

MOODY'S
ANALYTICS

The Impact of Electronic Payments on Economic Growth

ECONOMIC ANALYSIS FROM MOODY'S ECONOMY.COM

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Executive Summary

The Steady Migration to Card Payments Spurs Economic Growth

In the half-century since their introduction, payment cards—credit and debit—have changed how, when and where consumers pay for goods and services. Moody's Economy.com measured the effects of this shift from paper to electronic forms of payment and found that credit and debit cards stimulate economic growth.

The study calculates that, for the 51 countries in the sample—which collectively account for 93% of the world's gross domestic product—electronic card usage added \$1.1 trillion in real dollars to private consumption and GDP from 2003 to 2008. Put another way, real global GDP grew an extra 0.2% a year on average beyond what it would have without card usage. If not for card usage, global GDP would have grown by an average of only 3% a year, instead of actual growth of 3.2%.

The results demonstrate that the migration from paper to electronic payments is a positive phenomenon, and the study supports the adoption of policies that encourage and accelerate this shift.

When looking at the effect that card penetration—defined as the value of transactions using credit and debit cards as a percentage of total consumer spending—has had on GDP growth, we can relate it to real-world issues facing policymakers.

For example, the impact of card usage on GDP resulted in the creation of 4.9 million jobs among the 51 countries cumulatively from 2003 to 2008. In the U.S., the impact was the equivalent of 160,000 jobs.

Cards grease the economic engine, making transactions flow more smoothly and creating efficiencies in commerce. This efficiency increases consumption and in turn expands economic growth as inventories decline, production increases, and jobs are created, thereby expanding personal incomes and supporting more consumption.

While more access to credit is one contributing factor in increased consumption, it should not be overemphasized. In fact, the study found that countries with almost no revolving credit card products—including Norway, Sweden and Denmark—experienced card-related increases in consumption and GDP similar to or higher than the increases in those countries with significant credit volumes. Increased usage of debit cards generates many of the same benefits as does usage of credit cards.

This white paper looks at the inherent value of cards for various parties, the ongoing effects of greater card penetration on personal consumption, and the elasticity of that greater card penetration in specific markets, as well as a breakdown of the effect on individual countries' GDP over the six-year period.

The white paper also provides the Moody's Economy.com analysis of the macroeconomic benefits of card usage and penetration for specific countries. In particular, the paper explores the differing effects that card penetration had in developed versus emerging economies. For example, the relatively high growth rate (yet low starting point) for card penetration seems to have driven card usage's contribution to GDP in emerging economies such as China. Conversely, the high starting penetration rate (yet relatively low growth rate) in more developed economies such as Canada and the U.S. drove the contribution to GDP growth there.

Study Methodology

This study looked at the impact of increased card penetration on consumption in 51 countries over six years. Real private consumption was modeled as a function of real disposable income, interest rates, and card penetration—defined as spending using cards as a percentage of overall consumer spending. To isolate the impact of increased card usage, the study, conducted on behalf of Visa Inc., used actual income and interest rates during the survey period, while fixing card penetration at each country's lowest level from 2003 to 2008. The model measured the difference between what actually happened (higher consumption) and what it predicted would have happened if card penetration had stayed at the minimum value (lower consumption). *Details of the model are described on Page 9 and in Appendix B.*

The Economic Impact of Future Card Growth

The study also analyzed the impact that future card usage will have on economic growth. The study found that a 1% increase in card transaction volume would increase consumption each year by 0.039% and increase GDP growth by 0.024%. With average annual card penetration growth of 13%, we see a sizable 0.62% increase in consumption and a 0.38% increase in GDP due to card usage.

Analyzing the impact of future card usage on GDP is not simply an academic exercise. As more consumers around the world shift their spending from paper to electronic payments, these results quantify the positive macroeconomic impact of this secular trend.

The Macroeconomic Impact of Card Usage

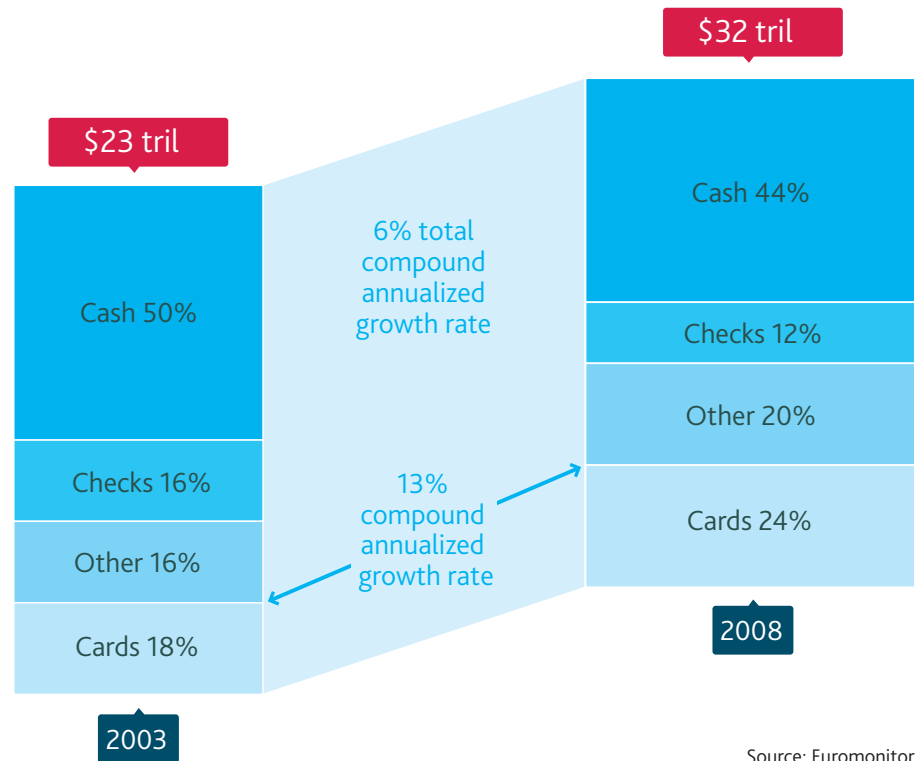
Fifty years ago, most consumer transactions were cash-based. The advent of general purpose payment cards in the 1950s allowed consumers and businesses to buy and sell with greater convenience. Since their introduction, card payments have grown in popularity. In 2008, almost 25% of worldwide consumer spending was card-based. This figure has grown by an average of 13% since 2003, more than three times the rate of PCE growth.

The growth in card usage globally raises a number of questions. Most notably, do electronic payments deliver macroeconomic benefits? In the model developed by Moody's Economy.com, the impact of card usage on GDP is tied to private consumption: Increases in private consumption that are attributable to card usage drive corresponding increases in GDP.

