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Table of contents

Perspectives

Exchange rate arrangements: Evidence from Central Asian countries

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Abstract: *The five post-Soviet nations in Central Asia have followed their own monetary policies since introducing their own currencies in the early 1990s. This paper empirically studies exchange rate arrangements in Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan. It tests whether these exchange rates follow a basket of the world's major currencies and, if so, which currencies especially influence the rates. Using a well-known Frankel and Wei methodology, the paper analyzes the influence of major currencies by estimating time-varying coefficients. The US dollar played an important role in exchange rates in the region over the period 1995-2014, although its influence has slightly declined.*

Key words: *exchange rate arrangements, monetary policy, exchange rate flexibility, time-varying coefficients*

1. Introduction

After the collapse of the Soviet Union in 1991, most of the former Soviet republics introduced their own currencies in an attempt to get rid of the influence of the Russian ruble. In Central Asia, Kyrgyzstan was the first country to adopt its own currency, in May 1993. It was followed by Kazakhstan and Turkmenistan in November 1993; Uzbekistan in July 1994; and Tajikistan in May 1995.

This paper analyzes how the US dollar and the ruble have influenced exchange rates in Kyrgyzstan, Kazakhstan, Tajikistan and Uzbekistan.[1]

Related studies of the Commonwealth of Independent States (CIS) include Pastor and Damjanovic (2001), on the effect of the Russian financial crisis on Central Asian countries and their responses in 1998-1999. A sharp devaluation of the ruble against the dollar led to a sharp decrease in exports of Central Asian countries to their major trading partner, Russia. To mitigate the consequences of the Russian financial crisis, and to keep their own economies competitive, some countries devalued their nominal exchange rates -- in particular, Kyrgyzstan, Kazakhstan and Tajikistan (Pastor and Damjanovic, 2001). Most CIS countries manage their exchange rates, due to dollarization (Keller and Richardson, 2003). Dollarization increases their financial vulnerability as well as their fear of floating currencies, and it is not easily reversed.

Although national currencies in Central Asia are largely dollarized, the economic growth of Russia during the 2000s[2] and the growing trade within the CIS might cause the ruble to become more influential in Central Asia as a nominal anchor. To verify such a trend, one must examine how the ruble and the dollar have affected each currency in Central Asia. To the best of my knowledge, there are no other empirical studies of the degree of influence exerted by the ruble and the dollar over the region's currencies.

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[1] Due to a lack of data, the analysis does not include Turkmenistan.
[2] Russian Economic Report (World Bank Russian Country Office, 2007).

This paper measures the degree of influence of the two major currencies by applying a model of Ordinary Least Squares (OLS) developed by Frankel and Wei (1994, 2007) to examine exchange rate policies in East Asia. Moreover, following Cavoli and Rajan (2007) and Ogawa and Yang (2008), this paper shows how the degree of influence has changed, by using OLS coefficient estimates that are time-varying and recursive.

Since Central Asian countries remained in the ruble zone until mid-1995, this paper uses monthly exchange rates for the period from June 1995 through December 2014.

The paper shows that the dollar is much more influential than the ruble over all local currencies in Central Asia. But recently the ruble became slightly more influential than before in Kazakhstan, Kyrgyzstan and Uzbekistan, just before Western sanctions against Russia for its Ukrainian policy took their full effect. This trend could relate to concurrent economic growth in Russia and to the growing role of that economy in the CIS.

The rest of this paper is organized as follows. The next section briefly reviews exchange rate arrangements in Central Asia. Section 3 measures and discusses the influence of the dollar and ruble. Section 4 concludes.

2. Exchange rate arrangements in Central Asian countries

After introducing their currencies, Central Asian countries (except Kyrgyzstan) maintained fixed exchange rates against the dollar.[3] But subsequent favorable economic conditions, such as the end of the ruble crisis and the rise in resource prices, enabled them to adopt flexible exchange rates around 2000. Figures 1-3 illustrate the exchange rate movements of four national currencies in Central Asia in terms of the dollar, the ruble and the Swiss franc.

The Kazakhstan tenge and the Kyrgyzstan som have been relatively stable against the dollar and the ruble over the sample period from 1995 through 2014, although the Russian crisis in 1998 caused these two Central Asian currencies to depreciate against the dollar and appreciate against the ruble.[4] On the other hand, the Tajikistan somoni and the Uzbekistan som have been depreciating against the dollar and the ruble, although the 1998 crisis caused the two local currencies to appreciate against the ruble. Moreover, trends show structural breaks in the movements of all national currencies, except those of the Uzbekistan som, against all major currencies during the 2008-9 world financial crisis.[5] The som had a structural break against only the ruble during that period.

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[3] See the Introduction to Symposium on "Monetary and Exchange Rate Policies in the CIS Countries: Between the EU and Russia," Brussels (2005).

[4] Kazakhstan maintained a managed floating exchange rate regime during the period 1995-1997. The appreciation of the Kazakhstan tenge against the ruble could also have related to a rapid rise in oil exports. In general, Kazakhstan's monetary policy was acknowledged to be successful in keeping inflation low and in managing the exchange rate (Keller and Richardson, 2003). The situation in Kyrgyzstan, which was the first country in Central Asia to float its exchange rate, was almost the same as in Kazakhstan. Kyrgyzstan began managing its exchange rate due to the tight links between inflation, exchange rates, and external debt (Keller and Richardson, 2003; and Pastor and Damjanovic, 2001), which provided a relatively stable exchange rate against the dollar after the 1998 Russian crisis.

[5] The level of external debt and an increase in government expenditure led the Kazakh economy to overheat until 2007. So the Kazakh economy was hit all the harder by the world financial crisis of 2008-9. In dealing with the expected depreciation of the tenge, the National Bank of Kazakhstan heavily intervened in foreign exchange market and spent more than $9 billion to stabilize the exchange rate from October 2008 to February 2009. In the case of the somoni, demand for the main export commodities of Tajikistan, such as aluminum and cotton, decreased in 2008-9. And international prices of these commodities decreased. These tendencies raised the trade deficit and the depreciation rate of somoni.

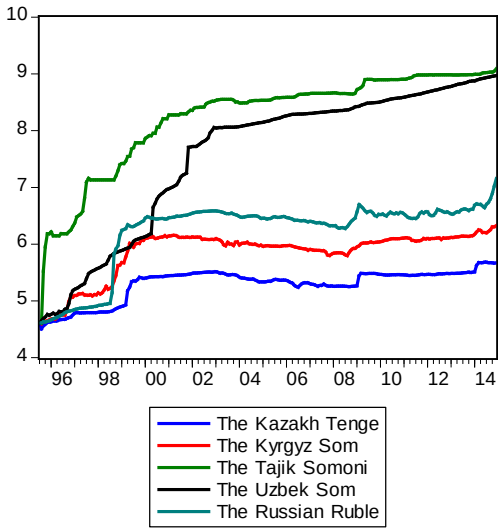


Figure 1: Logs of exchange rates against the US dollar.

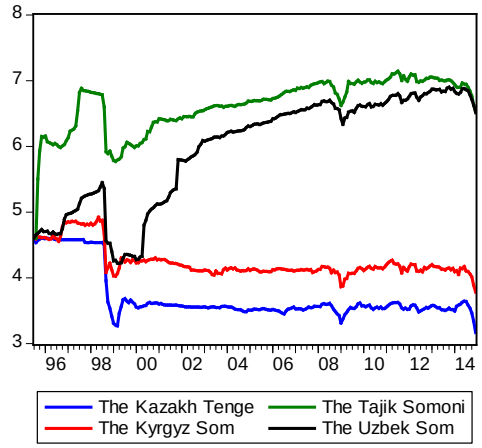


Figure 2: Logs of exchange rates against the Russian ruble.

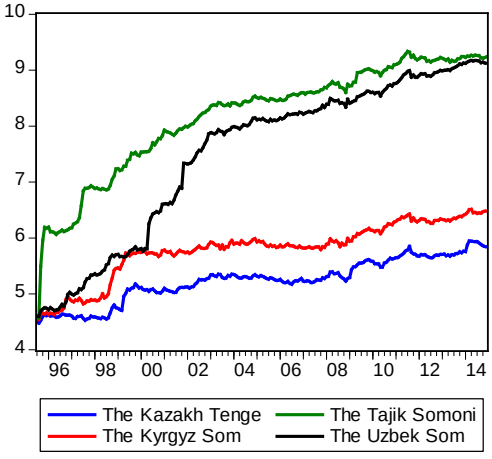


Figure 3: Logs of exchange rates against the Swiss franc.

The depreciation of the somoni against the dollar and the ruble might have been caused by political instability, enormous budget deficits, weak monetary policy, and a fall in real GDP of about 20% to 30% during the mid-1990s (Tashrifov, 2005). The considerable depreciation of the Uzbekistan som during the late 1990s might be explained by unification of exchange rates and the decline of the world prices of cotton and gold, two main sources of foreign exchange reserves.[6]

The first critical shock during the sample period was the 1998 ruble crisis, since Russia had been one of the most important trading partners for Central Asia. In August 1998, Russia declared a 90-day moratorium on foreign debt and defaulted on its domestic bond obligations. Moreover, the Russian central bank could not provide a stable exchange rate, and the ruble depreciated by more than two thirds within a month, falling from 6.2 rubles against the US dollar to 20 rubles.[7] The second shock was the 2008-9 crisis. Advanced economies suffered deep recession, while emerging and developing economies slowed due to declines in exports and in external financing.

Exchange rate movements in Central Asian currencies in terms of volatility and correlation are analyzed by dividing the time interval into three periods, demarcated by the two crises. The first period is from June 1995 through December 1997; the second, from January 2000 through June 2008; the third, from June 2009 through December 2014.

Tables 1-3 present summary statistics of monthly changes in the nominal exchange rates against the Swiss franc during each of the three sample periods. Among the four countries, the somoni had the highest volatility with a standard deviation of 0.1967 during the first period. The Uzbekistan som had the highest volatility, with a standard deviation of 0.0693, between the two crises, while the somoni was the most volatile currency in the last period, with a standard deviation of 0.0321. During all three periods, the Kazakhstan tenge was usually less volatile than other Central Asian currencies, implying that it was managed to some extent. The volatility of the tenge, the Kyrgyzstan som, and of the somoni decreased after the Russian crisis and changed little during the third period. But the volatility of the Uzbekistan som increased from the first period to the second; during the third period, it declined to its lowest level for all three periods.

[6] In 1997-2003, Uzbekistan maintained several exchange rates in order to promote import-substituting industries and to subsidize basic food imports in 1997-2003 (Rosenberg and Zeeuw, 2001). In October 2003, authorities unified the exchange rates.

[7] See Pastor and Damjanovic (2001).

	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	USA	Russia
Mean	-0.0005	0.0096	0.0795	0.0254	-0.0076	0.0026
Median	0.0007	0.0061	0.0195	0.0215	-0.0128	0.0004
Maximum	0.0703	0.1505	0.9244	0.1331	0.0378	0.0536
Minimum	-0.1281	-0.0606	-0.0814	-0.0366	-0.0481	-0.0353
Std. Dev.	0.0362	0.0444	0.1967	0.0432	0.0233	0.0236
Observations	29	29	29	29	29	29

Note: The base currency on which the statistics are based is the Swiss franc.

Table 1: Statistics of monthly changes in nominal exchange rates (1/1995 – 12/1997).

	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	USA	Russia
Mean	0.0026	0.0020	0.0126	0.0260	0.0041	0.0030
Median	-0.0007	0.0010	0.0093	0.0137	0.0007	-0.0016
Maximum	0.0774	0.0899	0.1052	0.4465	0.0750	0.0559
Minimum	-0.0504	-0.0759	-0.0381	-0.0502	-0.0396	-0.0350
Std. Dev.	0.0242	0.0323	0.0281	0.0693	0.0241	0.0227
Observations	102	102	102	102	102	102

Note: The base currency on which the statistics are based is the Swiss franc.

Table 2: Statistics of monthly changes in nominal exchange rates (1/2000 – 6/2008).

	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	USA	Russia
Mean	0.0048	0.0060	0.0043	0.0089	0.0019	0.0104
Median	0.0009	0.0102	0.0084	0.0115	0.0013	0.0062
Maximum	0.1222	0.0686	0.0700	0.0640	0.0672	0.1848
Minimum	-0.1025	-0.1262	-0.0891	-0.1164	-0.1103	-0.0434
Std. Dev.	0.0309	0.0304	0.0299	0.0280	0.0259	0.0357
Observations	67	67	67	67	67	67

Note: The base currency on which the statistics are based is the Swiss franc.

Table 3: Statistics of monthly changes in nominal exchange rates (6/2009 – 12/2014)

Tables 4-6 present the correlation matrix of monthly changes in the nominal exchange rates against the Swiss franc for each of the three periods. All currencies correlated positively with each other during all periods. The tenge shows a high correlation with the dollar and the ruble in the first two periods and with the dollar in the third period, while it has a lower correlation with the ruble in this period. For the Kyrgyzstan som and the somoni, correlations with the dollar and the ruble increased from the first to the second period. Their correlations with the dollar further increased during the third period, while their correlations with the ruble decreased during this period. In contrast, for the Uzbekistan som, correlation with the dollar and the ruble declined after the Russian crisis. After the 2008-9 crisis, its correlation with the dollar increased, while its correlation with the ruble declined further. Moreover, correlations among the tenge, the Kyrgyzstan som, and the somoni increased from period to period. For the Uzbekistan som, the correlations with the Kazakhstan tenge, the Kyrgyzstan som, and the Tajikistan somoni also increased from the first to the third period but declined in the second period.

To sum up, the volatilities of all national currencies decreased from the first period to the last, although the volatility of the Uzbekistan som increased in the second period. Correlations among Central Asian currencies increased considerably from the first period to the last. Correlations of these currencies with the dollar also increased, while their correlations with the ruble, except that of the somoni, decreased from the first period to the last.

	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	USA	Russia
Kazakhstan	1.000					
Kyrgyzstan	0.335	1.000				
Tajikistan	0.423	0.177	1.000			
Uzbekistan	0.240	0.577	0.312	1.000		
USA	0.727	0.316	0.283	0.343	1.000	
Russia	0.721	0.361	0.233	0.329	0.960	1.000

Note: The base currency on which the statistics are based is the Swiss franc.

Table 4: Correlation matrix of monthly changes in nominal exchange rates (6/1995 – 12/1997)

	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	USA	Russia
Kazakhstan	1.000					
Kyrgyzstan	0.412	1.000				
Tajikistan	0.613	0.220	1.000			
Uzbekistan	0.182	0.334	0.245	1.000		
USA	0.887	0.507	0.621	0.192	1.000	
Russia	0.750	0.612	0.577	0.213	0.789	1.000

Note: The base currency on which the statistics are based is the Swiss franc.

Table 5: Correlation matrix of monthly changes in nominal exchange rates (1/2000 – 6/2008).

	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan	USA	Russia
Kazakhstan	1.000					
Kyrgyzstan	0.631	1.000				
Tajikistan	0.553	0.776	1.000			
Uzbekistan	0.675	0.845	0.847	1.000		
USA	0.869	0.680	0.656	0.786	1.000	
Russia	0.152	0.213	0.260	0.099	0.073	1.000

Note: The base currency on which the statistics are based is the Swiss franc.

Table 6: Correlation matrix of monthly changes in nominal exchange rates (6/2009 – 12/2014).

3. Measuring the degree of influence

3. 1 Model specification

The theory of optimum currency areas suggests a plausible solution to balance of payment crises -- a system of national currencies with flexible exchange rates.[8] Neighboring countries can stabilize their exchange rates by choosing a major currency as a nominal anchor. In Central Asia, the anchor might be the dollar, the euro, the yen or the ruble.[9]

In analyzing the role of major currencies in determining exchange rates, most empirical analyses use the Frankel and Wei (1994) methodology. Frankel and Wei examine exchange rate policies of nine East Asian countries by estimating the weight of the yen or the degree of pegging to the yen over the sample period from 1979 to 1992. They hypothesize that central banks in the region were trying harder than before to stabilize exchange rates vis-à-vis the yen. As a test, the authors use OLS to determine implicit weights of major currencies in the currency basket. They regress national currencies on major currencies expressed in terms of the numeraire, the Swiss franc. OLS coefficients imply the weights of basket currencies. Of course, their signs are predicted to be positive.

Several papers similarly analyze exchange rate policies, including Bayoumi and Eichengreen (1998), Calvo and Reinhart (2002), and Reinhart and Rogoff (2004). But when they assume that local currencies follow a basket of the world's major currencies, most authors use the Frankel and Wei (1994) approach, including McKinnon (2001), Baig (2001), and Ogawa and Yang (2008).

