Luigi Paganetto *Editor*

Getting Globalization Right

Sustainability and Inclusive Growth in the Post Brexit Age

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ISBN 978-3-319-97691-4 ISBN 978-3-319-97692-1 (eBook)
https://doi.org/10.1007/978-3-319-97692-1

Library of Congress Control Number: 2018951203

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Contents

Global Implications of U.S. Trade Policies for Reducing Structural Trade Imbalances

D. Salvatore and F. Campano

Abstract The aim of this research is to assess the international transmission of trade policies originating in the United States to its major trading partners, most of whom are members of the G20. We began by estimating twenty-one macroeconomic models of the G20 based on the national accounts (by expenditure) from the United Nations Statistical Department. The baseline scenario is based upon a Harrod-Domar model on the supply side and demand equations for household consumption, government and imports. A 21 by 21 world trade matrix was constructed from the bilateral export data also produced by the UN statistical department. This provided a mechanism to estimate the exports of the national and regional models from the trade shares. Based on the new exports, GDP is re-summed and the demand side of the economy is re-estimated. This is continued until the system convergences. The final estimates and the baseline estimates are compared to give an estimate of the impact of the change resulting from the assumptions corresponding to the import policy.

Keywords Harrod-Domar model · Trade matrix · Basic scenario · U.S. import policy · International transmission of trade policies

1 Introduction

In the United States, the share of imports in GDP has been annually higher than the corresponding share of exports in GDP for decades (Fig. 1). Over the period 2000–2015, the average trade deficit was 3.87% of GDP, with no sign of improvement. One way to reduce the national debt, is to reduce the external deficit and that can be done either by reducing imports or increasing exports (or some combination of both). Most developing Asian countries have been successful in narrowing their

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L. Paganetto (ed.), *Getting Globalization Right*,
https://doi.org/10.1007/978-3-319-97692-1_1

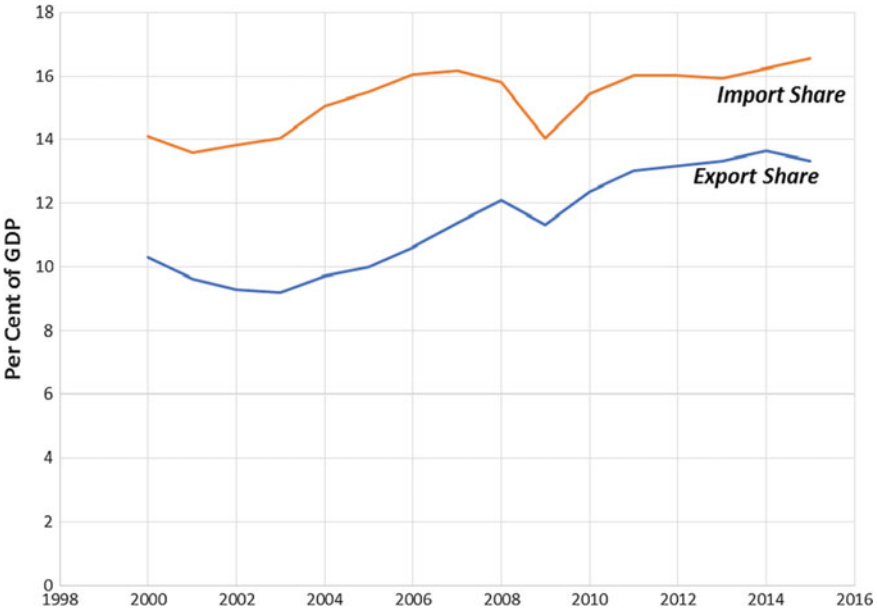

Fig. 1 U.S. trade shares in GDP, 2000–2015

external deficit by following the post-war Japanese model of export promotion, while developing countries elsewhere did not do as well with import substitution policies. However, part of the reason why import substitution policies have not worked in the past in developing countries is the delay it takes to develop a comparative advantage when the country lacks the technologies of the more advanced countries. So, the question arises what happens if the United States (which has the most advanced technology at its disposal) practices import substitution?

In this paper, we will simulate some of the results for the United States and its major trading partners in the G20, if the United States reduced its imports. To this end, four scenarios are estimated, namely: (1) a baseline scenario which is a continuation of the 2000–2015 trends without any intervention on imports; (2) a non-discrimination scenario where the US reduces its total import demand by 30%; (3) a discrimination scenario where the US reduces its imports by 30% only from China, Germany and Mexico (the nations with which the United States has the largest trade deficit), and (4) the same discrimination scenario as above, but in which China, Germany and Mexico retaliate by reducing their imports from the United States by 30%.

2 The Methodology

For each of the countries of the G20 a model to project the national accounts expenditure table to the year 2018 is estimated. This includes the rest of the European Union (those members of the EU not included in the G20) as a group and the rest of the world in another aggregate group. The rest of the world is an aggregation of 166 countries, but which only accounts for 15.4% of the US imports. Canada alone accounts for 15.1% of US imports, China for 19.8%, Mexico 14.9% and Germany 6.1%. The rest of the EU accounts for 6.6%. The remaining 22.0% comes from the other members of the G20. These figures are based upon the bilateral trade data for 2015 supplied by the United Nations Statistical Division. We also used the bilateral export data to construct a 21 by 21 trade share matrix in which the columns are the trade shares in the imports of the 21 countries and groups. When the matrix is multiplied by the vector of total import demand of the 21 countries (and groups), the vector of exports allocated to each country (or group) is obtained.

The expenditure models consist of a Harrod-Domar production function and three demand equations driven by the projected GDP for each country (Van den Berg 2013; Gana et al. 2013). These are used to obtain household consumption, government expenditure and imports. As mentioned above, exports are determined by the trade matrix shares. Investment shares in GDP are exogenous and based on the average shares from 2000 to 2015. The estimated parameters for each country (and group) are shown in the appendix.

3 The Baseline Projection

GDP is projected using the Harrod-Domar model. No assumption is made of any change in trade policy in the United States or anywhere else. Table 1 shows the projections for the United States in levels (in 2005 U.S. dollars) and each expenditure component as a share of GDP. The projected growth rate which is based on the estimated Harrod-Domar parameters is 1.65% per annum. The share of net exports in GDP shows a tendency to decline slightly from a negative 3.6% in 2016 to negative 3.3% in 2018. A summary of the rest of the countries (and groups) for the baseline is shown in Table 2. One of the goals of the new administration is to raise the growth rate from 1.65% to above 3%. We will see in the other scenarios how much the growth rate will change when the assumptions of each scenario are simulated.