- » Based on the methodology developed, card usage increased consumption by an average of 0.79% across the 51 countries included in the study from 2003 to 2008.
- » This equates to an increase in global GDP of \$1.1 trillion (2005 U.S. dollars) cumulatively from 2003 to 2008, an annual average of 20 basis points in additional GDP growth over the six-year period. To put this figure in context, real GDP grew at an annual average of 3.2% in the period, of which 0.2% was attributable to increased card penetration.

The impact varied considerably from country to country due to differing growth rates, larger penetration in some countries, and the consumer reaction to a more robust card infrastructure in some countries. At the high end, card usage increased consumption in China by 3.28%, in Australia by 2.47%, and in

Global Personal Consumption Expenditure



Source: Euromonitor

The Scandinavian Example

In today's economic environment, citing increases in consumption often ignites a debate about the perils of extending credit. However, this study is as much about debit card use as it is about credit. Increased consumption (and in turn GDP growth) brought on by card penetration and usage is not simply a matter of supplying consumers with credit to purchase goods and services. All countries in the study—even those where the vast majority of cards and transactions are debit such as Sweden, Denmark and Norway—experienced a lift from card usage. Much of the increased consumption associated with card penetration is due to the economic efficiencies of card transactions over other methods of payment rather than increased spending on credit.

Brazil by 2.29%. This compares with 0.1% in Belgium and 0.13% in Italy on the low end. The small impact in Belgium and Italy is a function of very low relative rates of growth in card penetration in these two

countries. In Belgium, card penetration of PCE increased by just 1% from 2003 to 2008—from 25% to 26%. In Italy, card penetration of PCE increased by 2%—from 10% to 12% in the six-year period.

Card Penetration Contribution to Consumption

%, weighted average 2003-2008

Country	Weighted average
Argentina	1.21
Australia	2.47
Austria	0.27
Belgium	0.10
Brazil	2.29
Canada	1.32
Chile	0.98
China	3.28
Colombia	0.59
Czech Republic	1.07
Denmark	1.61
Egypt	0.12
Finland	0.58
France	0.60
Germany	0.27
Greece	0.25
Hong Kong	1.06
Hungary	0.62
India	0.48
Indonesia	0.39
Ireland	0.29
Italy	0.13
Japan	0.36
Kuwait	1.79
Malaysia	0.62
Mexico	0.65
Netherlands	0.78
New Zealand	0.71
Norway	2.55
Peru	0.59
Philippines	1.89
Poland	1.05
Portugal	1.53
Puerto Rico	0.30
Russia	0.69
Saudi Arabia	0.33
Serbia	1.09
Singapore	1.08
South Africa	0.60
South Korea	1.44
Spain	0.73
Sweden	0.90
Switzerland	0.69
Taiwan	0.70
Thailand	1.16
Turkey	0.56
UAE	0.55
U.K.	1.07
Ukraine	0.38
U.S.	0.60
Venezuela	2.42
Vietnam	0.22
All countries	0.79

Card Payments, Private Consumption and GDP

Levels of consumption and card usage are highly correlated. Consumers in wealthier countries with more robust card infrastructure have the opportunity to use cards more often than those in lower-income countries. A natural question is how much increased credit and debit card usage or penetration contributes to consumption and GDP.

In essence, the impact of card usage on GDP in each market is a function of three factors:

- » Card penetration as a percentage of total personal consumption expenditure.
- » The growth of card usage year-over-year relative to PCE.
- » The percentage of GDP attributable to personal consumption.

Card usage stimulates economies in terms of percentage GDP increases and the dollar value of card usage's contribution to GDP for countries in the sample cumulatively from 2003 to 2008. *Further details are available in Table 1 in Appendix A.*

Results Differ for Developed and Emerging Economies

In general, a higher percentage of consumers in wealthier, more developed countries use cards and use them more often than in lower-income, emerging economies. The assumption is that increased penetration and more frequent usage of cards result in significantly different responses from the two groups because of a variety of factors—including the penetration rate at the beginning of the study (2003), the growth rate over the course of the study (2003-2008), and the overall size of a given economy. The belief is that because emerging economies have

shallower card penetration, card usage rose sharply in those countries during the sample years. In developed economies, where card usage has matured, penetration increased more slowly. The frequency of usage likely had more of an influence in developed countries than did the share of users. We hypothesized different results for countries based on the different maturity levels, growth rates, and consumer usage patterns for cards.

The model confirmed our hypothesis. Increased card usage added 1.9% to consumption in emerging markets and 0.7% in developed countries. The same figures for GDP were 0.78% for emerging countries and 0.4% for developed countries. All figures are weighted averages over the countries and the sample period. Card usage drove consumption and in turn GDP in each and every country, regardless of the size of its economy, its degree of card penetration, or its rate of growth in card penetration.

However, within these broad groupings are interesting anomalies. Australia, for example, experienced one of the largest effects—almost 1.5% in additional GDP. One possible reason is the confluence of positive factors in Australia—a high penetration of cards to PCE (50%), coupled with robust growth in card usage (10%). A similar phenomenon was noted in Brazil, which experienced a GDP impact of 1.4%. Brazil has one of the most dynamic card markets in Latin America, where card penetration is a healthy 21% of PCE, growing at a rate of more than 30%.

The model also observed a distinct impeding of GDP growth in Australia coinciding with transaction fee restrictions. One can assume that growth would have been higher without such regulation. Historic card penetration slowed from above 30% in 2004 to an average of 11% post-2004.

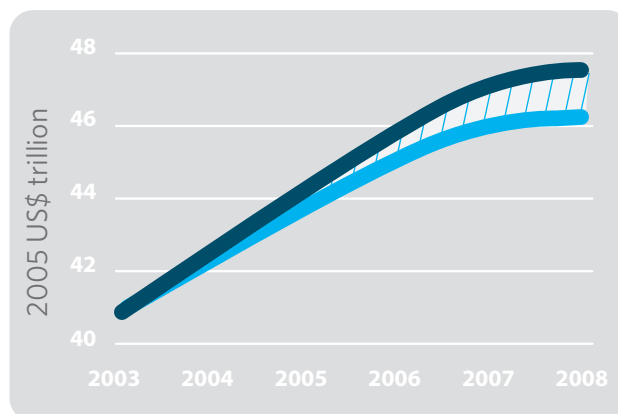
Conversely, in Russia and India, where card volume grew more than 30% over the period, card usage added only 0.3% to GDP. A plausible explanation is that card usage as a percentage of PCE in these two countries was still so low (4%) that even rapid growth did not increase GDP significantly.

