda (2014).

Data on foreign direct investment are based on countries' balance of payments statistics for the following countries: China (2014); Dominica (2014); Kazakhstan (2014); Malaysia (from 2010); Mongolia (2014); Samoa (2014); Solomon Islands (2014); Tanzania (2014); Uganda (2014); Vietnam (2014).

COUNTRY GROUPS

Regional Groups

East Asia and Pacific	*Europe and Central Asia*	*Latin America and the Caribbean*	*Middle East and North Africa*	*South Asia*	*Sub-Saharan Africa*
Cambodia (A)	Albania (A)	Belize (A)	Algeria (A)	Afghanistan (A)	Angola (A)
China (P)	Armenia (A)	Bolivia (A)	Djibouti (A)	Bangladesh (P)	Benin (A)
Fiji (A)	Azerbaijan (A)	Brazil (A)	Egypt, Arab	Bhutan (A)	Botswana (E)
Indonesia (A)	Belarus (A)	Colombia (A)	Rep. (A)	India (A)	Burkina Faso (A)
Lao PDR (A)	Bosnia and	Costa Rica (A)	Iran, Islamic	Maldives (A)	Burundi (A)
Malaysia (E)	Herzegovinaᵃ (A)	Dominica (A)	Rep. (A)	Nepal (A)	Cabo Verde (A)
Mongolia (A)	Bulgaria (A)	Dominican Republic	Jordan (A)	Pakistan (A)	Cameroon (A)
Myanmar (E)	Georgia (A)	(A)	Lebanon (A)	Sri Lanka (A)	Central African
Papua New	Kazakhstan (A)	Ecuador (A)	Morocco (A)		Republic (A)
Guinea (A)	Kosovo (A)	El Salvador (A)	Syrian Arab		Chad (E)
Philippines (A)	Kyrgyz	Grenada (A)	Republic (E)		Comoros (A)
Samoa (A)	Republic (A)	Guatemala (A)	Tunisia (A)		Congo, Dem. Rep. (P)
Solomon	Macedonia,	Guyana (A)	Yemen,		Congo, Rep. (A)
Islands (E)	FYR (A)	Haiti (A)	Rep. (E)		Côte d'Ivoire (A)
Thailand (A)	Moldova (A)	Honduras (A)			Eritrea (E)
Tonga (A)	Montenegro (A)	Jamaica (A)			Ethiopia (A)
Vanuatu (E)	Romania (A)	Mexico (A)			Gabon (E)
Vietnam (A)	Serbiaa, ᵇ (A)	Nicaragua (A)			Gambia, The (A)
	Tajikistan (A)	Panama (A)			Ghana (A)
	Turkey (A)	Paraguay (A)			Guinea (A)
	Turkmenistan (E)	Peru (A)			Guinea-Bissau (E)
	Ukraine (A)	St. Lucia (A)			Kenya (A)
	Uzbekistan (A)	St. Vincent			Lesotho (A)
		and the Grenadines			Liberia (A)
		(A)			Madagascar (A)
					Malawi (A)
					Mali (A)
					Mauritania (A)
					Mauritius (A)
					Mozambique (A)
					Niger (A)
					Nigeria (A)
					Rwanda (A)
					São Tomé and
					Príncipe (A)
					Senegal (A)
					Sierra Leone (A)
					Somalia (E)
					South Africa (P)
					Sudanᶜ (P)
					Swaziland (A)
					Tanzania (A)
					Togo (A)
					Uganda (A)
					Zambia (A)
					Zimbabwe (A)

Note: Letters in parenthesis indicate DRS reporters' status: (A) as reported, (P) preliminary, and (E) estimated. The status "as reported" indicates that the country was fully current in its reporting under the DRS and that World Bank staff are satisfied that the reported data give an adequate and fair representation of the country's total public debt. "Preliminary" data are based on reported or collected information, but because of incompleteness or other reasons, an element of staff estimation is included. "Estimated" data indicate that countries are not current in their reporting and that a significant element of staff estimation has been necessary in producing the data tables.

a. For Bosnia and Herzegovina, total debt before 1999, excluding IBRD and IMF obligations and short-term debt, is included under Serbia.

b. Data prior to 2006 include Montenegro.

c. Data include South Sudan.

How technology drove the shale oil industry and what it means to Russia

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Abstract. In this article, we discuss the implications of development of extracting technology of shale gas. Declining natural gas reserves during the 1970s prompted the United States movement to fund research into, leading to many advances in technology including micro seismic imaging. Observed progress in extracting technology of shale gas has some implications for Russian gas industry. As long as Russia is dependent on oil for 70 percent of its exports, Russia's economy will be intrinsically linked to the fluctuation of world oil prices. Moreover, nations and energy industry were forced to consider what a future with dwindling fossil fuel supplies might look like, after the first global oil shock during the 1970s. One response was to look for new types of fossil fuel reserves and develop ways to reach them. It would be stressed that current crisis creates an opportunity for Russia to provide tax and financial incentives to encourage technological innovations such as Big Data Analytics.

Keywords: shale gas, micro seismic imaging, Russian gas industry, world oil price, world gas price.

Как технологии стимулируют сланцевую индустрию и какое это имеет значение для России

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Аннотация. В статье обсуждается вопрос последствий развития технологий добычи сланцевого газа. Снижение резервов натурального газа в США в 70-х гг. вынудило государство и деловые круги США направить финансовые ресурсы на развитие технологий добычи сланцевого газа, в том числе технологий микросейсмических взрывов. Наблюдаемый прогресс технологий добычи сланцевого газа имеет также значение для российской газовой и нефтяной индустрии. Как долго 70% российского экспорта будет составлять нефть и газ, так долго российская экономика будет уязвимой из-за колебания цен на нефть. Общество, государство и представители нефтяной промышленности вынуждены были пересмотреть свои взгляды на будущее нефтяной промышленности после первого нефтяного шока в 70-х гг. Ответом на этот вызов был поиск новых типов резервов ископаемого топлива и развитие способов их добычи. Следует подчеркнуть, что современный кризис создает возможность проведения в России налоговой и финансовой реформы с целью стимулирования технологических инноваций, таких как аналитика больших данных.

Ключевые слова: сланцевый газ, технология микросейсмического взрыва, российская газовая промышленность, мировые цены на нефть, мировые цены на газ.

Nothing is more central to the Russian economy as the world oil price. A recent economic report indicates that a $1 decline in the price of oil entails annual losses to

the Russian budget of about $2 billion on an annual basis. So in recent weeks with oil price dropping from $43 to $31 per barrel the budget lost about $24 billion and the dollar exchange rate went from 65/$ to 77/$, demonstrating the linkage between the oil price and the rouble. Macroeconomic factors can influence the oil price, for example when the IMF lowered the world GDP forecast by.3% for 2015 the price of oil declined. When China lowered its 2015 GDP from 8% to 6.8% this also had a negative impact on the oil price and the 2016 decline in oil prices was attributed to economic uncertainty in China. Between 2003 and 2013, China accounted for 45% of the increase in world oil demand. Supply and demand are main drivers of oil price. World oil demand in 2015 was 94.6 million barrels a day while supply was 96.9 million barrels causing downward pressure on the oil price. The 3-billion barrels of worldwide oil inventory drives the price downward as it contributes to the glut in oil. The recent increase in US interest rates by the US Federal Reserve Bank created some downward pressure on the oil price as the dollar strengthened.

The most unpredictable driver of oil prices is geopolitical events. In the past 60 years, oil has spiked during the 1956 Suez crisis, the 1973 Yom Kipper war, the 1979 Iran Revolution and most recently, the war between Saudi Arabia and Yemen in April of 2015 caused the price of oil to increase to $65/b from $50. During the worldwide Financial Market meltdown in 2008, oil plummeted from $147 to $35 per barrel. The effect on Russia was devastating with a decline in GDP of 8%.

Nations and energy were forced to consider what a future with dwindling fossil fuel supplies might look like, after the first global oil shock during the 1970s. One response was to look for new types of fossil fuel reserves and develop ways to reach them. Over forty years later, these efforts are finally beginning to pay off. Horizontal drilling and hydraulic fracturing, the technologies for reaching "unconventional" reserves such as natural gas and light tight oil (LTO) trapped in rock formations (often shale) are now widely being used. These extraction techniques can to unlock both newly discovered reserves and previously known deposits that could not have been economically extracted using conventional methods.

As reserves that cannot be extracted by conventional drilling methods, unconventional oil and gas reserves are defined.

Oil or gas in these reserves are trapped in natural fractures in the rock or absorbed by nearly organic material. Besides shale gas and LTO, unconventional fossil fuel deposits include coal bed methane, tight sandstone and methane clathrates.

Declining natural gas reserves during the 1970s prompted the United States movement to fund research into extracting shale gas, leading to many advances in technology including micro seismic imaging. The government encouraged drilling for shale gas through tax credits, research dissemination, and industry support. In 1991, it supported the first horizontal drilling project, and in 1998, the first commercial shale fracture in the Barnett Shale basin in the state of Texas. The first combination of hydraulic fracturing and horizontal drilling followed in the Barnett basin in 2005.

The use of the latest drilling technologies generated productivity growth, as measured by initial production per rig of over 30% per year between 2007 and 2014. The "walking rig" or pad drilling is one technological advance that has contributed greatly to gains in rig productivity. Rather than a single well from a well pad, a walking rig can move around the pad, drilling multiple wells (sometimes dozens). Since 2006, the use of pad drilling has grown dramatically from a few percent to over 50 percent of new wells, with the potential to rise higher. This partially explains the disparity between the recent closing of 60 percent of rigs and a decline in production of only 3 percent. While the newer pad drilling rigs with multiple wells have remained active, the older less efficient rigs have been closed. Another innovation used extensively is 3D seismology that supports hydraulic fracturing by giving developers a better understanding of the geology of the reservoir and how best to stimulate it.

The single biggest advancement now coming to the shale industry is the use of big data for radically better asset optimization and operations. In every sector of the U. S. economy the availability and collection of data from machines, services and business operations is growing at an astonishing rate. Still a large

amount of data remains disparate and disordered. The use of big-data analytics offers nearly all industries the potential for unprecedented insight, efficiency and economic value. Big-data analytics can already optimize the surface mapping of the best drilling locations; indicate how and where to steer the drill bit; determine, section by section the best way to stimulate the shale; and ensure precise truck and rail operations. Mobile computing, using aap-centric analytics, can increase uptime, reduce maintenance, improve workforce productivity, reduce errors and rework, and enable low-cost compliance. Halliburton reports that its analytic tools achieved a 40 percent reduction in the cost of delivering a barrel of oil. Baker Hughes says that analytics helped it double output in older wells. Schlumberger announced a 50 percent gain in productivity thanks to the use of analytics. Conoco Phillips combined the latest sensors (which extract data by the minute rather than daily), wireless networks and big-data analytics to boost output by 30 percent in existing wells.

A key point is that the nature of fracking (also hydraulic fracturing, hydrofracturing, hydrofracking, or fraccing) is more like a standardized, repeated, manufacturing process, rather than the one-off, large scale engineering projects that characterize many conventional oil projects. While conventional projects might take 7 years to produce oil tight, oil projects can achieve production in 2 or 3 months. The U.S. has become the world leader in shale oil production because it has a long history of wildcat oil entrepreneurs and capital markets in addition to a legal system that allows any landowner to sell their mineral rights without government approval. Although Russia and China have huge shale deposits they lack a supportive environment to encourage the development of their shale resources.

Although U.S. shale production accounts for less than 5% of the global market, the rapid growth in U. S. shale oil was the key factor driving the collapse in oil prices during 2014. Since 2008, the U. S. has increased its shale production to 4.5 million barrels per day that has formerly imported from Saudi Arabia, Nigeria and other oil exporters. In November of 2014, OPEC led by Saudi Arabia maintained a production level of 30m/bd. This strategy has been primarily intended to maintain its market share by driving U. S. shale producers out of the market while also hurting Russia and Iran.