4 Scenario 1: 30% Reduction in Imports—No Discrimination

In this scenario, we assume that the United States can successfully reduce its imports by 30%. It manages to do this by import substitution and by increasing domestic

Table 1 Baseline scenario—historical and projected U.S. expenditure variables (levels in millions of 2005 U.S. dollars)

t	Y	C	G	I	X	M
2000	11,553,316	7,537,905	1,766,932	2,685,143	1,191,944	1,628,608
2001	1,166,6074	7,728,087	1,829,451	2,568,647	1,122,299	1,582,410
2002	11,874,444	7,927,027	1,900,210	2,584,667	1,102,948	1,640,408
2003	12,207,733	8,177,153	1,934,392	2,687,434	1,122,403	1,713,649
2004	12,669,888	8,494,837	1,964,330	2,888,042	1,231,867	1,909,188
2005	13,093,720	8,794,100	1,980,050	3,040,750	1,308,900	2,030,080
2006	13,442,886	9,060,970	2,001,853	3,111,320	1,427,163	2,158,420
2007	13,681,971	9,263,160	2,029,793	3,042,408	1,559,407	2,212,797
2008	13,642,076	9,238,330	2,081,207	2,829,860	1,648,857	2,156,178
2009	13,263,437	9,108,828	2,159,172	2,351,843	1,503,855	1,860,261
2010	13,599,256	9,275,229	2,161,648	2,576,443	1,682,737	2,096,801
2011	13,817,045	9,475,817	2,104,292	2,650,459	1,798,017	2,211,540
2012	14,124,336	9,605,853	2,085,790	2,834,082	1,859,463	2,260,852
2013	14,334,721	9,763,844	2,033,852	2,910,167	1,911,483	2,284,625
2014	14,701,679	1,013,208	2,021,736	3,046,703	2,006,358	2,386,325
2015	15,083,356	10,331,038	2,054,909	3,184,503	2,008,557	2,495,650
2016	15,332,549	10,362,811	2,162,800	3,350,929	2,029,853	2,573,844
2017	15,585,858	10,534,016	2,182,209	3,406,289	2,103,725	2,640,380
2018	15,843,353	10,708,048	2,201,939	3,457,891	2,183,490	2,708,016
Shares of GDP						
2007	100.0	67.7	14.8	22.2	11.4	16.2
2008	100.0	67.7	15.3	20.7	12.1	15.8
2009	100.0	68.7	16.3	17.7	11.3	14.0
2010	100.0	68.2	15.9	18.9	12.4	15.4
2011	100.0	68.6	15.2	19.2	13.0	16.0
2012	100.0	68.0	14.8	20.1	13.2	16.0
2013	100.0	68.1	14.2	20.3	13.3	15.9
2014	100.0	68.1	13.8	20.7	13.6	16.2
2015	100.0	68.5	13.6	21.1	13.3	16.5
2016	100.0	67.6	14.1	21.9	13.2	16.8
2017	100.0	67.6	14.0	21.9	13.5	16.9
2018	100.0	67.6	13.9	21.9	13.8	17.1

Table 2 Baseline expenditure projections for 2018 (in millions of 2005 U.S. dollars)

	Y	C	G	I	X	M
USA	15,843,353	10,708,049	2,201,939	3,457,891	2,183,490	2,708,016
China	7,697,523	2,837,647	1,230,870	3,614,998	2,531,987	2,517,979
Canada	1,459,205	827,011	294,262	342,144	544,616	548,828
Japan	5,150,134	2,898,536	998,695	1,100,294	957,816	805,206
Germany	3,403,903	1,807,810	636,971	649,361	1,838,454	1,528,692
France	2,478,169	1,374,338	596,983	589,611	728,765	811,528
United Kingdom	2,958,074	1,868,276	602,283	566,405	834,645	913,534
Italy	1,819,686	1,087,907	357,890	304,793	529,466	460,371
Rep. of Korea	1,426,562	663,932	206,603	457,973	763,454	665,401
India	2,087,784	1,129,056	207,720	825,451	551,097	625,540
Argentina	307,929	210,661	34,924	68,373	59,197	65,226
Australia	1,082,979	617,402	187,021	332,516	275,687	329,647
Brazil	1,245,463	811,883	220,333	259,511	237,629	283,893
Indonesia	618,364	370,826	55,711	151,115	228,624	187,911
Mexico	1,171,674	799,504	125,654	263,848	403,713	421,044
Russian Fed.	1,081,882	597,138	148,417	275,365	422,368	361,406
Saudi Arabia	541,135	169,637	138,868	158,960	318,610	244,940
South Africa	366,629	232,419	78,225	76,827	100,990	121,832
Turkey	797,567	545,719	104,942	160,899	203,766	217,759
EU rest	586,2478	3,088,869	1,222,979	1,386,835	3,424,009	3,260,215
Residual	7,768,589	4,419,584	1,056,495	2,070,814	4,606,436	4,384,740

investment in some of the industries, such as the shoe industry or the automobile industry, where at one time the US was self-sufficient but has since lost a good share of the domestic market to globalization. The revival of these industries is done without the intention of targeting any other nations exports to the United States—it is simply a reduction of the total imports to the United States by modernizing the selected industries. In such a case, we will assume all other countries will have the same share of total US imports as in the baseline, but the total imports will be lower. When we iterate this scenario to convergence, we get the result as shown in Table 3.

For the United State, GDP rises to $16,806,629 million as compared with $15,843,353 million in the baseline. This is about 6.1% higher for GDP, household consumption and investment. The larger GDP implies more government spending (both federal and state). However, the convergence levels only reduce imports by 23.5%, not the full 30% as targeted. Furthermore, exports are also reduced by 27.4%.

Table 3 Scenario 1: 30% reduction in U.S. imports in 2018, with no discrimination (in millions of 2005 U.S. $)

	Y	C	G	I	X	M
USA	16,806,629	11,359,098	2,275,747	3,668,131	1,584,642	2,072,726
China	8,491,383	3,120,653	1,335,805	3,987,819	2,842,142	2,789,489
Canada	1,275,051	722,641	254,708	298,965	444,537	445,396
Japan	5,279,774	2,953,216	1,031,669	1,127,991	1,021,714	853,505
Germany	3,625,411	1,874,497	680,643	691,617	2,169,117	1,791,066
France	2,321998	1,287,729	548,198	552,455	624,753	690,747
United Kingdom	2,328,318	1,470,531	472,421	445,820	580,447	639,859
Italy	2,081,875	1,213,326	381,924	348,709	713,918	575,618
Rep. of Korea	1,546,951	708,496	225,877	496,622	862,345	746,167
India	1,298,597	718,425	135,215	513,429	281,747	349,591
Argentina	345,690	236,494	39,408	76,758	71,011	77,789
Australia	1,022,151	582,724	176,499	313,839	247,570	298,149
Brazil	1,213,895	791,304	215,511	252,934	224,318	269,816
Indonesia	660,261	394,916	59,875	161,353	246,714	202,198
Mexico	1,144,463	780,936	122,879	257,720	388,404	405,164
Russian Federation	1,260,557	695,757	158,933	320,842	552,140	466,859
Saudi Arabia	506,192	158,683	128,046	148,695	291,705	220,830
South Africa	300,742	190,651	61,461	63,020	74,772	89,027
Turkey	711,079	488,330	93,289	143,451	175,537	189,100
EU rest	6,156,6752	3,228,218	1,289,393	1,456,449	3,751,854	3,569,672
Residual	8,406,414	4,782,446	1,145,123	2,240,834	5,074,676	4,834,427

Overall, the trade gap is reduced from −$524,525 to –$488,084 million. Hence the foreign deficit is reduced from 3.3 to 2.9%. Hence, this outcome would be beneficial for the United States.