We observe that card usage begets further card usage, however, and not in a linear fashion. As more cards are issued and more merchants accept cards, transaction volume grows exponentially. The size of the payments network in a given market—more merchants and more cardholders—has a multiplier effect. Consumers will feel more comfortable about using their cards for a larger percentage of their transactions as a critical mass of merchant locations is reached. Equally, merchants will want access to a larger pool of cardholders with guaranteed payment. We observe this phenomenon even in mature markets with close to 50% card penetration.

Methodology

This study looked at the impact of increased card penetration on consumption in 51 countries over six years. Real private consumption was modeled as comprising three main factors: real disposable income, interest rates, and spending using cards as a percentage of overall consumer expenditure—or card penetration. The data for all the countries were pooled to create a data set with over 300 observations, and a statistical technique called pooled cross-

Methodology Output



section time series estimation was used to estimate the parameters.

- » The model used observed and actual disposable income and interest rates from 2003 to 2008.
- » Card penetration was held at its lowest level for the six-year period (usually in the first year).
- » The model measured the difference between what actually happened (higher consumption) and what it predicted would have happened if card penetration stayed at the minimum value (lower consumption).

Finally, to measure the impact of card usage on actual GDP, the consumption figure was multiplied by the portion of GDP that is attributable to consumer spending in each country. The credit and debit card model can therefore

estimate the impact of card usage on the overall economy.

More detailed information on the methodology can be found in Appendix B.

Penetration Ratio

To isolate the impact of electronic payments, card penetration was fixed at the minimum observed value during 2003-2008 for each country in the model. The model used the minimum penetration because for most countries, the penetration ratio was rising steadily over this period. For a handful of countries, mainly developing ones, the relatively small penetration ratio fluctuated over the period. An appropriate measure of the contribution to GDP should look at the deviation of the card penetration ratio from the lowest level of penetration.

Card Payments: Less Friction, More Efficiency

Cards Benefit All Parties in Multiple Ways

Within the electronic payments ecosystem are two main parties: buyer and seller, or consumer and merchant. The evolution to electronic payments from cash and checks has changed the behavior of and, in some cases, the relationship between consumers and merchants.

Although the study does not explore the reasons for the incremental growth in GDP attributable to card usage, there are rational explanations. The advent of credit and debit cards has greatly facilitated consumers' ability to conduct commerce by giving them secure and immediate access to all of their funds on deposit or a line of credit. Merchants also benefit because there is less cash and fewer checks to handle. Merchants also have access to a large pool of customers with guaranteed payment. They are freed from developing and maintaining their own

credit systems, allowing them to focus on their core competencies.

These efficiencies lead to a virtuous economic cycle whereby increases in consumption lead to increased production, more jobs and greater income.

Benefits to Consumers and Merchants

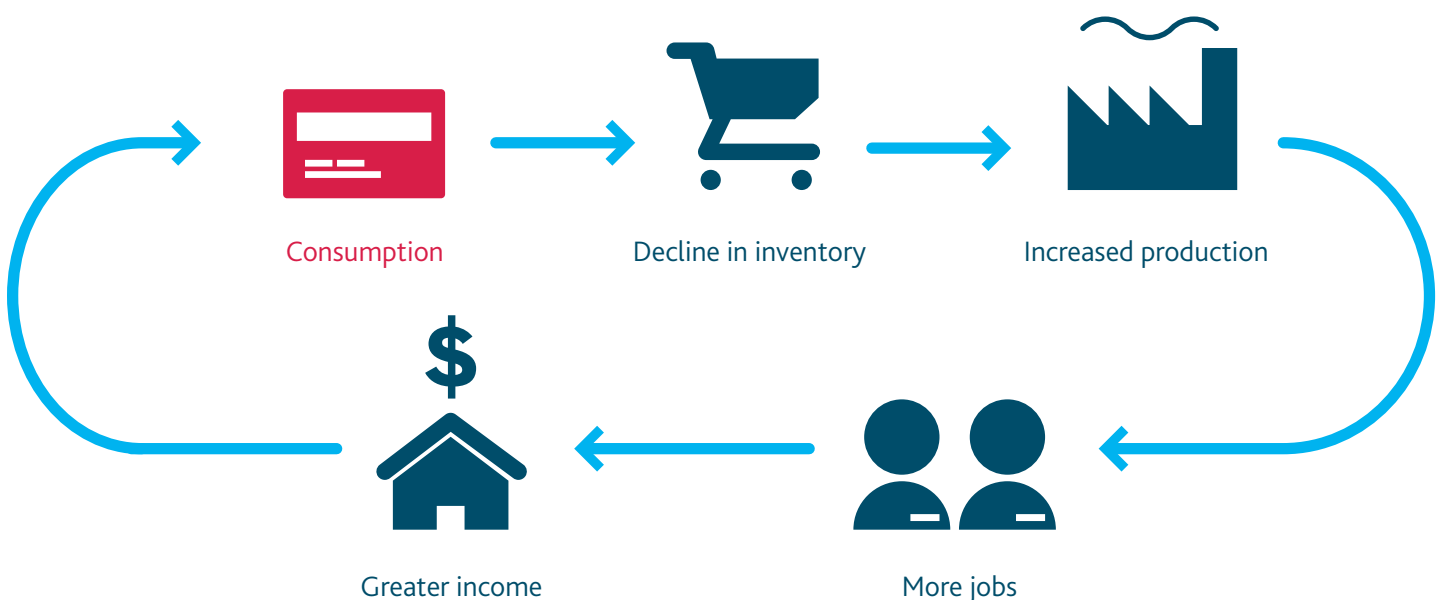
- » Cards provide access to financial resources. With cash, consumers are limited to the funds they have on hand. Merchants may be reluctant to accept checks for larger transactions because of the risk of nonpayment. Cards address both these issues, providing consumers with access to all available funds or lines of credit for a given transaction and providing merchants with peace of mind through payment guarantees, provided they follow appropriate procedures.
- » Access to credit helps calibrate periodic income with continuous

consumption. Wages and salaries are typically paid weekly, biweekly or monthly. Consumer spending, however, has no time profile. Food on the table or a broken-down vehicle should not have to wait for the next paycheck. Credit smoothes the consumption of durable and nondurable goods by lessening the need to wait for paydays. In obtaining credit, consumers generally have three options: bank loans, store credit or credit card. Credit cards are more convenient and offer lower consumer transaction costs, as the former two involve paperwork, hassle, and a potential waiting period.

Security

- » Trust in card transactions further drives consumption. With cards, consumers have recourse for fraudulent transactions, and the

Economic Cycle



card networks police unscrupulous merchant behavior. The peace of mind that merchants gain with guaranteed payment also extends to consumers, who feel more comfortable making purchases when they can pay with a card. This trust in the payment system eases friction, bolstering consumption and GDP.