Cavoli and Rajan (2007) characterize Singapore's exchange rate policy through Frankel-Wei regressions. Instead of referring to the "weights" of major currencies, they use the term "degree of influence" since "weights" could not be appropriate in interpreting currency coefficients when regressed exchange rates are correlated with each other. Given that exchange rates are typically correlated, as shown in Tables 4-6, this paper uses the term "degree of influence."

Central Asian countries stayed within the ruble zone immediately after the dissolution of the Union of Soviet Socialist Republics and have reduced the ruble's influence only since the middle of the 1990s. To discuss recent foreign exchange rates in Central Asia, this paper examines how monthly changes in each national currency respond to those in major currencies, over the period from June 1995 through December 2013. Monthly data are from the websites of the central banks. Following Frankel and Wei (1994), the analysis uses this regression model:

$$\Delta \ln(S^{local/SFR}) = a_0 + a_1 \Delta \ln(S^{US/SFR}) + a_2 \Delta \ln(S^{RUB/SFR}) +$$

$$+ a_3 \Delta \ln(S^{EUR/SFR}) + a_4 \Delta \ln(S^{JPY/SFR}) + e,$$

where the dependent variable, $\Delta \ln(S^{local/SFR})$, is the log difference of the nominal exchange rate of each national currency in Central Asia in terms of the Swiss franc. The independent variables,

[8] See Robert Mundell (1961).

[9] Fahad Alturky et al. (2009) examine the extent to which the growth rates in CIS countries are linked to developments in Russia. The paper finds an increasing Russian influence on Central Asian economies through remittances and financial channels.

$\Delta \ln(S^{US/SFR})$, $\Delta \ln(S^{RUB/SFR})$, $\Delta \ln(S^{EUR/SFR})$ and $\Delta \ln(S^{JPY/SFR})$, are the respective log differences of the dollar, the ruble, the euro, and the yen, in terms of the Swiss franc. A large coefficient corresponding to a major currency implies that it influences the local currency significantly.

Fear of a floating currency can be captured by the currency's flexibility against the dollar, measured as the deviation from unity of the dollar coefficient (Ogawa and Yang, 2008). As discussed in Baig (2001) and Cavoli and Rajan (2007), a large value of the coefficient of a major currency need not connote pegging to the currency, since it might reflect not exchange rate policy but market-driven correlations between the two currencies.[10]

To analyze the influence of major currencies on local ones, this paper estimates the Frankel and Wei (1994) equation through two methods: The standard time-invariant OLS; and the time-varying recursive OLS, following Cavoli and Rajan (2007) and Ogawa and Yang (2008). The first method is applied in a preliminary examination of the whole sample period. The latter method, an extension of the former, estimates repeatedly, using subsets of the data that increase by one observation at each iteration. This allows us to trace the evolution of the coefficients. Large variations in an estimated coefficient indicate a structural break.

Time-varying coefficients are a staple of the recent literature on exchange rates. In analyzing the influence of the dollar and the yen on Singapore's currency, Cavoli and Rajan (2007) used recursive OLS estimates. Beckmann et al. (2010) used time-varying coefficients to examine the relationship between the exchange rate for the Deutsche mark and the dollar and macroeconomic fundamentals, shown in monthly data from 1975 to 2007. With time-varying coefficients, Kim et al. (2009) investigated the purchasing power parity of Southeast Asian currencies. These papers use time-varying coefficients mainly to track changes in relationships.

Beckmann et al. (2010) use time-varying coefficients because of the Lucas critique: Coefficients change when people anticipate a change in policy. Fixed coefficients cannot capture the effects of anticipated and unanticipated shocks.

3.2. Diagnostic tests

One must determine whether the time series used are stationary – that is, whether their nature remains the same over time. If they are not stationary, the regression might be spurious and the coefficients invalid. Augmented Dickey-Fuller (ADF) unit root tests find that all variables are stationary in their first differences (Table 7).

[10] Cavoli and Rajan (2007) state that the standard deviation of the coefficient can inform us. For example, a small standard deviation implies that the monetary authority tries to maintain the correlation between its own currency and a major one, through market intervention.

Variables	Test Statistic	Critical Value (at 5% Level)
The Kazakh tenge, LnKZT	-13.0117	-2.8738
The Kyrgyz som, LnKGS	-14.3847	-2.8738
The Tajik somoni, LnTAD	-10.3947	-2.8738
The Uzbek som, LnUZS	-14.7175	-2.8738
The US dollar, LnUSD	-12.4766	-2.8738
The Russian ruble, LnRUB	-6.0638	-2.8739
The Japanese yen, LnJPY	-11.6512	-2.8738
The euro, LnEUR	-13.1483	-2.8738

Table 7: ADF statistics for unit root testing of first differences.

We also examine whether a long-run equilibrium relationship exists among variables (which may be nonstationary) in the Frankel and Wei regression model for each currency. Table 8 presents Johansen's cointegration test results for Central Asian currencies. In each national currency, the eigenvalue trace statistic rejects the null hypothesis of no cointegration between the respective national currency and major currencies at the 5% level of significance. (The variables are in first differences.) This suggests a long-run relationship between Central Asian currencies and major currencies.

Cointeg. Vectors	The Kazakh Tenge		The Kyrgyz Sum		The Tajik Somoni		The Uzbek Som	
	Eigenval.	Trace Statistic	Eigenval.	Trace Statistic	Eigenval.	Trace Statistic	Eigenval.	Trace Statistic
None *	0.2706	205.385	0.2609	201.595	0.2541	219.379	0.2287	192.014
At most 1 *	0.2139	133.433	0.1973	132.675	0.2241	152.546	0.2096	132.793
At most 2 *	0.1374	78.553	0.1564	82.558	0.1812	94.691	0.1355	79.152
At most 3 *	0.1048	44.860	0.1243	43.786	0.1245	49.099	0.1165	45.953
At most 4 *	0.0825	19.628	0.0576	13.532	0.0791	18.789	0.0747	17.712

* denotes rejection of the hypothesis at the 5% level.

Table 8: Johansen's cointegration test for the regression model of Central Asian currencies.

The Breusch-Godfrey Lagrange Multiplier (LM) test finds serial correlation in error terms only for the tenge and the somoni. In both cases, a first-order autoregressive process eliminates the problem.

Test results also indicate that all residuals are homoskedastic except those for the somoni in the full regression.

3.3 Results

Table 9 gives results of the standard time-invariant OLS model for each Central Asian country over the period from June 1995 through December 2014. The coefficient for each major currency represents the degree of influence of that currency. Influence of the dollar is statistically significant for the tenge, the Kyrgyzstan som, and the Uzbekistan som, with the largest coefficient of 0.81 for the tenge. The dollar's influence is statistically insignificant for the somoni. The ruble's influence is statistically significant only for the Kyrgyzstan som with its value of 0.19, but its practical significance in the sample is much smaller than that of the dollar with its value of 0.51. In practical terms, the euro is influential in the sample for the somoni and

the Uzbekistan som with relatively large coefficients (0.35 and 0.28 respectively), but it is insignificant for the tenge and the Kyrgyzstan som. Again in practical terms, the yen affects the somoni and the Uzbekistan som in the sample to some extent (0.34 and 0.10 respectively) but not the tenge or the Kyrgyzstan som.

Dependent variable	The Kazakh Tenge		The Kyrgyz Som		The Tajik Somoni		The Uzbek Som	
Constant	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02
	(2.16) **	(2.18)**	(2.40) **	(2.42)**	(2.39)**	(2.39) **	(5.25) **	(5.34)**
US Dollar	0.81	0.82	0.51	0.51	0.56	0.79	0.57	0.64
	(8.11) **	(9.98)**	(4.16) **	(5.10)**	(2.12)	(3.54) **	(3.11) **	(4.24)**
Russian Ruble	0.04	0.03	0.19	0.19	0.09	0.08	0.05	0.04
	(1.07)	(1.04)	(4.75) **	(4.84)**	(1.02)	(0.83)	(0.83)	(0.71)
Euro	0.03	0.03	-0.03	-0.03	0.35	0.29	0.28	0.26
	(0.19)	(0.17)	(-0.13)	(-0.14)	(0.82)	(0.68)	(0.95)	(0.88)
Japanese Yen	0.02	-	0.01	-	0.34	-	0.10	-
	(0.24)		(0.09)		(1.58)**		(0.68)	
AR(1)	0.20	0.20	-	-	0.37	0.38		
	(3.15)	(3.17)	-	-	(6.01)	(6.22)		
R-squared	0.40	0.39	0.27	0.27	0.11	0.09	0.12	0.12
Wald test (F-stat)	0.50	0.40	2.68	3.10	2.07	0.62	0.00	0.04
Probability	(0.48)	(0.53)	(0.10)	(0.08)	(0.15)	(0.43)	(0.98)	(0.84)
Observations	233	233	233	233	233	233	233	233

Note: Figures in parentheses are t-statistics. All currencies are based on the Swiss franc. The symbols * and ** imply the significance the levels of 10% and 5% respectively. The Wald test for the coefficient restriction tests the null hypothesis that the sum of all coefficients on the right-hand side equals 1.

Table 9: Estimation results of time-invariant OLS.

To check whether each currency follows a major currency or the currency basket, we test the null hypothesis that the coefficients of major currencies sum to unity, following Cavoli and Rajan (2007). Table 9 shows the Wald test results. The null hypothesis of the unity sum is rejected only for the Kyrgyzstan som, at the 10% level of significance. Evidently, most currencies follow the basket.

The method of time-varying coefficients also yields policy implications. As Cavoli and Rajan (2007) point out, a high and stable coefficient for a major currency suggests that the central bank is intervening often. A high and unstable coefficient indicates that the foreign exchange market, not intervention in it, influences the link between the major currency and the local one.

I applied recursive OLS to the sample period from June 1995 through December 2014.

Figures 4-7 illustrate the dynamic behavior of the coefficients for the dollar and the ruble. In the case of the tenge, the dollar's influence declined until the 2008-9 crisis (Figure 4). Then it slightly increased and remained significant. The ruble was influential until its crisis in 1998, when its power over the tenge declined drastically. After that, influence intensified very slightly, mostly due to the Kazakh authorities relaxing the exchange rate against the dollar in 2001-2.[11] Since then, the dollar has lost some influence over the tenge, while the ruble has gained influence slightly. But the dollar remains far more influential than the ruble.

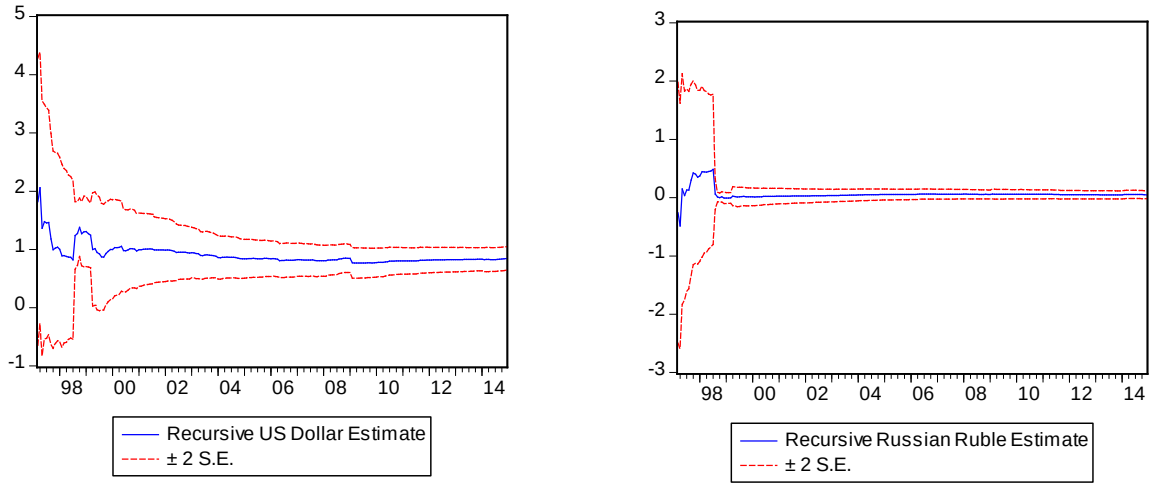
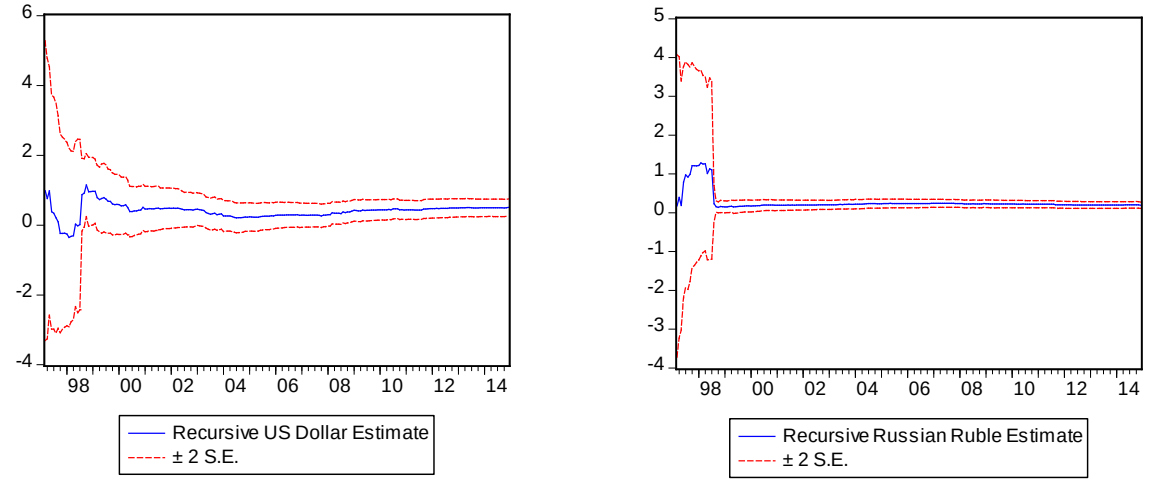


Figure 4: Recursive dollar and ruble coefficient estimates in Kazakhstan.

The result for the Kyrgyzstan som is somewhat like that for the tenge (Figure 5). The dollar's influence fluctuated over the period, slightly intensifying after the 2008-9 crisis. The ruble's influence also intensified to some extent but was less significant than the dollar, which in turn was less significant for the som than for the tenge.



[11] See Gissy (2009).

Figure 5: Recursive dollar and ruble coefficient estimates in Kyrgyzstan.

On the somoni, neither the dollar nor the ruble had a significant influence (Figure 6).

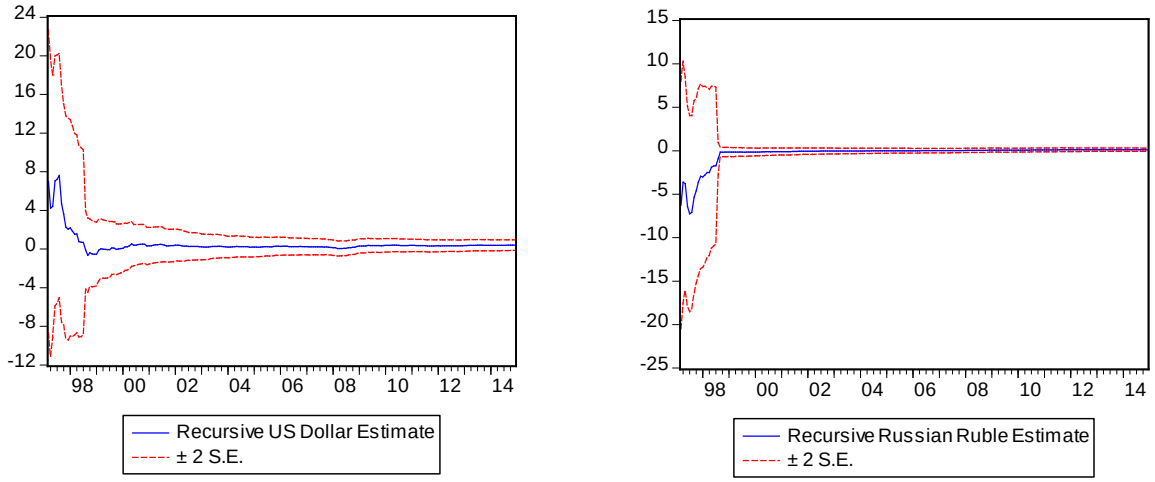


Figure 6: Recursive dollar and ruble coefficient estimates in Tajikistan.

As for the Uzbekistan som, the dollar's influence declined until the late 1990s and then increased steadily. The ruble's influence has been insignificant since the 1998 crisis but has been intensifying since 2003. Overall, the dollar has had more of an impact than the ruble has, but neither currency is very influential (Figure 7).