Since we are assuming that trade shares do not change, those countries which send a large proportion of their total exports to the United States will be affected the most by the reduction in total U.S. imports. These include Canada whose proportion of exports to the US is 76.8% and Mexico whose exports to the US is 81.2% of its total. China's exports to the United States are only 18% of its total and Germany exports only 9.6% of its total exports to the United States. As a result of this scenario, Canada's GDP decreases by 12.6% as compared to the baseline and Mexico's GDP decreases by 2.3%. On the other hand, both China's and Germany's GDP increase over the baseline by 10.3% and 6.5%, respectively. The United Kingdom, which sends 16.6% of its exports to NAFTA, faces a 21.3% decline in its GDP relative

to the baseline. The lowering of the U.K.'s GDP causes a lowering of its import demand, so that countries such as Australia and India which depend on the U.K.'s imports are affected negatively. Italy, which sends 8.7% of its exports to the United States and 12.3% of its exports to Germany, experiences a GDP growth of 14.4% over the baseline. France's GDP, on the other hand, decreases 6.3% relative to the baseline.

5 Scenario 2: The United States Reduces Its Import Share from China, Mexico and Germany, and These Countries Do Not Retaliate

In this scenario (Table 4), we simulate the result if the United States reduces its import share from China, Mexico and Germany by 30% and these countries do not retaliate. Such an action causes the GDP of the United States to increase by about 0.7% and, as a result, its total imports will not be lower, but increase by about 1%. However, the amounts imported from China, Germany and Mexico decrease by 30%. Net exports as a percentage of GDP remains above 3%, which is slightly lower than the baseline. The resulting change in GDP relative to the baseline for China would be −2.7%, for Germany −0.1% and for Mexico −13.7%. Canada would benefit with an increase of exports to the United States of 16.6%.

6 Scenario 3: The United States Lowers Imports from China, Mexico and Germany by 30%, and These Countries Retaliate

This scenario is similar to scenario 2 above, but in this case China, Germany and Mexico retaliate by also reducing their import share from the United States by 30%. In this case, the total exports of the United States decrease from $2,219,551 to $2,054,775 million, or by 7.4%. This causes a lower GDP and lower total imports for the United States. Now net U.S. exports as a percentage of GDP remain above 3% of GDP. Furthermore, the level of GDP is 2.8% lower than the baseline projection for the United States, 1.7% lower than the baseline for China, and 15.4% lower than the baseline for Mexico. On the other hand, Germany's GDP is 0.5% higher than under the baseline projection and Canada's 8.7% higher (Table 5).

7 Conclusions

Our model indicates that the United States can reduce its trade imbalance, but it should not try to reduce it by using protectionist policies. Targeting major trading

Table 4 Scenario 2: the United States lowers imports from China, Mexico and Germany by 30%, with no retaliation (in millions of 2005 U.S. dollars)

	Y	C	G	I	X	M
USA	15,947,674	10,778,556	2,209,932	3,480,659	2,219,551	2,735,417
China	7,492,019	2,764,386	1,203,706	3,518,487	2,457,230	2,447,694
Canada	1,624,238	920,544	329,709	380,8,,40	635,115	641,521
Japan	5,248,291	2,939,937	1,023,661	1,121,265	1,006,264	841,776
Germany	3,402,123	1,807,274	636,620	649,021	1,835,233	1,526,584
France	2,517,350	1,396,066	609,223	598,933	755,343	841,830
United Kingdom	3,060,840	1,933,181	623,474	586,082	877,674	958,193
Italy	1,850,955	1,102,865	360,757	310,030	551,663	474,115
Rep. of Korea	1,455,863	674,779	211,294	467,380	787,638	685,059
India	2,177,689	1,175,835	215,979	860,997	583,086	656,976
Argentina	314,205	214,954	35,669	69,767	61,279	67,314
Australia	1,093816	623,580	188,896	335,843	281,074	335,258
Brazil	1,264,929	824,572	223,306	263,568	246,389	292,573
Indonesia	641,612	384,193	58,022	156,796	238,778	195,839
Mexico	1,011,033	689,889	109,272	227,673	311,694	327,298
Russian Federation	1,098,191	606,140	149,377	279,516	434,359	371,032
Saudi Arabia	554,335	173,775	142,956	162,837	328,916	254,048
South Africa	376,289	238,543	80,682	78,851	105,023	126,641
Turkey	818,941	559,902	107,821	165,211	211,346	224,842
EU Rest	5,967,031	3,138,378	1,246,575	1,411,569	3,540,290	3,370,162
Residual	7,982,312	4,541,173	1,086,193	2,127,784	4,764,343	4,535,422

partners with quotas can lead to negative results for all parties concerned. This is especially true for countries like Canada and Mexico whose exports to the United States are the bulk of their exports. China and Germany spread their exports more globally, and are not as dependent on their exports to the United States, as Canada and Mexico do. Consequently, import sanctions against them do not disrupt their economies as much as sanctions against the NAFTA partners. Nevertheless, sanctions against China and Germany do not help the U.S. situation because it is unlikely that these nations would not retaliate, and this could hurt the United States more than hurt them. A better approach for closing the U.S. trade gap is to revitalize those industries that it has given up decades ago. To do this, it would be necessary to produce the products that the United States now imports more efficiently than the countries that are exporting them to the United States. This implies a technological update which lowers domestic costs for products that are more in line with tastes of

Table 5 Scenario 3: the United States lowers imports from China, Mexico and Germany by 30%, and they retaliate (in millions of 2005 U.S. dollars)

	Y	C	G	I	X	M
USA	15,395,565	10,405,402	2,167,628	3,360,159	2,054,775	2,590,396
China	7,567,003	2,791,118	1,213,617	3,553,701	2,483,909	2,473,339
Canada	1,585,670	898,685	321,425	371,797	613,852	619,858
Japan	5,271,608	2,949,772	1,029,592	1,126,246	1,017,037	850,463
Germany	3,420,899	1,812,927	640,322	652,603	1,863,103	1,548,824
France	2,534,605	1,405,636	614,613	603,039	766,700	855,175
United Kingdom	3,080,806	1,945,791	627,591	589,905	885,002	966,870
Italy	1,861,893	1,108,097	361,759	311,863	559,239	478,923
Rep. of Korea	1,474,204	681,568	214,231	473,267	802,648	697,362
India	2,192,293	1,183,434	217,321	866,771	587,437	662,083
Argentina	317,804	217,417	36,097	70,566	62,319	68,512
Australia	1,106,347	630,724	191,064	339,691	286,812	341,747
Brazil	1,274,993	831,132	224,843	265,664	250,596	297,060
Indonesia	648,370	388,079	58,693	158,448	241,476	198,143
Mexico	991,561	676,602	107,286	223,288	300,421	315,934
Russian Federation	1,108,897	612,049	150,007	282,241	442,057	377,350
Saudi Arabia	561,236	175,939	145,093	164,865	334,220	258,809
South Africa	379,783	240,758	81,571	79,584	106,337	128,381
Turkey	828,861	566,484	109,158	167,212	214,370	228,129
Eurest	6,018,581	3,162,789	1,258,209	1,423,763	3,597,871	3,424,371
Residual	8,083,556	4,598,770	1,100,261	2,154,772	4,837,845	4,606,801

U.S. consumers. This can be done for consumer goods, investment goods as well as for energy products (i.e. solar panels, wind turbines and shale oil). Likewise, more export promotion of U.S. services and less dependence on foreign suppliers would help. Once the domestic industries become lower-cost and more efficient producers, they would be able to compete in the global market place and the U.S. trade imbalance will naturally improve and correct itself.