Convenience

- » Consumers cite the convenience of cards, whether it means not having to visit the ATM to obtain cash or not having to count out the cash at the point of transaction. This convenience benefits merchants as well. For instance, when consumers swipe

their own cards at the self-service gasoline pump, it lowers labor costs for merchants. Each small point of friction that cards eliminate from the system contributes to higher consumption and GDP.

Transparency

- » Cards leave more funds flowing through the economy. The need to refund change during a cash transaction potentially removes a certain amount of money from circulation. The change sitting unused impedes economic growth. Increased penetration of cards as a percentage of PCE keeps the "spare change" where it can be more readily spent.

- » Cards reduce central bank costs in providing currency. By reducing paper transactions, card usage can reduce the cost to central banks of providing notes and coins or to treasury or finance departments of processing paper money, thereby improving overall efficiency in commerce and the economy.
- » Cards eliminate a substantial portion of the gray economy. Retailers who do not report some or all of their transactions to avoid paying sales taxes prefer cash transactions. Card transactions, on the other hand, are "above board" and create an audit trail that greatly reduces unreported transactions, thereby raising tax revenues.

Ongoing Effects on GDP: Measuring Elasticity by Country

The steady migration from paper to electronic forms of payment around the world begs another interesting question: What effect would a continued increase in card penetration have on overall consumption and therefore GDP across all the surveyed countries?

The following table measures elasticity. In this study, this is the percent increase in private consumption and GDP due to a 1% increase in credit and debit card volume, while all other variables are held constant. For policymakers, this is the growth-promoting payment card metric (see Tables 2A and 2B in Appendix A).

- » Overall, a 1% increase in card usage produced a 0.039% increase in consumption and a 0.024% increase in GDP.
- » For developed countries, the same metric was a 0.041% increase in consumption and a 0.025% increase in GDP.
- » In emerging markets, a 1% increase in card usage resulted in a 0.031% increase in consumption and a 0.017% increase in GDP.

The estimated elasticities show wide variation among countries. In general, developed countries have greater elasticity than emerging markets do. Compared with emerging markets, developed countries have well-established payment networks, consumers are comfortable using cards, and many merchants accept them. Hence, an increase in card usage in developed countries has a larger multiplier impact.

GDP Growth and Card Penetration

A key question from a growth-accounting perspective is how much increased card penetration adds to GDP growth. This is calculated as the difference between growth in observed GDP and growth in GDP without increased card penetration. *The results are presented in Table 3 in Appendix A.*

Globally, increased card penetration added almost 0.2% to the average annual real GDP growth rate reported from 2003 to 2008. Global real GDP growth during this period was 3.2% per annum. Without increased card usage, that growth would have been 3%. Card penetration and usage measurably boost economies, helping them grow more quickly and run more smoothly.

Card Elasticity

% increase in GDP due to 1% increase in cards, 2003-2008

Country	Weighted average
Argentina	1.21
Australia	2.47
Austria	0.27
Belgium	0.10
Brazil	2.29
Canada	1.32
Chile	0.98
China	3.28
Colombia	0.59
Czech Republic	1.07
Denmark	1.61
Egypt	0.12
Finland	0.58
France	0.60
Germany	0.27
Greece	0.25
Hong Kong	1.06
Hungary	0.62
India	0.48
Indonesia	0.39
Ireland	0.29
Italy	0.13
Japan	0.36
Kuwait	1.79
Malaysia	0.62
Mexico	0.65
Netherlands	0.78
New Zealand	0.71
Norway	2.55
Peru	0.59
Philippines	1.89
Poland	1.05
Portugal	1.53
Puerto Rico	0.30
Russia	0.69
Saudi Arabia	0.33
Serbia	1.09
Singapore	1.08
South Africa	0.60
South Korea	1.44
Spain	0.73
Sweden	0.90
Switzerland	0.69
Taiwan	0.70
Thailand	1.16
Turkey	0.56
UAE	0.55
U.K.	1.07
Ukraine	0.38
U.S.	0.60
Venezuela	2.42
Vietnam	0.22
All countries	0.79

Conclusions

Card usage makes the economy more efficient, increasing GDP by a statistically significant amount year after year through a multitude of factors, including transaction efficiencies, consumer access to credit, and consumer confidence in the payment system overall. This usage and penetration increased personal consumption in aggregate across economies. The Moody's Economy.com economic model documents this benefit.

Due to varying degrees of card penetration and growth rates over the period analyzed, the efficiencies affected different players in the payments environment in different ways, but for all

economies and markets analyzed, there is a positive correlation between card penetration and usage and economic growth. This correlation does not hinge upon access to credit. In various markets where debit is the predominant form of card payment such as Denmark and Norway, the correlation still exists. In markets such as the U.S., where debit represents an increasing percentage of card transactions and dollar volume, the correlation persists and has even accelerated.

The study therefore supports the adoption of policies that encourage the use of cards. Increased usage of cards boosts consumption and GDP. The growth

benefits increase as penetration rises. The study calculates that the 51 countries in the sample added \$1.1 trillion cumulatively to real GDP from 2003 to 2008 due to increased usage of cards, or a 0.5% increase in the total dollar value of GDP over this period. Increased credit and debit card usage contributes to economic activity by reducing transaction costs and improving efficiency in the flow of goods and services. Credit cards allow consumers to spend more consistently over time despite changes in income. All cards—credit and debit—reduce transactional and opportunity costs by eliminating the need to carry cash.

Appendix A: Table 1A

A zero in Table 1A marks the starting point from which contributions to consumption and GDP were calculated. While most countries' base points were in 2003, card penetration in six countries regressed slightly after 2003 and reached the base point in 2004 or 2005. The model calculates the card contribution to consumption in each year from that base point. Increased card penetration accelerated the contribution to consumption. The final column provides the weighted average contribution, 2003 through 2008.