Perhaps the dollar's influence on the Uzbekistan som weakened during the 2000s because the Central Bank of Uzbekistan committed at that time to making the som convertible for current account transactions in order to improve the balance of trade as well as to speed up industrialization. Policymakers accepted the Article VIII obligations of the Articles of Agreement of the International Monetary Fund (IMF) that relate to currency convertibility;[12] unified the official and parallel market exchange rates; increased access to and sale of foreign exchange; and promoted investment in exporting and in import substitution. These measures liberalized foreign exchange markets (Bakhromov, 2011; Olimov and Sirajiddinov, 2008) and so may have reduced the dollar's influence.

[12] This is according to the IMF's press release issued on November 11, 2003. IMF members that accept Article VIII of the IMF's Articles of Agreement should not impose restrictions on payments for current transactions and engage in discriminatory currency practices.

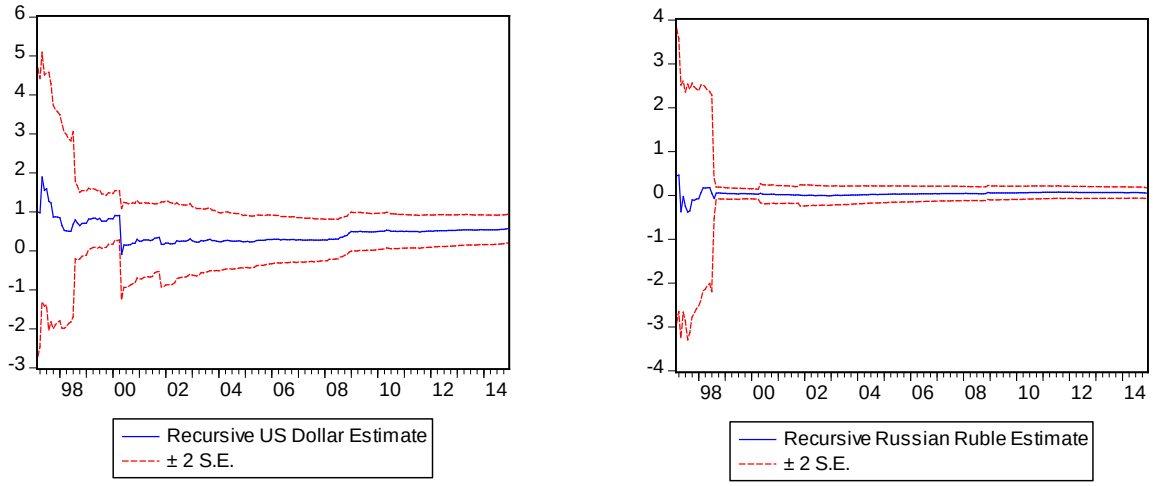


Figure 7: Recursive dollar and ruble coefficient estimates in Uzbekistan.

In sum, recursive OLS estimations suggest structural changes in the exchange rate movements of some currencies in Central Asia. The dollar's influence is significant in Kazakhstan, Kyrgyzstan and Uzbekistan, although it has declined over time. The ruble's influence is insignificant in Kazakhstan, Tajikistan and Uzbekistan but recently intensified in Kazakhstan, Kyrgyzstan and Uzbekistan.

4. Conclusion

Central Asian countries have been orienting their economies towards markets, with monetary autonomy, since the introduction of national currencies. This paper examined the influence of the world's major currencies on exchange rate arrangements in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan over the period from June 1995 through December 2014. Empirical evidence shows that the tenge, the somoni, and the Uzbekistan som might follow a basket of regressed currencies. The dollar's influence is significant in all countries but has fallen over time. The ruble's influence is insignificant in Kazakhstan, Tajikistan and Uzbekistan. It is statistically significant in Kyrgyzstan but in practical terms less significant than the dollar.

In addition, a long-run equilibrium relationship exists between national currencies in Central Asia and the world's major currencies.

Research is needed to identify the sources of influence of the dollar and the ruble. Two sources are plausible: Discretionary exchange rate management by central banks; and market-driven factors associated with economic conditions.

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Bayesian estimates of the parameters for portfolio optimization

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Abstract: *This paper proposes Bayesian estimation techniques to find the parameters for a minimum variance portfolio within the Markowitz framework. Motivation for this method comes from a series of scenarios relating to an analyst's confidence in the generalizability of recent stock data. The paper posits that an optimal stock allocation relies on a balance between recent and long-term stock behavior. The use of prior distributions for the parameters allows for this balance. Monte Carlo sampling techniques validate results.*

Keywords: *portfolio optimization, Bayesian statistics, Gibbs Sampling, Markov Chain Monte Carlo*

1. Introduction

Most contemporary financial theory traces its lineage to Harry Markowitz (1952) and to a solution of this optimization problem: Given a selection of assets, what's the best way to make a portfolio? There are nearly countless answers to this question, each depending on assumptions about ways in which investors try to maximize personal utility. For example, investors could seek to maximize long-term wealth -- or, just as easily, to maximize immediate gain. Either perspective depends on the investor's attitude towards risk.

Markowitz's model does not try to answer questions about personal preferences about risk. All investors have different reasons for preferring different risk levels. Instead, Markowitz assumes general risk aversion. That is, given a certain attitude towards risk, any investor will prefer to maximize her return without increasing risk. This is the same as saying that an investor will seek to minimize the risk of attaining the given return to her investment.

How? The answer is surprisingly simple: Diversify. A broad basket of returns will minimize the risk that any asset under-performs, which reduces overall risk. Similarly, given the choice of a wide variety of assets and the option to borrow or lend at a risk-free rate, any investor can form a portfolio that maximizes her possible return for a given risk. Markowitz named this the *efficient portfolio frontier*.

Markowitz's model is not without its criticisms. This paper will focus on three:

- Outputs of the Markowitz model are sensitive to input parameters, especially for expected returns (Best and Grauer, 1991).
- Stock data are often noisy, making estimation error likely (Chopra and Ziemba, 1993). Since asset fundamentals are dynamic, an analyst is challenged to balance relevant and representative data.

[13] A project repository is available on Github. This includes the original .Rnw file for generating this paper and supplementary R code used in this project. See here: https://github.com/michaelquinn32/bpoR .

- The Markowitz model often encounters a "corner problem," where an extreme allocation of a limited number of assets is favored over a broad diversification of risks (Black and Litterman, 1992). This goes against the intuition of the theory and should be avoided.

Rachev et al. (2008) offer a Bayesian framework for avoiding these three problems. A Bayesian methodology helps make the estimate more robust by properly capturing the risk of estimation error. This results in a full distribution for each parameter. Furthermore, Bayesian techniques allow the model to incorporate more information. The average of analysts' forecasts has predictive ability, especially when considering systematic biases (Clement, 1999). The traditional Markowitz model cannot take this into account.

Bayesian methods differ from frequentist statistical methods through the use of priors (Hoff, 2009). Frequentist methods consider data to be generated by random processes, while the parameters governing these processes are fixed. The best example is a physics experiment, where laws of motion govern observed processes and data are generated from imperfect measurements.

Bayesians reverse this relationship: The data are fixed, while parameters are random. A Bayesian approaches a problem with a set of beliefs and uses data to update them. This can be a source of high risk and reward. On one hand, incorrect priors will result in incorrect models, and many can be troubled by the subjective element added to statistical modeling. On the other hand, the existence of a prior allows incorporation of diverse sources of information, including publications, experts' beliefs, and personal experience (Kruschke, 2010). These tools provide foresight that is not available in data.

Bayesian methods were previously limited in application because of their computational challenges. Thanks to powerful sampling techniques like Markov Chain Monte Carlo, this is no longer the case. Most statistical software can easily handle the calculations. I will use R.

This paper will employ three Gibbs samplers to estimate portfolio parameters. The first will use an unknown mean and known variance. It corresponds to an analyst lacking reliable information about asset returns while keeping a sense of asset riskiness. The second will use an unknown mean and variance along with an uninformative prior. This corresponds to an analyst having limited or no information about the future market for assets in her portfolio. Last, an informative prior will be used to estimate mean and variance, incorporating an analyst's knowledge about possible outcomes.

The examples in this paper highlight how Bayesian methods help analysts manage uncertainty and non-representative data. This is a problem faced by many investors in Central Asia. A Bayesian framework can rigorously support the heuristic judgment in financial decisions, optimizing portfolios and reducing risks.

2. Methodology

We must address several methodological issues. I'll begin with a discussion of portfolio allocation, following the optimization algorithm described by Constantinides and Malliaris (1995) and Zivot (2013). Next, I'll consider issues concerning the probability distributions of capital asset returns. I will follow that with a discussion of the Gibbs sampler, which I rely on heavily for estimating Bayesian parameters. Last, I'll highlight Monte Carlo techniques for validating results.

2.1 Optimal portfolio allocation

Define a portfolio p as the weighted average over a vector consisting of k random assets.[14] I'll call this vector $\boldsymbol{X}$

$$\boldsymbol{X} = (\boldsymbol{X}_1, \dots, \boldsymbol{X}_k)^T. \quad (1)$$

This vector follows a multivariate normal distribution that depends on expected individual asset returns μ and variance $\boldsymbol{\Sigma}$.[15]

$$\boldsymbol{X} \sim N(\boldsymbol{\mu}, \boldsymbol{\Sigma}) \quad (2)$$

The linear combination of these random variables across a vector of weights $\boldsymbol{\omega}$ is our portfolio:

$$p = \boldsymbol{\omega}^T \boldsymbol{X}. \quad (3)$$

Portfolio weights are determined by the share of total wealth allocated to each asset. I will limit the weight ω_i of each asset in the portfolio to fall between -0.5 and 0.5, since I hope to reduce the effects of extreme distributions. A negative allocation is equivalent to short-selling that asset.

Thus the expected return from a portfolio is just the weighted average of the expected returns of each of the k assets,

$$\mu_p = \mathrm{E}[p] = \mathrm{E}[\boldsymbol{\omega}^T \boldsymbol{X}] = \boldsymbol{\omega}^T \boldsymbol{\mu}\,. \quad (4)$$

We will define risk as the variance of these returns. Since the movements of individual prices, dividends and returns within the stock market are correlated, a portfolio can either magnify or mitigate the risks of holding two assets. This can be captured in the covariance matrix

$$\boldsymbol{\Sigma} = \mathrm{E}[(\boldsymbol{X} - E[\boldsymbol{X}])^{\boldsymbol{T}}(\boldsymbol{X} - \mathrm{E}[\boldsymbol{X}])]. \quad (5)$$

The portfolio variance σ_p^2 is a scalar that depends on the asset allocation weights and on the covariance matrix:

$$\sigma_p^2 = \boldsymbol{\omega}^T \boldsymbol{\Sigma} \boldsymbol{\omega}. \quad (6)$$

The investor holds the portfolio for a limited time. The optimization problem has two parts. First, the investor selects weights to minimize risk while exceeding a minimum level of returns μ^*. That is,

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[14] All discussions of assets will center on returns, and data are formatted accordingly. A typical stock offers capital returns in the form of price increases and dividends. Bonds offer returns in the form of coupon payments and the difference between market and face value.

[15] This is a simplifying assumption that does not hold in all market conditions. See Mandelbrot (2004). Plenty of research, including that of Markowitz, has shown that an optimal portfolio can still be found after relaxing this assumption. See Ortobelli, Rachev and Schwartz (2002).

$$\omega^* = \min \sigma_p^2$$
$$\text{subject to } \boldsymbol{\omega}^T \boldsymbol{\mu} \geq \mu^*$$
$$\boldsymbol{\omega}^T \mathbf{1} = 1. \qquad (7)$$

Above, $\mathbf{1}$ is a vector of 1's with the same dimension as $\boldsymbol{\omega}$. The equation tells us that the weights must always sum to 1. At the same time, the investor wishes to maximize returns while not exceeding the maximum acceptable level of risk σ^{2*}:

$$\omega^* = \max \mu_p$$
$$\text{subject to } \omega^T \Sigma \omega \leq \sigma^{2*}$$
$$\boldsymbol{\omega}^T \mathbf{1} = 1 \qquad (8)$$

Without constraints on the maximum and minimum allocations of assets in the portfolio, this problem can be solved with matrix algebra. The investor's minimum variance portfolio is

$$\omega^* = \frac{\boldsymbol{\Sigma}^{-1}\mathbf{1}}{\mathbf{1}^T \boldsymbol{\Sigma}^{-1}\mathbf{1}} \qquad (9)$$

The investor can add both risk and return up to her predefined *risk limit*. For each desired level of return μ_p, the optimal weights ω^* are found in the solution to the following linear system:

$$\boldsymbol{D}\boldsymbol{z} = \boldsymbol{d} \qquad (10)$$

In the preceding formula,

$$\boldsymbol{D} = \begin{pmatrix} 2\boldsymbol{\Sigma} & \boldsymbol{\mu} & \mathbf{1} \\ \boldsymbol{\mu}^T & \mathbf{0} & \mathbf{0} \\ \mathbf{1}^T & \mathbf{0} & \mathbf{0} \end{pmatrix}, \quad \boldsymbol{z} = \begin{pmatrix} \boldsymbol{\omega}^* \\ \boldsymbol{\lambda} \end{pmatrix}, \quad \boldsymbol{d} = \begin{pmatrix} \mathbf{0} \\ \mu_p \\ 1 \end{pmatrix} \qquad (11)$$

The parameter vector $\boldsymbol{\lambda}$ is chosen to satisfy the following Lagrangian equation. As can be seen, the vector has two elements.

$$L(\boldsymbol{\omega}, \boldsymbol{\lambda}) = \boldsymbol{\omega}^T \boldsymbol{\Sigma} \boldsymbol{\omega} - \boldsymbol{\lambda}(\boldsymbol{A}\boldsymbol{\omega} - \boldsymbol{b}) \, . \qquad (12)$$

The matrix $\boldsymbol{A}$ and vector $\boldsymbol{b}$ allow for the creation of the three constraints in this problem:

- The return of the portfolio must exceed the desired return at that risk level. This allows the solver to iterate over a range of possible returns and variances.
- The weights must sum to 1.
- Each weight must fall between -0.5 and 0.5.

I implemented this problem in R using the quadprog package and the example of Matuszak

(2013). With a loop, you can generate an efficient portfolio across a range of risk levels.

2.2 Bayesian inference with the multinormal distribution

Unless otherwise noted, all Bayesian forms of the multivariate normal distribution come from Gelman et al. (2013). I will implement three versions of the Bayesian multivariate normal model. First, define the distribution as follows. Given a vector of random variables $\boldsymbol{y}$, the multivariate normal distribution can be defined and denoted:

$$\boldsymbol{y}|\boldsymbol{\mu},\boldsymbol{\Sigma} \sim N(\boldsymbol{\mu},\boldsymbol{\Sigma}). \quad (13)$$

This is the simulation distribution of our asset returns. This model has the parameter vector of means $\boldsymbol{\mu}$ of length k and the parameter matrix of variances and covariances $\boldsymbol{\Sigma}$ which is $k$by k. The probability density function of this model is

$$P(\boldsymbol{y}|\boldsymbol{\mu},\boldsymbol{\Sigma}) \propto |\boldsymbol{\Sigma}|^{-\frac{1}{2}} \exp\left(-\frac{1}{2}(\boldsymbol{y}-\boldsymbol{\mu})^T\boldsymbol{\Sigma}^{-1}(\boldsymbol{y}-\boldsymbol{\mu})\right) \quad (14)$$

For $n$independently and identically distributed (i.i.d.) observations, the likelihood is

$$P(\boldsymbol{y}_1,\dots,\boldsymbol{y}_n|\boldsymbol{\mu},\boldsymbol{\Sigma}) \propto |\boldsymbol{\Sigma}|^{-\frac{1}{2}} \exp\left(-\tfrac{1}{2}\mathrm{tr}(\boldsymbol{\Sigma}^{-1}\boldsymbol{S_0})\right). \quad (15)$$

$\boldsymbol{S}_0$ is the sum-of-squares matrix relative to μ:

$$\boldsymbol{S}_0 = \sum_{i=1}^{n}(\boldsymbol{y}_i-\boldsymbol{\mu})(\boldsymbol{y}_i-\boldsymbol{\mu})^T \ . \quad (16)$$

When variance is known, the *posterior distribution for μ with known* $\boldsymbol{\Sigma}$ is

$$P(\boldsymbol{y}|\boldsymbol{\mu},\boldsymbol{\Sigma}) \propto \exp\left(-\tfrac{1}{2}(\boldsymbol{\mu_n}-\boldsymbol{\mu})^T\boldsymbol{\Lambda}_n^{-1}(\boldsymbol{\mu_n}-\boldsymbol{\mu})\right). \quad (17)$$

The precision matrix $\boldsymbol{\Lambda}$ is the inverse of the covariance matrix and is easier to work with in certain distributions. I will define it and the parameterized version of $\boldsymbol{\mu}_n$ as

$$\boldsymbol{\mu}_n = (\boldsymbol{\Lambda}_0^{-1}+n\boldsymbol{\Sigma}^{-1})^{-1}(\boldsymbol{\Lambda}_0^{-1}\boldsymbol{\mu}_0+n\boldsymbol{\Sigma}^{-1}\overline{\boldsymbol{y}})$$
$$\boldsymbol{\Lambda^{-1}} = \boldsymbol{\Lambda}_0^{-1} + \ n\,\boldsymbol{\Sigma^{-1}} \quad (18)$$

where $\boldsymbol{\mu}_0$ and $\boldsymbol{\Lambda}_0$ are the prior mean vector and the variance matrix for the conjugate prior distribution of $\boldsymbol{\mu} \sim N(\boldsymbol{\mu}_0,\boldsymbol{\Lambda}_0)$. $\boldsymbol{\Sigma}$ is the sample variance and $\overline{\boldsymbol{y}}$ is the sample mean.