For the time being OPEC's strategy seems to be working as U. S. oil production is expected
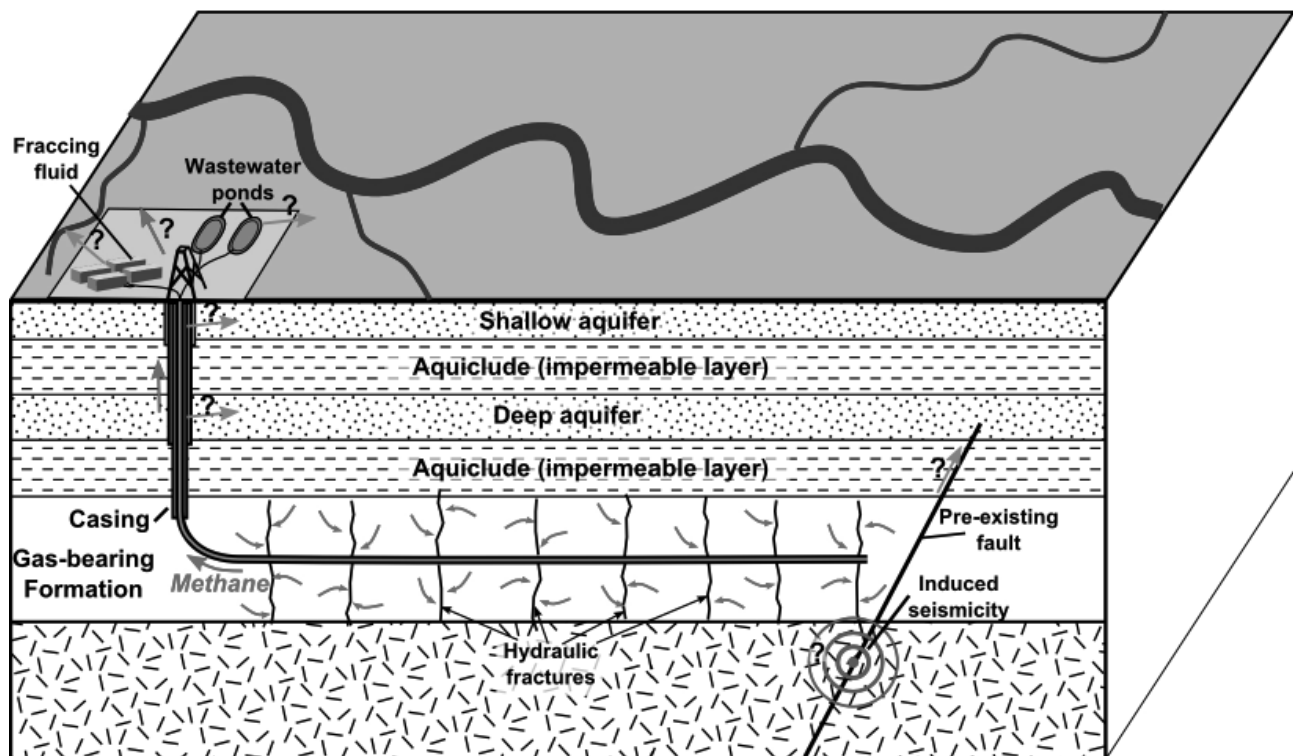
Figure. **Hydrofracturing**

to decline by around 1 million b/d in 2016 from its 2015 peak of 9.6 million bd. Many high cost shale producers are going bankrupt and "zombies" (companies that can afford only to pay interest and other expenses and cannot afford to drill for oil) becoming more common. This strategy has some risks for Saudi Arabia, for example, if the price of oil remains at $40 a barrel it has to use $10 billion a month from its currency reserves to maintain current budget spending levels. This is important because a significant portion of its budget goes to social spending that is needed to maintain political stability. Although the U. S. shale companies have significantly cut production they can quickly start producing when the oil price recovers in 2017 as Daniel Yergin and other analysts are forecasting.

As long as Russia is dependent on oil for 70 percent of its exports, Russia's economy will be intrinsically linked to the fluctuation of world oil prices. A main driver of oil prices is the Saudi/US shale conflict, which was a direct result of the advancement of shale extraction technologies employed in the United States. The current crisis creates an opportunity for Russia to provide tax and financial incentives to encourage technological innovations such as Big Data Analytics. These innovations can be applied not only to the development of Russia's massive shale reserves but also to the enhancement of productivity in other areas such as logistics and the localization of manufacturing. Improvement in these areas will help Russia to be competitive in a dynamic global environment.

ABOUT BIG DATA ANALYTICS

Big data analytics examines large amounts of data to uncover hidden patterns, correlations and other insights. With today's technology, it is possible to analyze your data and get answers from it almost immediately–an effort that's slower and less efficient with more traditional business intelligence solutions.

History and evolution of big data analytics
The concept of big data has been around for years; most organizations now understand that if they capture all the data that streams into their businesses, they can apply analytics and get significant value from it. But even in the 1950s, decades before anyone uttered the term "big data," businesses were using basic analytics (essentially numbers in a spreadsheet that were manually examined) to uncover insights and trends.

The new benefits that big data analytics brings to the table, however, are speed and efficiency. Whereas a few years ago a business would have gathered information, run analytics and unearthed information that could be used for future decisions, today that business can identify insights for immediate decisions. The ability to work faster–and stay agile–gives organizations a competitive edge they did not have before.

Why is big data analytics important?
Big data analytics helps organizations harness their data and use it to identify new opportunities. That, in turn, leads to smarter business moves, operations that are more efficient, higher profits and happier customers. In his report Big Data in Big Companies, IIA Director of Research Tom Davenport interviewed more than 50 businesses to understand how they used big data. He found they got value in the following ways:

1. *Cost reduction*. Big data technologies such as Hadoop and cloud-based analytics bring significant cost advantages when it comes to storing large amounts of data–plus they can identify more efficient ways of doing business.

2. *Faster, better decision making*. With the speed of Hadoop and in-memory analytics, combined with the ability to analyze new sources of data, businesses are able to analyze information immediately — and make decisions based on what they have learned.

3. *New products and services*. With the ability to gauge customer needs and satisfaction through analytics comes the power to give customers what they want. Davenport points out that with big data analytics, more companies are creating new products to meet customers' needs.

Organizations are inundated with data– terabytes and petabytes of it. This is not new. However, what is new is the velocity of growth, the diversity of the data and the imperative to make better use of information to transform your business.

How it works and key technologies

There's no single technology that encompasses big data analytics. Of course, there's advanced analytics that can be applied to big data, but in reality several types of technology work together to help you get the most value from your information. Here are the biggest players:

Data management. Data needs to be high quality and well governed before it can be reliably analyzed. With data constantly flowing in and out of an organization, it is important to establish repeatable processes to build and maintain standards for data quality. Once data is reliable, organizations should establish a master data management program that gets the entire enterprise on the same page.

Data mining. Data mining technology helps you examine large amounts of data to discover patterns in the data–and this information can be used for further analysis to help answer complex business questions. With data mining software, you can sift through all the chaotic and repetitive noise in data, pinpoint what is relevant, use that information to assess likely outcomes, and then accelerate the pace of making informed decisions.

Hadoop. This open source software framework can store large amounts of data and run applications on clusters of commodity hardware. It has become a key technology to doing business due to the constant increase of data volumes and varieties, and its distributed computing model processes big data fast. An additional benefit is that Hadoop's open source framework is free and uses commodity hardware to store large quantities of data.

In-memory analytics. By analyzing data from system memory (instead of from your hard disk drive), you can derive immediate insights from your data and act on them quickly. This technology is able to remove data prep and analytical processing latencies to test new scenarios and create models; it is not only an easy way for organizations to stay agile and make better business decisions, it also enables them to run iterative and interactive analytics scenarios.

Predictive analytics. Predictive analytics technology uses data, statistical algorithms and machine-learning techniques to identify the likelihood of future outcomes based on historical data. It is all about providing a best assessment on what will happen in the future, so organizations can feel more confident that they were making the best possible business decision. Some of the most common applications of predictive analytics include fraud detection, risk, operations and marketing.

Text mining. With text mining technology, you can analyze text data from the web, comment fields, books and other text-based sources to uncover insights you had not noticed before. Text mining uses machine learning or natural language processing technology to comb through documents–emails, blogs, Twitter feeds, surveys, competitive intelligence and more–to help you analyze large amounts of information and discover new topics and term relationships.

Under which conditions can an import substitution policy be a driver for re-industrialisation?

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Abstract. This paper examines various mechanisms of import substitution policies that can be implanted in Russia, with specific examples in the areas of agro-industry and high technology. It states the condition, under which these policies can help to pursue a strategy of re-industrialisation, and what some potential pitfalls are. Specific attention is being paid to the importance of vertical linkage effects, to relations between science, education and industry and to the role of favourable financial environment, especially in the field of innovation. As concerns the tools of import-substitution and their efficiency it would be stressed that to realize import-substitution policy it may be used a variety of mechanisms: customs tariff (fee) and non-tariff (quotas, import licensing) regulations, as well as subsidies for domestic production and other tools of financial and non-financial state support. They do not have the same efficiency in terms of industrial policy.

Keywords: Agro-industry, competitiveness, financial environment, import-substitution mechanisms, import-substitution policies, innovation policies, re-industrialisation, vertical linkages.

При каких условиях политика импортозамещения может стимулировать реиндустриализацию

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Аннотация. Авторы статьи оценивают различные механизмы политики импортозамещения, которые можно применить в России. Приведены отдельные примеры в области применения этих механизмов в АПК и в сфере высоких технологий. В статье указаны условия, при которых такие механизмы могут помочь осуществить стратегию реиндустриализации, показано также какие здесь кроются подводные камни. Особое внимание уделено важности эффектов вертикальных связей, взаимоотношениям между наукой, системой образования и промышленностью, а также роли соответствующего финансового обеспечения, особенно в сфере инноваций. Что касается средств импортозамещения и их эффективности, то в статье рекомендуется применять следующие механизмы: тарифные и нетарифные ограничения, субсидии и другие финансовые и нефинансовые средства государственной поддержки отечественных производителей.

RELEVANCE OF THE CONCEPT OF IMPORT-SUBSTITUTION

The concept of the import substitution was created in 18th century by Alexander Hamilton and much developed in 19th century by Friedrich List[1]. These economists advocated for the introduction of protective duties on imported foreign goods in order to stimulate national production. "The most notorious example was the promotion of infant industries through temporary protectionism in order to allow them to become competitive in the context of overall development of the economy"[2]. List's thought had an inspirational role for the implementation of several national economic policies, such as those of Sergei Witte, in Russia at the end of the 19th century[3].

In the second half of the 20th century, several countries implemented import-substitution policies, some in a covert form, some more overtly, especially in Latin America. In these countries the main ideologist of the concept of import substitution was an Argentinean economist Raul Prebisch, who had a great influence on the economic theory and practice[4]. According to Prebisch, import substitution industrialization consisted of active government support of national mechanical engineering and other industrial productions, with stress put on vertical linkages. In the case of Argentina, one can argue that the result was mixed, with an obvious lack of competitiveness of national companies. Similar policies were implemented

with some success in Brazil in the second half of the 20th century[5].

Import-substitution should been distinguished from pure protectionism in a sense that its aim is to promote the coherence and competiveness of the National System of Economy in the long-run period. The main goal consists neither to close the domestic market no to preserve a backwardness, but rather to create truly competitive new industries that produce high quality and highly demanded products.

The major difficulty in implementing an import substitution policy is to find a proper balance between these mechanisms in order to promote long-term coherent industrial development. In modern economies, the interaction between industries is complex. Increasing the competiveness of one industry requires increasing the competitiveness of its suppliers. Therefore, any import-substitution policy aiming at "re-industrialisation", or "new industrialisation" should act simultaneously at several levels to increase the competitiveness of local production.

THE TOOLS OF IMPORT-SUBSTITUTION AND THEIR EFFICIENCY

To realize import-substitution policy it may be used a variety of mechanisms: customs tariff (fee) and non-tariff (quotas, import licensing) regulations, as well as subsidies for domestic production and other tools of financial and non-financial state support. They do not have the same efficiency in terms of industrial policy.