	2003	2004	2005	2006	2007	2008	Weighted average
Argentina	0.00	0.28	0.50	1.04	1.66	2.20	1.21
Australia	0.00	1.47	2.28	2.46	2.91	3.11	2.47
Austria	0.00	0.05	0.18	0.28	0.37	0.45	0.27
Belgium	0.00	0.02	0.07	0.08	0.12	0.21	0.10
Brazil	0.00	0.38	1.05	2.02	3.22	4.24	2.29
Canada	0.00	0.51	0.86	1.28	1.71	2.06	1.32
Chile	0.44	0.13	0.00	0.59	1.35	2.04	0.98
China	0.00	0.96	1.37	2.88	4.48	5.61	3.28
Colombia	0.01	0.00	0.22	0.50	0.96	1.08	0.59
Czech Republic	0.00	0.28	0.58	0.93	1.40	1.99	1.07
Denmark	0.00	0.33	1.00	1.54	2.25	2.77	1.61
Egypt	0.00	0.04	0.06	0.09	0.16	0.24	0.12
Finland	0.00	0.31	0.32	0.48	0.82	0.90	0.58
France	0.00	0.16	0.25	0.48	0.91	1.13	0.60
Germany	0.00	0.04	0.14	0.24	0.41	0.53	0.27
Greece	0.00	0.08	0.20	0.22	0.31	0.39	0.25
Hong Kong	0.00	0.59	1.05	1.03	1.15	1.39	1.06
Hungary	0.00	0.17	0.47	0.58	0.87	0.99	0.62
India	0.00	0.09	0.25	0.37	0.61	0.94	0.48
Indonesia	0.00	0.10	0.18	0.43	0.54	0.65	0.39
Ireland	0.10	0.03	0.00	0.15	0.48	0.63	0.29
Italy	0.04	0.03	0.00	0.02	0.17	0.38	0.13
Japan	0.00	0.20	0.25	0.32	0.44	0.56	0.36
Kuwait	0.00	0.78	1.28	1.70	2.17	2.58	1.79
Malaysia	1.18	0.29	0.00	0.18	0.61	0.87	0.62
Mexico	0.00	0.11	0.28	0.60	0.93	1.23	0.65
Netherlands	0.00	0.34	0.59	0.75	1.02	1.19	0.78
New Zealand	0.00	0.09	0.53	0.63	1.00	1.21	0.71
Norway	0.00	0.98	0.97	1.76	4.04	4.58	2.55
Peru	0.00	0.06	0.17	0.43	0.83	1.22	0.59
Philippines	0.00	0.62	1.69	2.04	2.29	2.56	1.89
Poland	0.00	0.26	0.54	0.92	1.50	1.85	1.05
Portugal	0.00	0.92	1.19	1.51	1.80	2.15	1.53
Puerto Rico	0.00	0.13	0.27	0.28	0.37	0.44	0.30
Russia	0.00	0.11	0.26	0.48	1.02	1.25	0.69
Saudi Arabia	0.00	0.04	0.21	0.29	0.42	0.57	0.33
Serbia	0.00	0.21	0.66	1.44	1.45	1.46	1.09
Singapore	0.00	0.36	0.49	0.97	1.52	1.89	1.08
South Africa	0.00	0.14	0.39	0.59	0.77	1.00	0.60
South Korea	1.51	0.00	0.53	1.23	1.77	2.07	1.44
Spain	0.00	0.26	0.42	0.64	0.97	1.28	0.73
Sweden	0.00	0.10	0.26	0.79	1.41	1.83	0.90
Switzerland	0.00	0.39	0.58	0.68	0.83	0.94	0.69
Taiwan	0.00	0.74	0.67	0.66	0.67	0.77	0.70
Thailand	0.00	0.30	0.56	1.16	1.71	1.93	1.16
Turkey	0.00	0.02	0.16	0.33	0.86	1.28	0.56
UAE	0.00	0.01	0.03	0.35	0.85	1.29	0.55
U.K.	0.00	0.42	0.81	1.15	1.41	1.50	1.07
Ukraine	0.00	0.11	0.20	0.34	0.47	0.60	0.38
U.S.	0.00	0.17	0.32	0.56	0.80	1.08	0.60
Venezuela	0.00	1.23	2.02	2.35	2.78	3.10	2.42
Vietnam	0.00	0.06	0.15	0.20	0.27	0.37	0.22
All countries	0.03	0.25	0.43	0.72	1.08	1.38	0.79
<i>Developed Countries</i>	<i>0.03</i>	<i>0.07</i>	<i>0.14</i>	<i>0.21</i>	<i>0.30</i>	<i>0.37</i>	<i>0.27</i>
<i>Emerging Markets</i>	<i>0.00</i>	<i>0.17</i>	<i>0.29</i>	<i>0.51</i>	<i>0.78</i>	<i>1.01</i>	<i>3.29</i>

Appendix A: Table 1B

Table 1B multiplies the consumption contribution from Table 1A and the percentage of each country's GDP that comes from personal consumption to obtain the contribution to GDP from card usage. For example, U.S. GDP is 70% personal consumption, so 0.6% (from Table 1A) multiplied by 0.7%=0.42%, the contribution to U.S. GDP from card usage.

	2003	2004	2005	2006	2007	2008	Weighted average
Argentina	0.00	0.17	0.31	0.63	1.01	1.34	0.74
Australia	0.00	0.84	1.30	1.41	1.67	1.78	1.41
Austria	0.00	0.03	0.10	0.16	0.20	0.25	0.15
Belgium	0.00	0.01	0.04	0.04	0.06	0.11	0.05
Brazil	0.00	0.22	0.63	1.23	1.97	2.61	1.39
Canada	0.00	0.28	0.48	0.72	0.97	1.20	0.74
Chile	0.25	0.08	0.00	0.35	0.82	1.25	0.45
China	0.00	0.38	0.53	1.11	1.70	2.11	1.26
Colombia	0.01	0.00	0.14	0.32	0.62	0.70	0.38
Czech Republic	0.00	0.15	0.28	0.45	0.67	0.95	0.52
Denmark	0.00	0.16	0.48	0.75	1.10	1.37	0.78
Egypt	0.00	0.02	0.04	0.07	0.11	0.16	0.09
Finland	0.00	0.16	0.17	0.25	0.42	0.46	0.30
France	0.00	0.09	0.14	0.26	0.51	0.63	0.33
Germany	0.00	0.02	0.08	0.14	0.23	0.30	0.16
Greece	0.00	0.06	0.14	0.15	0.21	0.27	0.17
Hong Kong	0.00	0.36	0.61	0.59	0.68	0.81	0.62
Hungary	0.00	0.12	0.32	0.38	0.56	0.64	0.41
India	0.00	0.05	0.14	0.21	0.34	0.50	0.27
Indonesia	0.00	0.07	0.11	0.27	0.34	0.40	0.25
Ireland	0.05	0.02	0.00	0.07	0.23	0.31	0.07
Italy	0.02	0.02	0.00	0.01	0.10	0.22	0.004
Japan	0.00	0.11	0.14	0.18	0.25	0.32	0.20
Kuwait	0.00	0.38	0.64	0.88	1.20	1.51	0.95
Malaysia	0.50	0.12	0.00	0.08	0.29	0.42	0.20
Mexico	0.00	0.07	0.19	0.40	0.62	0.82	0.43
Netherlands	0.00	0.17	0.29	0.35	0.47	0.55	0.37
New Zealand	0.00	0.05	0.31	0.37	0.60	0.73	0.42
Norway	0.00	0.41	0.41	0.77	1.82	2.05	1.11
Peru	0.00	0.04	0.11	0.28	0.54	0.79	0.38
Philippines	0.00	0.43	1.17	1.41	1.57	1.77	1.30
Poland	0.00	0.16	0.33	0.57	0.91	1.13	0.65
Portugal	0.00	0.57	0.75	0.96	1.13	1.38	0.96
Puerto Rico	0.00	0.09	0.19	0.20	0.26	0.31	0.21
Russia	0.00	0.05	0.13	0.25	0.55	0.71	0.36
Saudi Arabia	0.00	0.02	0.08	0.12	0.19	0.26	0.14
Serbia	0.00	0.14	0.45	0.99	1.00	1.01	0.74
Singapore	0.00	0.15	0.20	0.38	0.58	0.73	0.43
South Africa	0.00	0.09	0.24	0.38	0.50	0.65	0.38
South Korea	0.84	0.00	0.28	0.66	0.95	1.09	0.09
Spain	0.00	0.15	0.25	0.37	0.56	0.73	0.42
Sweden	0.00	0.05	0.13	0.38	0.67	0.88	0.43
Switzerland	0.00	0.24	0.35	0.40	0.49	0.55	0.41
Taiwan	0.00	0.46	0.41	0.40	0.39	0.44	0.42
Thailand	0.00	0.17	0.32	0.65	0.93	1.05	0.64
Turkey	0.00	0.02	0.11	0.22	0.59	0.86	0.38
UAE	0.00	0.01	0.02	0.21	0.51	0.78	0.33
U.K.	0.00	0.27	0.53	0.74	0.91	0.98	0.69
Ukraine	0.00	0.05	0.12	0.21	0.32	0.44	0.24
U.S.	0.00	0.12	0.23	0.39	0.56	0.76	0.42
Venezuela	0.00	0.55	0.95	1.18	1.52	1.74	1.23
Vietnam	0.00	0.04	0.09	0.13	0.17	0.26	0.14
All countries	0.02	0.15	0.26	0.43	0.64	0.82	0.47
<i>Developed Countries</i>	<i>0.02</i>	<i>0.04</i>	<i>0.09</i>	<i>0.13</i>	<i>0.18</i>	<i>0.22</i>	<i>0.17</i>
<i>Emerging Markets</i>	<i>0.00</i>	<i>0.10</i>	<i>0.18</i>	<i>0.31</i>	<i>0.46</i>	<i>0.60</i>	<i>1.76</i>