Appendix

See Tables 6 and 7.

Table 6 Production function parameters

Country	ICOR	I/Y	Growth rate
United States	13.20	21.83	1.65
China	4.63	46.96	10.13
Canada	12.15	23.45	1.93
Japan	24.65	21.36	0.87
Germany	16.91	19.08	1.13
France	22.27	23.79	1.07
UK	12.01	19.15	1.59
Italy	16.75	16.75	1.00
R. Korea	8.21	32.10	3.91
India	5.22	39.54	7.57
Argentina	5.73	22.20	3.87
Australia	10.54	30.70	2.91
Brazil	6.37	20.84	3.27
Indonesia	4.42	24.44	5.53
Mexico	9.64	22.52	2.34
Russia	6.47	25.45	3.93
Saudi Arabia	6.92	29.38	4.24
South Africa	6.60	20.96	3.17
Turkey	4.54	20.17	4.45
EU Rest	17.90	23.66	1.32
Residual	6.24	26.66	4.27

Table 7 Demand functions' parameters[a]

Consumption			Government		Imports	
Country	Intercept	MPC/APC	Intercept	Slope	Intercept	Slope
U. States	0	0.6758701	987,989.3	0.076622	−1,453,526.3	0.262668
China	93,534.05	0.356493	213,388.03	0.132183	−114,674.05	0.342013
Canada	0	0.5667544	−19,156.5	0.24787	−270,749	0.56166
Japan	72,6250.1	0.421792	−311,247	0.254351	−1,113,559	0.372566
Germany	783,023.8	0.301062	−341,35.8	0.197158	−2,503,200.5	1.184491
France	0	0.5545778	−177,162	0.312386	−1,105,061	0.773389
UK	0	0.6315852	−7,698.97	0.206209	−371,965	0.434573
Italy	217,457	0.478352	191,086.9	0.091666	−339,483	0.439556
R. Korea	135,878.6	0.3701585	−21,786.4	0.160098	−291,638	0.670871
India	42,737.88	0.520321	−15908.64	0.091873	−104,479	0.349662
Argentina	0	0.6841216	−1,643.22	0.118752	−37,218.9	0.332691
Australia	0	0.570096	−323.22	0.17299	−231,136	0.517815
Brazil	0	0.6518723	30103.39	0.1527377	−271,468	0.4459071
Indonesia	15,271.93	0.5749909	−5749.09	0.0993916	−22,949.7	0.340998
Mexico	0	0.6823603	−6168.66	0.101978	−262,715	0.5835741
Russia	0	0.5519442	84,743.17	0.058855	−277,115	0.590195
Saudi Arabia	0	0.3134842	−28,722	0.3097	−128,431	0.689977
South Africa	0	0.6339345	−15,058	0.254433	−60,708.3	0.497887
Turkey	16,496.38	0.663546	−2,517.85	0.134734	−46,526.9	0.331365
Rest of EU	312,792.2	0.473533	−100,118	0.225689	−2,904,732	1.051594
Residual	0	0.5689044	−22,981.7	0.138954	−1,092,364	0.705032

[a]R-squares and t statistics furnished upon request

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The Dutch Disease in Reverse: Iceland's Natural Experiment

Thorvaldur Gylfason and Gylfi Zoega

Abstract For a long time, abundant natural resources brought Iceland a high and volatile real exchange rate with adverse effects on manufacturing and services. During 2003–2008, another national treasure, the sovereign's AAA rating, was used by privatized banks to attract foreign capital, elevating the real exchange rate even further. The financial collapse and the associated collapse of the currency in 2008 left the country with a large foreign debt which offset some of the effect of the natural resources on the real exchange rate. In effect, this was the Dutch disease in reverse as witnessed, in particular, by a massive increase in the number of tourists following the financial collapse. This paper discusses the behavior of the exchange rate of the Icelandic króna before and after 2008 as well as its relationship to natural resources, capital flows, output, exports and imports, including tourism.

Keywords Natural resource curse · Dutch disease · Financial crisis

JEL Classification F41 · O23 · O33

Gylfi Zoega—Member of the Monetary Policy Committee of the Central Bank of Iceland. We thank Benedikt Goderis, Gylfi Magnússon, Fredrick Van der Ploeg, Hamid Raza, Ron Smith and Ragnar Torvik for helpful comments on earlier versions of this paper and also Yu-Fu Chen for his comments as well as research assistance. The views expressed are our own and do not necessarily reflect the views of the Central Bank of Iceland. An earlier version of the paper appeared as OxCarre Research Paper 138, Oxford Centre for the Analysis of Resource Rich Economies, Oxford University, May 2014.

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L. Paganetto (ed.), *Getting Globalization Right*,
https://doi.org/10.1007/978-3-319-97692-1_2

Rarely does the opportunity arise for economists to revisit their theories using data from natural experiments. The recent economic history of Iceland offers such an opportunity. We refer to the literature, relaunched by Sachs and Warner (1995), on various aspects of the potentially adverse effects of natural resource discoveries on employment and investment as well as on economic growth. The inverse cross-country relationship between natural resources and growth has been broadly confirmed in several studies[1] while questioned by others.[2]

The literature on the macroeconomic consequences of natural resources highlights several channels through which economic growth can be retarded. These include rent seeking,[3] the Dutch disease,[4] poor governance,[5] political or ethnic conflict,[6] corruption,[7] autocracy,[8] excessive borrowing[9] and low levels of education.[10] Ross (2011), van der Ploeg (2011), Frankel (2014) and Venables (2016) survey the literature.

If learning-by-doing occurs mostly in the secondary (i.e., manufacturing and services) export sector and not in the primary (i.e., natural-resource-based) sector, a large and volatile primary sector will adversely affect the production of tradable goods by increasing real wages and the real exchange rate, lowering the relative price of tradable goods (i.e., exports and import-competing goods) and hampering employment, investment and growth.[11] Insofar as the trouble with abundant natural resources has to do with the real appreciation of the currency, the depreciation resulting from the sudden stop of a capital inflow and a financial crash can be viewed as a bout of the Dutch disease in reverse.

Recent events offer us an opportunity to reassess the validity of this thesis. It has for some time been well understood that foreign aid shares an important property with natural resource discoveries in that aid constitutes an unrequited transfer emerging like manna from heaven.[12] In the past, aid-receiving countries such as Zambia have seen their currencies appreciate as a result of aid inflows. Further, like resource windfalls, aid inflows have about them an aura of 'other people's money' which,

[1] See, e.g., Sachs and Warner (2001), Gylfason and Zoega (2006), Collier and Goderis (2012) and Sala-i-Martin and Subramanian (2013).

[2] See Brunnschweiler and Bulte (2008), Lederman and Maloney (2008), Alexeev and Conrad (2009) and James (2015).

[3] See Paldam (1997), Tornell and Lane (1999), Auty (2001), Mehlum et al. (2006a, b) and Robinson et al. (2006).