Import restrictions. This type of measure is no necessarily efficient by itself. Although decided for geopolitical reasons the current Russian embargo on Western agricultural products could have propped up local production in such area as dairy products, fruits and vegetables. In the short term, the results have been mixed for two reasons. First, the local producers have not been able to raise their output instantly. Import restrictions with

[1] List, Fredrich. *Das Nationale System der Politischen Ökonomie* (1841), translated into English as *The National System of Political Economy*, London: Longmans, Green and Co., 1909.

[2] Truel, Jean-Louis. The concept of national system of economy and its relevance for modern Russia, *Теоретическая экономика*, 2014, N 6, p. 17.

[3] This view was developed afterwards in Serguei Witte's Lectures on Political Economy and State Finance, published in 1912. "The wealth of a nation consists not so much in the sum of exchange values it disposes of, but rather in its labor and in the diversity of its productive forces, which create those values and for whose benefit it must strive for a many-sided development".

[4] Prebish, Raúl. *The Economic Development of Latin America and Its Principal Problems*, New York: United Nations, 1950.

[5] Казначеев, Петр. *Об иллюзиях импортозамещения. К чему ведет самоизоляция нефтяной экономики?* SLON, 8 June 2015: https://slon.ru/posts/52426.

immediate effect mostly provided windfall profits to local producers, without enticing them to be more competitive. The result was also a decrease in quality[6]. Second reason, production cannot be raised immediately to substitute to imports if the production of inputs–from seeds to machinery–does not follow. In the case of Russia, 80% of the seeds are imported–mostly for China–as well as 50 to 90% of equipments and spare parts[7]. With the fall of the rouble, producers delayed their investment rather than purchase imported inputs: In the first quarter of 2015, 70% of the food industry companies reported a decrease or cessation of purchases of imported machinery and equipment but only 3% of the companies reported a growth of purchases of domestic equipment[8].

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[6] A recent investigation by Rosselkhoznadzor showed that one third of all dairy products on sale in Russia are not true dairy. The cheese shelves were the worst affected, with 78 percent of cheeses recognized as fraudulent. "Fake Cheese Floods Russian Stores", *The Moscow Times*, 2 October 2015.

[7] Колбина, Л. Меж берез дожди косые, *Эксперт Урал*, 2015, № 29 (653), 13 July 2015: http://expert.ru/ural/2015/29/mezh-berez-dozhdi-kosyie / Тимошенко, Валерий. *Политика импортозамещения в России: от слов к делу*, 9 June 2015: http://www.garant.ru/article/630000.

[8] Цухло, Сергей. Как идет импортозамещение в России, *РБК-daily*, 09.06.2015: http://rbcdaily.ru/economy/562949995519511.

Subsidies. They are usually the basis of import-substitution measures. In agriculture, several mechanisms have been specifically implemented since 2014. The major priority has been investment: a list of 464 investment projects in priority areas of import substitution programmes have been approved at the beginning of 2015 by the Ministry of Agriculture of the Russian Federation. They includes the construction of greenhouses and vegetable stores, farms for dairy and beef cattle, piggeries, poultry yards, facilities of processing of dairy products, of fruits and berries. 2015's budget has allocated 266 billion roubles of credit resources for these purposes[9]. Other mechanisms include support for animal breeding as well as direct subsidies linked to in such area as milk production[10].

By themselves, subsidies do not guarantee increased efficiency. Examples abound all over the world where sheer subsidies only help the persistence of non-competitive industries. In Russia, the experts in milk industry have concluded that the program of state support in the

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[9] Колбина, Людмила. Меж берез дожди косые, *Эксперт Урал*, 2015, № 29 (653), 13 July 2015: http://expert.ru/ural/2015/29/mezh-berez-dozhdi-kosyie.

[10] http://agroinfo.com/wp-content/uploads/2015/08/15.jpg.
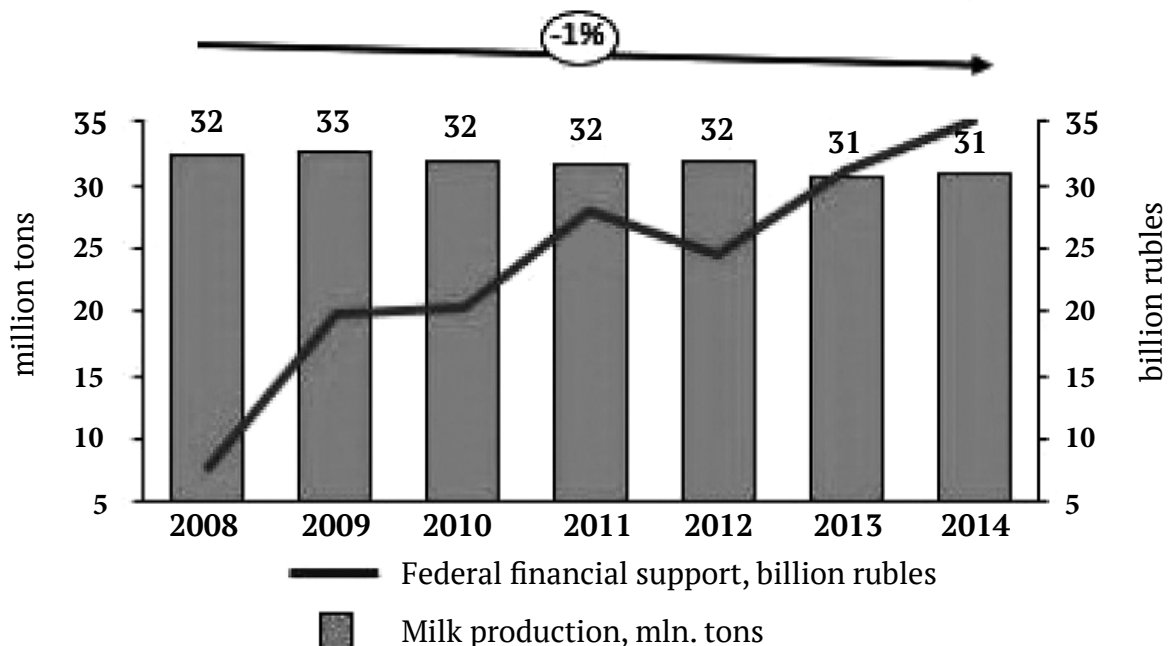
Figure. **Dynamics of milk production and of federal subsidies for milk-animal breeding***

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* Пономарев о складывающейся ситуации с импортозамещением в АПК, Агроинфо, August 26, 2015: http://agroinfo.com/a-ponomarev-o-skladyvayushhejsya-situacii-s-importozameshheniem-v-apk-2608201502.

past years has not helped to increase effectiveness of national milk production in Russia. For instance, the Chairman of the Russian Dairy Union, Arkady Ponomarev underlined that 390 billion roubles of state participation between 2008 and 2014 was to increase the number of dairy cows by 3 million. On the contrary, it decreased. As a result, the production of milk fell (*Figure*).

Therefore subsidies can only be part of a more global strategy.

Action on the whole productive chain from inputs upstream to related support industries downstream. As seen in the case of agriculture, the production in one area is dependent on many other sectors–this is often called vertical linkages. This idea of vertical linkages has been further developed by the theory of "filières" in France in the 80's[11]. Under this form, the concept of "filière" tried to show how industries, and especially manufacturing industries, are linked not only by input/output relations but also by technological relations. A similar concept, focusing on the combinations of technologies as well as on the conditions in which they are produces, is that of "technical system"[12]. This policy of "filières" has proved its efficiency in France in industries such as the aerospace, rail equipment, nuclear energy and electronic industry.

In the case of Russia this raises the issue of whether the economic policy should be targeted towards export-oriented industries or towards industries with more linkage effects. Russia has the potential to develop competitive industries in high-tech sectors such as IT and internet, or aerospace. Yet, being at a competitive edge in a few industries is not sufficient if they are isolated from the rest of the economy.

For instance, in IT, the cumulative turnover of Russian software development companies increased by 5% and amounted to $12 Bn in 2014. Yet the most dynamic part of the industry — 6B$ and 11% growth — is offshore outsourcing[13]. This segment has been favoured by the depreciation of the rouble but has little linkage effect with the rest of the economy.

Recent policies measures have pushed to replace foreign suppliers of software by national companies, especially for purchased by public companies or organisations.

This makes sense under two conditions:

That national suppliers are technically able to provide the same quality — which seems to be true in the most cases — at the same price or lower.

That there is real competition between domestic suppliers.

Software industry will be a good case study of whether import substitution measures to boost an already a competitive domestic industry and promote linkages with other sectors.

Such a policy of linkages could be applied in a whole array of industries in order to build synergies between traditional industries and the modern sector:

- agro-industries;
- aircraft and aerospace;
- pharmacy;
- fine chemistry;
- etc.

One specific area where action in the completely productive chain could be very efficient is energy transition. It can be defined as the path to reduce the consumption of fossil energy in favour of a wide array of alternate sources. Even for a major producer of fossil energy such as Russia, energy transition is a major opportunity of new industrialisation and development of a strong national economy involving new technologies, new products, improvement of existing products and improvement of the efficiency of existing industries[14]. This can be a major driver of re-industrialisation.

Strengthening of the links between all the participants of the productive ecosystem: education, science, industry, support services. When these links do not exist or are weak there can be strong science and education with little effect on the competitiveness of the industry. A striking phenomenon is the huge discrepancy between Russia's high science and technology potential and the fairly low level of innovative output in the industry.

The scientific and technological potential is high in quantitative terms: According

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[11] Lorenzi, Jean-Hervé, Pastre, Olivier, Toledano, Joëlle. La crise du XX eme Siècle, *Economica*, Paris, 1980.

[12] Dosi, Giovanni. *Technical change and industrial transformation*, Macmillan, London, 1984.

[13] Russoft 12th Annual Survey of the Russian Software Export Industry, October, 2015.

[14] Truel, Jean-Louis. "The link between innovation and new industrialisation", *Integration of production, science and education and re-industrialisation of the Russian economy*, Neland, Moscow, mars 2015, pp 78-87.

Table 1. **Major innovation indicators. Relative performance to EU average (100)**

Indicators	Russia	France	Germany
Input indicators			
Population with completed tertiary education	187	122	89
R and D expenditures in the public sector	57	104	128
R and D expenditures in the business sector	51	111	149
Output indicators			
PCT patent application	7	103	138
Knowledge intensive services exports	101	74	123

Source: "Innovation Union Scoreboard 2014". European Commission, Enterprise and Industry Directorate, Feb. 2014.

to the «Global Innovation Index»[15] Russia is 15th out of 142 countries for tertiary enrolment — and 14th for the % of graduates in science and engineering in tertiary enrolment[16]. Yet Russia is lagging in Rand D expenditures — 30th, behind most industrial countries.

As far as output indicators are concerned, Russia is below European average in most areas: in medium and high technology exports, in international publications, etc. The worst situation is for international patents: in Russia, the ratio of PCT patents to GDP is 7% of the EU average[17]. This is the legacy of decades, during which these issues have not be being tackled.

Interestingly, in one area Russia is at par with the EU average — export of knowledge intensive services. This is due to the strength of its IT outsourcing industry, based on top-level workforce in this area.

As a whole, it can be said, that "the Russian system of innovation is strong at its input and relatively weak at the output"[18]. A major reason is probably the lack of interactions between agents: "The quality of relationships between agents and organizations is crucial for the performance of the system. It is not efficient to enhance effort or performance of the single elements if the interaction does not work well"[19].

One example of an attempt to better connect all the participants of the innovative and industrial eco-system is the policy that has been implemented in France for the past ten years. The major and most innovative component has been an ambitious programme of "pôles de compétitivité" (competitive clusters — полюс конкурентоспособности) from 2004 onwards. 71 clusters have been created all over France, on criteria of technical specialisation as well as of regional dimension. A key issue was cooperation between Research centres, Universities, large companies, small and medium-size enterprises and public authorities. As a whole, "Pôles" have helped to create a new environment in which innovative companies have benefited from support and synergies that would not have existed otherwise[20].