Appendix A: Table 2A

Table 2A shows the percentage change in consumption generated by a 1% change in card penetration and also the weighted average. For example, a 1% change in card penetration as a percentage of PCE in the U.S. will add 0.045% to U.S. consumption. This amounts to an increase of more than \$24 billion in consumption for each 1% increase in card penetration.

	2003	2004	2005	2006	2007	2008	Weighted average
Argentina	0.033	0.036	0.038	0.043	0.049	0.055	0.043
Australia	0.051	0.066	0.074	0.076	0.080	0.082	0.072
Austria	0.017	0.018	0.019	0.020	0.021	0.022	0.020
Belgium	0.043	0.043	0.043	0.043	0.044	0.045	0.043
Brazil	0.031	0.035	0.042	0.051	0.063	0.073	0.051
Canada	0.062	0.067	0.070	0.074	0.079	0.082	0.073
Chile	0.051	0.048	0.046	0.052	0.060	0.066	0.054
China	0.016	0.025	0.029	0.044	0.060	0.070	0.044
Colombia	0.023	0.023	0.025	0.028	0.033	0.034	0.028
Czech Republic	0.016	0.019	0.022	0.026	0.030	0.036	0.025
Denmark	0.041	0.044	0.051	0.056	0.063	0.068	0.054
Egypt	0.005	0.005	0.005	0.006	0.006	0.007	0.006
Finland	0.036	0.039	0.039	0.041	0.044	0.045	0.041
France	0.042	0.044	0.045	0.047	0.051	0.054	0.047
Germany	0.014	0.015	0.016	0.017	0.018	0.019	0.016
Greece	0.004	0.005	0.006	0.007	0.008	0.008	0.007
Hong Kong	0.046	0.052	0.057	0.057	0.058	0.060	0.055
Hungary	0.011	0.013	0.016	0.017	0.020	0.021	0.016
India	0.003	0.004	0.005	0.006	0.009	0.012	0.007
Indonesia	0.011	0.012	0.013	0.015	0.016	0.017	0.014
Ireland	0.030	0.029	0.029	0.030	0.033	0.035	0.031
Italy	0.017	0.017	0.017	0.017	0.019	0.021	0.018
Japan	0.015	0.017	0.018	0.019	0.020	0.021	0.018
Kuwait	0.091	0.099	0.104	0.108	0.113	0.117	0.107
Malaysia	0.086	0.078	0.075	0.077	0.081	0.083	0.080
Mexico	0.018	0.019	0.021	0.024	0.027	0.030	0.023
Netherlands	0.041	0.044	0.047	0.048	0.051	0.053	0.047
New Zealand	0.042	0.043	0.047	0.048	0.052	0.054	0.048
Norway	0.068	0.078	0.078	0.085	0.108	0.113	0.089
Peru	0.017	0.018	0.019	0.021	0.025	0.029	0.022
Philippines	0.007	0.013	0.024	0.027	0.030	0.032	0.023
Poland	0.014	0.017	0.019	0.023	0.029	0.032	0.023
Portugal	0.027	0.036	0.039	0.042	0.045	0.048	0.040
Puerto Rico	0.011	0.012	0.013	0.013	0.014	0.015	0.013
Russia	0.004	0.005	0.007	0.009	0.014	0.017	0.010
Saudi Arabia	0.015	0.015	0.017	0.018	0.019	0.021	0.018
Serbia	0.003	0.005	0.010	0.017	0.018	0.018	0.013
Singapore	0.028	0.031	0.033	0.037	0.043	0.046	0.037
South Africa	0.063	0.064	0.066	0.068	0.070	0.072	0.068
South Korea	0.068	0.053	0.058	0.065	0.071	0.074	0.065
Spain	0.018	0.021	0.022	0.025	0.028	0.031	0.024
Sweden	0.042	0.043	0.045	0.050	0.056	0.061	0.050
Switzerland	0.034	0.038	0.040	0.041	0.043	0.044	0.040
Taiwan	0.027	0.034	0.034	0.033	0.034	0.035	0.033
Thailand	0.027	0.030	0.033	0.038	0.044	0.046	0.037
Turkey	0.023	0.023	0.024	0.026	0.031	0.035	0.028
UAE	0.017	0.017	0.018	0.021	0.026	0.030	0.022
U.K.	0.062	0.067	0.071	0.074	0.077	0.077	0.071
Ukraine	0.002	0.004	0.004	0.006	0.007	0.008	0.006
U.S.	0.040	0.042	0.043	0.046	0.048	0.051	0.045
Venezuela	0.029	0.041	0.049	0.052	0.056	0.060	0.050
Vietnam	0.002	0.003	0.003	0.004	0.005	0.006	0.004
All countries	0.033	0.035	0.037	0.040	0.043	0.046	0.039
<i>Developed Countries</i>	<i>0.010</i>	<i>0.010</i>	<i>0.011</i>	<i>0.012</i>	<i>0.013</i>	<i>0.014</i>	<i>0.012</i>
<i>Emerging Markets</i>	<i>0.160</i>	<i>0.166</i>	<i>0.168</i>	<i>0.174</i>	<i>0.181</i>	<i>0.185</i>	<i>0.173</i>

Appendix A: Table 2B

Table 2B shows the percentage change in the total dollar value of GDP represented by a 1% change in card penetration and also the weighted average. For example, a 1% change in card penetration as a percentage of PCE in the U.S. will add 0.032% to U.S. GDP, which equates to the same amount as in Table 2A, or more than \$24 billion.