For sampling purposes it is usually easier to work with the posterior conditional marginal distributions of subvectors of $\boldsymbol{\mu}$ with a known variance. Let the index (-1) or $(-1,-1)$ indicate the absence of an element with the index (1) or $(1,1)$ from the vector of means or the matrix of variances. Then appropriate conditional and marginal distributions are

$$\mu^{(1)}|\boldsymbol{\mu}^{(-1)}, \boldsymbol{y} \sim N\left(\boldsymbol{\mu}_n^{(1)} + \boldsymbol{\beta}^{(1|2)}\left(\boldsymbol{\mu}^{(-1)} - \boldsymbol{\mu}_n^{(-1)}\right), \boldsymbol{\Lambda}^{(1|2)}\right) \tag{19}$$

The preceding marginal distribution allows us to sample for a single mean in the means vectors. The coefficients to find the conditional mean $\beta^{1|2}$ and the conditional precision matrix $\boldsymbol{\Lambda}^{1|2}$ are defined as

$$\begin{aligned} \boldsymbol{\beta}^{\mathbf{1|2}} &= \boldsymbol{\Lambda}_n^{(\mathbf{1},-\mathbf{1})}\left(\boldsymbol{\Lambda}_{\boldsymbol{n}}^{(-\mathbf{1},-\mathbf{1})}\right)^{-\mathbf{1}} \\ \boldsymbol{\Lambda}^{\mathbf{1|2}} &= \boldsymbol{\Lambda}_{\boldsymbol{n}}^{(\mathbf{1},\mathbf{1})} - \boldsymbol{\Lambda}_{\boldsymbol{n}}^{(-\mathbf{1},\mathbf{1})}\left(\boldsymbol{\Lambda}_{\boldsymbol{n}}^{(-\mathbf{1},-\mathbf{1})}\right)^{-\mathbf{1}}\boldsymbol{\Lambda}_{\boldsymbol{n}}^{(\mathbf{1},-\mathbf{1})}. \end{aligned} \tag{20}$$

The preceding notation is perhaps the most difficult in the paper to follow. Nonetheless, the computational algorithm is intuitive. The coefficients for the first conditional mean are formed by multiplying the inverse of the precision matrix that has the first row and column removed with the first row of the precision matrix that has its first element removed. Similarly, the conditional precision matrix for the first variable takes the difference between the (1, 1) element of the precision matrix and the quadratic product of the first rows or vectors and the inverse of the precision matrix that has the first row and column removed.

Setting up the multivariate normal distribution with an unknown mean and unknown variance is much easier than when only the mean is unknown. First, the conjugate prior is parameterized as

$$\begin{aligned} \boldsymbol{\Sigma} &\sim \text{Inv-Wishart}_{\nu_0}(\boldsymbol{\Lambda}_{\mathbf{0}}^{-1}) \\ \boldsymbol{\mu}|\boldsymbol{\Sigma} &\sim N\left(\mu_0, \frac{1}{k_0}\boldsymbol{\Sigma}\right) \end{aligned} \tag{21}$$

The parameter ν_0 is the number of degrees of freedom, and $\boldsymbol{\Lambda}_0$ is the scale matrix for the inverse-Wishart distribution.[16] This is the final element that we need in our algorithm to create random matrices that follow a normal distribution.

This distribution is part of the MCMC package in R. In the distribution for the mean (line 2), κ_0 is the prior number of measurements used to calculate the mean (see Equation 22), while $\boldsymbol{\mu}_0$ is our prior mean. The application of the parameters follows intuition: when we have lots of data to estimate our prior mean $\boldsymbol{\mu}_0$, its prior variance should decrease.

From the prior density and the normal likelihood, we derive the following set of parameters for the final sampling algorithm.

$$\begin{aligned} \boldsymbol{\mu}_n &= \frac{\kappa_0}{\kappa_0 + n}\boldsymbol{\mu}_0 + \frac{n}{k_0 + n}\overline{\boldsymbol{y}} \\ \kappa_n &= \kappa_0 + n \\ \nu_n &= \nu_o + n \end{aligned} \tag{22}$$

[16] Given a standard multivariate-normally distributed matrix $\boldsymbol{Z} \sim N(\boldsymbol{0}, \boldsymbol{I})$, a variable $\boldsymbol{W} = \boldsymbol{Z}^T\boldsymbol{Z}$ follows a Wishart distribution. In that sense, it is a multivariate generalization of the chi-square distribution. If $\boldsymbol{W}$ follows a Wishart distribution, $\boldsymbol{S} = \boldsymbol{W}^{-1}$ follows the inverse Wishart distribution.

$$\boldsymbol{\Lambda}_n = \boldsymbol{\Lambda}_0 + \boldsymbol{S} + \frac{\kappa_0 n}{\kappa_0 + n}(\bar{\boldsymbol{y}} - \boldsymbol{\mu}_0)(\bar{\boldsymbol{y}} - \boldsymbol{\mu}_0)^T .$$

Sampling from this distribution occurs iteratively over two steps.

- First sample $\Sigma|y \sim \text{Inv-Wishart}_{\nu_n}\left(\Lambda_n^{-1}\right)$.
- Then sample $\mu|\Sigma, y \sim N(\mu_n, \Sigma/\kappa_n)$.

If instead we employ a uninformative prior, the process will need only a few small adjustments.

- First, sample $\Sigma|y \sim \text{Inv-Wishart}_{n-1}(S)$.
- Then sample $\mu|\Sigma, y \sim N(\bar{y}, \Sigma/n)$.

2.3 Gibbs sampling algorithms

A Gibbs sampler is a class of the Markov Chain Monte Carlo (MCMC) procedure that uses conditional probability distributions (Geman and Geman, 1984). In each of the three sampling cases, we will work with marginal distributions that are conditioned on other parameters. In the case of an unknown variance, we condition on the other means. When the means and variances are unknown, we condition the variance on the data and the mean on the variance.

In general, the Gibbs sampling algorithm is as follows. Suppose that $\boldsymbol{x}$ is a vector of random variables, and $\boldsymbol{x} = (x_1, \dots, x_d)$. The sample will "update" iteratively, so that at time $t + 1$ you will have $\boldsymbol{x}^{(t)} = \left(x_1^{(t)}, \dots, x_d^{(t)}\right)$.

- For $i = 1, \dots, d$, draw $x_i^{(t+1)}$ from the conditional distribution

$$\pi\left(x_i^{(t+1)} \middle| x_1^{(t+1)}, \dots, x_{i-1}^{(t+1)}, x_{i+1}^{(t)}, \dots, x_d^{(t)}\right). \qquad (23)$$

- The process updates along a chain. By the time it reaches d , all of the other elements will have been plugged in. For example,

$$\begin{aligned} x_1^{(t+1)} &\sim \pi\left(x_1 \middle| x_2^{(t)}, \dots\right) \\ x_2^{(t+1)} &\sim \pi\left(x_2 \middle| x_1^{(t+1)}, x_3^{(t)}, \dots\right) \\ x_3^{(t+1)} &\sim \pi\left(x_3 \middle| x_1^{(t+1)}, x_2^{(t+1)}, x_4^{(t)}, \dots\right). \end{aligned} \qquad (24)$$

- Keep plugging in the conditional samples for each $i = 1, \dots d$ until you get your sample.

Every sample created with the Gibbs algorithm has 10,000 observations. Each was constructed using a burn-in period of 5,000 observations. This initial set of observations was thrown out to make sure that the algorithm had already converged.

2.4 Validating outcomes

The same Monte Carlo techniques that estimate the parameters for the Bayesian portfolios can also validate the results. By simulating possible returns for each asset in the portfolio and for the market as a whole, we can gain a sense of the frequency with which each individual portfolio will outperform the market. This is another performance dimension not fully captured by the Sharpe ratio.

While we have only market history to build our model on, we can simulate alternative histories. To do this, I calculated means and variances for the individual assets and the market index for 01-09-2012 to 12-30-2013. From there, I simulated 50,000 matrices, each consisting of 104 weeks of returns. With these new returns, I estimated the probabilities that our portfolio outperformed the market using a multivariate normal distribution. This is relatively easy, since you can just treat the variables as if they were bivariate normals:

$$P(X > Y) = P(Y - X < 0)$$
$$W = Y - X$$
$$W \sim N(\mu_Y - \mu_X, \sigma_Y^2 + \sigma_X^2 - 2\sigma_{XY}). \quad (25)$$

In the last equation, σ_y^2 is the variance of Y and σ_{xy} is the covariance of X and Y.

Using these simulated results, we can also assess the individual asset contribution to the total return. A well-designed and robust portfolio should generate returns across many assets over an extended period. Otherwise, a particular portfolio outcome may have more to do with a particular market outcome than with our asset allocation. Given an $m$by $n$matrix of returns $\boldsymbol{X}$, where $m$equals the number of periods in the simulation and $n$is the number of assets, the vector of asset contributions $\boldsymbol{C}$ can be calculated as

$$\boldsymbol{C} = \frac{1}{\mu_p} \mathrm{D}(\boldsymbol{\omega}_p) \boldsymbol{X}^T \mathbf{1}_n. \quad (26)$$

In the preceding formula, μ_p is the total return for a given portfolio, and $\mathrm{D}(\boldsymbol{\omega_p})$ is a diagonal matrix constructed from the corresponding asset weights. Ultimately, this will amount to the weighted column sums divided by their sum, a relatively simple proportion that is calculated for each portfolio.

For the sake of interpretation, I index returns at one in this paper when discussing portfolio performance over a given period. In other words, all time series start at one instead of zero. But for these calculations, this indexing must be removed. If the contribution of each asset is part of the total return, indexing at one will bias all of these ratios.

Last but not least, this contribution can be found for each simulation, which we can average for the final analysis. Moreover, we can find the stability of these contributions by looking at their variance. Under normal market conditions, we'd like to see somewhat evenly divided positive contributions with low variance for each asset.

In particular, extremely large negative contributions indicate a misallocation. While small losses might occur from hedging within a diversified portfolio, large losses on certain assets in favor of massive returns on other assets is the equivalent of leveraging. This strategy is risky and runs against the intuition behind diversification. The analyst is making a large bet that only a portion of her chosen assets will perform well. She is putting all of her eggs in one basket.

3. A motivating example

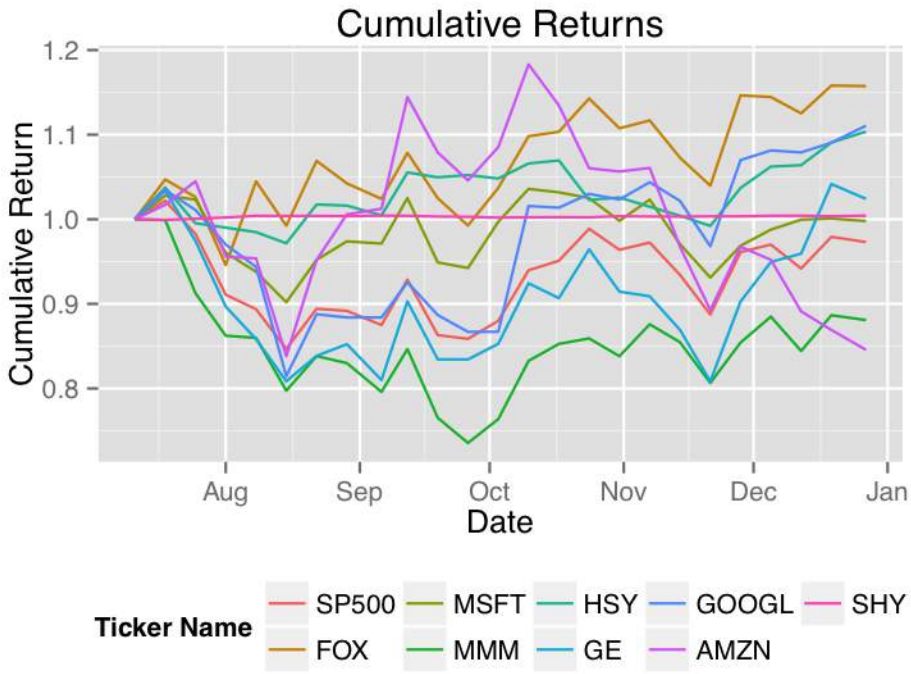

Figure 1: Indexed stock returns for the period of 07-18-2011 to 12-27-2011.

	FOX	MSFT	MMM	HSY	GE	GOOG	AMZN	SHY
Annualized	34.03	-0.48	-25.81	22.45	5.25	23.97	-33.45	0.93
Annualized St.	36.54	26.21	31.37	17.94	38.61	38.78	48.46	0.55
Sharpe Ratio	0.93	-0.02	-0.82	1.25	0.14	0.62	-0.69	1.70

Table 1: Expected returns, standard deviations and Sharpe ratios for the candidate assets for the various portfolios shown below.

Consider the case of a hypothetical financial analyst at the end of 2011. The year has been pretty rough, especially the last six months. High volatility in the market was matched with low returns, and many fund managers perform poorly in this sort of environment (Figure 1). Nonetheless, with the beginning of the new year, there is broad consensus in future stock growth. This turns out to be correct, since the last few years have witnessed one of the strongest bull markets in recent history.

Our analyst downloads the previous year's weekly return data from *Yahoo Finance* using the stockPortfolio package in R. She also has access to stock prices for most publicly traded assets dating back as far as 10 years. She believes that while the *Yahoo Finance* data are more relevant to current market conditions, the older stock performance reports might minimize noise

and provide a better sense of long-term trends for these companies.

Given this environment, our analyst would like to build a new portfolio consisting of the following assets:

- FOX: 21st Century Fox, Inc., the media holding company that includes stakes in film, television and satellite companies. It was formed during the Newscorp split but has a ticker tape dating back to 1996.
- MSFT: Microsoft Corporation, the technology and consumer goods company.
- MMM: The 3M Company, a conglomerate that produces a wide array of consumer goods.
- HSY: The Hershey Company, a producer of candies and other foods.
- GE: General Electric, the multinational conglomerate that operates in the energy, technology, finance, consumer and industrial sectors.
- GOOGL: Google, the internet search engine and technology company.
- AMZN: Amazon.com, Inc., the online retailer.
- SHY: iShares Barclay's 1-3 Treasury Bond Fund, a proxy for a risk-free asset.

The performance of each of these assets is summarized in Table 1, which shows annualized mean returns and annualized standard deviations. It also shows each asset's annualized Sharpe Ratio. The relatively high frequency of Sharpe ratios with a value less than one indicates a difficult market. It also tends to be a sign of market turbulence when the risk-free asset has the highest Sharpe ratio.

Our analyst believes that this is a somewhat representative portfolio for the American economy, providing a good opportunity for diversification. But it's also worth acknowledging that even this selection of assets is significantly smaller than an index like the S&P 500 or the Dow Jones Industrial Average. She will use the former as a benchmark for portfolio performance.

Using the means and variances for only the previous six months, she builds a naive Markowitz portfolio. It performs terribly over the next two years. Her data hardly resembled the emerging bull market.[17] In annualized terms, her portfolio had a return of only 7.45% and a standard deviation of 15.72%. But the market (as shown by the returns to the S&P 500) had a return of 19.08% and a standard deviation of only 10.93%. The market's Sharpe ratio was more than three times that of the analyst's portfolio (Table 2).

[17] Based on weekly returns from 01-09-2012 to 12-30-2013.

	Expected Return	Risk	Sharpe Ratio
Market	19.08	10.93	174.60
Basic	7.45	15.72	47.40
Foresight	15.67	5.78	271.11
Unknown Mean	8.50	13.76	61.76
Uninformative Prior	7.46	15.66	47.62
Informative Prior	32.10	14.04	228.65

Table 2: Annualized portfolio return and risk profiles (in percentages) for each of the estimation methods considered. The final three portfolios use Bayesian estimates.