INCENTIVES FOR FOREIGN INVESTMENTS, TECHNOLOGY TRANSFERS AND INTERNATIONAL COOPERATION

The involvement of foreign companies has the advantage of bringing extra capital for investment and different skills, especially in the area of production processes. It thus allows a gain of time in promoting local production. The main

[15] Dutta, Soumitra, Lanvin, Bruno, Wunsch-Vincent, Sacha. "The global Innovation Index 2014, *"The Human Factor in Innovation"*, published by INSEAD and WIPO, Fontainebleau, 2014.

[16] By comparison, the US are 2nd and France 38th for % of tertiary enrolment, and respectively 74th and 20th for the % of graduates in science and engineering in tertiary enrolment.

[17] "Innovation Union Scoreboard 2014". European Commission, Enterprise and Industry Directorate, Feb. 2014.

[18] Nureev, R. *Concepts of Socio-Economic Development of Russia: myths and reality, conference,* "Recent Development in the Russian. Business Economics", held at Kyoto University in 9–10 December 2011.

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Table 2. **Comparison of VC investment in the US, in Europe and in Russia 2013**

	US	Europe	Russia (2014)
Number of VC investments	3,480	1,395	279
Amount of invested capital B$	33.1	7.4	0.6
Average size per investment M $	9.5	5.3	2.2

Source: "Global venture capital insights and market trends 2014"; industry sources.

driver for these companies is usually improved market access. This has been the case in the automotive industry, and very much in agriculture: Danone (dairy products), Louis Dreyfus (grains), and Bonduelle (canned vegetables) … Over years, these companies are leaders in the Russian market with most of their production being local.

New regulations as well as the depreciation of the ruble have offered new opportunities, not only to access market but to help developing the research and scientific potential of Russia. This can take the form of:

• Cooperation between Russian Universities and research centres and their foreign counterparts;

• Integration of Russian technology by foreign companies.

Joint ventures in Russia to develop business based on the Russian technology. With a cheaper rouble, current economic conditions are an incentive for local production in Russia by foreign company, to replace sheer importations. The next step can be local production with local technologies[21].

DEVELOPMENT OF A FAVOURABLE FINANCIAL ENVIRONMENT

This is one the most important issue concerning import-substitution. Otherwise, national industries will not be financed to achieve significant growth well enough.

The development of a favourable financial environment can be seen at a microeconomic level with direct support to companies, and especially small and medium size enterprises.

Among other things, this includes subsidies, low-cost loan, tax breaks, R and D financing and public purchasing that favours domestic products

and technologies. These accompanying measures are implemented in a more or less open form in most developed economies, including the US. Public financing of R and D also plays a major role[22]. Yet, as stated above, measures such as public purchasing are an efficient form of financial support only if the level of domestic production is nearly at par with international competition.

More generally, this raises the issue of redirection of financial flows towards the real sector of the economy rather than towards purely speculative financial markets. In the US, one of the most fundamental factors structuring the development of the productive system is the domination of its financial sector that is largely put to the service of the development of the real economy[23]. Such a structure has a major impact on the availability of capital for the development of the productive sector. To give one example, this allows the US Venture Capital to be much larger and more diversified in the US than in Europe or Russia (*Table 2*).

Moreover, as far as Russia is concerned, private investment reflects a strong unbalance between industries. In 2014, 87% of the VC investments were in software and internet, 5% in computer hardware, 4% in biotech and 3% in industrial tech[24]. Globally investment goes mostly to companies that imitate existing business models within in a limited range of industries. Moreover, synergies with other industries are very limited. Such a structure is not favourable to a balanced process of reindustrialisation.

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[24] Source: NAIMA report "*Private Equity & Venture Capital in Russia 2014*".

As a conclusion, import substitution is a difficult path and many experiences in the past led to mixed results or outright failures. One of the key is to use these policies not for sheer protection but to promote competitiveness of local production. Theory as well as international experiences shows that such a path is possible provided it is part of a long-term multifaceted strategy.

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Bounded rationality: psychological analysis of debt behaviour

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Abstract. This paper provides the results of an empirical investigation of decision-making in case of multiple debts. 211 respondents took part in the research. Methodological basis of the research are prospect theory and game theory. As the research method were used computer simulation games. In contrast to following the rational pattern of behavior, the results indicate that individuals tend to pay small loans first and decrease the number of outstanding debts rather than pay debts with the highest interest rate and decrease the total debt amount. Also 50% of respondents prefer to put money on a savings account with a lower interest rate instead of using it to pay the debts. The findings supporting the idea of the rationality of individuals is bounded, when they make decision about the order of debt repayment and are in agreement with findings of other authors.
Key words: psychology of debt behaviour, multiple debt, decision-making, prospect theory, game theory, debt aversion.

Ограниченная рациональность: психологический анализ поведения должников

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Аннотация. В статье представлены результаты эмпирического исследования процесса принятия решений в случае множественных долгов. В исследовании приняло участие 211 респондентов. Методологической основой исследования является теория проспектов и теория игр. Методом исследования послужила компьютерная симуляция игр. В отличие от ожидаемого соответствия поведения рациональному образцу, результаты показали, что индивиды склонны сначала возвращать небольшие долги и уменьшать количество остающихся долгов, чем возвращать долги с высокой процентной ставкой и уменьшать общий объем долга. 50% респондентов предпочли внести средства на сберегательный счет с низкой процентной ставкой, вместо того чтобы использовать средства для погашения долгов. Эти выводы подтверждают мысль о том, что рациональность индивидов является ограниченной, когда они принимают решение об очередности возврата долгов, и согласуются с выводами некоторых других исследователей.
Ключевые слова: психология поведения должников, множественные долги, принятие решений, теория проспектов, теория игр, долговая аверсия.

INTRODUCTION

Relevance of the study

Nowadays more and more people are living in debt, and few of them pay back their loans on time. In September 2014, the average credit card debt of an American household reached $15,607, and the average mortgage debt increased to $153,500. Overall, the amount of total outstanding debt in the US now exceeds $11.5 trillion. In Europe, the percentage of non-repayment of credit card debt approximately equals 7%. Moreover, 4 out of 10 students in Great Britain cannot settle their student loans! The situation in Russia is almost similar: according to the Central Bank, the share of "bad" credits this year has reached 13.3%. That is the highest non-repayment level observed over the last 3.5 years. [18]. Meanwhile, experts say that the amount of overdue debts in Russia is going to increase in the future. Because of social significance and topicality, debt behavior is of great scientific interest, so its causes and consequences should to be investigating.

Background

Keese, M. & Schmitz, H. (2010) analyzed the impact of household indebtedness on physical and mental health. Using a large and representative panel dataset, they figured out that indebted individuals reported to be less satisfied with their health status, had worse mental health, and were more likely to be obese. A causal effect of debt on obesity has not detected. [8]. J. Gathergood (2012) revealed sizeable causal links and social norm effects in the debt-psychological health relationship [6].

Debt can be analyzed as a choice; that is, a person deciding whether to take a loan is choosing between several alternative outcomes that might take place. In terms of finance, taking a loan implies receiving an amount of money on the condition that it is paid back later in exchange of extra payment for the service. According to S. Lea et al. (1993) "debt implies an obligation that borrower is either unable or is trying to avoid discharging, at least at the time when it should be discharged" [10]. C. Roland-Lévy et al. present the study in which saving behaviors can be saw as an opposite to credit taking since they are often related to postponing the consumption of goods and services. In that paper, saving and borrowing are studied in the specific context of the major financial crisis of the years 2008 and 2009. The results show that for the participants who are personally afraid of the consequences of the financial crisis, the representation of credit is somewhat influenced by their representation of the crisis, but does not lead to a different type of credit taking behavior; thus, the representation of saving is not influenced by this variable. [12]. Another study looks at the role of attitudes in debt behavior of 2,000 households, selected as a sample in Italy. [2] The results state that a more favorable attitude toward credit increases the likelihood of using consumer credit, even taking into account the simultaneous effect of other factors that may influence family financial decisions, like per-capita income and earnings expectations. Motivations for using credit are also related to people's attitudes towards borrowing.

Our previous studies were devoted to the problem of debt and credit attitudes [14] and to the role of objective and subjective factors in debt repayment [16] in Russia; but the research samples included only students, [15, 17] so the study needs to be extended.

Despite the fact that many factors influencing consumer debt have been proposed in literature, we can agree with other authors that a clear and conceptual model of consumer indebtedness has not yet emerged [9].

Root causes of the problem of bad debt

What is the cause of the problem that makes a 'debt' becomes a 'bad debt'? Well, it is widely believed that banks are to blame, because they provide subprime loans to indigent people. However, regulations applied to lenders and borrowers have obviously become more rigid. The set of documents necessary to get a loan has enlarged considerably over the last years; new rules regarding pledge and surety have come into force. What is more, the amount of available information about borrowers is growing rapidly and new computerized systems are being introduced to process it. Undoubtedly, from the technical point of view the process of risk assessment has advanced greatly over the last few years. However, what about the results of risk assessment? Have they become more accurate? Why do banks face

non-repayment of credits, despite all preventive measures?

Ergo, the problem of our study can be formulated as follows: we must model the situation, consider the relations between the lender and the borrower, and examine their behaviors. The basis for modeling and analyzing optimal communication strategies in this case will be game theory.

Let us consider a situation when a person has several debts, but the resources available for covering these debts are limited. Consequently, the borrower must decide what debt to pay off first. Facing multiple debts is a complex situation, and the decision-making process in this case can be viewed with the help of prospect theory. We have already conducted research that showed that people tend to make mistakes when choosing one option over several alternatives. In addition, these mistakes do not depend on the respondent's education or occupation. [1, 3] While making a decision, the person assesses complex options by generating an intellectual system of ideas, which are used to evaluate the benefits and drawbacks associated with a particular option. The resulting value of the choice is then derived by comparing the prospective benefits and drawbacks with the checking characteristics of the initial state. Thus, the option is acceptable, if the sum of the benefits exceeds the total value of the drawbacks. This kind of analysis assumes the psychological (but not physical) ability to differentiate between benefits and drawbacks attributable to any option. The concepts of utility and value can be used here in two flavors:

• experience value — the level of pleasure or pain, satisfaction or suffering one gets in a real-life situation;

• decision value — the contribution made by the expected outcome into the overall attractiveness or repulsiveness of a particular alternative/option.

It is pretty hard to feel the difference between these two concepts, because the decision-making theory generally suggests that the real value of the choice coincides with its expected value. This assumption is a part of the idealistic concept of a purely rational individual, who is able to forecast events and evaluate available options in the most accurate way. However, a real-life decision-maker does not perceive the coincidence between the real and expected value of the

choice. [7] Some factors that affect the situation cannot be forecast, and the influence of others is too weak to be accounted for.

Financial decision-making is affected by a cognitive bias called "framing effect". Frame is the way in which the problem or question is stated. People often come up with different solutions to problems that are equivalent in terms of profit or loss but are formulated in different ways. When the statement of a problem puts an emphasis on prospective gain, people tend to avoid risk. However, when the problem is formulated in terms of potential loss, people are more willing to take risks. [7]

Framing effect plays a crucial role in understanding debt behaviour. Firstly, a decision about whether to repay a loan or not can be viewed as a choice between an inevitable loss and a game of chance which provides an opportunity to avoid losses. In other words, a debt repayment decision is regarded as the one that involves risk, and people tend to choose the chance not to pay anything (accompanied by the likelihood of paying more money at the end due to huge fines and penalties) over covering the debts. Secondly, if we say that preferring prosperity to poverty, avoiding risks and using probability theory and mathematical statistics to make decisions under uncertainty are all components of rational behaviour then the rational choice would be to pay off the loan. Moreover, in case of multiple debts, the order of debt repayment also matters. Here, the optimal strategy would involve distributing some money among all debts (to get rid of fines) and paying off the loans in decreasing order of the interest rate. In other words, a rational borrower would use all available money to settle the debt with the highest interest rate then he'd pay off the debt with the second highest interest rate, and so on.

Thus, our research aims at studying the decision-making about repaying multiple debts. The following hypothesis is stated: while making a decision about debt repayment, respondents will stick to those strategies that deviate from the optimal one.

Objectives of our research are:

• examine the market of credit cards in Russia; estimate the average size of the loan and the annual interest rate;

• design an experiment that simulates the relationship in the lender-borrower dyad;

• conduct the experimental investigation and process the results.