	2003	2004	2005	2006	2007	2008	Weighted average
Argentina	0.020	0.022	0.023	0.026	0.030	0.033	0.027
Australia	0.029	0.038	0.042	0.043	0.046	0.047	0.041
Austria	0.010	0.010	0.011	0.011	0.012	0.012	0.011
Belgium	0.023	0.023	0.023	0.023	0.023	0.023	0.023
Brazil	0.019	0.021	0.025	0.031	0.039	0.045	0.031
Canada	0.034	0.037	0.039	0.042	0.045	0.048	0.041
Chile	0.029	0.027	0.027	0.031	0.036	0.041	0.032
China	0.006	0.010	0.011	0.017	0.023	0.026	0.017
Colombia	0.015	0.015	0.016	0.018	0.021	0.022	0.018
Czech Republic	0.008	0.010	0.011	0.012	0.014	0.017	0.012
Denmark	0.019	0.021	0.024	0.027	0.031	0.034	0.026
Egypt	0.003	0.003	0.004	0.004	0.004	0.005	0.004
Finland	0.019	0.020	0.020	0.021	0.022	0.023	0.021
France	0.023	0.024	0.025	0.026	0.029	0.030	0.026
Germany	0.009	0.009	0.009	0.010	0.010	0.011	0.010
Greece	0.003	0.004	0.004	0.005	0.005	0.006	0.004
Hong Kong	0.028	0.032	0.033	0.033	0.034	0.035	0.033
Hungary	0.008	0.009	0.011	0.011	0.013	0.014	0.011
India	0.002	0.002	0.003	0.004	0.005	0.006	0.004
Indonesia	0.007	0.008	0.008	0.010	0.010	0.011	0.009
Ireland	0.014	0.014	0.014	0.014	0.016	0.017	0.015
Italy	0.010	0.010	0.010	0.010	0.011	0.012	0.010
Japan	0.009	0.010	0.010	0.011	0.011	0.012	0.010
Kuwait	0.049	0.049	0.052	0.056	0.062	0.069	0.057
Malaysia	0.037	0.034	0.034	0.035	0.038	0.041	0.036
Mexico	0.012	0.012	0.014	0.016	0.018	0.020	0.016
Netherlands	0.020	0.022	0.023	0.023	0.024	0.024	0.023
New Zealand	0.024	0.025	0.028	0.028	0.031	0.032	0.028
Norway	0.028	0.032	0.033	0.037	0.048	0.050	0.039
Peru	0.012	0.012	0.012	0.014	0.016	0.019	0.015
Philippines	0.005	0.009	0.016	0.019	0.020	0.022	0.016
Poland	0.009	0.010	0.012	0.014	0.017	0.020	0.014
Portugal	0.017	0.022	0.024	0.026	0.028	0.031	0.025
Puerto Rico	0.007	0.008	0.009	0.009	0.010	0.011	0.009
Russia	0.002	0.002	0.003	0.005	0.008	0.009	0.005
Saudi Arabia	0.006	0.006	0.007	0.008	0.009	0.009	0.007
Serbia	0.002	0.003	0.007	0.012	0.012	0.012	0.009
Singapore	0.012	0.013	0.013	0.015	0.016	0.018	0.015
South Africa	0.038	0.039	0.042	0.044	0.046	0.047	0.043
South Korea	0.038	0.028	0.031	0.035	0.038	0.039	0.035
Spain	0.010	0.012	0.013	0.014	0.016	0.018	0.014
Sweden	0.021	0.021	0.022	0.024	0.027	0.029	0.024
Switzerland	0.021	0.023	0.024	0.024	0.025	0.025	0.024
Taiwan	0.017	0.021	0.021	0.020	0.019	0.020	0.020
Thailand	0.015	0.017	0.019	0.022	0.024	0.025	0.021
Turkey	0.016	0.016	0.017	0.018	0.021	0.024	0.019
UAE	0.010	0.010	0.011	0.013	0.016	0.018	0.013
U.K.	0.041	0.043	0.046	0.048	0.049	0.050	0.046
Ukraine	0.001	0.002	0.003	0.004	0.005	0.006	0.004
U.S.	0.028	0.029	0.030	0.032	0.034	0.036	0.032
Venezuela	0.013	0.018	0.023	0.026	0.031	0.033	0.025
Vietnam	0.001	0.002	0.002	0.003	0.003	0.004	0.003
All countries	0.020	0.021	0.022	0.024	0.026	0.027	0.024
<i>Developed Countries</i>	<i>0.006</i>	<i>0.006</i>	<i>0.007</i>	<i>0.007</i>	<i>0.008</i>	<i>0.009</i>	<i>0.007</i>
<i>Emerging Markets</i>	<i>0.086</i>	<i>0.089</i>	<i>0.090</i>	<i>0.093</i>	<i>0.097</i>	<i>0.098</i>	<i>0.093</i>

Appendix A: Table 3

Table 3 shows how increased card penetration boosts the GDP growth rate (as opposed to the GDP amount). Keeping with the U.S. example, card penetration added 16 basis points on average to the GDP growth rate over the course of the study.