While this is discouraging, it does not necessarily discredit the theory. Let's pose a counterfactual. What if the analyst had perfect foresight and could predict each asset's mean and variance over the next two years? With these impossible advantages, the Markowitz model performs dramatically better. It significantly reduces portfolio risk and only slightly under-performs the market in absolute terms. This "perfect foresight" portfolio has a Sharpe ratio 271.11%. This is obviously a sharp departure from reality, but it does provide a road towards improving the performance of the portfolio.

Returning to the original formulation of the problem, the analyst has two pieces of information that are not incorporated in the basic estimates of parameters for the Markowitz model. The consensus is that the market is due to improve, and the analyst has extensive historical data to provide context for recent returns. Her Bayesian prior, in the most general sense, is a composite of these two pieces of information. This composite is not perfectly useful, but it should be considered when constructing her portfolio. It certainly has the potential to improve over the poor performance of the basic portfolio.

4. Results

Ultimately, improving portfolio performance comes down to improving estimates of parameters. Consider three scenarios: Only the mean is unknown; both parameters are unknown but the prior distribution is not informative; and the prior is informative.

Even under the uninformative conditions, I included an upward adjustment in means of 20% for the priors. This is meant to capture the consensus that market conditions will improve over the next two years. While space doesn't allow for validating the prior,[18] the following section demonstrates some simulations of returns using each portfolio.

[18] It's also not realistic. In practice the priors are set before developing the statistical model. If the results are poor, you simply set a better-informed prior next time. We can't repeat history.

	FOX	MSFT	MMM	HSY	GE	GOOGL	AMZN	SHY
Baseline	25.12	45.08	-50.00	50.00	-12.09	27.90	-36.01	50.00
Foresight	11.40	0.89	19.39	16.76	-2.91	3.88	0.59	50.00
Unknown Mean	19.48	39.83	-37.24	46.95	-15.75	26.08	-29.36	50.00
Uninformative Prior	24.93	45.20	-50.00	50.00	-11.92	27.44	-35.65	50.00
Informative Prior	14.81	11.19	13.11	5.93	15.24	17.47	22.26	-0.02

Table 3: Asset allocations (in percentages) for each of the portfolios in this project. The final three portfolios use Bayesian methods.

The annualized expected returns, standard deviations and Sharpe ratios for each portfolio are in Table 2. These results are found by applying the weights in Table 3 to the asset returns for the period from 01-09-2012 to 12-30-2013. The weights indicate which portfolios hew closely to the parameters derived from the six months of data available to the analyst. We can identify these portfolios by comparing asset allocations.

4.1 Bayesian portfolios

From the beginning, we can get a sense of the factors accounting for the different performances of the basic and foresight models. The latter has one asset that suffers from an extreme allocation, while the baseline model has three in addition to another model that is quite close to the limit. Financial theory predicts that portfolio performance improves with diversification, all other things being equal. Avoiding extreme allocations would be a plus.

As an alternative, the first Bayesian portfolio was generated using an unknown mean but a known variance. From the analyst's perspective, this is akin to the assumption that while returns over the last six months were not representative, overall market variation was not extremely atypical. This attitude is supported in the literature, which notes that mean estimates have a much stronger effect on the Markowitz model than variance estimates do.

Following the model set out by Gelman (2013), the unknown mean model returns a parameter that is hardly distinguishable from that of the basic Markowitz model. This is a good thing in most circumstances but not a particular benefit here. Rachev et al. (2008) suggests resolving this issue by readjusting weights on the prior and on the data, based on investor confidence. Since other estimation options are available, I just moved on.

The same issues appeared with the model relying on an uninformative prior. Again, this should be expected, given the mathematical and theoretical basis of uninformative priors, but this is not the desired result. Moreover, we cannot add a subjective "correction" to the model or benefit from general knowledge. Strictly speaking, that is the point of an uninformative prior.

On the other hand, we can improve performance by applying analysts' prediction of growth and the full weight of knowledge through the long-term asset means and variances. Furthermore, we can diminish the problematic effects of recent data by weighting the model parameters by using the much larger number of observations in these historical estimates.

	FOX	MSFT	MMM	HSY	GE	GOOGL	AMZN	SHY
Annualized Return	0.40	0.20	0.29	0.27	0.25	0.30	0.43	0.00
Annualized St.	0.18	0.22	0.13	0.13	0.17	0.22	0.28	0.00
Sharpe Ratio	2.19	0.88	2.22	1.99	1.52	1.32	1.55	0.59

Table 4: Expected returns, standard deviations and Sharpe ratios for candidate assets in portfolios over the test period. Data are for 01-09-2012 to 12-30-2013.

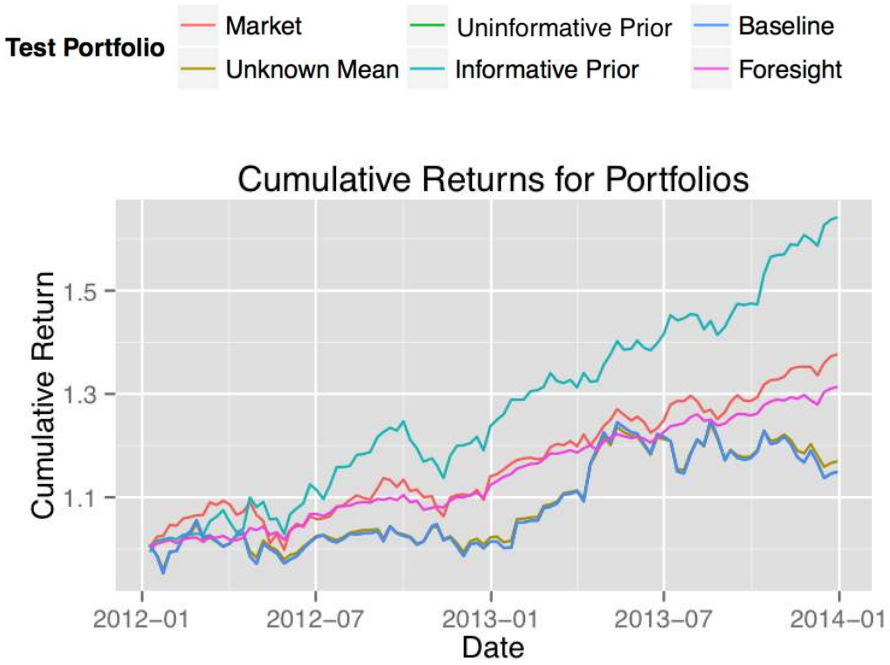

Figure 2: Cumulative returns for each model portfolio, as tested against asset data from 01-09-2012 to 12-30-2013.

While the final Bayesian model still does not outperform the foresight portfolio in terms of the Sharpe ratio, it has a much higher return. In fact, it is the only portfolio that outperforms the market index in absolute terms. The performance is achieved by acquiring much higher risk, an appropriate response during a period of high returns. Nonetheless, this portfolio retains a much higher Sharpe ratio than the market. Either way, this portfolio is better.

The gains in performance come through avoiding extreme allocations while favoring generally risky assets over the safer risk-free asset. In fact, the Bayesian is the only portfolio that does not take the maximum allocation possible for the risk-free asset. Although the risk-free asset had the highest Sharpe ratio during the six months of data available to the analyst, this is not the general case. It certainly wasn't true for the following two years, and it is not sound financial thinking to favor risk-free assets during bull markets.

4.2 Validation

The Sharpe ratio is useful for assessing overall performance, but it isn't the only tool available. And it has its limits: One cannot generalize a single market outcome, and previous market performance cannot guarantee future performance. This is an issue of simulation. We can't observe more than one stock market, but we can at least generate possible market outcomes given a set of parameters.

	Return	St. Dev.	P > Market
Baseline	1.15	0.22	0.19
Foresight	1.31	0.08	0.26
Unknown Mean	1.17	0.20	0.19
Uninformative Prior	1.15	0.22	0.19
Informative Prior	1.64	0.20	0.99
Market	1.38	0.16	0.00

Table 5: Starting from the left, the total expected return after two years in the simulation indexed with t0 = 1. This is followed by the standard deviation of these total returns and the probability that the portfolio will outperform the market after two years. This probability assumes return normality and depends on the means and standard deviations in the table.

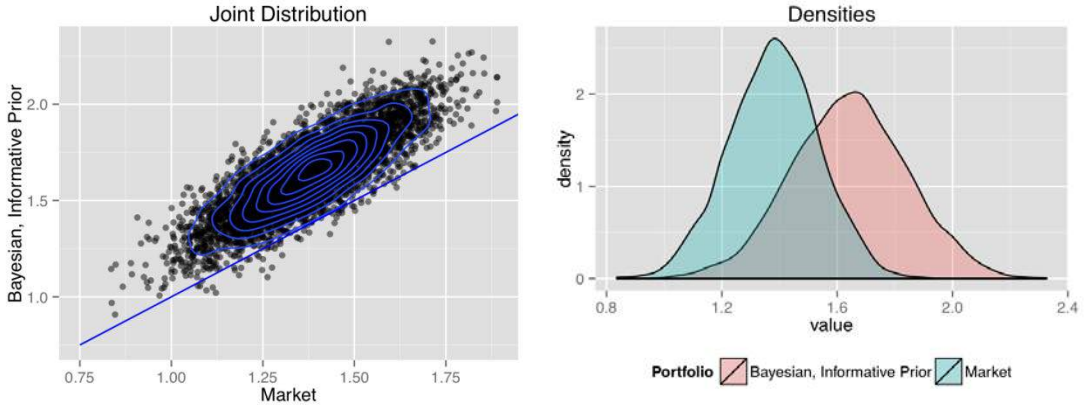

Figure 3: On the left: A joint density plot for the market index and the Bayesian portfolio with an informative prior. Included are contour lines and annotation for where Y > X. On the right: An overlay of the two densities.

If the underlying assumptions given the normality of the returns are correct, the informative prior will outperform the market 98.93% of the time over this investment horizon (Table 5). This is much better than the probability that the portfolio with foresight will beat the market. That said, the much higher returns of the informative prior come through the willingness to accept more risk.

We can visualize these relationships with plots. Overlays of the distributions allow easy comparisons of the portfolio and the market. In particular, since the distributions are roughly normal, overlays allow for easy comparisons of center and spread. On the other hand, the overlays cannot give a sense of the correlation between the two distributions and the final calculation of inequalities within the probability statements. Figure 3 illustrates the distribution plots for the Bayesian portfolio with an informative prior.

One question remains about these results: What drives this improved performance? If we're interested in generalizability, it would be worrisome if these results came through the performance of only one asset. To be blunt, that would be the result of luck, not of improved analytic techniques.

	AMZN	FOX	GE	GOOGL	HSY	MMM	MSFT	SHY
Baseline	8.96	-2.79	1.16	-2.80	-4.24	4.56	-3.82	-0.02
Foresight	0.02	0.29	-0.05	0.07	0.28	0.36	0.01	0.01
Unknown Mean	0.49	-0.26	0.37	-0.11	0.29	0.53	-0.29	-0.01
Uninformative Prior	0.12	-0.47	0.13	0.15	-0.47	0.80	0.76	-0.01
Informative Prior	0.29	0.19	0.12	0.16	0.05	0.12	0.07	-0.00

Table 6: Mean asset contributions to 5,000 simulated portfolio returns for the five portfolios examined in this project. The final three rows refer to portfolios constructed using Bayesian estimates of the parameters.

	AMZN	FOX	GE	GOOGL	HSY	MMM	MSFT	SHY
Baseline	720.01	228.97	87.10	264.76	360.50	368.80	318.29	1.37
Foresight	0.01	0.07	0.02	0.04	0.08	0.08	0.01	0.01
Unknown Mean	100.23	52.99	36.11	51.27	89.71	102.23	53.32	2.21
Uninformative Prior	146.76	82.96	27.74	57.01	86.63	119.31	77.86	0.93
Informative Prior	0.40	0.18	0.10	0.18	0.12	0.11	0.14	0.00

Table 7: Standard deviation of asset contributions to 5,000 simulated portfolio returns for the five portfolios examined in this project. The final three rows refer to portfolios constructed using Bayesian estimates of the parameters.

Looking at contributions and their standard deviations (Tables 6 and 7), we can see that the foresight and informative prior portfolios show similar results, with evenly distributed contributions among the chosen assets and relatively low variances. The same cannot be said about the other portfolios. The baseline portfolio, in particular, derives the overwhelming majority of its total return from the performance of a single asset. This is not a prudent decision.

Looking at the asset contributions to total returns, the informative-prior portfolio outperforms the foresight portfolio by generating wealth across all assets while avoiding losses. At the same time, variances in contributions indicate a degree of risk similar to higher variances in asset returns. The low variances in asset returns in the foresight portfolio indicate that returns remain consistent and are derived in similar amounts from similar sources, across a range of market conditions.

5. Conclusions

While the results are encouraging, we should resist the temptation to read too much into them. Drawing general conclusions from a single period of stock market performance is difficult. Even when resample returns to make outcomes more general (as in the preceding validations), it is difficult to believe that any one period of returns will resemble another. Moreover, with the work provided above, it is hard to balance the pieces of information going into the model. The use of an informative seems to indicate that the portfolio will do better when it is weighted away from the data of the previous three months. But how much weight is appropriate? It’s hard to say.

With those things in mind, one can use these small experiments to highlight positive features. For one, a Bayesian framework of parameter estimation allows the analyst to incorporate a broader spectrum of information. This matters in a setting like the stock market. Much useful information about stock prices is available and awaiting tools for incorporating it into pricing models and portfolio design. Moreover, as Rachev et al. (2008) shows, one can balance a variety of models by using a similar Bayesian framework.

Bayesian methodologies would help financial analysts in Kazakhstan, since it is a data-poor nation, like other developing countries. The Kazakhstan Stock Exchange (KASE) provides information to institutional investors, but it pales in comparison to data in Western markets. Furthermore, locally generated data are often perceived as unreliable.

What can be done? The institutions needed for better financial data might not emerge soon, but much information is available from local experts, businessmen and politicians. A

Bayesian analyst would seize the opportunity to incorporate it through informative priors. Since Kazakhstan has experienced several periods of high volatility and uncertainty, including the example in this paper, informative priors can improve portfolios.

For people familiar with business in Kazakhstan, these recommendations may seem common sense. Most would agree that personal connections and word-of-mouth channels are critical to understanding the local business climate. Nonetheless, these heuristics often lack a reliable rigorous framework, as is the case with ad hoc techniques for building portfolios. In that regard, Bayesian methodologies encourage a broader selection of knowledge along with robust mathematical techniques.

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Perspectives

Prospects for small and medium-sized businesses: A comparative study of Poland and Kazakhstan

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Abstract: *Small and medium-sized businesses (SMEs), which account for substantial shares of employment in Poland and Kazakhstan, have low survival rates in both countries. No more than a third is still in business after four or five years of operation. Surveys indicate that SMEs face administrative and legal barriers as well as psychological ones. The Second Chance program of the European Union, meant to revive bankrupt firms, has not worked perfectly in Poland. The authors support their conclusions with statistics about SME revenues, contributions to GDP, and demographics of bankruptcy.*

Keywords: *administrative barriers, business, second chance, career, finance*

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1. Introduction

To become competitive, transition economies must cultivate entrepreneurs -- business people who carry out their own ideas. This paper describes entrepreneurship in one of the most successful post-Soviet economies, Poland, and it draws lessons for Central Asia. As a relatively small economy in the European Union, Poland is an example for members of the Eurasian Economic Union, including Kazakhstan, that wish to strengthen European ties.

SME entrepreneurs in Poland face administrative barriers, legal and mental. To survive, they must generate wages at least five times higher than the national average. Many struggle for existence and appeal for state aid.

George Stigler, a pioneering analyst of economic regulation, theorized that studies of industries should use the survivor principle – i.e., that only the strongest companies can survive keen competition (Jasinski, 2008). Second Chance (European Commission, 2011), a European Union (EU) program, helps bankrupt firms recover and grow stronger, despite controversial Polish regulations in law, bankruptcy and reorganization.

We will first describe the Polish sector of small and medium-sized firms, then turn to its problems. The second half of our article compares the SME performance in Kazakhstan to that in Poland. Our main research methods are analysis of the international literature and of statistics.

2. Dominant role of the SME sector in Poland

EU guidelines classify firms according to size. Small and medium-sized enterprises consist of these categories:

- Micro (up to 9 employees, with annual income below 2 million euros)
- Small (10 to 49 employees, with annual income or total assets below 10 million euros)
- Medium-sized (50 to 249 employees, with annual income below 50 million euros or total assets below 43 million euros)

In 2012, of 517,704 companies that began operations, 517,277 (99.92%) were SMEs (Table 1). They generate almost half of Poland's gross domestic product (Figure 1). Compared to SME sectors in other countries, Poland's ranks in the midfield. The leader is Norway, where SMEs account for almost 60% of GDP (Figure 2). In Kazakhstan, the SME share is remarkably small – less than a third.