METHODS

The methodological framework for our research is the prospect theory [7] and game theory. The method by which our study was carried out was borrowed from the authors of the article "Winning the battle but losing the war: the psychology of debt management" [1]. We adapted the method to domestic conditions of Russia. With the help of Excel (computer application), we created a small 'debt game' — a kind of a simulator modeling a real-life situation. The essence of the game is as follows: the participant receives a credit portfolio that consists of six credit cards (*Table 1*). The game lasts 25 rounds; each round shall be one year. Each year the participant receives 50,000 rubles. He/she must use the entire sum to cover the credit card debts. In addition to this, during the game the participant gets additional bonuses that must to be used to settle the debts as well. The aim of the game is to get the smallest amount of overall debt at the end.

To make the situation as close to real life as possible, we have significantly improved the game model offered by foreign scholars. Firstly, all conditions of the game match the relevant features of Russian financial markets. We have chosen the interest rates in accordance with the real-life rates charged by Russian banks. Secondly, financial resources provided to participants in our experiment enable them to repay the debts in full. Thus, not only can we consider the debtors' behaviour, but we can also involve the creditors in our analysis and explain the situation when loans are granted but never paid back.

All in all, the lending process can be presented as a simple positional game, where the bank — the lender (L) — is the first player, and the borrower (B) is the second player. All positions of the game are shown on the tree below (*Figure 1*).

As you can see from the scheme, the lender is to make the first "move" in the game: the bank decides whether to lend the money out to a potential borrower or not. The decision is usually based on the analysis of the potential borrower's solvency. If the bank concludes that the person is able to repay the loan, it gives him/her the money. Then, the turn comes of the second player. As well as the lender, the borrower has to choose: he/she can either pay off the credit or not. In the latter case, the borrower becomes a debtor. [10]

At first sight, the game appears to be very primitive. Obviously, the preferred final position for both players is the repayment of the loan. With this outcome, the bank gets back the money and earns profit from the interest on the loan, while the borrower does not have to lose the collateral, receive phone calls from collectors or go to the court. In practice, however, the game is complicated by several factors. Firstly, both the bank and the borrower face incomplete information: they do not know about each other's intentions and, as a result, they cannot say for sure what positions they occupy on the game tree. Secondly, our research has shown that the lender and the borrower use completely different evaluation principles and methods while selecting their positions.

What factors does the bank focus on while making a decision about lending out the money? Simply put, it evaluates the ability of a potential borrower to repay the loan. A wide variety of methods is being used for that: the bank considers the potential borrower's sources of income; his/her credit history, purpose of the loan, etc. Of course, in the case of long-term credit lines it is very difficult to make an accurate forecast for several years, so the ultimate score can be misleading. To make our model less complicated, though, let us assume that the bank is fully informed about the borrower's future income and it is even able to work out the exact scheme of debt repayment. As a specialized financial institution, the bank carries out its calculations

Table 1. **Initial debt amounts and interest rates**

	Debt 1	Debt 2	Debt 3	Debt 4	Debt 5	Debt 6
Initial debt amount	10,000	25,000	30,000	35,000	150,000	200,000
Interest rate	20%	19%	24%	21%	28%	30%
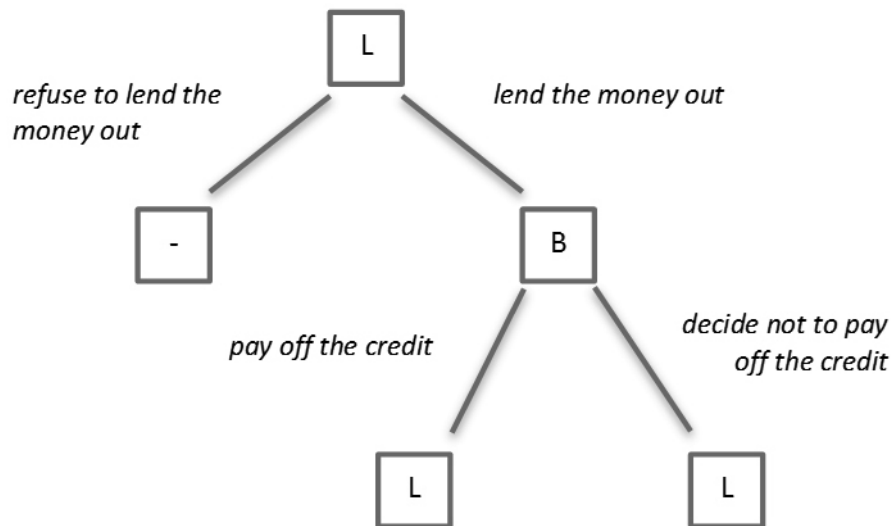
Figure 1. **All positions of the game**

in accordance with a rational approach, taking into account the future value of money. Thus, the debt with the highest interest rate has to be repaid first. To model the situation, let's define a payoff matrix $A = (r_j; a_{ij})$, where r_j is the percentage interest rate on the loan, a_{ij} is the current amount of debt. In fact the game involves 2 players (the lender and the borrower), but since the game is positional (you can see its two major stages in the tree *Figure 1*), the players work with the matrix alternately and make their moves in turns. The game lasts 25 rounds for each player; each round the player repays his/her current debt using the money at his/her disposal. The bank "runs in" (tests) the game to make sure that the borrower is able to repay the loan; meanwhile, the borrower plays in and makes payments after receiving the money. The main problem is that the strategies of the players can differ dramatically.

In the initial position of the game tree, the payoff matrix looks as follows:

[(0.2; 10,000) (0.19; 25,000) (0.24; 30 000)
0.21; 35,000) (0.28; 150,000) (0.3; 200,000)]

As we have already said, while checking the potential borrower's ability to repay the loan the bank sticks to the optimal repayment strategy, according to which the debt with the highest interest rate is supposed to be paid off first (see *Figure 2*). This means that the sixth credit card debt has to be settled first; then the fifth credit card debt must be repaid; after that comes the third one, the fourth one and the second one respectively. Thus, the

bank minimizes the debt with the highest interest rate, or, using mathematical language, it employs the "minimax" strategy:

$$\alpha = \min a_{ij} \max r_j \qquad (1)$$

The strategy the bank uses in fact leads to the optimal outcome of the game, because it enables the borrower to repay all loans in full. This scheme can be visualized using a loan calculator designed in Excel, or with the help of a scatter diagram displaying the rounds of repayment of each debt. Based on our assumption that the bank takes into account only the potential borrower's ability to repay the loan when making a lending decision, we can conclude that in this particular case the borrower will receive the money.

Now comes the turn of the second player to make the move. As we have already understood from the bank's calculations, the borrower is able to repay all loans using the money at his/her disposal. Unlike banks, however, people do not always behave in a rational way. If the borrowers' actions always coincided with those of the lenders', the problem of bad loans would not have become a burning issue. This gives us a reason to assume that people tend to stick to some other schemes of loan repayment. In order to identify these schemes, we have conducted an empirical study of the "potential debtors'" behaviors, giving them an opportunity to play our "debt game".
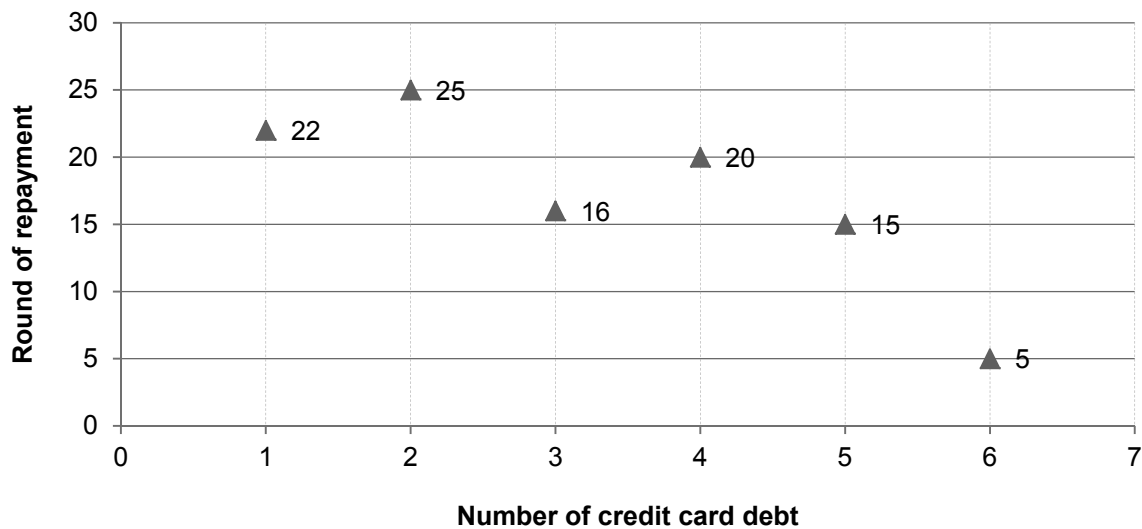
Figure 2. **The strategy of debt repayment proposed by bank**

The sample included 211 participants, aged from 18 to 67 (Mean = 24.2); among them 118 were females and 82 males; in other cases sex was not mentioned. The respondents were undergraduate students as well as adults with higher education, specializing in economics, techniques and humanities.

RESULTS

From our analysis have been excluded uncompleted games and games with mathematical errors, so the final number of respondents equaled 171.

From the rational point of view, borrowers should have an incentive to understand the terms on which consumer credit was priced in order to make well-informed decisions about borrowing and repayment. However, our results show that people tend to make wrong decisions about the order of debt repayment in case of multiple credits, and that leads to growing debts (*Table 2*).

We can see that the participants were more likely to completely pay off small debts (Debt 1, 2, 3, 4 Median = 0) by the end of the game than to pay off the entire amounts of Debt 5 and 6.

The minimal total debt at the end of the game achieved through the rational repayment strategy equals −5,185 rub (which means that the individual paid off the entire debt and achieved a positive cash balance). However, only four respondents from our sample followed this strategy. The mean total debt was 25 million and the maximum total debt equaled 73 million rubles. For analysis, all the respondents were categorized according their total debt (see *Figure 3*).

The distribution of total debts among players is similar to normal but has two extremes: in the

Table 2. **Descriptive statistics of debts at the end of the game 1**

	M (₽)	Med (₽)	Min (₽)	Max (₽)	SD (₽)
Debt 1	154,703	0	0	953,962	312,101
Debt 2	234,694	0	0	1,934,702	539,506
Debt 3	393,413	0	0	6,496,260	1,124,745
Debt 4	288,822	0	0	4,108,680	789,420
Debt 5	9,704,604	1,352,630	0	53,895,542	12,412,080
Debt 6	14,293,118	4,085,612	0	73,985,358	18,220,396
Total debt	25,052,749	27361897	−5,185	73,985,355	18,640,152

interval from 0 to 5 million and in the interval from 30 to 35 million. We explored the strategies of debt payments corresponding with these extremes.

Extreme from 0 to 5 million debt corresponds with a strategy close to rational. A half of respondents (19) from this group began the game by paying off the debt with the highest interest rate and closed this debt at round 5. 14 respondents out of 19 continued to follow the financially rational strategy and started paying off the debt with the next highest interest rate (Debt 5), but then deviated from this strategy. They either closed all small debts or distributed cash among several accounts.

The other extreme (22 respondents) is an interval from 30 to 35 million. This interval corresponds with an irrational strategy, which involves reducing number of outstanding debt or distributing the available resources among several accounts. All the participants of this group except for 3 respondents totally paid off all small debts (Debt 1–4). 21 respondents finished the game with Debt 5 open, and 8 respondents had Debt 6 unpaid at the end of the game. These results support the idea of loss aversion [7] and "debt account aversion" (the latter described by Moty Amar, Dan Ariely, Shahar Ayal and co-authors [1]). Other errors worth mentioning are: mathematical mistakes, uncompleted games and ignorance of small numbers — players considered a debt closed while tenth (kopecks) remained unpaid.

We also observed reactions of the participants during the game. Such exclamations as "You have a mistake in program, because I put money on the account but my debt is still growing!" or "Why do we have annual percentage rate annually (every round)?" illustrate that people tend to underestimate how interests accumulates over time. They may know about interest rates in general but do not have enough experience in operating them. These aspect leads to poor debt management.