	2003	2004	2005	2006	2007	2008	Weighted average
Argentina	0.185	0.152	0.351	0.418	0.352	0.292	0.027
Australia	0.868	0.480	0.113	0.278	0.116	0.371	0.041
Austria	0.029	0.075	0.056	0.047	0.045	0.050	0.011
Belgium	0.010	0.027	0.004	0.026	0.042	0.022	0.023
Brazil	0.236	0.424	0.622	0.797	0.680	0.552	0.031
Canada	0.291	0.200	0.247	0.268	0.232	0.248	0.041
Chile	7.228	3.615	14.152	18.818	18.239	12.411	0.032
China	0.000	0.010	0.012	0.019	0.002	0.009	0.017
Colombia	0.131	0.129	0.153	0.197	0.248	0.171	0.018
Czech Republic	0.351	0.699	0.549	0.659	0.436	0.539	0.012
Denmark	0.122	0.006	0.068	0.141	0.039	0.075	0.026
Egypt	2.190	1.111	3.043	5.525	2.052	2.784	0.004
Finland	0.086	0.119	0.024	0.085	0.090	0.081	0.021
France	0.029	0.023	0.001	0.010	0.014	0.015	0.026
Germany	0.001	0.001	0.001	0.002	0.002	0.001	0.010
Greece	0.142	0.268	0.227	0.449	0.592	0.335	0.004
Hong Kong	0.119	0.076	0.267	0.111	0.122	0.139	0.033
Hungary	-0.059	-0.028	0.141	0.312	0.134	0.100	0.011
India	0.773	0.117	0.191	0.274	0.261	0.323	0.004
Indonesia	-0.038	-0.122	0.089	0.525	0.630	0.217	0.009
Ireland	0.100	0.075	0.064	0.082	0.107	0.085	0.015
Italy	-0.026	-0.009	0.007	0.018	0.013	0.001	0.010
Japan	0.013	0.023	0.043	0.044	0.043	0.033	0.010
Kuwait	0.129	0.605	0.113	0.472	0.197	0.303	0.057
Malaysia	0.025	0.045	0.104	0.171	0.180	0.105	0.036
Mexico	0.153	-0.001	0.124	0.372	0.085	0.146	0.016
Netherlands	0.066	0.119	0.044	0.035	0.038	0.060	0.023
New Zealand	1.029	0.290	0.347	0.287	0.433	0.477	0.028
Norway	0.168	0.178	0.266	0.409	0.281	0.260	0.039
Peru	0.093	0.099	-0.004	0.044	0.025	0.051	0.015
Philippines	0.416	0.640	1.003	2.670	1.465	1.239	0.016
Poland	0.012	0.047	0.027	0.045	0.045	0.035	0.014
Portugal	0.095	0.038	0.136	0.167	0.116	0.110	0.025
Puerto Rico	0.061	0.135	0.243	0.046	0.051	0.107	0.009
Russia	0.030	0.052	0.045	0.036	0.042	0.041	0.005
Saudi Arabia	-3.759	1.200	1.606	1.340	0.552	0.188	0.007
Serbia	0.581	0.941	3.050	3.212	1.415	1.840	0.009
Singapore	1.611	0.907	1.140	1.675	1.562	1.379	0.015
South Africa	0.009	0.012	0.008	0.013	0.018	0.012	0.043
South Korea	0.134	0.093	0.048	0.087	0.055	0.084	0.035
Spain	0.055	0.149	0.156	0.217	0.162	0.148	0.014
Sweden	0.253	0.113	0.055	0.092	0.073	0.117	0.024
Switzerland	-0.052	-0.024	0.117	0.160	0.150	0.070	0.024
Taiwan	0.023	0.140	0.164	0.536	0.398	0.252	0.020
Thailand	0.985	-0.096	-0.043	-0.013	0.096	0.186	0.021
Turkey	0.133	0.118	0.178	0.221	0.183	0.167	0.019
UAE	0.009	0.008	0.210	0.317	0.286	0.166	0.013
U.K.	0.071	0.055	0.121	0.105	0.049	0.080	0.046
Ukraine	0.006	0.010	0.004	0.008	0.004	0.006	0.004
U.S.	7.956	7.375	6.280	4.758	1.711	5.616	0.032
Venezuela	0.000	0.000	0.001	0.001	0.001	0.001	0.025
Vietnam	13.369	10.355	16.712	17.689	22.555	16.136	0.003
All countries	1.603	1.234	0.776	1.090	0.861	1.113	0.024

Appendix B: The Model

This model looks at the impact of credit and debit cards on consumers and the overall economy in 51 countries over six years. The data for 51 countries are pooled for robust estimation. Real per capita private consumption is modeled as a function of real per capita disposable income, interest rates, and credit and debit card penetration with fixed cross-country effects. The estimated equation is shown below.

Variable	Description
C\$	Real private consumption
POP	Population
YPD\$	Real personal disposable income
PCTCCE	Credit card penetration (ratio)
RINT	Interest rate
INGRP(EM)	Dummy for emerging markets
INGRP(DC)	Dummy for developed (rich) countries

Dependent Variable	LOG(C\$?/POP?)
Method	Pooled EGLS (Cross-section weights)
Date	09/18/09 Time 09:55
Sample (adjusted)	2004 2008
Included observations	5 after adjustments
Cross-sections included	52
Total pool (balanced) observations	260
<ul style="list-style-type: none"> • Iterate coefficients after one-step weighting matrix • Convergence achieved after 17 total coef iterations 	

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.293864	0.091534	25.06021	0
LOG(YPD\$?/POP?)*@INGRP(EM)	0.11076	0.020603	5.375945	0
LOG(YPD\$?/POP?)*@INGRP(DC)	0.031969	0.009774	3.270941	0.0013
(PCTCCE?)*@INGRP(EM)	0.352383	0.156801	2.247321	0.0257
(PCTCCE?)*@INGRP(DC)	0.169142	0.040039	4.224453	0
RINT?	-0.000689	0.000372	-1.855249	0.065

Weighted Statistics

R-squared	0.999961	Mean dependent var	3.974082
Adjusted R-squared	0.99995	S.D. dependent var	5.493746
S.E. of regression	0.016478	Sum squared resid	0.054849
F-statistic	91202.83	Durbin-Watson stat	1.894527
Prob(F-statistic)	0		

Unweighted Statistics

R-squared	0.999959	Mean dependent var	1.665927
Sum squared resid	0.057218	Durbin-Watson stat	1.803619

Construction of tables in the appendix

The tables are constructed using the following formulas (* means multiplication).

Table 1A: $100 * (Cit - CPit) / Cit$

Table 1B: $100 * (GDPit - GDPpit) / GDPit$

Table 2: Calculated by simulation of the model. For each country in each year, the card penetration ratio is increased by 1%. The percent divergence of the simulated consumption and GDP from actual consumption and GDP is reported in Tables 2A and 2B, respectively.

Table 3: $PCT(GDPit) - PCT(GDPpit)$

Cit: Private consumption in constant 2005 U.S. dollars for country i in year t.

GDPit: Gross domestic product in constant 2005 U.S. dollars for country i in year t.

CPitPrivate: Consumption predicted by the model when card penetration is held constant at its minimum value over t=2003 to 2008 for each country i.

GDPpit = GDPit + CPit - Cit is GDP predicted by the model when card penetration is held constant at its minimum value over t=2003 to 2008 for each country i.

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