Year	Micro			Small			Medium-sized		
	Registered	Established	Liquidated	Registered	Established	Liquidated	Registered	Established	Liquidated
2003	3,410,233	265,946	148,202	137,974	7,569	3,888	28,329	1,071	978
2004	3,402,150	223,863	204,979	141,499	4,144	3,723	28,309	484	911
2005	3,436,841	282,517	228,171	145,745	6,144	4,059	28,343	651	665
2006	3,455,565	311,732	283,271	147,393	4,409	3,742	28,406	448	451
2007	3,502,303	309,248	253,100	150,128	4,317	3,348	28,462	442	490
2008	3,568,137	334,812	257,717	154,833	5,180	5,166	29,323	526	988
2009	3,548,354	397,114	377,920	159,705	5,240	4,726	29,730	381	612
2010	3,713,677	459,270	264,133	161,550	5,838	3,963	29,731	494	493
2011	3,674,970	401,208	412,995	160,851	6,153	5,498	29,340	531	734
2012	3,794,489	498,336	303,576	146,489	17,179	6,527	29,787	1,762	617

Table 1: Small and medium-sized enterprises in Poland, 2003-12.
Source: Authors' estimates based on PARP (2014).

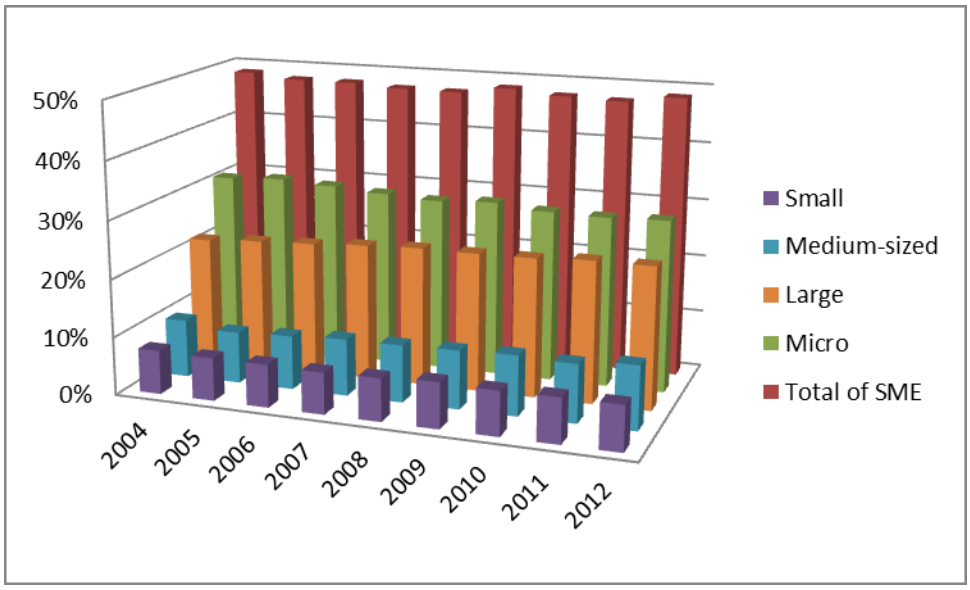

Figure 1: Shares of enterprise groups in GDP in Poland, 2004-12.
Authors' estimates based on PARP (2014).

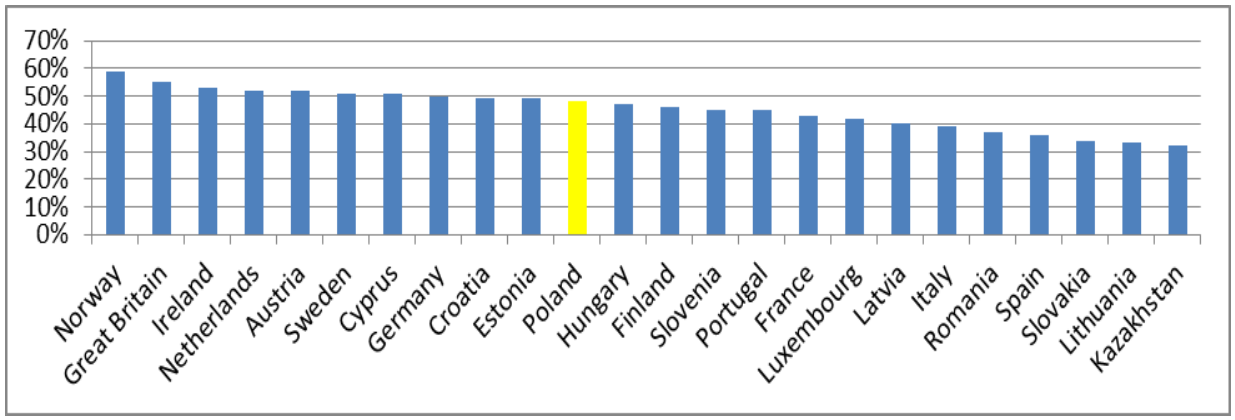

Figure 2: The share of the SME sector in GDP in 24 countries, 2009.
Authors' estimates based on PARP (2014).

Revenues are smaller for SMEs than for large enterprises in Poland. But in 2012 the cumulative value of SMEs exceeded the income of the largest companies by almost 25% (Figure 3).

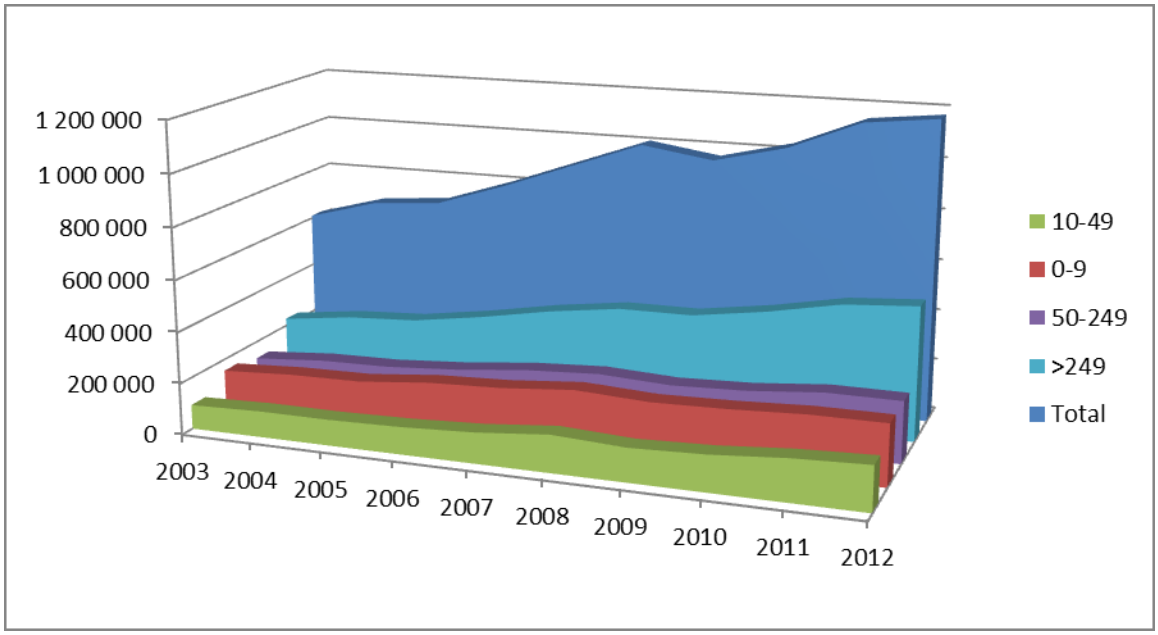

Figure 3: Revenues (USD) of SMEs in Poland in 2003-12.
Authors' estimates based on PARP (2014).

Among all firms, SMEs employ the largest number of workers in Poland. Micro firms in years 2003-2012 had more than three million employees (Figure 4).

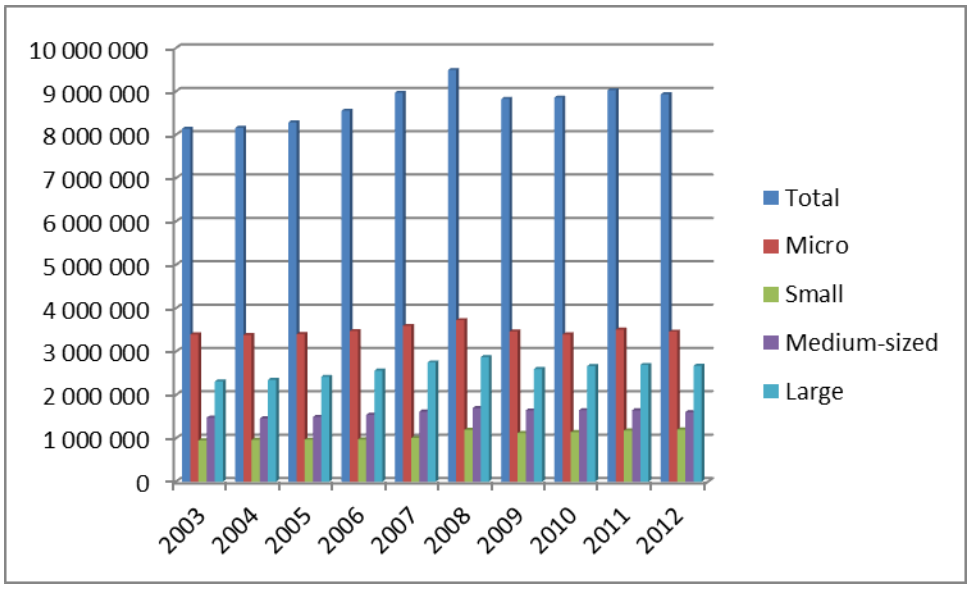

Figure 4: Number of employees in each category of enterprises in Poland.
Source: Own studies based on PARP (2014).

SME wages are much lower than those for the largest enterprises although they are

growing steadily (Figure 5). The worst-paid workers are in the smallest firms, while wages paid in medium-sized companies almost equal the average wage in Poland.

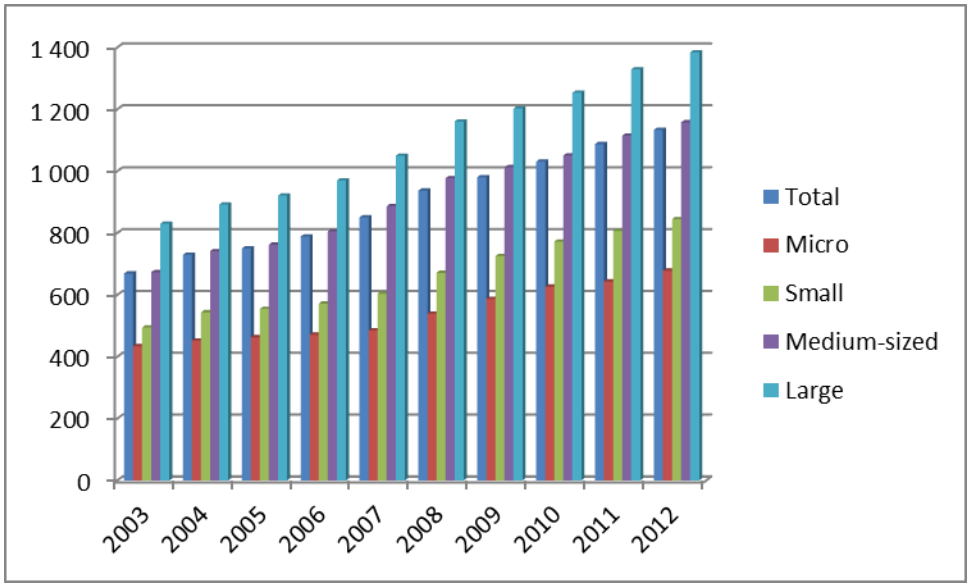

Figure 5: Average salary (USD) in companies in Poland, 2003-2010.
Authors' estimates based on PARP (2014).

In 2011, in the wake of the global financial crisis of 2008-2009, more Polish businesses closed than opened, except for small businesses (Figure 6). Only about 700 SMEs declared bankruptcy, a time-consuming and complicated court procedure that many closing firms preferred to bypass. More than a fifth of SMEs do not survive their first year, and each year this number increases (Table 2). Most SMEs do not survive as long as three years.

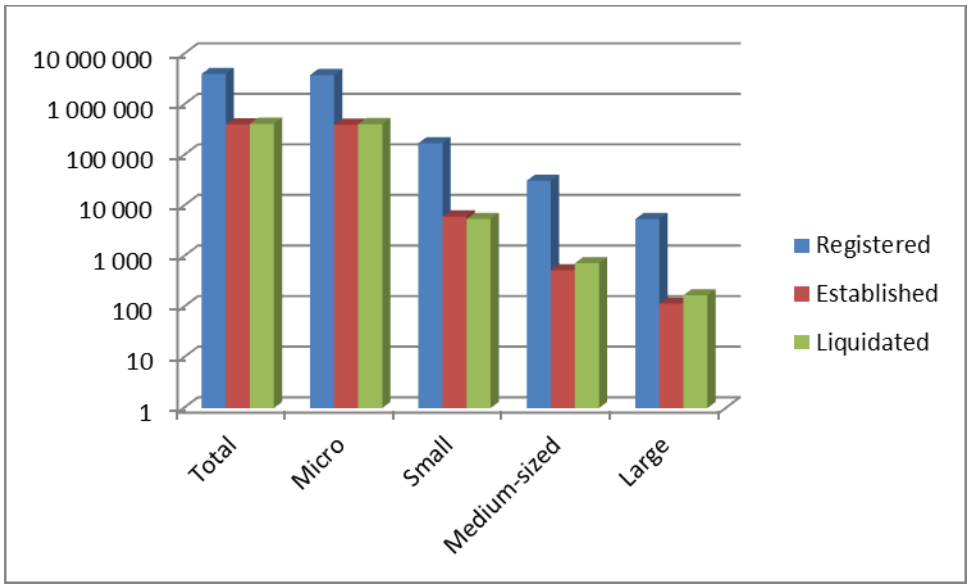

Figure 6: Business demography in Poland, 2011.
Authors' estimates based on PARP (2013).

Year established	Companies registered (in thous.)	The survival rate of the first year (in %)	The survival rate for the year (in %)			
			008	009	010	011
2006	241.6	66.5				
			5.2	1.0	6.2	1.3
2007	273.6	70.7				
				4.1	3.5	7.1
2008	294.3	76.4				
					8.3	6.8
2009	275.3	77.0				
						9.7
2010	286.2	77.8				

Table 2: SME survival rates in Poland.
Source: www.parp.gov.pl.

In sum, the SME sector is growing. The number of SMEs registered is rising, as well as their revenue, share of GDP, and number of employees.

3. System barriers

SMEs face barriers in taxation, finance, exports, and recovery from bankruptcy (Masiukiewicz, 2012). In 2010, entrepreneurial risks associated with the recent crisis were not seen as the most important (Table 3). Threats most often cited by entrepreneurs included high

and poorly administered taxes, falling demand, and changing economic conditions.

No.	Type of threat (N = 1205)	Answers (in %)
1	The tax system, high taxes	44.0
2	Few new customers	43.0
3	Market unpredictability	37.0
4	Unfair competition	36.0
5	Strong competition	35.0
6	Delayed payments by customers	19.0
7	Instable regulations	18.0
8	Difficulties in obtaining loans	9.0
9	Corruption during public procurements	8.0
10	Unqualified staff	8.0

Table 3: The main threats to SMEs.
Source: Own studies based on: Orłowski et al. (2010, p. 37).

When surveyed about customer risks faced by entrepreneurs, most of them (59.3%) pointed to delayed or no payments for goods (59.3% and 56% respectively) and the risk of bankruptcy (53.3%) (Table 4).

No.	Types of risk from customers (N = 150)	Answers (in %)
1	Failure to pay for goods	59.3
2	Lack of full payment	56.0
3	Threat of bankruptcy	53.3
4	Returns of unsold goods	45.3
5	De-registration or disappearance of contractors	49.3
6	Delayed payment	47.3
7	Delayed transport causing goods to deteriorate	48.0
8	Late deliveries, breaching contracts or increasing costs	1.3
9	Other risks	0.7
10	No answer	2.0

Table 4: Risks from customers as seen by entrepreneurs.
Source: Survey by the Marketing Department of the School of Economics (2009).

Particularly dangerous was the sudden de-registration of the customer's business and his disappearance (49.3% of responses). Troubled companies can expect little support from the creditor bank or the tax office.

To repair the company, the bank can (Masiukiewicz, 2011):

- restructure debt, by amortizing interest or rescheduling payments in installments
- lend more
- consolidate loans
- participate in the supervisory board and the general meeting of shareholders

- advise restructuring

The Enterprise Europe Network and chambers of commerce (e.g., the Chamber of Small and Medium Enterprises in Warsaw) support consulting. But Poland does not have a restructuring fund for companies in crisis.