[4] See Corden (1984), Corden and Neary (1982), Van Wijnbergen (1984) and Herbertsson et al. (2000).

[5] See Baland and Francois (2000), Tornell and Lane (1999), Torvik (2002), and Boschini et al. (2007).

[6] See Easterly and Levine (1997) and Hodler (2006).

[7] See Arezki and Brückner (2011) and Arezki and Gylfason (2013).

[8] See Ross (2001), Collier and Hoeffler (2009) and Tsui (2011).

[9] See Mansurian (1991) and Manzano and Rigobon (2007).

[10] See Gylfason (2001).

[11] See Gylfason and Zoega (1999).

[12] See Younger (1992), Burnside and Dollar (2000), Svensson (2000) and Djankov et al. (2008) and also Deaton (2013, Chap. 7).

like lottery winnings, as well as due to their transitory and often volatile nature, may seem easier to fritter away than one's own hard-earned incomes. This may explain why natural resource abundance does less harm to growth in democracies with good policies than elsewhere (Burnside and Dollar 2000).[13]

Reputation mining as described by Akerlof and Shiller (2015) can be viewed the same way as other forms of resource depletion. During exuberant credit booms inflows of foreign credit can exert a similar manna-from-heaven effect on its recipients as resource windfalls and foreign aid.[14] Admati and Hellwig (2013, Chap. 9) describe the considerable hidden subsidies that banks deemed too big to fail extract from taxpayers through implicit or explicit government guarantees. With its gross foreign debt rising from 100% of GDP in 2002 to nearly 700% in mid-2008, Icelandic banks, aided and abetted by the government, used the sovereign's AAA rating to attract huge private capital inflows during 2003–2008 in the wake of their privatization of 1998–2003 followed by a sudden stop and a subsequent capital outflow.[15,16] The inflows, mostly in the form of short-term bank credits, were accompanied and, indeed, spurred by a persistent, policy-induced appreciation of the currency intended to keep a lid on domestic inflation through a high-interest-rate policy aiming also to attract foreign funds. While earlier work showed how abundant natural resources (or, specifically, a heavy reliance on natural resources) had the effect of slowing down investment and growth (Gylfason and Zoega 2006), recent events offer an opportunity to analyze the effects of a capital outflow that offset the effects of the primary sector on the real exchange rate as well as on secondary output and growth by reversing the earlier appreciation of the currency.

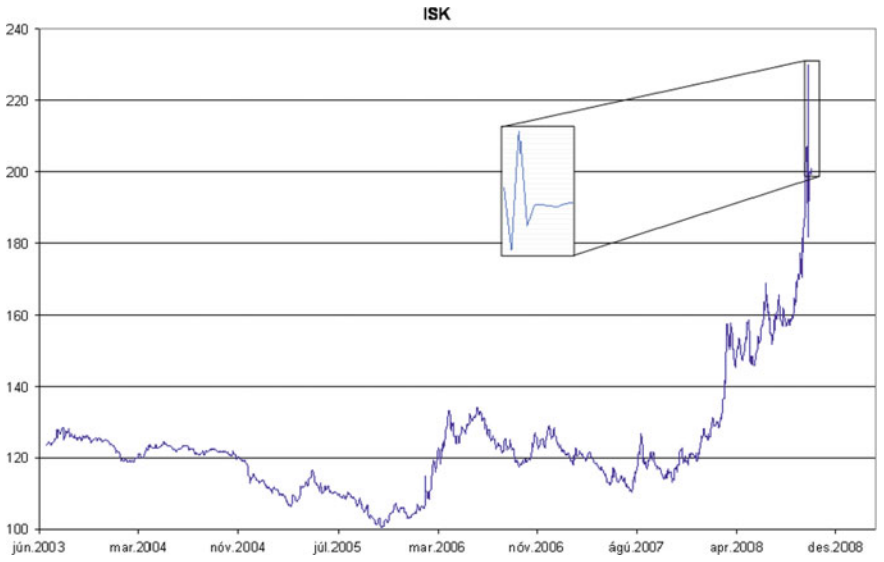
Figure 1 shows the evolution of the nominal (trade-weighted) exchange rate, defined as the domestic currency price of foreign currency so that an increase in the index indicates depreciation. The gradual appreciation of the Icelandic króna until 2008 was interrupted in the spring of 2006 when the capital inflow stopped briefly, and was reversed in the spring of 2008 when the capital inflow suddenly turned into an outflow, followed by a collapse in October 2008. The sudden stop was triggered by the world financial crisis, in particular the collapse of Lehman Brothers. The collapse wiped out the foreign currency market by bankrupting all market participants; hence the exchange rate series in Fig. 1 terminates in October 2008. Before and after the crash, the burden of the large foreign debt lowered the exchange rate by a half in

[13] Gylfason and Zoega (2003) and Goderis and Malon (2011) consider the relationship between natural resources and inequality.

[14] Benigno and Fornaro (2014) use the term 'financial resource curse' to describe episodes of abundant access to foreign capital coupled with weak productivity growth.

[15] See Gylfason et al. (2010), Benediktsdottir et al. (2011), Johnsen (2014) and Gylfason (2015, 2016).

[16] See Calvo (1998) and Calvo et al. (2004) on how a sudden stop in international credit flows may cause financial and balance-of-payments crises. Calvo and Reinhart (2000) recommend dollarization as a way to eliminate the problems caused by the sudden reversal of capital inflows. Calvo (2007) argues that emerging economies should intervene in the credit market rather than relying solely on interest rates as a policy tool to reduce the likelihood of a sudden stop. Lane and Milesi-Ferretti (2008) discuss the impact of capital inflows on domestic variables.



Source: Central Bank of Iceland.

Fig. 1 Evolution of the nominal exchange rate 2003–2008

nominal terms and a third in real terms,[17] offsetting some of the adverse effects of the primary sector on employment, investment and output in the secondary (i.e., non-primary) sector.

Our main aim here is to use Iceland's recent experience to illustrate the strong relationship between the real exchange rate and the current account of the balance of payments, a relationship that 'elasticity pessimists' have often questioned. A subsidiary aim is to show how volatility in primary (i.e., natural-resource-based) exports as well as in foreign capital flows makes exchange rates volatile and thereby also other macroeconomic variables that depend on exchange rates. We do this by drawing a parallel between the way in which the exploitation of natural resources as well as of Iceland's high credit rating before the 2008 collapse increased the recorded value of the Icelandic króna and the way in which the collapse of the credit rating in 2008 (as if fish stocks had collapsed!) led to a sudden collapse also of the króna, which in turn facilitated a recovery of employment, investment and output. By 2016, output was at last restored to its 2007 level in terms of purchasing-power-parity-adjusted US dollars per capita.[18]

Meanwhile, the króna gradually regained lost ground. In 2015, the IMF considered the real exchange of the króna to be roughly in equilibrium (IMF 2016, Box 2,

[17] Specifically, from 2007 to 2009 the real exchange rate fell by 35% based on relative consumer prices at home and abroad and by 50% based on relative unit labor costs. Source: Central Bank of Iceland, see http://hagtolur.sedlabanki.is/data/set/1wui/#!display=table&ds=1wui!1z9x=1.3.

[18] Source: World Bank, *World Development Indicators*.