We were also interested in the influence of possibility to save money on debt behavior. We added a "saving" option to the game described above — that is, players could put money on a savings account with an annual interest rate of 8.4%. The results presented in *Figure 4*.

In such circumstances it was not financially rational to put money on a savings account before all the debts are completely paid off, but more than 50% of our respondents chose that option.

Variable: Var21, Distribution: Normal

Kolmogorov-Smirnov d = 0,11036, p < 0,05

Chi-Square test = 131,65168, df = 11 (adjusted), p = 0,00000
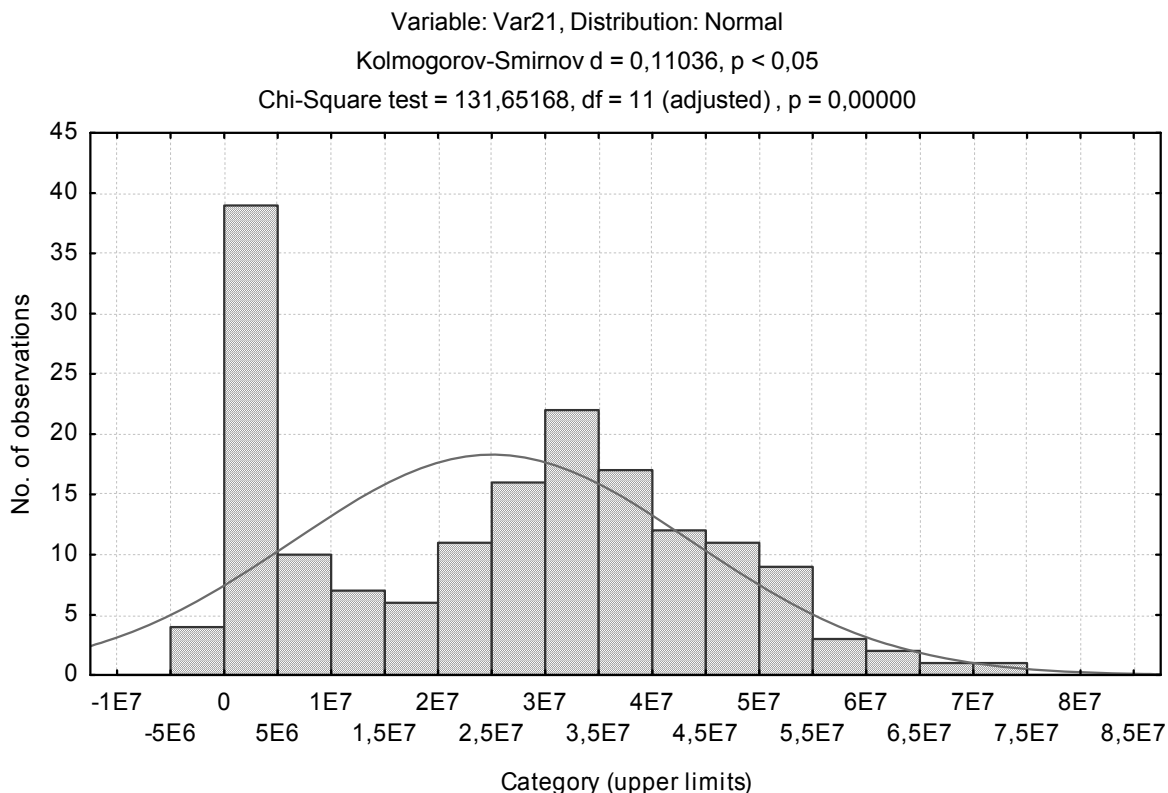
Figure 3. **Categorization of respondents according their total debt**

Table 3. **Descriptive statistics of debts at the end of the game 2**

	M	Med	Min	Max	Std. Dev.
Debt 1	254,253	0	0	953,962	391,383
Debt 2	422,850	0	0	1,934,702	731,699
Debt 3	822,126	0	0	6,496,260	1,903,810
Debt 4	683,853	0	0	4,108,680	1,304,073
Debt 5	10,375,782	564,537	0	71,835,728	15,888,471
Debt 6	17,428,861	57	0	141,128,200	28,908,183
Savings	1,418,387	20,000	0	98,254,000	7,347,237
Total debt	29,987,587	23,355,633	−5,185	218,026,609	35,045,621

In comparison with the no-saving game we observed a slightly larger total debt and a higher diversity.

The diversity in game with the saving option can be explained by two opposite trends. Firstly, having passed the first game, participants obtain some knowledge about interest accumulation and gain a better understanding of the rational pattern of debt repayment. However, at the same time, the use of the saving option led to an increase in total debt. The distribution of total debt among players is presented in *Figure 4*. Three respondents with a total debt over 200 million were excluded from analysis.

Financially rational strategy for this game is the same as for the previous one and gives positive balance of 5,185 rub. Five respondents followed this strategy. The extreme from 0 to 10 million includes the players with a strategy that slightly deviates from rational; none of those 5 players used the saving option.

In contrast, respondents with a total debt over 110 million put large sums (about 10 million) on saving accounts.

Variable: общ долг, Distribution: Normal

Kolmogorov-Smirnov d = 0,12374, p < 0,01

Chi-Square test = 124,05423, df = 7 (adjusted) , p = 0,00000

Figure 4. **Influence of possibility to save money on debt behavior**

DISCUSSION

The results can be interpreted in accordance with the game theory. The two main strategies can be distinguished. Firstly, looking at the behavior of most payers, we found a straight connection between the size of the debt and the round when it was closed: the higher the debt, the later it was started to be paid. In other words, instead of paying large debts with high interest rates players paid small debts with lower interest rates. Mathematically it leads to decreasing the number of credits with the smallest debt and can be described as "minimin":

$$\beta = min\ min\ \alpha_{ij} \qquad (2)$$

Minimin strategy gives the player a sense of progress, but it is an illusion. The player decreases number of credits, but the total amount of debt continues to grow. What minimin strategy gives a person is the sense of progress, and this sense makes people feel comfortable. The problem is that the feeling of progress can sometimes backfire and draw people away from their goals. [11] In our case the players listened to their feelings instead of sticking to their ultimate goal, and they were mislead by the sense of progress they got from reducing the number of credits d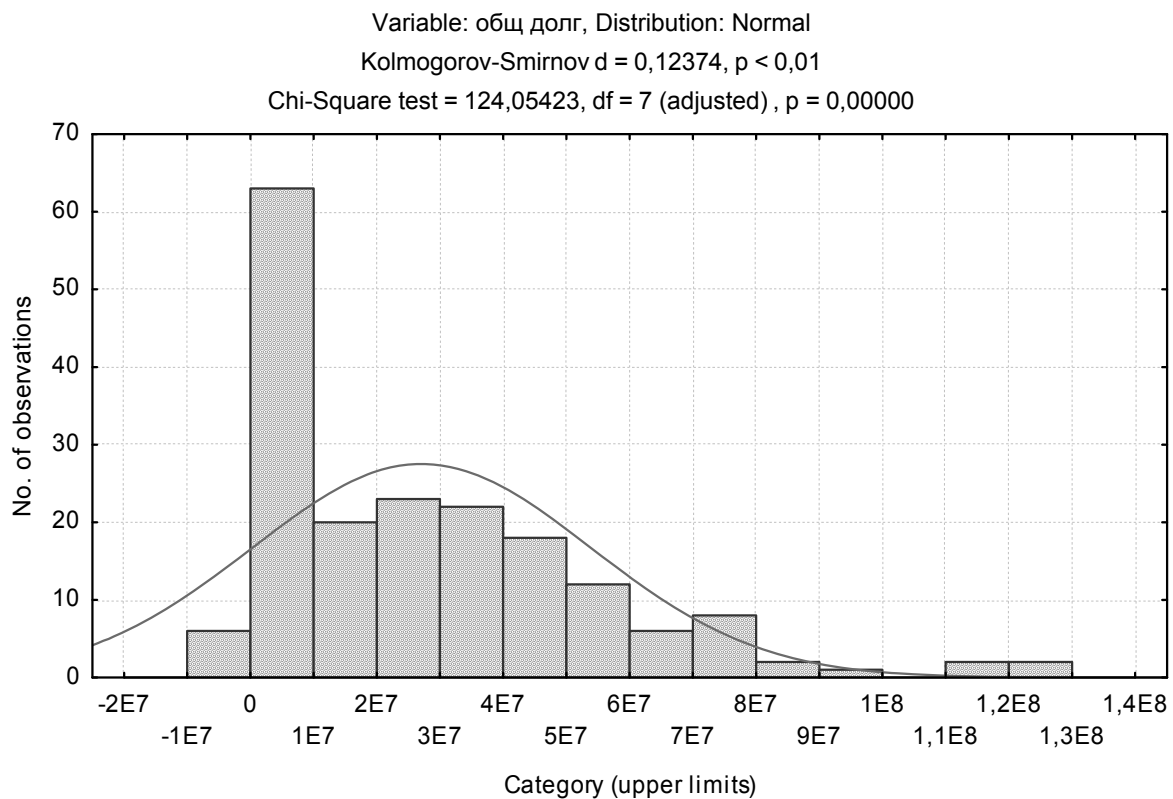uring the first rounds of the game, while the ultimate goal remained unachieved. Investors who lose money in the stock market make the same mistake. If the losses an investor suffers decrease, he or she might even think that the situation is gradually improving. From the mathematical and economic points of view, however, the total amount of losses increases, so the situation is actually becoming worse. [5]. Another possible cause of using the minimin strategy might be the desire of people to better control the process of debt repayment. When you keep paying down one loan and you see that the five other debts keep growing, you become anxious and you feel tempted to do something about it. Perhaps players associate the growing amounts of debt with losing money, and they feel themselves more comfortable, facing one "loss" instead of five. Finally, the use of minimin strategy is likely to be attributed to certain cognitive limitations that affect our perception of information, particularly to mental accounting. It refers to the tendency of people to break a large complex problem into several small pieces called mental accounts and analyze them separately. However, the optimal solution to the initial problem might not be achieved through the sum of solutions to those small sub-problems [13]. Here, the players break the multiple debt repayment problems into a series of subtasks associated with repaying each debt, and they simply do that without taking into account the relationships between the debts and the impact of the differences in interest rates.

Another frequently used strategy is 1/n heuristic. Player just split money among different debts. In fact, the vast majority of our participants used this strategy at a certain point in the game. The problem is that people view debt repayment as resource allocation. However, despite the fact that 1/n strategy may diminish risks through hedging when keeping assets on several accounts, it does not work for debt repayment. Paying off a loan is not an investment decision; although both concepts utilize the notion of interest rate, it works differently in each case. When you allocate your resources, you are paid interest on your investment; when you repay the debt, you are charged for using someone else's money, and you have better minimize the amount of interest you pay. The primary reason behind the use of 1/n strategy is that people do not actually understand the way interest rate works. This conclusion is supported by the fact that that 1/n strategy was used more often when only two large debts remained or when there was some money left after closing a debt on a particular round. People simply do not know what to do next, and they behave in the way they believe to be the safest.

CONCLUSION

In general, repaying multiple debts is a difficult task, so people simplify it by splitting the problem into small more manageable parts or use the solutions they found to be efficient in the past. All in all, subjective psychological factors such as loss aversion and the desire to experience a sense of progress (even when it's actually false) are more instrumental in driving the debt behaviour than objective economic factors such as annual percentage rates on loans. These findings indicate that debt behaviour significantly deviates from the rational pattern. It is pointed out not only in our laboratory experiment, but it is also observed on individuals who participate in consumer credit markets: they actually display, on average, a poorer level of financial

literacy, compared to those people who do not get consumer loans, even conditioned on characteristics such as income and education [3].