In 2011, we studied bankruptcies for the Polish Agency for Enterprise Development, which annually commissions SME research. (Dec, 2013) Two thirds of the surveyed entrepreneurs said they needed counseling and financial support (Table 5).

No.	Type of support	Definitely yes (%)	Probably yes (%)	Probably not (%)	Definitely not (%)
1	Advisory support	48.0	38.0	12.0	2.0
2	Training support	33.0	40.0	21.0	5.0
3	Financial support	29.0	38.0	24.0	9.0
4	Psychological support	14.0	45.0	40.0	0.0

Table 5: Survey of bankrupt entrepreneurs about needed support
Source: Authors' studies based on Pentor (2011)

Polish law provides only one way to repair bankrupt firms, and the supporting infrastructure is negligible. In the TNS survey by Pentor (a leading Polish research agency) in 2011, respondents gave low marks to most proceedings (Table 6).

No.	Type of proceedings	Very well (%)	Fairly well (%)	Neither good nor bad (%)	Rather badly (%)	Very poor (%)
1	Liquidation proceedings	7.0	51.0	22.0	17.0	2.0
2	Arrangement with creditors	2.0	24.0	27.0	39.0	7.0
3	Reorganization proceedings	0.0	10.0	20.0	22.0	49.0

Table 6: The effectiveness of legal proceedings for bankruptcy and reorganization.
Source: Authors' work based on Pentor (2011).

In Delphic research (Masiukiewicz and Nowak, 2012), experts said the Treasury should help pay for repairing enterprises but not in cases of mismanagement or deliberate bankruptcy.

A separate issue is taxation of canceled debt. When a borrower has long been delinquent, the bank sometimes cancels part of the debt to help him recover (Masiukiewicz and Nowak, 2012). But the government taxes the waiver as income. Accountants should change how they value intangible assets although these amounts are not disclosed in financial statements.

4. Behavioral barriers

The entrepreneur's behavior, which affects the probability of his bankruptcy, depends on customers and crises as well as on his own traits. A study of 609 SME entrepreneurs in Poland found that over 47% had higher education. Most were innovators though few were expansive (65.1% and 21% respectively; Table 7).

No.	Profile of businessmen SME	% Share of the profiles of the respondents	% Entrepreneurs who in the last three years have innovated
1	Involved	21.0	65.1
2	Paternalistic	35.0	48.9
3	Fulfilled	23.0	44.1
4	Resourceful	10.0	34.3
5	Frustrated	10.0	30.8
	Average		44.1

Table 7: Profiles of businessmen and their attitudes toward innovation.
Note: Research of the Warsaw School of Economics in 2011, covering the owners and co-owners of 609 SMEs.
Source: Authors' work based on Gardawski (2012)**.**

Entrepreneurs are split on the need to expand. In a PARP survey of 1,206 SME companies, 44% of the respondents were satisfied with the status quo and 38% wanted more growth (Table 8).

No.	Attitude of SME entrepreneur towards his business	Answers (in %)
1	I do not press for company growth; business is good	44.0
2	enough.	38.0
3	I stress development. I offer new services or seek new	4.0
4	markets.	14.0
	My business is poorly developed and must close.	
	Don't know	

Table 8: Attitude towards business.
Source: Orłowski et al. (2010. p. 60).

No.	Willingness to continue working with the entrepreneur	Answers (in %)
1	Immediate suspension of supplies	50.0
2	Supply would continue but would ask for prepayment or payment in cash	56.0
3	If I signed the contract, I would like to resolve them	44.0
4	Consultation with an attorney	47.0
5	I would take the case to the court for payment of	39.0
6	debts	55.0
7	I would be willing to spread the repayment of debts over installments to help the debtor to his feet	37.0
8	Notice of the situation of other enterprises I include applicants for bankruptcy	29.0

Table 9: Willingness to continue working with a bankrupt entrepreneur.
Source: Own studies based on Pentor (2011).

In a crisis, the company's survival may depend on its relationships with suppliers and customers. Studies by the Polish Agency for Enterprise Development (PARP) show that 50% of the traders immediately stopped supplies to a defaulting business (Table 9).

A survey asked business owners how they had coped with the 2008 financial crisis. Of those who were traders, 12% sought informal employment, and 17% sought help in social systems (Table 10). The crisis raised the demand for -- and the supply of – informal loans.

No.	What is your attitude toward the economic crisis:	Business owners	Managers
1	Getting help in the family	9.8	0.0
2	Finding work in the informal economy	12.2	11.8
3	Getting help among the closest circle of friends	17.1	11.8
4	Getting help in social organizations	12.2	5.9
5	Going abroad for business purposes	9.8	17.6

Table 10: Attitudes of entrepreneurs toward the financial crisis (in %).
Source: Authors' studies based on Słaby (2009).

5. Second Chance Program in the EU and its implementation

Since bankruptcy is costly to the economy (Altman and Hotchkiss, 2007), a bankrupt entrepreneur should have a second chance. An EU program offers guidelines for state aid for SME firms in difficulty; a directive on late commercial payments; and a procedure for small claims. The EU's Enterprise Europe Network – with 600 organizations and 4,000 employees –

advises bankrupt businesses on how to start again.

The Polish government has:

- simplified procedures for setting up companies (including e-registration)
- prepared a law on recovery and insolvency
- put into effect a law on commercial transactions as well as the program Support for Export
- introduced free one-year guarantees for SME loans
- helped to establish and develop SMEs from EU grants (de minimis) under the Innovative Economy Operational Programme.

Taxes and startup procedures must be simplified. A 2012 World Bank report on tax treatment of entrepreneurs ranked Poland in the second hundred of 183 countries. And in its Index of Economic Freedom, the Heritage Foundation ranked Poland 64th.

6. SMEs in Kazakhstan

SMEs are not as prevalent in Kazakhstan as in Poland. According to Kazakhstan's Ministry of Economic Development and Trade (2012), SMEs in 2010 employed 30.4% of the workforce. But they accounted for only 20.2% of GDP, less than half of the share in Poland. This was well below the average for developed countries. In most nations belonging to the Organization for Economic Cooperation and Development (OECD, 2009), SMEs account for 60-70% of employment. In high-income countries, SMEs amount to 51% of GDP (Edinburgh Group, 2012). Some possible constraints on the development of SMEs in Kazakhstan, as this study will illustrate, include administrative barriers, relatively high nominal interest rates on loans, lack of access to business credit, difficulties in financial planning resulting from high inflation, and poor logistics.

Cheap loans, and cuts in administrative costs, would help SMEs, which face high interest rates. For Kazakhstan, the average nominal interest rate for business loans in the national currency has been in the range 10%-14.4% (National Bank of Kazakhstan, 2014, Table 11), as opposed to 3.8% (December 2014) and 8% (October 2008) for Poland (National Bank of Poland, 2015). In Kazakhstan, annual inflation ranged from 4.8% (2013) to 9.5% (2008); for Poland, from -1% (2014) to 3.3% (2008) (International Monetary Fund, 2015). As both economies recovered, real interest rates rose higher in Kazakhstan than in Poland, offsetting the benefit to SMEs of the increased demand for goods. Tenge depreciation in 2014 and 2015 has made loans in foreign currency risky for borrowers. The anticipation of inflation and devaluation may also have shifted the preferences of consumers toward purchasing durables, which are sold primarily by large retailers. High indebtedness of Kazakh consumers (20% of bank loans in Kazakhstan were non-performing in 2013) has lowered demand for many goods (World Bank, 2014).

SMEs in food and beverage processing may apply for subsidized loans from the Damu Fund, priced at no more than 6%. Firms may spend these subsidies only to refinance loans not granted under the Business Road Map 2020, the Program of Recovery of the finance ministry, JSC KazAgro or Damu Ondiris. Neither may firms spend the subsidies on new or modernized fixed assets. Other subsidized loans in tenge may be priced between 6% and 14% (Damu Fund for Development of Entrepreneurship, 2014).

Banks in Kazakhstan receive five times more interest revenue from SMEs than from large enterprises. Nevertheless, since 2010, lenders have extended to small businesses less than a

fourth of their loans (Table 12). During the crisis year of 2009, small businesses in agriculture, trade and communications received higher shares.

	31.12.08		31.12.09		31.12.10		31.12.11		31.12.12		31.12.13		31.12.14	
	FC	KZT	FC	KZT	FC	KZT	FC	KZT	FC	KZT	FC	KZT	FC	KZT
Loans to non-banking legal entities	13.1	16.5	10.8	15.1	9.2	12.8	6.9	11.2	8.7	10.6	7.6	10	8.1	14.4
of which :														
Short-term (up to 1 month)	9.5	19.2	8.1	14.8	5	14.3	1.9	11.7	4.6	10.1	4.3	10	6.7	22.3
Long-term (over 5 years)	14.9	16.1	8.6	13.9	12	11	4.3	7.4	8.1	11.9	7.4	11.3	9.6	10.9

Table 11: Interest rates on loans to non-banking legal entities in Kazakhstan (2008-2014). Source: The National Bank of Kazakhstan.

As of:	01.01.10	01.01.11	01.01.12	01.01.13	01.01.14	01.01.15
Total	22.35%	18.24%	15.28%	14.18%	11.37%	14.77%
Industry	22.66%	17.39%	18.26%	15.63%	11.88%	16.72%
Agriculture	33.66%	23.40%	18.25%	16.66%	11.40%	16.50%
Construction	18.93%	14.11%	17.86%	16.42%	9.64%	20.37%
Transport	18.40%	20.79%	11.41%	11.68%	14.44%	19.47%
Communication	40.14%	23.95%	43.80%	26.84%	23.63%	22.68%
Trade	38.53%	28.93%	22.66%	23.04%	17.80%	24.91%
Other	13.40%	13.19%	9.86%	9.05%	8.70%	8.71%

Table 12: Volume of loans to small businesses as a percentage of total volume of loans to the economy by sector (2010-2015). Source: National Bank of Kazakhstan; authors' calculations.

Important barriers for SMEs in Kazakhstan include instable demand, unfair competition, and scarcity of loans and qualified workers. Western sanctions against Russia destabilize its demand for Kazakhstani exports, which declined 7.6% in 2014, compared to 2013 (Kaznex Invest, 2014). The weak ruble puts Kazakhstani producers in import-competing industries at a disadvantage. The Eurasian Union may overcome low export demand among its members, but it also increases competition with Russian producers.

Most university graduates in Kazakhstan prefer work in the humanities and social sciences, attracted by higher salaries and prospects for career growth, while supply of specialists

in many other fields remains low. A study of over 120,000 vacancies and 350,000 résumés, submitted to the website of Headhunter Kazakhstan (2014), a labor market research and recruiting agency, has shown that about four times more applicants apply for jobs in law and accounting than do for blue-collar positions, and two times more applicants apply for these jobs than for information technology and telecommunications or for science and education. It is also estimated that 65% more citizens with a higher education have emigrated from Kazakhstan than immigrated into the country over 2010-2014 (*Kapital*, 2014). Poor quality and corruption in education, its obsolescence and inflexibility in adapting to technological progress as well as to changes in the labor market, and lack of experience among graduates also contribute to the shortage of specialists. Due to rampant unemployment during the recession of the 1990s, many university graduates could not acquire adequate professional experience, and the quality of their education suffered, because of the shortage of qualified instructors, many of whom quit their jobs at universities and moved into industry (RFCA Ratings, 2012). Though it is not their main problem, it is still an issue that they complain about, according to a study of business representatives that we will discuss.

A possible reason why the labor market has failed to adjust is the excessive provision of scholarships to students studying in the humanities and the excessive role of the government in providing to them jobs and privileges that artificially increase supply. Specialists in economics and business administration are employed by the government extensively through national companies, the Samruk-Kazyna national welfare fund, the recently merged Unified Accumulated Pension Fund, and many others. Most graduates of the Bolashak study-abroad program receive their degrees in humanities and social sciences. As of 2014, only 40% of the program's graduates studied in technical specializations. This is not enough to drive down their labor costs to the point that they become affordable for SMEs, though it is an improvement from the 15% share of Bolashak graduates studying in technical specialties before 2000 (*Delovoy Mir Astana*, 2014).

SMEs also face political challenges. After President Nursultan Nazarbayev leaves office, regulations unfavorable to SMEs may pass. Another threat is pressure by Belarus and Russia (backed by Armenia and Kyrgyzstan) on Kazakhstan to pass laws that may worsen its business climate. In 2013, both countries had lower ratings than did Kazakhstan on the Heritage Foundation's Index of Economic Freedom: 143rd for Russia ("mostly unfree"); and 153rd for Belarus ("repressed") (Heritage Foundation, 2015). In 2014, Kazakhstan ranked 69th ("moderately free"). But on the World Bank's Ease of Doing Business Index, Russia and Belarus outranked Kazakhstan (77th). According to that index (Table 13), Kazakhstan has a relatively liberal tax regime (17th). Still, severe complaints about taxation remain. Contract enforcement, too, may be a relatively minor issue in Kazakhstan, which has a rating of 30, compared to 52 for Poland. But getting credit, dealing with construction permits, and trading across borders are harder for Kazakhstan than for Poland. (World Bank, 2014).

Economy	Poland	Belarus	Russian Federation	Kazakhstan	Kyrgyz Republic	Armenia
Ease of Doing Business Rank, Overall	32	57	62	77	102	45
Starting a Business	85	40	34	55	9	4
Dealing with Construction Permits	137	51	156	154	42	81
Getting Electricity	64	148	143	97	168	131
Registering Property	39	3	12	14	6	7
Getting Credit	17	104	61	71	36	36
Protecting Minority Investors	35	94	100	25	35	49
Paying Taxes	87	60	49	17	136	41
Trading Across Borders	41	145	155	185	183	110
Enforcing Contracts	52	7	14	30	56	119
Resolving Insolvency	32	68	65	63	157	69

Table 13: Components of the Ease of Doing Business Index for Poland and the economies of the Eurasian Economic Union. Source: World Bank (2014).

In Kazakhstan, most entrepreneurs would probably seek remedies from the financial crisis in the form of government aid. The Damu Fund for Development of Small Entrepreneurship provides financial aid and consulting.

Survival rates among SMEs in Kazakhstan are like Poland's. In 2012, only 61.3% of SMEs in Kazakhstan were active. The others were inactive or bankrupt. Of active entities, 69.9% were entrepreneurs. Few failing enterprises get restructured (Table 14); in 2010-2012, about half of those restructured were in the construction industry. Restructuring during that period preserved 11,151 jobs. (Strategy Kazakhstan 2050, 2013).

	2010	2011	2012
Number of Liquidated Organizations	2145	1571	1997
Number of Restructured Organizations	15	9	9

Table 14: Bankruptcy and restructuring of business organizations in Kazakhstan (2010-2012). Source: Strategy Kazakhstan 2050.

Like Poland, Kazakhstan must improve its bankruptcy laws. In 2014, it had a ranking of 3, on a scale of 0 to 12, where 12 was strongest, on the World Bank's Strength of Legal Rights

Index, which evaluates protection of rights of borrowers and lenders in collateral and bankruptcy disputes. Poland's ranking was 7; Russia's, 4; Belarus', 2; Armenia's, 5; Kyrgyzstan's, 8; the United States, 11. Recent amendments to bankruptcy laws in Kazakhstan introduce electronic auctions and mandate selling all of the enterprise's assets in one set. The latter regulation is meant to preserve jobs, reduce selling costs, and to enable the enterprise to keep operating when sold (Uchet.kz, 2014).

Regarding shipment and delivery, Kazakhstan in 2014 ranked 88th in the World Bank Logistics Performance Index. Poland ranked 31st, outperforming Kazakhstan in all components (Table 15). Delays in transport or late deliveries may typify Kazakhstan. Other members of the Eurasian Economic Union performed no better than Kazakhstan (World Bank, 2014).

	overall LPI score	Customs	Infrastructure	International shipments	Logistics quality and competence	Tracking and tracing	Timeliness
Country	score	score	score	score	score	score	score
Poland	3.49	3.26	3.08	3.46	3.47	3.54	4.13
Kazakhstan	2.70	2.33	2.38	2.68	2.72	2.83	3.24
Russian Federation	2.69	2.20	2.59	2.64	2.74	2.85	3.14
Armenia	2.67	2.63	2.38	2.75	2.75	2.50	3.00
Belarus	2.64	2.50	2.55	2.74	2.46	2.51	3.05
Kyrgyz Republic	2.21	2.03	2.05	2.43	2.13	2.20	2.36

Table 15: Components of the Logistics Performance Index for members of the Eurasian Economic Union and Poland. Source: World Bank, Logistics Performance Index (2014).