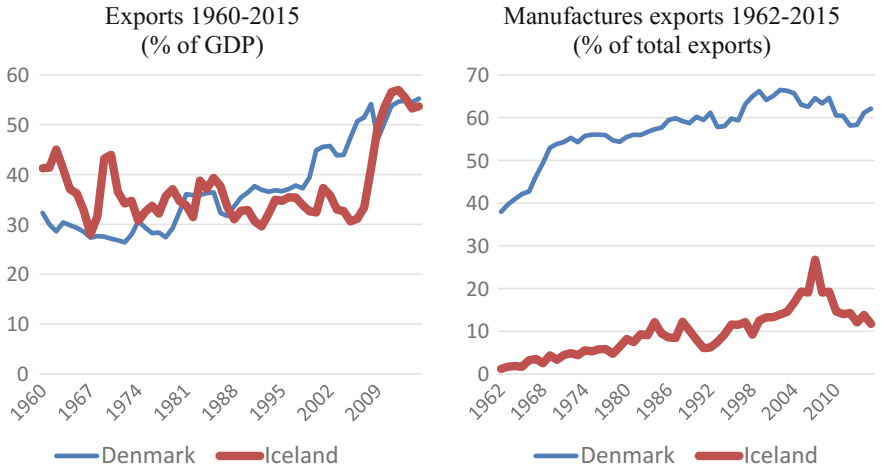
p. 11). From mid-2015 until early 2017, the króna appreciated in real terms by 25% based on relative consumer prices and by 21% based on relative unit labor costs (source: Central Bank of Iceland), restoring the real exchange rate to its 2007 extent of overvaluation or thereabouts.

In the next section we briefly review the recent economic history of Iceland. We then present a simple stochastic model intended to capture relevant elements of the Dutch disease by showing how the volatility of primary output affects the real exchange rate and hence also total (i.e., primary plus secondary) output. The model sets the stage for—or, if you prefer, aims to illuminate—our empirical account of the encouraging effects of the collapse of the real exchange rate surrounding the financial crash of 2008 on secondary output, especially via foreign tourism which has expanded by leaps and bounds. The number of foreign tourist arrivals in 2016 was 1.8 million, more than five times Iceland's population, up from 0.3 million in 2000 when the number of tourists bypassed the number of inhabitants.

1 Background

Iceland is unique among OECD countries in that the ratio of Iceland's exports of goods and services to GDP was stuck at about a third from 1870 (this is not a misprint) until 2008 when its three main banks collapsed. Why did Iceland's exports remain stagnant for so long at such a low level relative to GDP? All other OECD countries saw their exports grow more rapidly than GDP, especially after 1960 when liberalization of trade in goods and services gained momentum. For example, Denmark's export ratio rose from 32% in 1960 to 52% in 2007 while Iceland's export ratio remained stuck at about a third (Fig. 2a). With a population that is just one-sixteenth of that of Denmark, Iceland, like other very small open economies, would need a much higher export ratio than Denmark to finance the importation of things that Iceland is too small to produce. Denmark is a significant high-tech producer, Iceland is not. Moreover, Iceland is marred by oligopolies unencumbered by foreign competition. For example, the combined market share of the three largest banks is still well above 90% and the same applies to the three largest insurance companies, oil retailers, and sellers of building materials.

Iceland was until 2008 a high-real-exchange-rate country, its overvalued currency holding back exports and thereby also imports except insofar as imports were financed by foreign borrowing. In 2007, a year before the crash, the IMF considered the króna overvalued by 15–25% in real terms (IMF 2007). Even so, two months before the crash in September 2008, the IMF reported (IMF 2008): "[t]he long-term economic prospects for the Icelandic economy remain enviable." The IMF overlooked the danger posed by the overvaluation of the króna as well as by the huge inflows of short-term capital before the eruption of the 2008 crisis. Looking back, the IMF's Independent Evaluation Office (2011, Box 4, p. 15) was not amused.



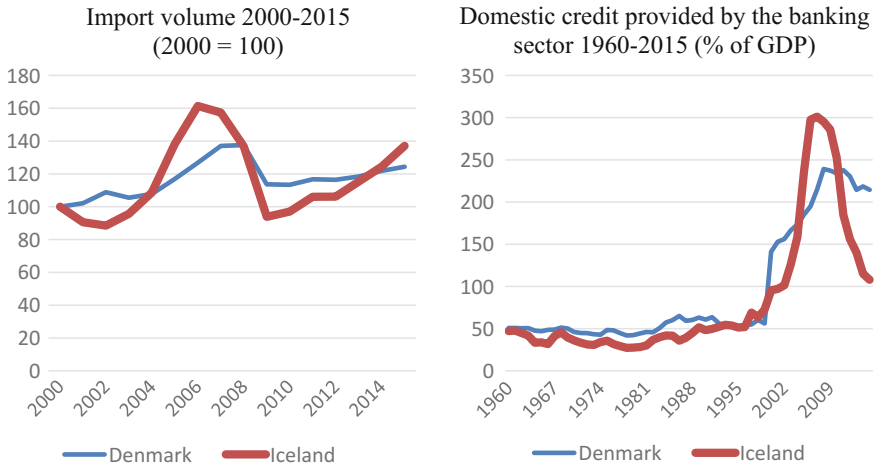
Source: World Bank, *World Development Indicators*.

Fig. 2 Exports of goods and services and manufactures

The systemically high real exchange rate, a condition we associate with the Dutch disease, can be traced to several causes, including high inflation[19] and an abundance of natural resources, mainly fertile fishing grounds but also energy. Export subsidies to the fishing industry, direct at first through the government budget, then indirect through gratis allocation of highly valuable and macroeconomically consequential common-property fishing rights to select vessel owners, increased the supply of foreign exchange, lowering its price and increasing the real exchange rate. Other factors reinforced the effect of the primary sector on the real exchange rate, including the protection of agriculture against imported farm products, an arrangement that reduced the demand for foreign exchange, lowering its price and thereby exerting upward pressure on the real exchange rate. Further, the high real exchange rate skewed the composition of exports by hampering the development of, for example, high-tech export industries like those that emerged in Scotland, Ireland and Norway next door. Mostly, Iceland's exports were, and remain, resource-based (fish and aluminum) and thus mostly low-tech, a common symptom of the Dutch disease (Fig. 2b).[20] A currency can remain overvalued for long periods just as a pendulum continues to tilt the same way as long as the wind blows from the same direction.

[19] Since 1960, Iceland has had the OECD region's second highest average rate of inflation, second only to Turkey. High inflation has often been seen to go along with high real exchange rates because the government hesitates to devalue the currency as expectations of inflation are not anchored and devaluation is likely to encourage inflation. As a result the government resorts to foreign borrowing instead, a common scenario in Africa and Latin America, for example.

[20] In 2012, fish products accounted for 27% of total export earnings in Iceland, aluminum for 22% and foreign tourism, 24% (source: Statistics Iceland). Kristjansdottir (2012) describes the determinants of the geographical pattern of Iceland's export trade.