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Experiences of green credit development — lessons learned to Vietnam

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Abstract. The concept of green credit resembles that of sustainable finance in that both concepts highlight the potential of the financial sector to respond to environmental and social challenges of the world through financial instruments. This article studied the experiences of green credit development in some countries in over the world such as China, Korea, Bangladesh, and Germany. According to the difficulties in applied green credit in China, or the successes of green credit in other countries for examples the cases of Korea, Bangladesh and Germany, this study highlights several recommendations and suggests lessons learned from these countries to Vietnam. It would be especially stressed that raising awareness of consumers about using environmentally friendly products, and boycotting products that are not clean or polluting to environment is crucial. On the other hand, the support of the government could help enterprises reduce green production costs.
Keywords: green economy, green banking, and green credit.

Опыт развития «зеленого» кредитования: уроки важные для Вьетнама

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Аннотация. Концепция «зеленого» кредитования является сходной с теорией устойчивых финансов, поскольку обе помогают финансовому сектору отвечать на экологические и социальные вызовы мира с помощью финансовых инструментов. В статье раскрывается практика применения «зеленого» кредитования в Китае, Корее, Бангладеш и Германии. С учетом проблем в применении «зеленого» кредитования в Китае, а также успешного его применения в Корее, Бангладеш и Германии, и уроков, извлеченных в этих странах, даются рекомендации для Вьетнама. В статье особо подчеркивается значение растущего осознания обществом пользы от экологически чистой продукции и важность бойкота «грязной» и загрязняющей окружающую среду продукции. Отмечается необходимость поддержки государством предприятий, что должно способствовать снижению издержек «зеленой» продукции.
Ключевые слова: «зеленая» экономика, «зеленое» банковское обслуживание, «зеленое» кредитование.

1. INTRODUCTION

In recent years, the concept of a green economy has become controversial issue that takes many attentions from not only the scholars but also the politicians. There are several definitions that involved in green economy; however, UNEP has already emphasized the definition of a green economy "as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities". The concept of green economy should been understood in accordance with broader concept of sustainable development. This concept has highlighted the inter-generational equity — economic, social and environmental. On order to implement the objectives of green economy,

many countries have conducted different macroeconomic policies in their economic development strategy. One of the most effective issues that have been applied in many countries is green banking, which concentrates on green credit. Sahoo and Nayak (2008), Bihari (2010) indicated the importance of green banking, sites international experiences and addressed on important lessons for sustainable banking and development in India. Biswas (2011) paid attention on the major benefits, confronting challenges, strategic aspects of green banking. Commercial banks should become green and implement a pro-active role to take environmental and ecological issues as part of their lending principle, which tend to economy for environmental management purpose, use of green technologies and green management systems. Bahl (2012) and Kaeufer (2010) has mentioned that green banking is concerned in promoting environmental and social responsibility through providing banking services in order to maintain sustainable banking. Green banking is also taken into account of ethical banking that starts with the aim of protecting the environment. With the purposes of green economy, many countries have carried out various solutions to make amendment and advocacy for the environment protection and sustainable developing policies. Green credit, among those numerous measures, is getting vigorous attention and interest from both the Government and international institutions. Many commercial banks have started to put higher priority on the investment projects, which can improve the environment condition and community benefits. Green credit is a strategy to support economy to grow into a green, low-carbon and recycled model through business innovation, manage environmental and social (E&S) risks, improve banks' own E&S performances, and in doing so, optimize credit structure, improve services and contribute to the transformation of economic growth pattern.

The concept of green credit resembles that of sustainable finance in that both concepts highlight the potential of the financial sector to respond to environmental and social challenges of the world through financial instruments. Green credit activities are those that can bring about substantial benefits for economic growth, people's lives, environment protection as well as sustainable development. Green credit policies are the significant measures in the transition into green growth targets. Green credit products of the banking systems are often used in projects on energy savings, renewable energy and clean technology. These priority sectors are allocated in accordance with green credit policies in different countries. However, most of current funds for the green credit in commercial banks are still based on internationally financed projects/programs. This is due to the lack of confidence and assurance of banks regarding credit risks from these investment projects. Aizawa and Yang (2010) described a series of green policies that applied by China government, including green tax, green procurement, as well as green policies relevant to the financial sector, namely, green credit, insurance, and security policies. As consequently, green credit policy is the most advanced, with three agencies which shared the responsibility for implementation. Zhang, Yang and Bi (2011) examined the implementation of the green credit policy both at the national and provincial levels in China and proved that the green credit policy is not fully implemented in this country. Weiguang and Lihong (2011) showed a problem existed in China's green credit, which was some external obstacles constraint to the implementation of efficiency. These difficulties required generating the environmental risk management system in the commercial banking system.

The implementation of active solutions from the banking system to promote and mobilize credit funds to be invested in green and environment friendly projects may create many benefits, as follows:

• On the national aspect: the development of green credit — green banking will make progressive contributions to the balance and harmonization between environment, economic and social development, poverty reduction, people's lives improvement. In addition, it helps Vietnam to prevent social and environmental risks faced by many countries that did not take into consideration their environmental issues in their economic growth strategy. Furthermore, this can create great opportunities for international finance institution to invest in Vietnam.

• On the business aspect: Green credit offers a wide range of new environmental products to

their clients to earn more revenues and ensures the enterprises to go green. It means that if enterprises emphasize the fact that they are attempting to be environmentally friendly can gain the favor of like-minded consumers, save cost because of saving energy to enhance their reputation as well as competitive advantages in the fierce market. However, the most important is to increase consumer demand. As environmental consciousness grows, consumers are demanding more green products and services. Environmentally conscious consumers check labels for products and packaging made from recycled materials. Due to this growing consciousness, the market share for green products has continued to expand in a variety of industries. Enterprises can tap into this market by offering more green products and services.

• On the banking system: Green credit not only ensures the enterprises to go green, but also facilitate improvement the asset quality of banks in the future via feasible and efficient loans. Even in this global integration, firms are required higher standards to export products, such as a requirement on green label, ecological label, or green license. The regulation therefore become stricter and stricter on environment impact of the firms thus can result in legal risks for the borrowers if they cannot meet them. Therefore, it is wise for financial institutions to assess environmental impact of their borrower's project before lending, or advise clients to do so. Therefore, green credit can help protect the bank's asset portfolio quality by decreasing non-performing loans, thus increasing financial stability and maintain the bank's reputation. Being aware of those benefits, more and more banks have joined in the Equator Principles, which provides guidelines to facilitate banks to go green, with IFC initiative. Since 2006, banks have been selected annually for best practices in their environmental performance in the Sustainable Banking Awards, held by IFC, and results show that best green banks, like Dash (2008) about Triodos (2009), Itau Unibanco (2011), Standard Chartered (2012), Banco Santander (2013), proved to have increasingly better financial performance over time, even in years of financial crises.

• On the community and customers aspect: Green credit supports to protect the environ-

ment and human health while providing other social and economic benefits to communities. Moreover, the development of green credit will provide customers with many opportunities to use clean and environment friendly products and restrict the poisonous products. Furthermore, green credit indirectly contributes to improve living environment, maintain the natural resource benefits for the next generations. The role of green credit is also expressed in raising awareness of managers, enterprises and individuals about the significance of green investment for sustainable development.

2. EXPERIENCES OF GREEN CREDIT DEVELOPMENT IN SOME COUNTRIES IN THE WORLD

2.1. China

After many failures in controlling environmental risk, the Chinese Government aims to control pollution in firms via financial institution. The Circular of the People's Bank of China on the Implementation of Credit Policies and Strengthening Environmental Protection issued on February 6, 1995 was the first official document to link credit policies with environment protection. On July 12, 2007, State Environment Protection Administration (SEPA), the People's Bank of China, and China Banking Regulatory Commission (CBRC) jointly issued the Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks, emphasized the role of credit policies as tools of environmental protection, and to strength environmental monitoring and credit management of construction projects and enterprises. This is the basic framework of China's green credit policies. CBRC is responsible for supervision and administration of banks' green credit operations, and environmental risk management.

However, there was no detailed guideline for the Green Credit policy until 2012 when CBRC issued Green Credit Guidelines. That is why this policy was not considered to be effective and efficient during these 5 years absence of guidelines. The guidelines plan to establish an environmental system, which covers tax, credit and insurance policies to control and treat the environment pollution by use of market forces. Under the policies, enterprises that has been punished by environmental protection authori-

ties will not be able to obtain further credit from financial institutions and will have to repay their borrowed loans too.

According to Environmental Records of Chinese Banks (Green Watershed, 2010) very few of listed banks made strides towards green credit. One of the reasons is their lack of disclosure of environmental information. Disclosure of environmental information is the basis for the assessment of the banks' performance in implementing environmental policies and fulfilling their environmental and social responsibilities. But, there is no detailed guideline for disclosure of environment information because this is only voluntary. Consequently, banks still participate in environmentally controversial projects, especially overseas projects, and ignore criticism from society. This research suggests a compulsory regulation to financial institutions on disclosure of environmental information.

Another research in 2014 conducted by an international environmental NGO, E3G (Third Generation Environmentalism), reported that financial innovation can be led by financial institution championing green finance, like China Industrial Bank and Shanghai Development Bank, which pioneer the use of non-credit instruments such as equity, guarantees and insurance for green investments. The report also suggested creating a platform for Low Carbon Finance and Investment between the Government, financial institutions and regulatory authorities on green banking pathway, with more integrated thinking and policy dialogue. Public finance alone in China has not always satisfied investment need, so the report recommended that China should try new financing models such as public-private-partnership (PPP) together with a thorough financial reform to support a larger impact. Due to emphasis on environment policies, China surpassed many developed countries to become the world's largest green investment country (IFC, 2011). Nevertheless, only one financial institution is the member of Equator Principles and 6 joined UNEP FI (updated until August 2014), a very small number for a large country like China.

2.2. Korea
Korea is proved successful in promoting green credit, but their experience is quite different from other countries. Besides banks that prac-

tice green operations, there is a government non-profit credit guarantee institution founded in 1989, called Korea Technology Finance Corporation (KOTEC). This institution acts as a credit guarantee system to solve the problem of lack of financial resources due to banks' prevalent collateral-based lending practice. It enables businesses with competitive and environmental friendly technology, innovation and other knowledge-based business contents at all growth stages. The mission of KOTEC is to take a lead in converting Korean economy to be creative and innovative. KOTEC is also the only financial institution to assess and grant "green" license to businesses. Until 2013, 65% of green businesses have received support from KOTEC. From 2011 to 2013, KOTEC granted guarantee for green investment of up to 10,000 billion Won (equivalent to US$9.24 billion). Each firm who received the green license can apply for the guarantee of up to 7 million Won (US$6.49 million). Firms who received excellent green license can obtain special support from KOTEC, such as an increase in guarantee amount on number of green-tech experts (Won 30 million for each expert), age of experts, support for R&D expenses and copyright registration fee.

2.3. Bangladesh
Bangladesh is a country with the level of economic development similar to Vietnam. Bangladesh Bank, the central bank of Bangladesh, requires commercial banks to comply with Environment Conservation Act to control environmental pollution before obtaining finance for projects. Bangladesh Bank later also issued a Guideline on Corporate Social Responsibility (CSR). It also published annual review of CSR practices by scheduled banks to keep track of country's green credit. However, all the guidelines have no directions to quantify environmental risk in credit risk management. Banks, nevertheless, under many policies and guided by the central bank, offer a wide range of green credit products, such as solar home system, solar irrigation pumping station, bio-gas plant, effluent treatment plant, green credit card, efficient waste management, etc. BRAC, a Bangladeshi bank, even was awarded Best Sustainable Bank in Emerging Markets of the year 2010 by IFC, and is a founder member of Global Alliance for

Banking on Values (GABV) — a network of the world's leading sustainable banks. Despite recent good results on green credit promotion, only one bank is the signatory of the Equator Principles. In order to better following the guidelines, there is an urgent need to quantify all the environmental risk assessment in lending.

2.4. Germany

In the transition into a green economy, green banking plays a crucial role in providing fund for green activities of the private sector because the banking system is such a blood vessel of the whole economy. Germany is a country that has been successfully implementing its green credit policies. The German state-owned KfW Group — the national development bank — supports Germany's development policy, international development cooperation and sustainability strategy. Sustainability is one of KfW's primary business targets with responsibility to promote environmental and climate protection worldwide. Moreover, KfW is also committed to social responsibility and participating in dialogues with its stakeholders. Good corporate governance plays an important role in the banking development.