7. Attitudes of SME entrepreneurs in Kazakhstan

Entrepreneurs in Kazakhstan may lack enthusiasm. In 2010, the BISAM (Business Information, Sociological and Marketing) Research Center surveyed 1,636 beginning and potential entrepreneurs in this country, using a poll questionnaire. BISAM is a company created by Kazakhstani researchers and Bilesim International, a Turkish marketing research agency, in 1997.

BISAM also interviewed 18 focus groups of agricultural heads and failed entrepreneurs – as well as 45 business representatives and entrepreneurs in depth. Most respondents (86%) anticipated good prospects for business, perhaps due in part to the 2009 tax reform, which had reduced the corporate income tax to 20%, from the rate of 30%. Even so, as shown by the survey, SME representatives criticized pressure during inspections, fearing demands for bribes. Over one-third (36%) of all respondents said resources were sufficient for sustaining the business but not for expanding or perfecting it. Another 39% said resources were sufficient only for sustaining the current business (Table 16). The share of such respondents is highest for owners of businesses with no employees, and lowest for businesses with 21-50 employees.

Respondents owning businesses with no employees are also the most likely to be in a critical financial condition (Table 17). In this regard, agricultural entrepreneurs are the worst off,

with nearly half (49%) having enough resources only for sustaining the current business, 4% being in a critical financial condition, and 7% lacking resources for just sustaining business, while legal entities are the best off, with only 1% in a critical financial condition and nearly one-quarter (24%) having enough resources for expanding (Table 18).

Most enterprise representatives report medium development of their businesses. Representatives of agricultural enterprises report less development than do entrepreneurs; representatives of legal entities report the most development (Tables 19 and 20).

In 2009 and 2010, more than half of the respondents in all three types of SMEs were most willing to install equipment. All were less willing to spend, which reflected increased risk aversion. This was especially true for entrepreneurs (Table 21).

Excessive competition was the most common complaint of business representatives, followed by inadequate resources and high taxes (Table 22). Entrepreneurs were suspicious of the government and ill-informed about it. Over half of them (53%) complained that government officials had a negative attitude toward their businesses (Table 23). Over half of the entrepreneurs knew nothing about the Road Map for Business, and the overwhelming majority (87%) knew nothing about the Program of Accelerated Industrial-Innovative Development (Table 24).

Over two thirds of the entrepreneurs said they would quit their enterprises and get well-paid jobs if they had a chance. About one third said they had become entrepreneurs because of circumstances, not because of their desires. Only 31% found their businesses interesting, and only 30% viewed business as their life mission (Table 25).

Most entrepreneurs underestimated how much they needed to know in order to succeed. They also underestimated the importance of hiring skilled personnel. The 2008 financial crisis decreased willingness to train personnel, modernize and expand equipment, repair works and install facilities.

Condition	Percentage of Respondents
There are enough resources for maintaining and expanding the business	18
There are enough resources for sustaining the business; insufficient resources for expanding or perfecting it	36
Resources are sufficient only for sustaining the current business	39
Not enough resources even for sustaining the current business	4
The business is in a critical financial condition	3

Table 16: Assessment of business conditions by survey respondents. Source: BISAM.

	No Employees, Working Alone	Fewer than 5 Employees	6-20 Employees	21-50 Employees	Over 50 Employees
Enough resources for sustaining and expanding the business	12	13	23	29	17
Enough resources for sustaining the business; insufficient resources for expanding or perfecting it	26	36	41	36	36
Resources available are sufficient only for sustaining the current business	48	43	31	29	38
Not enough resources even for sustaining the current business	8	4	4	3	5
The business is in a critical financial condition	6	3	1	2	3

Table 17: Assessment of the condition of the business by size of the organization, % of respondents. Source: BISAM.

	Individual Entrepreneurs	Representatives of Legal Entities	Representatives of Agricultural Enterprises
Enough resources for sustaining and expanding the business	17	24	12
Enough resources for sustaining the business; insufficient resources for expanding or perfecting it	36	42	27
Resources available are sufficient only for sustaining the current business	40	28	49
Not enough resources even for sustaining the current business	4	4	7
The business is in a critical financial condition	3	1	4

Table 18: Assessment of the condition of the business by type of organization, % of respondents. Source: BISAM.

Self-Assessment	No Employees; Working Alone	Fewer than 5 Employees	6-20 Employees	21-50 Employees	Over 50 Employees	Overall
Extremely low	4	2	0	1	0	2
Pretty low	15	11	7	7	5	10
Medium	70	78	73	65	64	74
Pretty high	10	7	18	19	26	13
Extremely high	0	0	1	9	5	2

Table 19: Respondents' self-assessment of the level of development of the business by number of employees, % of respondents. Source: BISAM.

	Individual Entrepreneurs	Representatives of Legal Entities	Representatives of Agricultural Enterprises	Overall
Extremely low	2	1	2	2
Pretty low	11	8	11	10
Medium	74	70	76	74
Pretty high	11	18	11	13
Extremely high	2	3	0	2

Table 20: Respondents' self-assessment of the level of development of the business by type of business, % of respondents. Source: BISAM.

Aspect	Overall		Legal Entities		Individual Entrepreneurs		Agricultural Enterprises	
	2009	2010	2009	2010	2009	2010	2009	2010
Acquiring and installing new equipment	57.8	44.6	61.5	51.1	58.3	41.7	52.1	46.5
Updating of existing equipment	45.8	39.3	49.7	47.6	45.6	35.4	42.4	42.2
Overhaul	44.8	29.3	40.5	31.9	47.1	25.6	40.8	40.3
Creation of new plants: Compartments and assembly lines	34.5	19.9	37.4	24.8	33.2	17.9	36.6	20.5
Training and increasing the qualification of personnel	43.5	29.1	61.0	44.4	39.8	25.4	39.3	20.8

Table 21: Willingness to invest more funds into various aspects of development by business type, % of respondents. Source: BISAM.

Key Threats	A Problem of SMEs	A Particularly Relevant Problem of SMEs
Excessive competition	32	22
Lack of own funds for development	31	19
High taxes	29	17
Low customer demand	23	15
Difficulties in obtaining loans	21	14
Absence of effective government support	19	11
High rates of rental fees	18	10
Frequent supervision by regulatory and tax authorities	14	8
Problems in attracting needed specialists	13	6
Searching for sources of investment	11	6
Lack of necessary equipment	11	4
Problem in realization of produced goods and services	11	7
Lack of funds for modernizing the business	10	5
Instability of regulation of small businesses	10	3
High rental fees	10	7
Unjustifiably high volume of financial reporting required	10	3
Lack of knowledge and skills for development of the business	9	3

Table 22: Key threats and problems of SMEs perceived by respondents (%). Source: BISAM.

Attitude	Percent of Respondents
Contempt and a negative attitude, caused by envy	53
Neutral attitude	20
Positive attitude, combined with a formal declaration of support for the business	12
Negative attitude: Government officials believe that their role is to crack down on entrepreneurs	8
Excessive and total control on the part of the government	5
Positive attitude, combined with real support for business	2

Table 23: Government's attitude towards business as perceived by respondents, %. Source: BISAM.

Familiarity Level	Road Map for Business	Program of Accelerated Industrial-Innovative Development
Know nothing	56	87
Heard something	32	11
Know what it is and what it is for	10	1
Familiar in detail	2	1

Table 24: Familiarity of respondents with government programs supporting SMEs, %. Source: BISAM.

Reasons for Becoming an Entrepreneur	Percentage of Respondents
I became an entrepreneur due to pressuring circumstances	32
I became an entrepreneur, because I find it interesting	30
I became an entrepreneur, because of prestige	7
I became an entrepreneur, because I think it is my life mission	1

Table 25: Reasons for becoming an entrepreneur, reported by respondents, %. Source: BISAM.

8. Conclusions

Since the subprime crisis of 2007-2009, the EU, as well as national governments and central banks, have tried to rescue firms in difficulty. In Poland, commercial banks should support public policies giving these firms a second chance. This will enable the banks to recover part of their debt and maintain their customers.

Restructuring firms can impose on them debts, payment delays, and a loss of market share. Poland needs:

- changes in bankruptcy, recovery and banking laws
- institutions providing organizational and financial support
- specialists in company emergencies
- a center coordinating research, education and scientific information

Compared to Polish SMEs, Kazakhstani firms face more troublesome inspections and over-regulation. They also seem to depend more on government support than Polish businesses do. Entrepreneurs in both countries think that they face keen competition. This perception is a warning signal, given Kazakhstan's accession into the Eurasian Economic Union and the World Trade Organization.

SMEs in Kazakhstan must become more competitive. Although they complain of high taxes, in reality Kazakhstan has a liberal tax regime. Advancing business education and financial literacy may take care of this complaint. In addition, logistical problems are probably more prevalent in Kazakhstan than in Poland, and the country's accession into the WTO and the Eurasian Economic Union will exacerbate them.

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Long-run growth barriers in Kazakhstan: Possible causes and repercussions

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Abstract: *In economics, endogenous growth theory emphasizes the ability to influence the national pace of technological development. Obstacles slowing the rate of innovation in Kazakhstan include low population density, deficient transportation, and income inequality. Solutions include economic diversification, equitable taxation, and regional and global integration.*
Keywords: *Economic growth, infrastructure, institutions, natural resources, spillovers, trust*

1. Introduction

Unlike exogenous neoclassical growth theory, endogenous growth theory argues that long-run economic growth is influenced by internal processes. So it is possible to finance innovations. Paul Romer (1994, pp. 20-2) emphasized policies that will affect discovery, diffusion and technological advance. Creating opportunities for spillovers becomes essential.

In Kazakhstan, however, several factors can block technological advancement and long-run economic growth. One is the country's vast territory; winter transportation is difficult. Air transportation can partly eliminate problems that are due to low population density; but in Kazakhstan, the state has a monopoly on domestic flights. A more important problem is income inequality, which permits a decent environment for innovations in only the two major cities, Almaty and Astana. The country needs policies and improvements in infrastructure, regional integration, and communication.

The political and social environment in Kazakhstan creates disincentives for investment in research, development and diversification. This creates space for profit-seizing techniques, which firms in Kazakhstan value more than innovations. Some business entities (especially small ventures) face costs in shielding themselves from the rent-seeking behavior of their competitors or even of their employees. Usually, this behavior is a consequence of the information available to firms. For example, a firm knows that its cashier may take advantage of it, so it adds monitoring devices. This cuts the resources available for research and development. Perhaps weak institutions account for this problem. So might another barrier: the lags in global integration that stem from the loss of intangible assets, from questionable trust, and from over-reliance on physical resources.

2. Spillover effects

The vast territory of Kazakhstan may discourage spillovers that lead to long-run economic growth. With poor communication, roads and income distribution, Kazakhstan is left with only the two big cities where everything "boils." Government investment in human capital and innovation becomes complicated because the income gap between big cities and small ones is huge. In addition, the lack of incentives to travel to small cities may prevent beneficial

spillovers.

High inequality can reduce growth for several reasons. In an unequal society with imperfect capital markets, many talented people lack access to capital or education, resulting in individual poverty traps (Guriev et al., 2009, p. 9). The already small population, spread across an enormous territory, is trapped, as movement is not completely free. Rapid innovation occurs only when people can interact easily. As Romer pointed out, technological advance comes from the things people do. "When more people start prospecting for gold or experimenting with bacteria, more valuable discoveries will be found. There are monopoly rents on discoveries. People and firms have some control over the information produced by most discoveries; therefore they can charge prices higher than zero if they have a control over the access to a discovery. As information has no opportunity cost, the firm enjoys monopoly profits" (Romer, 1994, pp. 12-13). There are incentives to conduct research and organize development. In Kazakhstan, however, the incentives are obstructed and misguided.

3. Impact of weak institutions

May poor countries eventually converge with rich ones in terms of per capita income? This depends on whether they can absorb technological advancements of rich countries and maintain higher returns to capital. These conditions depend in turn on political and economic institutions. If these are weak, investors will under-invest because they fear expropriation. But good institutions will raise the private return to investment and innovation. They are critical to long-term growth (Guriev et al., 2009, p.8).

North (1990) stated that institutions are formal and informal constraints on political, economic and social interactions. In this respect, Kazakhstan could improve. The social aspects of doing business and of investing are far from ideal; the post-Soviet atmosphere and unreliable governance have created an economy in which trust plays a minor role.

Inefficiency and disturbance of long-run growth are just one side of the coin. The other side, as Aghion et al. (2010) suggest, is that countries lacking trust and civic capital may produce businesses that do not consider themselves constrained by civic norms. Regulation restricts entry. The regulators do not consider themselves constrained, either; they allow entry in exchange for bribes, which are paid by businessmen who do not consider this a violation of a norm. The population knows of the corruption but demands regulation anyway since large bribes deter some businesses from entry. In such societies, not being civic pays off, and children learn this "optimal" behavioral strategy from their parents. If trust erodes, transaction costs for businesses will rise. People will spend more time choosing the person (or firm) with whom to do business, to avoid being taken advantage of. This blocks long-term growth and investment in innovation.

To compensate for the lack of transparency, the state invests in "social happiness," generated by such factors as entertainment, national identity and pride. This is easier to do than to completely restructure moral behavior by creating institutions.

Let's turn to a related question. Kazakhstan survives on its revenues from natural resources. Is possessing resources a curse?

4. Emergence of weak institutions and resource curse

Kazakhstan's government relies on resource revenues rather than on conventional taxes. This reduces the incentives for governments to seek popular support for spending. In turn, this creates undemocratic conditions, corruption, and a lack of accountability (Pomfret, 2006, pp. 94-95; Pomfret, 2011, p. 148). Kazakhstan is a transition economy starting from scratch, with no initial institutions. Resources might have been a blessing had they been discovered while strong institutions were present. Williamson (1990) argued that it had been a huge blunder to fail to create economic institutions at the beginning of the transition. In addition, Guriev et al. (2009, p. 8) contended that weak initial institutions increased rent extraction, slowing economic growth.

Natural resource exports may come at the expense of the manufacturing sector (Corden and Neary, 1982) -- the famous Dutch Disease.[20] If manufacturing increases through "learning by doing," product quality improvements, and through discovery of products, then the disease can depress long-term growth. Moreover, the presence of commodity resources may create disincentives to investment that create the resource curse (Guriev et al., 2009, p. 6).

Is the curse impossible to defeat? "Resource booms can be harmful (Sachs and Warner, 1995), but this is not inevitable" (Pomfret, 2005, p. 863). The example of Georgia shows that Kazakhstan is not doomed. Guided by Kakha Bendukidze, Georgia managed a politically painful elimination of government regulation and introduction of economic freedom, creating a business environment with considerable trust (Sonin, 2012, p. 9).

5. Conclusions

For steady economic growth and for convergence to a Western level of income per capita, reformers in Kazakhstan should target three issues: Diversification, taxation, and global and regional integration.

Vertical diversification implies direct government investment or preferential treatment of firms, which shows willingness to create higher-value-added goods (that is, to expand the production chain). Studies suggest that the sophistication of export products predicts higher economic growth (Hausmann et al., 2007). If raw materials are used to create something more complicated, then the export based economy should shield the country from volatile commodity prices and boost long-run growth. Policies to improve the business environment and to direct the investment flows of micro firms in the right direction include improvements in property rights protection, contract enforcement and financial regulation, investment in education and infrastructure, and broad support for financial development.

Guriev et al. (2009, p. 13) argued that infrastructure and education are feasible even with weak institutions. But these can be strengthened by growth of the middle class, better corporate governance, and by external sources (p. 38). By institutions, I mean the rules of the business game within the country. By changing the rules, the government can accelerate economic growth. Institutions may evolve more rapidly than before, due to pressure from a stronger middle class and from foreign firms that operate in Kazakhstan.

Improvements in tax collection will increase demand for a responsible government,

[20] The term was coined in 1977 by *The Economist* to describe the decline of manufacturing in the Netherlands after the discovery of a large natural gas field in 1959.

especially from the middle class. If the tax price of government services increases, citizens may demand better services. Tax increases may slow private investment by reducing the after-tax return; but they would also encourage public spending on human capital, infrastructure and financial development.

Guriev et al. (2009, p. 15) maintained that in developing countries progressive taxation does not work because the rich can avoid taxes. The quality of institutions plays a crucial role; for resource-rich Kazakhstan the need for higher taxes and better institutions (to reduce tax evasion) is low because the country enjoys export revenues from commodities.

Regional integration can induce innovative spillovers.

Although reputation is an intangible asset, it can depreciate. For example, Kazakhstan's attempts to seize profits from foreign oil companies have damaged the country's reputation, discouraging foreign investment (Pomfret, 2005; Pomfret, 2011, p. 152). What should be targeted is improvement of the business environment for foreign firms. This will accelerate global integration, and it will set new innovative standards for firms.

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