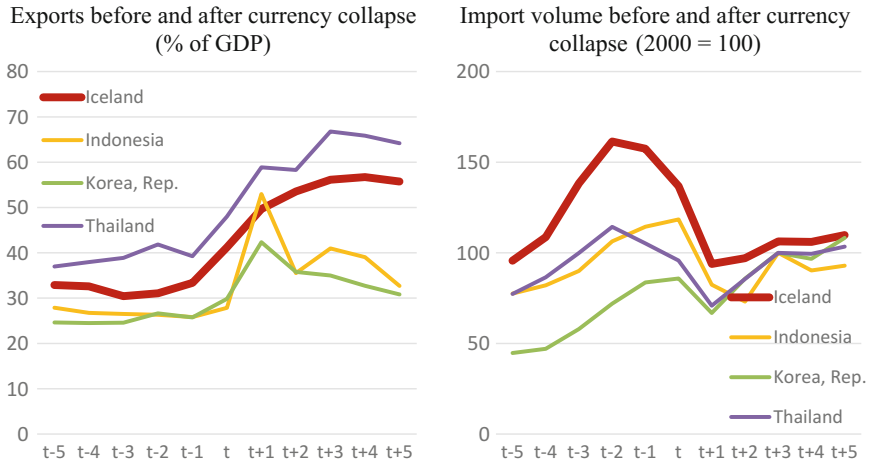
Source: World Bank, *World Development Indicators*.

Fig. 3 Imports and domestic credit

Recent events offer an opportunity to assess the effects of the collapse of the real exchange rate. Surrounding the financial crash of 2008 the collapse of the Icelandic króna made exports jump from a third of GDP to 60% of GDP (Fig. 2a), and caused imports to plunge (Fig. 3a) in keeping with the elasticity approach to the balance of payments (Goldstein and Khan 1985). The fact that GDP fell by 8% after the crash shows that the hike in the export ratio stems mostly from a sharp increase in export earnings. Likewise, the fact that import volume contracted by 44% suggests a strong effect of the currency depreciation on imports on top of a much smaller income effect. Even so, the behavior of the real exchange rate of the króna before and after the crash accords well with the asset market approach to exchange rates (Branson 1977) which predicts that increased foreign borrowing to finance imports of goods and services causes the currency, on impact, to appreciate in real terms.

The reaction of Icelandic exports and imports to the large depreciation of the króna in 2008 resembles the response of exports and imports in South-East Asian countries to the collapse of their currencies in 1997. Figure 4 shows the evolution of export earnings and import volumes during a period spanning five years before and after the financial crisis in South-East Asia (t = 1997) as well as in Iceland (t = 2008).

The financial crash in Iceland was preceded by the privatization of the country's banking system and a subsequent capital inflow from 2003 to 2008 that propelled the real exchange rate to new heights and fueled the stock market and the housing market as well as a boom in consumption and investment through a current account deficit averaging 14% of GDP. Real equity prices increased by 35% per year during this period, a record surpassed only by Cyprus, and real estate prices rose by 12%



Note: For Iceland, t = 2008, whereas for Indonesia, Korea and Thailand we set t = 1997.

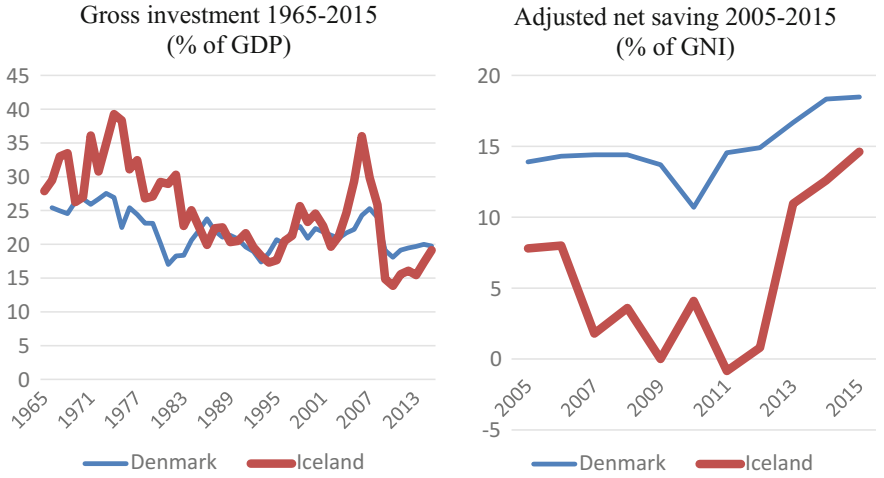
Source: World Bank, *World Development Indicators*.

Fig. 4 Exports and imports in Iceland and South-East Asia

per year.[21] The current account deficit rose from 5% of GDP in 2003 to 16% in 2007. The growth of per capita GDP went from 1.8% in 2003 to 6.6% in 2004, 6.0% in 2005, 1.8% in 2006 and 3.6% in 2007 before turning negative three years in a row, 2008–2010. Unemployment dropped to 2.3% of the labor force 2007. Gross foreign debt grew from a stable level of about 60% of GDP in the 1990s to nearly 700% before the collapse in mid-2008. Because the inflow of capital was unsustainable, and also because the Central Bank's foreign exchange reserves, in a violation of the Giudotti-Greenspan rule, had fallen to 7% of the short-term foreign liabilities of the banking system, the expansion was bound to end in a sudden stop. The reversal of capital flows in 2008 caused the currency to tank, consumption and GDP to fall, investment to plummet from 27% of GDP to 19% of a lower GDP,[22] real imports of goods and services to contract by more than 60% from 2006 to 2009 (recall Fig. 3a showing the volume of merchandise imports), bank lending relative to GDP to contract by 54% from 2007 to 2012 (Fig. 3b) and equity prices to plunge by, yes, 95% from peak to

[21] The OMX15 covering the 15 largest corporations increased by a factor of six over the same period and nearly by a factor of nine from its bottom in 2001 to its peak value in 2007. See Aliber (2011) and Halldorsson and Zoega (2010).

[22] Net investment, i.e., gross investment minus depreciation, was negative from 2009 to 2012.



Source: World Bank, *World Development Indicators*.

Fig. 5 Investment and adjusted net saving

trough.[23,24] By 2011, real estate prices in the Reykjavík area had receded back to their 2004 level in real terms.[25]

The boom before the crash of 2008 masked an underlying structural weakness illustrated by a comparison between gross investment and adjusted net saving (Fig. 5). As defined by the World Bank (2006), adjusted net saving aims to measure the real difference between production and consumption by adjusting net saving for changes in human capital (measured by spending on education and innovation) and depreciation or depletion of natural resources (e.g., through energy or mineral depletion). A comparison of the two panels of Fig. 5 shows that, before the crash, despite Iceland's investment boom, adjusted net saving in Iceland was far below that of Denmark even without including estimates of natural resource depletion, a controversial subject. This finding reflects Iceland's long-standing aversion to saving and correspondingly strong propensity to borrow, a common characteristic of high-inflation countries.

In sum, Iceland's experience before and after the fall mirrors the three-stage experience of many other countries in similar circumstances (Reinhart and Rogoff 2009). First, large capital inflows, mostly bank credits, elevated the value of the currency well beyond its historical state of structural overvaluation. Second, the sudden reversal of capital flows and the associated debt overhang made the currency

[23] Sources: *Statistics Iceland* (hagstofa.is), Central Bank of Iceland (sedlabanki.is), World Bank, *World Development Indicators*, and Trading Economics (tradingeconomics.com/iceland/stock-market). See also Halldorsson and Zoega (2010).