Germany has universal banking system. The private customer mostly has to choose between three kinds of banks (German "three pillar system"):

(A) Private banks (including direct banks):

The largest ones are Deutsche Bank, Postbank (acquired by Deutsche Bank), Unicredit Bank AG (HypoVereinsbank), Commerzbank and Dresdner Bank (which was acquired by Commerzbank in 2008) — they cooperate together as the Cash Group.

(B) Cooperative banks:

Co-operative banks make up about two thirds of all German retail banks, and have a broad customer base consisting of individuals and small businesses. However, their small size means they only account for about 11% of total bank's assets. Nevertheless, co-operative banks are a very important part of the German economy. They are significant lenders to the small and medium-size enterprises, many of them also co-ops, which are the bedrock of the German economy.

Co-operative banks (e. g. GLS bank) are owned by their members, who broadly are their customers — depositors and borrowers — although most of the banks accept non-member customers as well. Each member has one vote, regardless of their contribution to the cooperative bank. Co-operative principles apply not only within individual banks but also across the sector as a whole, with stronger banks supporting weaker ones. This means co-operative banks could stay small and local, and prevented them from taking excessive risks. Because of this, the German co-op banking sector required no public funds in the recent financial crisis: few bank failures were been handled within the sector itself. Co-operative banks continued to provide finance throughout the crisis period — in fact increasing lending in 2008–9. The speedy recovery and subsequent robust performance of the German economy is, to a considerable extent, due to the stability and resilience of the co-operative banking sector.

(C) Public savings banks:

Savings banks in Germany work as commercial banks in a decentralized structure. Each savings bank is independent, locally managed and concentrates its business activities on customers in the region it is located. In general, savings banks are not profit oriented. Shareholders of the savings banks are usually single cities or numerous cities in an administrative district.

They intended to develop solutions for people with low income to save small sums of money and to support business start-ups. Fulfilling public interests is still one of the most significant characteristics of public banks in general and the savings banks in particular. Savings banks are universal banks and provide the whole spectrum of banking services for private and commercial medium-sized customers.

In Germany, there is not a green banking strategy. Actually, the demand for green banking has increased after the financial crisis, because green banking. Especially green banks were not been severely affected by the financial crisis. Almost every bank in Germany offers green investment products, but only four green banks have fully integrated sustainability into their business models, including GLS, UmweltBank, Triodos and EthikBank. These are the small and medium sized banks, possibly commercial banks, savings banks or cooperative banks. The operating target of these banks is to mobilize funds from their members and depositors who have good awareness and willingness to achieve low depositing

interest rate with aim to invest in meaningful and environment protection social activities. Meanwhile, borrowers will have to obtain high lending interest rate because their environment protection products would be sold at very high price in the market. Especially, customers are willing to buy these expensive products as long as they can assure those products come from green investment companies. Investment sectors are clean energy, renewable energy, energy savings, environment protection, organic production, and housing for the poor, education and support for the disables.

Among the above-mentioned banks, GLS was been voted as 'bank of the year' in Germany for the five consecutive years (2010–2014), and has been got the prize namely 'the most sustainable enterprise' in 2012. In GLS, depositors will have right to choose specific sectors in which they like their money to be invested. In addition, to ensure the transparency in financing activities information, GLS also make public to the depositors all the lists of their loans divided into specific sectors.

Likewise, the establishment of environment protection units to implement green credit policies plays a critical role in Germany. During the process of implementing green credit policies in Germany, these units will have to ensure the price reduction policies to support the projects in environment protection and energy savings.

3. RECOMMENDATIONS — LESSONS LEARNED FROM OTHER COUNTRIES TO VIETNAM

The lessons learned from the Green Credit Policy of China is very useful for Vietnam. One of the greatest difficulties of implementing green credit policy in China, but Vietnam may consider is the lack of a reliable evaluation system for the polluting trades and sectors as a basis for banks to classify the project, especially as many polluting industries is also expected to produce high profits for many locals. If Vietnam banking sector goes down this path, this will probably be also the biggest challenge, and may become a reason for banks to delay and evade credit reductions for polluting industry, which affects livelihoods but brings more profits for businesses and banks.

At the same time, the introduction of the regulations and detailed guidelines on green credit policy is very important for enterprises and banks to operate. This also requires close coordination between relevant ministries to expedite the complex administrative procedures. That causes a significant impact on the promulgation of policies in order to improve the legal framework for promoting green credit operations in Vietnam.

From the experience of South Korea, Vietnam may consider to establish a governmental credit guarantee institution. This institution will support banks and financial organizations, who of lack of funds, to grant credit for enterprises, which use friendly environmental technologies. Furthermore, one needs to draw lessons for Vietnam is to have the involvement of senior political system to solve the problems related to the transition and institutional reforms, as well as the proactive intervention of the Government for legal and institutional framework of green credit growth. Government intervention can maximize the power and influence of the market on green credit growth, as well as an incentive system to encourage the involvement of the private sector. The harmonious and efficient combination from the top down and bottom up of the political system is the key for the success of green credit growth strategy. Comprehensive solution from above will provide the vision and clarify the medium to long-term target of credit growth in green. This may consult and cooperate, persuade stakeholders and promote effectively the coordination in the banking system and businesses. The active engagement of the community from the ground up creates a sustainable platform for growth of green credit. Therefore, policies should include the participation of community, increase the sense of community about green credit growth as well as offer measures to change the behavior of the community. Raising green credit communication is very necessary in locals and rural areas across the country. The next step is to mobilize global cooperation when the backing of senior political system, the participation of the Government and the community has been available.

Lessons from Germany: Enterprises who invest in green technology mostly meet advantages, because products with the green label favored by consumers despite high prices. Therefore, raising awareness of consumers about using environmentally friendly products, and boycotting

products that are not clean or polluting to environment is crucial. On the other hand, the support of the government could help enterprises reduce green production costs.

The second success lesson from Germany is the transparency of information, when banks expose their loan portfolio. Meanwhile, former opposite lesson of China, there is no requirement of disclosing information, so banks hide their loans for business that caused environmental pollution and ignored public opinion. Therefore, it is necessary for Vietnam to set up rules that banks are required to report information on the environmental performance of its loan to the relevant authorities and the public.

In addition, Vietnam also considers experience from developing countries such as Bangladesh, under which central banks will play an important role in the promulgation of policies and guidelines to support businesses develop green credit products. For example, solar energy research: solar housing system, water-pumping stations for irrigation used solar energy. Vietnam is an agriculture country so this model will be very effective; Green credit card, efficient waste management.

4. CONCLUSION

This article has highlighted some definitions that concerned on green economy, green banking and green credit. Furthermore, this study has taken into account the experiences of green credit development in some countries over the world, for instant, China, Korea, Bangladesh, and Germany. Based on the difficulties in application of green credit in China, or the success of green credit in other countries, for example, in Korea, Bangladesh and Germany, this study emphasize several recommendations and suggests lessons learned from these countries to Vietnam. Firstly, Vietnam have to consider about the reliable evaluation system for the polluting trades and sectors as a basis for banks to classify the project, especially as many polluting industries is also expected to produce high profits for many locals. Secondly, the communication about the regulations and detailed guidelines on green credit policy is very important for enterprises and banks to operate. Thirdly, establishing a governmental credit guarantee institution to support banks and financial organizations, which of lack of funds, to grant credit for enterprises, which use environmental friendly technologies? Finally, setting up rules that banks are required to report information on the environmental performance of its loan to the relevant authorities and the public should to been considered in Vietnam banking system.

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Review of the book of Alexander Melnikov "Risk Analysis in Finance and Insurance"

Roman Makarov

Обзор книги Александра Мельникова «Риск-анализ в финансах и страховании»

Роман Макаров
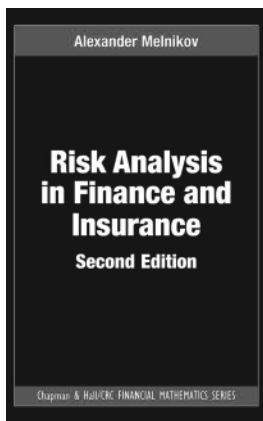
Review of the book of Alexander Melnikov "Risk Analysis in Finance and Insurance" (Second edition: Chapman&Hall/CRC Press, Boca Raton, 2011, 328 p., Extended translation into Russian: ANKIL, Moscow, 2015, 416 p.)

Writing a solid textbook can be a challenge due to many factors that have to be been taken into account. What audience has the book written for? What topics should been chosen and how can they be presented? At first glance, the book "Risk Analysis in Finance and Insurance" written by Prof. Alexander Melnikov looks as one of many other similar texts that have been published in the last two decades. However, this book has many unique features. Many of which make it stand out above all others.

First, as follows from its title, the quantitative analysis of risks inherent in financial securities and insurance contracts is the focus of the book. Identification, estimation and control of financial risks are keys to financial stability that plays an important role not only for financial institutions but also for all people making various business and investment decisions on a regular basis. In his book, Prof. Melnikov has demonstrated the power of stochastic analysis in dealing with uncertainty of finance and insurance. The unified approach to problems of financial

and actuarial mathematics helps the reader to see different links within risk analysis and valuation of equity options, fixed-income derivatives and insurance products.

Second, the author has managed to maintain a balance between the clarity and rigorousness of presentation and the length of the book. It is a condensed yet comprehensive and accurate survey of the theory and applications of financial and actuarial mathematics. Every important concept is explained as it arises so that no prior knowledge of the theory of probability and stochastic processes is necessary. However, it may not be an easy reading for everyone since a solid background in general mathematics is required. Besides the fact that the book is self-contained, no result is taken for granted. The reader can find a compact proof of every theorem and proposition used in the book. On the other hand, it contains multiple worked-out problems, which illustrate important aspects of the theory, and quantitative examples demonstrating the practical usefulness of results.

The book begins with the introduction of basic concepts of financial markets and risk management in Chapter 1. There, essential facts of the modern probability theory are presented, from the axioms of probability to martingales. On discrete-time financial models are focused the next two chapters. The binomial tree, introduced in Chapter 2, is a perfect model to study pricing and hedging of options. It allows for writing the fair value of every European-style derivative as a sum of weighted payoffs with

respect to all possible market scenarios. Every important concept such as arbitrage, completeness, replication, hedging, fundamental theorems of asset pricing, etc. can be defined with the full rigour in the discrete-time setting. In limiting case, the binomial tree model converges to a continuous-time model and from the Cox-Ross-Rubinstein pricing formula is obtained the famous Black-Scholes formula. Additionally, in Chapter 3, the reader can study pricing and hedging options in incomplete market models and in models having restrictions on the capital and in models with transaction costs.

Chapter 4 deals with the Black-Scholes model where the stock price process is constructed from Brownian motion. Fundamental problems related to pricing, hedging, optimal investment and risk assessment are thoroughly studied. As the original Black-Scholes model as its generalizations that, for example, take into account transaction costs and non-uniform distribution of information about the market among traders, have been considered. Chapter 5 is devoted to pricing fixed-income derivatives such as bonds and options on bonds using stochastic models of short rates and forward rates. Chapter 6 is fully concentrated on the risk analysis. Different players of financial markets can find something appealing to them in that chapter. An investor can optimize her long-term strategy using the Bellman principle. A trad-

er can learn methods of technical analysis used to identify different trends in stock prices. Finally, a risk-manager can make use of risk measure discussed at the end of Chapter 6. The last two chapters are concentrated on insurance models and ruin theory. Those chapters successfully link together insurance and finance. As it is well known, many large insurance companies are active players on financial markets and use derivatives for hedging their investment portfolios. Therefore, the risk analysis of diversified portfolios that in addition to traditional insurance contracts include investments in stocks and bonds is of great importance.

In the appendix is hidden the true treasure, where 140 exercises sorted by topics and accompanied by answers and hints are presented to the reader. A unique combination of well-chosen topics from financial and actuarial mathematics blended with a rich selection of exercises makes this book a must-have text for every individual interested in quantitative finance. Book, needless to say, written by Prof. Melnikov is an excellent choice of textbook for a university-level course on quantitative risk analysis in finance and insurance.

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