[24] Gylfason et al. (2010) and Gylfason (2015) compare economic conditions in the Nordic countries during these years.

[25] Source: Registers Iceland (skra.is/Markadurinn/Talnaefni).

collapse. Third, the depreciation of the currency in real terms made imports plunge while providing a strong boost to exports, both old and new. The dramatic reversal of capital flows in 2008 offers us an opportunity to gauge the effects of a lower real exchange rate on the secondary sector. We revisit our stochastic model of the Dutch disease in Sect. 2 to describe the first two stages of the process and to prepare for the empirical account of the effects of the exchange rate on exports and output in Sect. 3.

2 A Prototype Model

Tradable output is produced in both the primary sector and the secondary sector. The primary sector utilizes a natural resource and is subject to fluctuations. In Iceland, the natural resource is mainly fish stocks that yield an annual output that fluctuates from year to year, based mostly on natural factors. Further, there are capital inflows and outflows. Both fluctuations in primary output and in capital flows affect the secondary tradable sector, i.e., manufacturing and services. The volatility of the primary sector and capital flows makes the real exchange rate fluctuate, which affects the relative price of the secondary-sector tradable output, or secondary output in short, as we will show. Moreover, an abundance of natural resources affects secondary employment, output and investment through wages.[26] The stock of external debt also has an effect on these variables through the real exchange rate. In a way, natural resource rents have an impact similar to the inflow of foreign capital while external debt works in the opposite direction due to the outflow of interest and amortization payments. Our main aim here is to show how the volatility of primary production causes exchange rate volatility which in turn makes secondary output and hence also total output volatile as well. This matters because output, especially in countries that depend significantly on volatile natural resources, needs, like assets, to be assessed in two dimensions: level and volatility.

2.1 Output and Employment in the Secondary Sector

Profits in the tradable sector measured in terms of nontradables are

$$\Pi = \lambda_t K_t^{\alpha} (e(w_t/\overline{w_t})N_t)^{\beta} R^{1-\alpha-\beta} - w_t N_t \tag{1}$$

where K is the stock of capital, N is employment, R denotes a fixed factor such as land and infrastructure, e is the level of industry-wide productivity and $\alpha < 1$ and β

[26]The model of this section differs from that in Gylfason et al. (1999) by having two factors of production rather than only labor. Here, however, we do not derive the growth effect of the abundance of natural resources but only the effect on the level of primary and secondary output.

<1.[27] The real exchange rate $\lambda = p^T/p^N$ is defined as the price of tradable goods in terms of nontradables. An increase in λ denotes a real depreciation of the currency.

Wages in the primary sector affect secondary-sector wages. The (strictly concave) function $e(w_t/\overline{w_t})$ measures worker effort as a function of the ratio of secondary-sector wages to wages paid in the primary sector, $\bar{w}$, which we take as given. We assume the following functional form for e, invoking Solow's elasticity condition (Solow 1979)

$$e = \left(\frac{w - b\bar{w}}{b\bar{w}}\right)^{\kappa}, 0 < \kappa < 1 \tag{2}$$

where b is a measure of the attractiveness of jobs in that sector; $b < 1$ suggests that jobs in the secondary sector are preferable to jobs in the primary sector.

The representative firm has to determine the optimal level of wages and employment at each point in time, w and N, and can costlessly hire or fire workers. The first-order condition for wages generates the following solution for secondary-sector wages

$$w = \frac{b\bar{w}}{1 - \kappa} \tag{3}$$

so that a higher primary-sector wage, a lower disutility of working in that sector and greater responsiveness of effort to relative wages as measured by κ all make secondary-sector wages go up. The first-order condition for employment follows

$$N = \lambda^{\frac{1}{1-\beta}} K^{\frac{\alpha}{1-\beta}} w^{-\frac{1}{1-\beta}} Z \tag{4}$$

with $Z = \beta^{\frac{1}{1-\beta}} R^{\frac{1-\alpha-\beta}{1-\beta}} e^{\frac{\beta}{1-\beta}}$. The equation determines optimal employment for a given stock of capital, the real exchange rate and real wages, in addition to land, capital and productivity.[28]

Equation (4) and the production function (1) give short-run output supply as a function of the real exchange rate and primary-sector wages holding the stock of capital fixed. If primary and secondary-sector wages are initially equalized, the supply function is

$$Y^S = \lambda^{\frac{\beta}{1-\beta}} K^{\frac{1}{1-\beta}} w^{-\frac{\beta}{1-\beta}} B \tag{5}$$

where $B = R^{\frac{1-\alpha-\beta}{1-\beta}} \beta^{\frac{\beta}{1-\beta}} e^{\frac{1}{1-\beta}}$. It follows that secondary output depends on the real exchange rate, which, as we now will show, depends on the output of the primary sector as well as the real wage in the primary sector.

[27] Depreciation of capital is assumed away.

[28] Paldam (1997) describes the impact of the Dutch disease in Greenland through wages.

2.2 Primary Output and Capital Flows

Primary output, including the inflow of foreign currency, is stochastic and follows a Brownian motion subject to random productivity shocks described by Eq. (6), and is independent of the real exchange rate;

$$dy^P = \eta dt + \sigma dW \tag{6}$$

Here dW represents the increment of a Wiener process $= \varepsilon_t \sqrt{dt}$, ε having a zero mean and a unit standard deviation, i.e., $E(dW) = 0$ and $V(dW) = dt$. The drift term ηdt reflects the growth of primary output or a rising level of capital inflows while the stochastic term σdW represents the vicissitudes of commodity prices that make primary output rise or fall at random and of international capital markets that can make a capital inflow quickly reverse itself during a sudden stop, thus creating uncertainty about output in the primary sector.

2.3 The Intertemporal Budget Constraint and the Real Exchange Rate

The external budget constraint equates the sum of the present discounted value of the difference between future output of primary goods Y^p and tradable goods from the secondary sector Y^S, on the one hand, and of tradable goods consumption C^T, on the other hand, to the current stock of net foreign debt D. A capital inflow relaxes the constraint in the short run by enabling a country to service its short-term debt with a smaller current account surplus.

There is an infinite number of paths satisfying the intertemporal budget constraint. Instead of solving for the optimal path, we posit a simple rule that satisfies the constraint, making saving r a function of the sum of the output and foreign exchange earnings of the primary sector Y^P including net capital inflow (i.e., inflows of foreign currency) and output from the secondary sector Y^S less consumption c:

$$r_t = y_t^P + y_t^S - c_t \tag{7}$$

where $y^P = \log(Y^P)$, $y^S = \log(Y^s)$, $c = \log(C^T)$ and r is an exogenous parameter that depends on the level of net foreign debt. We then choose the value of saving r so that the external budget constraint is satisfied. Thus, the higher the level of external debt D, the greater is the external surplus r required to service the debt.[29] The choice of this saving rule simplifies the derivations to follow while making the real exchange

[29] Equation (7) implies that the sum of the growth rates of primary and secondary (tradable) output always equals the rate of growth of (tradable) consumption.